DKRF670 Series

Driesen+Kern GmbH

Humidity and temperature transducers





Manual

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Introduction

This manual will help you with the installation and the use of the transducer series DKRF670.
If any problems with the instruments should occur, please try to solve them with the help of this manual first.
In case of further questions or if you discover device defects, please contact your local distributor or Driesen+Kern GmbH:

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1 General Information

1.1 Important information on measuring humidity

When measuring humidity or calibrating humidity transducers the temperature balance between the humidity sensor and the surrounding environment is of significant importance.
Even a small temperature difference of only ±1°C at ambient conditions of 20°C and 50% RH can cause measuring errors ±of 3% RH. At a humidity level of 90% RH the measuring error can actually be ±5,4%.

1.2 Limitations of use

A number of factors can complicate the measurement of humidity.
The following information is to help prolong the sensor's durability and increase the accuracy of measurements.
In case of doubt please don't hesitate to contact us for further advice.

1.3 Chemicals

The transducers work on basis of a capacitive humidity sensor in CMOSens technology. This technology along with some other protective measures makes the sensor relatively resistant against dust and other pollutants.
However, chemicals, in particular detergents, solvents, and acids can affect the measurement or damage the sensor.
It has to be kept in mind that some of the substances become dangerous only at higher temperatures or after the sensor has been exposed over longer periods (i.e. outgassing).
If measurements can be made at such a point (e.g. with the help of filters or bypasses) has to be clarified individually.

1.4 High humidity

Under conditions with a very high level of humidity, a temperature difference of only a few degrees can lead to condensation at the sensor. Short-term condensation on the sensor is innocuous, however regularly long-term or even permanent moistening can lead to corrosion within the sensor and on the conductors.

The following actions can be taken in order to improve operating conditions.

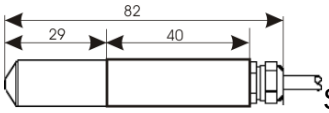
1. Use the DKRF676 transducer, specially designed for use in high humidity.
2. Remove the sensor filter for faster drying.
3. Install a bypass with better manageable conditions in it. If applicable, convert to absolute humidity or dew point.
4. Build a baffle plate or an immersion pipe in order to prevent the sensor from moistening.

Please note that it can possibly take a couple of hours for the sensor to dry in non-ventilated measuring sites. In case of occasional condensation, the sensor works fine after the condensate has dried off. Condensates with contaminant loads (e.g. acid formers, solvents) can cause a reduction of the sensor's durability or an irreversible measurement drift.

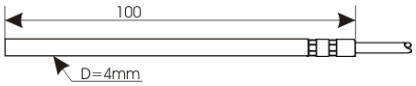
The special transducer DKRF676 is suitable for application at very high humidity levels. It has a special sensor heater which prevents bedewing on the sensor head. In addition it helps the sensor dry faster after moistening.
Since strong continuous heating is not recommended the heater's effect is limited. Measuring in permanent water vapour for instance is not possible.

In that case an immersion pipe or a baffle plate can help ease the conditions' effects.

The DKRF676 has two sensor heads.



Sensorhead with heated Humidity sensor

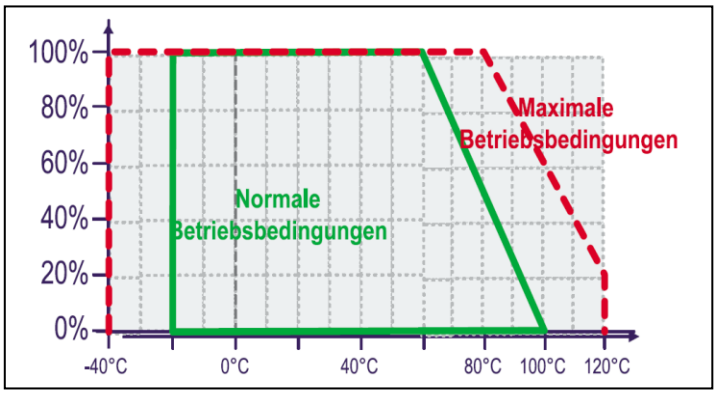


Sensorhead with temperature sensor

Because the humidity sensor of the DKRF676 is heated, you have to make sure that during measurement both sensor heads are inside the process.
The heater is automatically turned on and off if condensation may occur.
Only, when the additional temperature sensor head is also inside the process, relative humidity can be calculated correctly.

