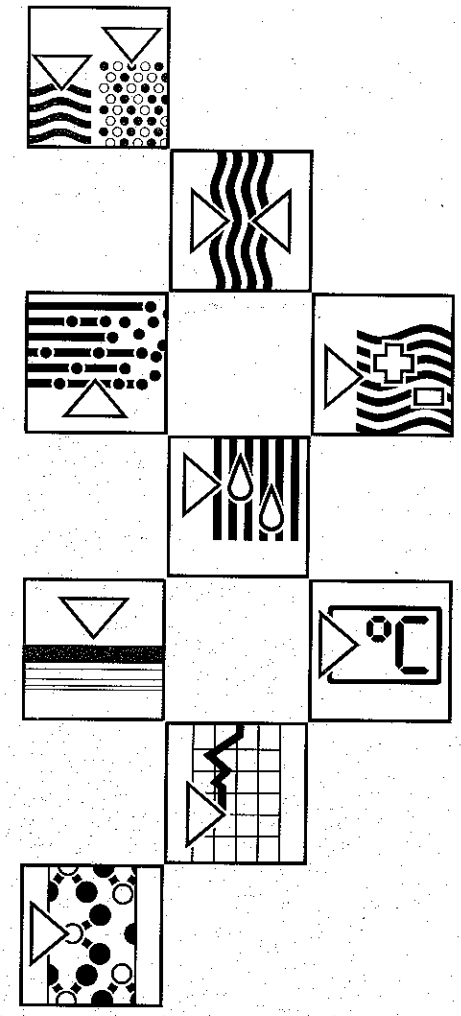
Instruction Manual
BA 057/00/e/5.91

hygrolog
WMY 770 + DY Sensors
Humidity Measurement

Montage- und Betriebsanleitung
Installation and Operating Instructions



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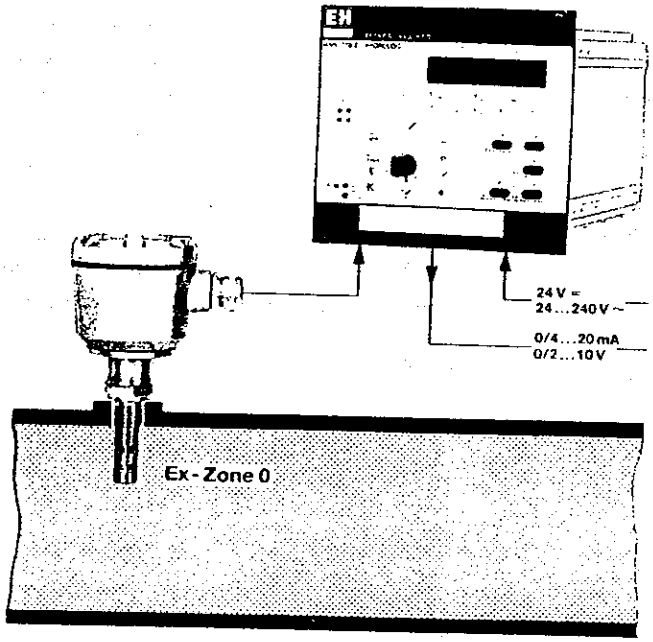


Fig.1

1. Introduction

1.1 Where is the WMY 770 Z moisture measuring system used?

In addition to measuring the dewpoint temperature, the WMY 770 Z measures seven moisture variables, which can be displayed individually. One of the most important measured variables, however, is the dewpoint temperature. This variable indicates the temperature at which a gas or a liquid is saturated with water (or, more precisely, water vapour) and hence the temperature at which water condenses. This figure is particularly important for evaluating the quality of, for example, instrument air, natural gas, ethylene, propylene, etc.

If the moisture content is too high, there can be a danger of

- corrosion
- icing
- hydrate formation
- polymerization, etc.

These phenomena can result in equipment downtime, high maintenance costs, environmental pollution and even personal injury.

The WMY 770 Z universal measuring system has been designed for such applications. It is used with

- moisture sensor DY 70 (for crude gases)
- ALPHASENSOR DY 73 Z (for ultrapure gases/liquids)
- natural gas sensor DY 76 NZ (for natural gas, sweet gas)

Measurement is possible either in-line or with bypass under operating conditions.