1.5 High humidity and high temperature

The transducer can be used within range from 0…100% RH under the above restrictions.
The temperature dependent operating range is limited by the electronics, the sensor itself, and the employed material respectively. See specifications at the end of this manual for the relevant limits.
Furthermore, the sensor may not be used at high humidity and high temperature at the same time.
The diagram shows the limits of operation.
When operating outside the recommended ranges the humidity signal can transitionally be increased by up to 3%. After a short period of time the sensor returns to its original calibration.
Application beyond the maximum operating range is not recommended.

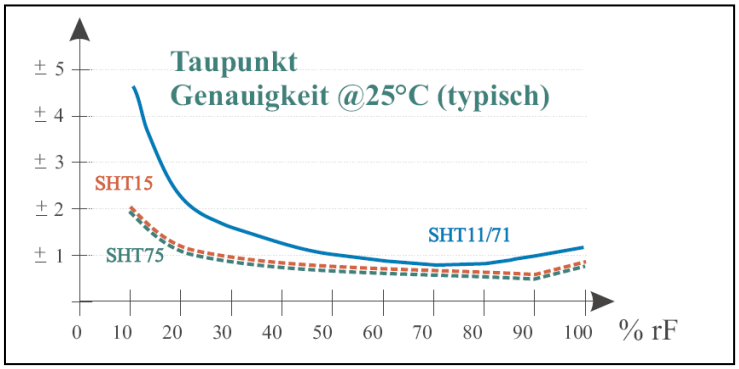


1.6 Low humidity

The humidity sensor is less accurate when working under low operating conditions (close to 0% RH). Moreover, the relative error in measurement (i.e. relating to the actual value) increases enormously at very low measurements.

Example:
You take measurements at 50% RH. The error of the sensor at this point is approximately +/- 1,8 RH. This results in a relative error of 1,8/50=3,6%.

This time you take measurements at 5% RH. The sensor error at this point is approximately +/-2,5%. That results in a relative error of 50%.



This makes the dew point calculation quite inaccurate at low humidity. (See diagram for details.)

If you want to apply a transducer for relative humidity at very low value levels this can be achieved for instance by measuring with the help of a bypass.

1.7 H_2O_2-Atmosphere

Driesen+Kern GmbH offers a special model DKRF67X-H2O2 which can be used in H2O2-Atmosphere. As most oft he DKRF67x, this transmitter has an interchangeable sensorhead (SK673-H2O2). This sensorhead sends a digital output to the transmitters and is calibrated, so it may be exchanged from the transmitter without recalibration.
The optimized sinterfilter blocks H2O2-molecules from the sensor element, and allows for accurate measurements as well as protection from aggressive atmosphere.

Anyway , there is a small influence on humidity measurments: approx +1%RH at 300ppm H2O2 and +3%RH at 900ppm H2O2 (@23°C)

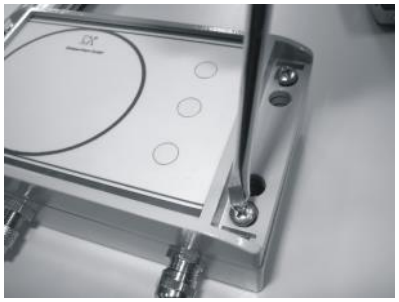
2 Installation of the transducer

2.1 Mounting the transducer

The sensor head's installation place should be chosen carefully. Continuous airstream ensures fast response times, and the environment should be free of contaminants and dust.

In addition any potential for the creation of condensation ought to be eliminated.

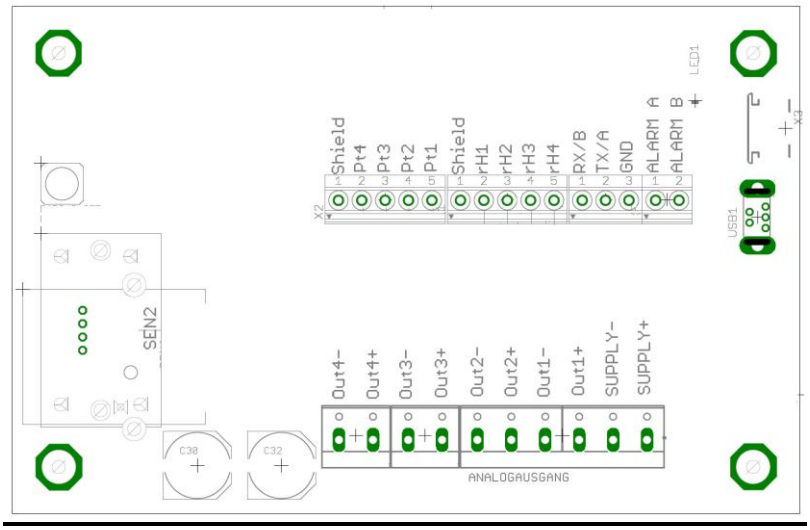
For the mechanical as well as for the electrical connection the housing cover has to be opened. First pull off the protective caps on the left and on the right of the casing (use a small screw driver or your fingernail).



Below you will then find four holes which are used to mount the transducer at a wall. In addition there are four screws which have to be opened for the electrical connection.

In any case the measuring head of the humidity probe should always be mounted horizontally or at least with a small decline in the sensor's direction so that potential condensate is prevented from accumulating on the sensor.

2.2 Electrical installation



SK670 pin assignment
rH-1 = Green
rH-2 = Yellow
rH-3 = Black
rH-4 = Red
Shield = Yellow/Green

Temp-1 = blue
Temp-2 = white
Temp-3 = Brown
Temp-4 = orange

SK670-H2O2 pin assignment
rH-1 = white
rH-2 = blue
rH-3 = brown
rH-4 = black
Shield = yellow/Green

Connector pin assignment
Channel A
Out1+ = Temperature +
Out1- = Temperature -

Channel B
Out2+ = Rel.Humidity +
Out2- = Rel.Humidity –

Channel C
Out3+ = Berechnete Größe 1 +
Out3- = Berechnete Größe 1 -

Channel D
Out4+ = Berechnete Größe 2 +
Out4- = Berechnete Größe 2 –
Supply = 11-35V DC (Output 0-10V/4-20mA)
8-35V DC (Output 0-1V/0-5V)

Note:
If the transducer has been delivered with calculated variables (dew point, absolute humidity, etc.) please see the label for the assignments.

3 LCD Display

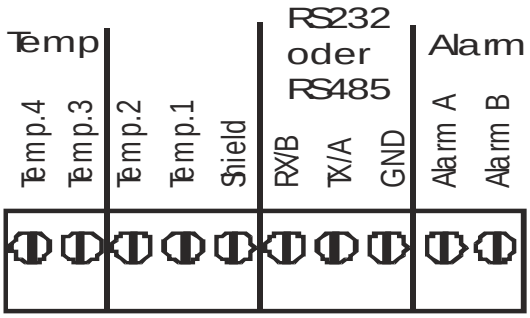


The transmitter can optionally be delivered with an LCD-display. It will always show the values on screen which have been selected as analogue outputs.

Furthermore it will display alarm massages.