Application ranges:

Because the sensors are calibrated in the dew point temperature range from about -80°C to +20°C, they can be used in both gases and liquids.
The gas/liquid temperature should be at least about 10 to 15 K above the dewpoint temperature being measured, and the relative humidity should not exceed about 50% for extended periods of time. Moist media should not contain more than 10 ppm of heavily corrosive substances, e.g. chlorine. The sensors should not be used in electrically conductive or polar media such as alcohols (methanol, propanol), ammonia (NH_3), halogens, (fluorine, chlorine). Liquids, and most particularly hydrocarbons, should not be arbitrary miscible with water; instead, they should exhibit a saturation level (C_s) that varies as a function of temperature (T).

1.2 How the measuring system works

The two values measured by the sensor - capacitance and temperature - are passed in the form of disturbance-proof PFM signals (pulse frequency modulation) to the HYGROLOG WMY transmitter. The HYGROLOG uses them to calculate the desired variables (see display selector).
The specific calibration data of the sensor can be entered and stored in the WMY 770 Z transmitter either at the factory or at site without any special aids.
The sensor's calibration data are contained on the data sheet in the sensor housing or else can be generated by a calibration unit (e.g.: WSX 160). Temperature compensation is carried out either individually or with standard values.
The measured variable and measuring range can be adjusted as desired for the standardized current or voltage output.
The entire measuring system monitors itself, providing a continuous indication of its own availability.
The WMY 770 Z transmitter can be installed in any RACKSYST housing. To adapt the sensor to specific operating conditions, accessories such as

- filters
  cooling coils
- sensor chambers
- rotameters
- pumps, etc.

or even complete gas treatment systems are available.

Block diagram of the moisture measuring system

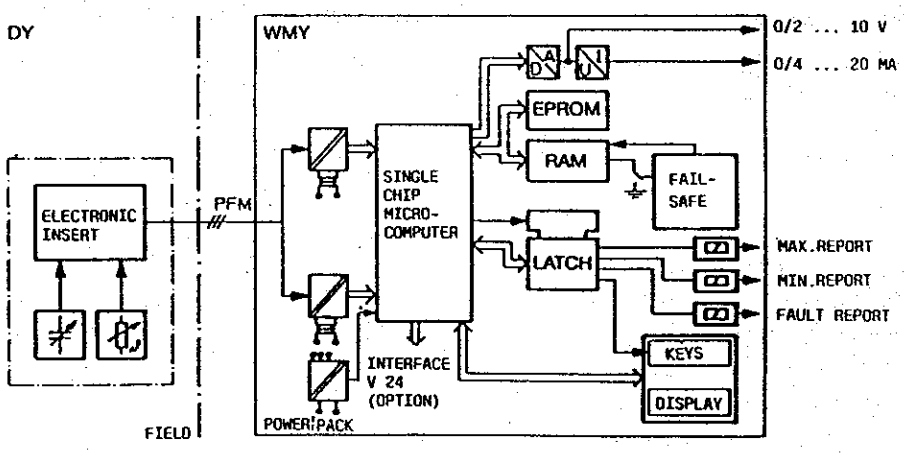


Fig.2

2. Startup

2.1 Standard program

The moisture measuring line HYGROLOG WMY 770/ moisture sensor DY 70, DY 73, DY 76 NZ requires only a minimum amount of work at startup. All that needs to be done is to install the transmitter and sensors and make the electrical connection.
If the HYGROLOG WMY 770 Z and moisture sensor have been supplied together as a measuring line, standard programming has already been carried out at the factory.

The standard programming consists of:

- input of data for the basic calibration and temperature compensation (levels 3770, 2687, 2688)
- measuring range -80°C ... +20°C dewpoint temperature, corresponding to 0 - 20 mA output signal (level 1770)
- alarm points at -80°C and +20°C dew-point temperature (level 2770)

For suitable variables, all one has to do is to enter the values for the basic calibration (level 3770) and temperature compensation (levels 2687, 2688). All other settings are identical with the standard programming (see above). Changes to the standard programming are carried out in the so-called functional levels. The setting possibilities for each levels are summarized starting on page 7.

2.1.1 The operating data are complete

Normally, the most important operating data for the measuring system such as:

- required measuring variable
- required measuring range, or required measuring ranges
- required switching points of the two alarm relays
- required switching hysteresis of the two alarm relays
- required safety function of the two alarm relays (max-min safety mode)
- measurement in gases or in liquids (absolute pressure Henry'sche constant etc.)
- measuring range of external pressure measurement (if connected, option)

are specified when ordering. The HYGROLOG WMY 770 Z is then correspondingly programmed to customer-specific requirements prior to delivery.
As a result, commissioning of measuring equipment specified in this manner requires absolutely no manipulation of the setting elements provided on the unit.