1. ← ↑ ↓ →Arrows flash simultaneously = sensor error
2. an alarm is active
3. an alarm had been activated previously but alarm condition is not valid anymore

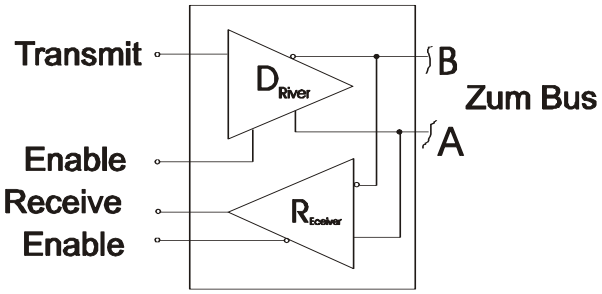
4 Digital Communication



The DKRF670 can be delivered with a digital interface.
As a standard, they have a USB connector (except 4-20MA two-wire versions)
Furthermore you may select between RS232 and RS485 interface.

4.1 RS485-Communication

Typical setup of the RS485-interface



56 RS485 probes oft he same type can be connected together with one master.

Bus specification
Standard RS485, 2-wire, halfduplex,
-7V to +10V Common-Mode Input Voltage Range

4.1.1 Protocoll/Dataformat

4.1.1.1 General

Specification
Baudrate: 9600
Databits: 8
Parity: none
Stoppbits: 1
Codierung: 1 Byte per Character
Echo: OFF

4.1.1.2 Command structure

A full list of commands can be found in chapter 4.

A command includes a data command consisting of multiple ASCII characters terminated by CarriageReturn. Command and Adress will be separated by a SPACE (ASCII-code 32dez or 020hex).

There is no checksum calculation.
The Address can be within 0..255 freely selectable.
When shipped initially D+K provides Adress „0“ to any of the probes.

Commandsyntax: *PREFIX ADRESS* 0x20 COMMAND CR

The PREFIX can be used optionally and is used for synchronisation.
It consists of 3 byte and uses the following format.

?#: = ASCIICode 0x3Fhex 0x23hex 0x3Ahex

The Address has to be placed directly behind the PREFIX (without SPACE)

[SPACE] = ASCIICode 32dez / 0x20hex
[CR] = ASCIICode 13dez / 0x0dhex
[TAB] = ASCIICode 09dez / 0x09hex

The output syntax is as follows:
Sensorvalue[SPACE]°C[TAB]**Sensorvalue** [SPACE]% [CR]

The sensorvalue has a constad length of 8 characters, 2 decimal places, one delimeter, anda number of places before the delimeter.
An algebraic sign will only be used when it is negative, otherwise the string is filled up with SPACEs.

Example

Get sensor values (once) for address „0“

Command sequence: 0[SPACE]Meter[CR]
Answer: T : 23.159 'C [TAB]rH: 34.240 % [TAB][CR][LF]

4.1.1.3 Change RS485 Address

Command Sequence : 0[SPACE]commconfig[CR]
Antwortsequenz : *Transmitter answers:*
Set basic communication mode for host communication.[CR][LF]
(1)..RS485 addressable (2)..RS232 none addressable ? >

Transmitter waits for input:
Send 1[CR] to select RS485-mode

Transmitter answers:
RS485 address (0) ? >

Transmitter waits for input:
Enter a value between 0..255: 12[CR]

Transmitter anwers:
Send startup info via RS485 on booting?[CR][LF]
(1)..no (2)..yes ? >

Transmitter waits for input:
Enter 1 (for not displayed) or 2 (for displayed) : 2[CR]

Transmitter anwers:
Echo disabled![CR][LF]
Wait for RESET System to activate the new settings: 1

Note: If you send values out of range the Transmitter answers:

[CR][LF]…out of range![CR][LF]>

Please correct your command and retry

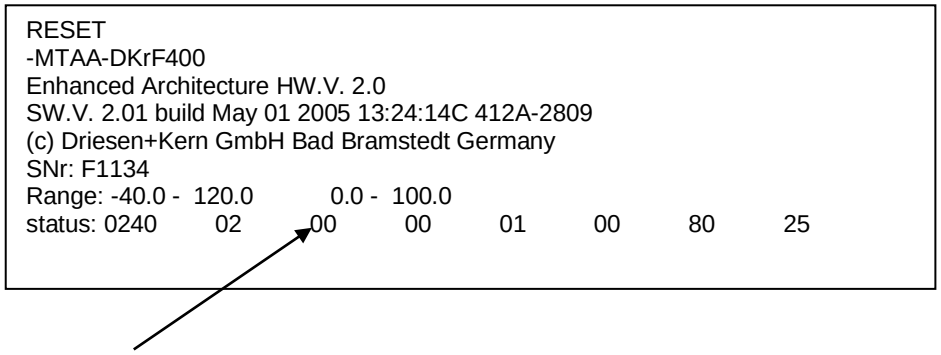
Note: If you send values which cannot be interpretated as numbers the Transmitter answers:

[CR][LF]…incorrect![CR][LF]>

Please correct your command and retry

After everything has been done, wait 5 seconds to have the transmitter change its Address to 12.

At POR (PowerOnReset) the probe executes an internal system test and outputs parameters via the RS485 bus. The current RS485 address can be deduced from this data. The start screen looks like this:



Current RS485 address, in this case 0

We recommend to only perform changes to the RS485 address with a terminal program and not during the normal RS485-operation!

4.2 RS232-Interface

As standard the DKP10XX is supplied with a USB-interface (see chapter 4.3) for communication and configuration. Optionally it can be delivered with an RS232-interface.
The command set is further explained in chapter 4.4..

4.3 USB-Interface

The USB Interface can be used for communication and configuration.
In ordert o use the USB port, you will have to install the VCP-USB-Dirver. (VCP_WindowsUSBDriver.zip)
These can be downloaded from the Driesen+Kern Homepage:

Link: http://www.driesen-kern.de/updates/index.html
Directlink: http://www.driesen-kern.de/downloads/VCPWindowsUSBDriver.zip

After unzipping the file you will have two exe-files:
64 bit-Computer: CP210xVCPInstaller_x64.exe
32 bit-Computer: CP210xVCPInstaller_x86.exe
Start the file that you would need for your computer type (32bit/64bit) and follow the instruction.

Connect a Micro-USB (Type B) cable to your computer and to the transducer.
A virtual COM-Port will be installed – you will find the assigned COM-Port in the device manager.

Start a terminal program now and select settings:
COM-Port: as assigned from device manager
Baudrate: 9600
Datenbits: 8
Parity none
Stoppbits: 1
Fluxcontrol: none

The complete list of commands can be found in chapter 4.4

4.4 Command List

The following commands are supported; please note that writing is not case sensitive:

Command	Description
METER	Singular transmission of sensor data (humidity/temperature)
METER ALL	Singular transmission of all measured and calculated values.
METERMODE	Periodic transmission of sensor data (humidity/temperature) every 2 seconds
METERMODE ALL	Periodic transmission of all measured and calculated values every 2 seconds
S	Ends MeterMode
USCAL	Usercalibration for physical parameters
ACAL	User calibration of analogue outputs
CONFIG	Allows you to select the parameters which will be set for the analogue outputs.
REFACUSCAL	Will reset to factory calibration
REFAC-CONFIG	Will rest to factory configuration

4.5 Online-Meter

METER <cr>:The transducer sends one set of actual values. Note, that only these values are sent that have been selected for the analogue outputs.
METER ALL <cr>: The transducer sends one set of all measured values as well as all calculated values on the screen.
METERMODE <cr> The transducer continually sends actual values. Note, that only these values are sent that have been selected for the analogue outputs.
METERMODE ALL <cr>: The transducer continually sends all measured values as well as all calculated values on the screen