2.1.2 The operating data are incomplete

If for some reason, important specifications with regard to operation of the device cannot be provided or provided only incompletely (see overleaf), the functionality of the measuring system is nevertheless given: When no specifications are quoted, so-called standard programming is provided.
The standard programming is specified for each function in each function level.
It is however obvious that optimum adaption to existing measuring requirements cannot be achieved in this manner. For this reason, particular importance is attached to the fact that practically all functions can be quickly and easily changed also on site. For the sake of clarity so-called function levels have been defined, making it possible for even untrained personnel to quickly and safely implement settings on the HYGROLOG WMY 770 Z.
In this way, each function level has its own clearly arranged part function (e.g. set function of measuring signal output or set function of alarm relays etc.), which can be varied within the device specifications as required.
Of course only the functions which are important for operation of the measuring equipment need be defined.
Before you can carry out an adjustment on the HYGROLOG WMY 770 Z in a function level, you must enter the code of the corresponding level with the aid of the setting elements provided on the front panel of the device.

2.2 Setting elements

1. Multi-function Switch

Rotary switch for selecting various device functions for display or setting values.

2. Display

Digital display of numbers up to 4 digits as well as display of order of magnitude 10^{-3} (m ≙ milli) or 10^{+3} (k ≙ kilo)

3. Selector Table

Measurement variables/units which can be permanently calculated and displayed if necessary

4. Programming Keys

Change or entry of value

5. Limit Value Signalling

LEDs for signalling the switching status of the limit value relays

Green LED: change-over contact of relays in ON-position
RED LED: change-over contact of relays in OFF-position

6. Fault Indicator

RED LED: change-over contact of fault indicator in OFF-position, indicating a fault in the measuring equipment

7. Test Socket

The value of the output current is also fed to the test socket.

8. Labelling Strip

E.g. to note the selected measurement variable or the measuring range or measuring ranges.

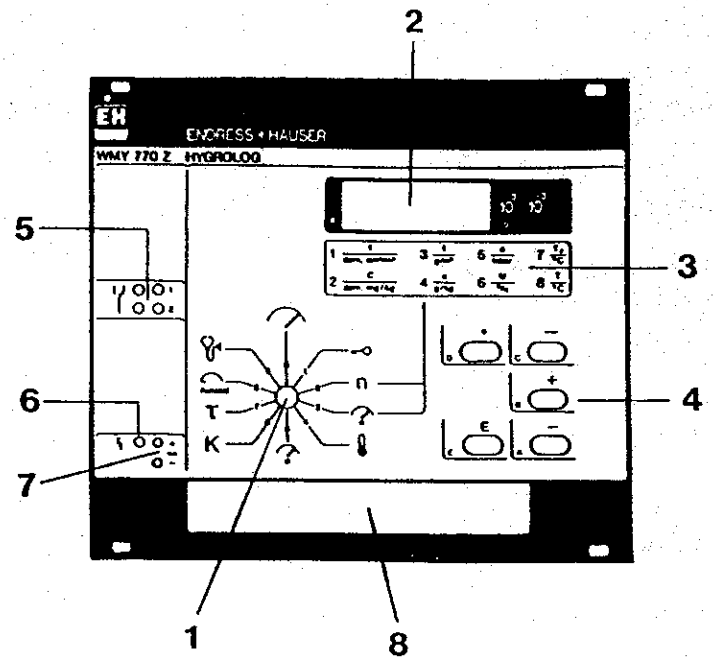


Fig.3

2.2.1 The Multi-function Switch

With the aid of the multi-function switch, you can select various individual functions in one function level.
The symbols on the front panel apply in the basic level.
The most important operating parameters or measured values are indicated at this point.
Not before the code for the basic level is stored is it possible to change the values (e.g. time constant, K-factor or pressure). A code is automatically deleted when the multi-function switch is in the basic position "0", ensuring the values cannot be changed unintentionally.

0: In this switch position, the main measured value (the selected measurement variable) is displayed which also defines the value of the signal output. Any codes which may have been entered previously are deleted.

1: In this switch position, the key to a function level, i.e. the corresponding code may be entered.