4.6 Configuration

CONFIG <cr> Configure scaling and outputs settings for analogue outputs.

```
config
Transmitter configuration for analog output
OutputChannel (1) ... (4) ? >1
Define type of electrical output 1
(0) .. nothing, no output
(1) .. voltage [mV] output
(2) .. current [mA] output  ? >2
Define limits of electrical output 1
Minimum [ mA  ](     0..    24) ? >4
Maximum [ mA  ](     0..    24) ? >20
Choose output signal on output 1
( 0)..nothing, no output        [-----]
( 1)..AirTemperature            ['C   ]
( 2)..rel.Humidity              [%    ]
( 3)..AirTemperature2           ['C   ]
( 4)..BarometricPressure        [hPa  ]
( 5)..Abs.Humidity              [g/m3 ]
( 6)..DewPoint                  ['C   ]
( 7)..WetBulbTemperature        ['C   ]
( 8)..MixingRatio               [g/kg ]
( 9)..Abs.Humidity              [ppm  ]
(10)..AirTemperature            ['F   ]
 ? >1
Define physical limits of AirTemperature     on output 1
Note that the cable specification may limit the range!
Minimum ['C   ] (   -60..   250) ? >-20
Maximum ['C   ] (   -60..   250) ? >80
Configuration change successfully finished.
You can use following formular to calculate the physical parameter ['C   ]
from the Transmitters output [ mA  ]
y ['C   ] =  -45.000 +   6.250 * x [ mA  ]

Configuration change successfully finished.
Wait for RESET System to activate the new settings: 7
```

After a few seconds the DKRF670 is programmed and shows the configuration of the DKRF670 System.

4.7 User-Calibration

USCAL <cr> User-calibration of DKRF670
The User-calibration allows for adjusting the humidity temperature transducer.
You should only perform a calibration if you have accurate and reliable calibration equipment.
Please make sure to wait until the sensor readings have stabilized before confirming a calibration point.

USCAL <cr>
Transmitter input sensor user calibration:
Choose sensor channel:
(1)..AirTemperature [°C]
(2)..rel.Humidity [%]
? >**1**
Choose the calibration points for AirTemperature [°C]
(1).. Offset calibration on one point
(2).. Offset & span calibration on two points
? >**2**
2 points sensor calibration on input channel 1
Apply stable reference condition to sensor.
Then type in reference value after sensor has reached stable condition.
point 0: (press spacebar to enter ref. value!) -20.20 °C
point 0: (press spacebar to enter ref. value!) -20.15 °C
point 0: (press spacebar to enter ref. value!) -20.15 °C
point 0: (press spacebar to enter ref. value!) -20.15 °C
Reference value [°C] on point 0: ? **>-20**
point 1: (press spacebar to enter ref. value!) 79.80 °C
point 1: (press spacebar to enter ref. value!) 79.80 °C
Reference value [°C] on point 1: ? >**80**
...sensor user calibration successful

4.8 Restore Factory calibration

REFACUSCAL<cr> > Restore factory calibration.

Transmitter input sensor reset to factory calibration:
(1)..Yes (2)..Cancel ? >**1**
(1)..Cancel (2)..ReallyYes ? >**2 (*doublecheck that you really want to reset to factory calibration*)**
Choose the sensor channel:
(1)..AirTemperature [0C]
(2)..rel.Humidity [%]
? >**1 (*example to restore factory calibration on channel 1, which has been set to temperature*)**

Restore Factory Configuration
REFACCONFIG <cr> > Restore factory configuration
The sensor is typically shipped with cannel one set to temperature and channel two set to relative humidity. The ranges are typed on the transducers´ label.

5 Humidity calibration



If you wish to verify the output values Driesen+Kern GmbH offers you the HumidityCalibration KIT MHT-Series.
(Checks MHT0, MHT11, MHT33, MHT54, MHT75 and MHT97.)

The MHT Series HumidityChecks are insensitive to orientation and suitable for verifying the accuracy (relative humidity) of probes, transmitters, and indicating devices.
They are best suited for application in the field (e.g. in industrial plants) or in laboratories.



It is important that the HumidityCheck and your probe are balanced regarding the temperature. That means it has to be ensured that the temperature of the salt solution, the air temperature within the measuring chamber, and the probe's temperature have to be equal ($T_{Solution} = T_{Tester\text{-}Air} = T_{Probe}$!).

When these temperatures are equal an energetic equalised system has successfully been established. If the system has to stabilise from +5°C to +20° it takes very long for the energetic equalised system to be established. If the tester and the probe have been in the same room for a longer period of time the adapting time goes down to 20-30 minutes.
Putting the HumidityCheck and the probe together into a box can help adapting when working in the field.

Warning notices

- The solutions included in the HumidityChecks must not come in contact with your skin in case of a leak or a breach.
- Make sure that there is no liquid above the filter in the humidity chamber before inserting the humidity probe into the HumidityCheck. (It could cause damage at the sensor!) Liquids can form by condensation, the tester falling down, or damaging the internal diffusion filter.
- Avoid direct sunlight on the tester.
- Avoid infrared radiation.
- Do not touch the check during temperature adapting (heat transfer)!
- Close the HumidityCheck properly after usage.
- Use a proper rubber plug with an adequate borehole for your probe head.
- Make sure that the sensor is effectively within the measuring chamber.

You'll find the particular relative humidity levels depending on the temperature on the check's label. Usually humidity probes/transmitters are equipped with a temperature probe as well. Read the indicated value from your probe and compare it to the temperatures from the table. The value below is the reference value for relative humidity. Careful attention of the above advice allows you to achieve an accuracy of up to ±2 % RH.

6 Alarm Function (optional)

The DKRF670s Series can optionally be equipped with an alarm function.
This feature offers an isolated contact which is freely programmable for the most part.
For this you need a USB-cable and a terminal program.

The switch contact can separate voltages of up to 60 Volts and currents of up to 1A.
The accessible contacts are on the surface of the probe's board and labelled AlarmA and AlarmB.
Please ensure that the higher voltage is connected to contact A.

Setalarm [CRr]

You can set alarm values for the two output channels. These values are threshold1, threshold2 and a hysteresis. You can link both channels with logical AND / OR to get the final alarm value.
Alarm value TRUE means close alarm-switch on motherboard.

Setup alarm parameters for:
(1)..Temperature [°C]
(2)..relative humidity [RH]
(3)..other
? >2

Alarm mode for Humidity [%RH]:
(1).. deactivated
No alarm calculation on this output channel.
(2).. ONE ALARM-ON Area
Alarm is true, if actual transducer value is greater threshold1 and smaller threshold2.
(3).. TWO ALARM-ON Areas
Alarm is true, if actual transducer value is smaller threshold1 or greater threshold2.
? >2

Threshold1 [m3/h] (0.. 100) ? >50
Threshold2 [m3/h] (0.. 100) ? >70
Hysteresis [m3/h] ? >2
Logical channel alarm linkage of output ch1 and output ch2:

(1).. OR linkage
If alarm on outputch1 O R on outputch2 true, then close alarm switch.
(2).. AND linkage
If alarm on outputch1 **AND** on outputch2 true, then close alarm switch.
? >1 Configuration change successfully finished.

Driesen + Kern GmbH

Certificate of Conformity

Driesen + Kern GmbH
Physikalisch-Technische-Messgeräte

Product: **Humidity Transducers**
DKRF67x, DKRF67x-H2O2

This is to certify that above products are calibrated using dedicated equipment which is calibrated according to ISO/IEC 17025 and calibrated by comparison against natural standards, natural physical constants, consensus standards, or by ratio type measurements using self-calibrating techniques.
The specification given in datasheets are met by the above products.

Bad Bramstedt
30.11.2016

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