2: Selector for measurement variables/units.
A number n from 1 - 10 can be set by depressing the keys "plus" or "minus" (a code is not necessary for this purpose).
The numbers have the following significance:

1.	Moisture content f	ppm (cm^3/m^3)
2.	Moisture content C	ppm (mg/kg)
3.	Absolute moisture f	g/m^3
4.	Water vapour content x	(g/kg)
5.	Water vapour partial pressure e	mbar
6.	Relative humidity U	in %
7.	Dewpoint temperature T_d	°C
8.	Temperature T	°C
9.	Dewpoint distance Δ T	°C
10	Frequency ALPHASENSOR	Hz

3: Display of a measured value corresponding to the number n previously selected in switch position 2. If basic calibration of the HYGROLOG WMY 770 Z has still not been carried out, 4 dashes appear in the display (----) for the numbers n = 1 - 7. (Refer to page 24 for basic calibration).

4: Display of process temperature in °C.

5: Display or entry of process pressure (absolutely pressure) in bar.

6: Display or entry of Henry'sche constant (for measuring in liquids)

7: Display or entry of time constant in s with which the input signal is smoothed exponentially (RC low-pass filter). The time constant indicates the time required for the measuring signal output to reach the 63% value after the measured value has been applied to the input of the measuring instruments.

8: Autoca
Display of a new zero point frequency when the instrument has implemented an automatic zero point correction. 4 horizontal dashes appear in the display if automatic zero point correction has not taken place.

9: Display of malfunctions, e.g. sensor not connected or short circuit on sensor line (refer to fault table page 60).

In the basic level, all important operating parameters can be interrogated directly with the multi-function switch. Furthermore, values for time constant, pressure and Henry's constant can also be entered if the code for the basic level was stored beforehand (see function level). Only single settings are generally carried out at all other function levels. For this reason, the symbols on the front panel are limited to the basic level with the exception of the switch positions 0, 1 and 9.

2.2.2 Key Functions

(Entry of an arbitrary number)

This key shifts the decimal point, allowing you to define the resolution of a number entry.
The decimal point is shifted from left to right.
The limits of the decimal point both left and right are set in the instrument.
When the right stop is exceeded, the decimal point skips to the left limit.
LEDs serve the purpose of indicating the order of magnitude sinde the resolution of a number is limited to 4 digits.
Basically, the following digit arrangements are possible:

0.000 * 10^{-3}	(Display in milli-)
00.00 * 10^{-3}	(Display in milli-)
000.0 * 10^{-3}	(Display in milli-)
0.000	
00.00	
000.0	
0000	
00.00 * 10^{3}	(Display in kilo-)
000.0 * 10^{3}	(Display in kilo-)
0000 * 10^{3}	(Display in kilo-)

The digit which can be changed in the display is marked in that it flashes. This marking is shifted further with the → key. This position moves from left to right.
After reaching the right stop, it once again skips to the left stop.

Increments the flashing digit by 1.

Decrements the flashing digit by 1.
Note: In order to obtain negative numbers, decrease the first digit of a number until a minus sign and the desired number is displayed.

The new value is adapted when this key is pressed. The device operates with the new value only from the moment the key is pressed.
During selection or parameterizing, the device continuous to measure with the available data.

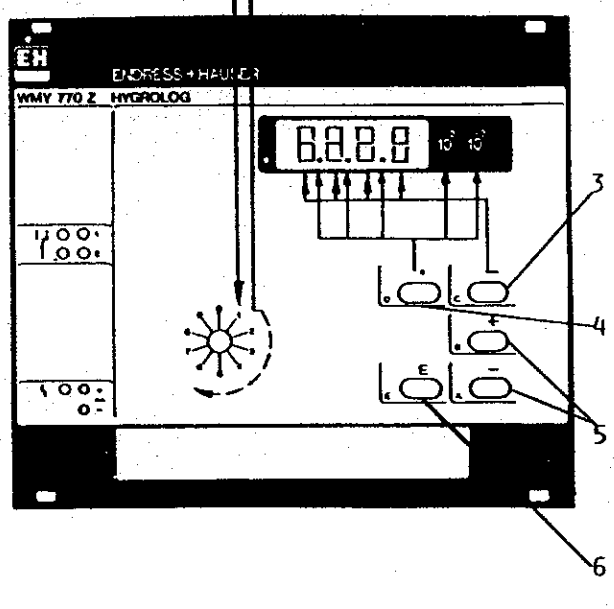


Fig.4

3.0 Function Levels

The HYGROLOG WMY 770 Z features a total of 10 function levels. Each function level can be selected by means of a code number:

Code — Function Level

0770 Basic level
Display of main operating parameters, such as: measured variable, temperature, pressure, etc., as indicated by the symbols on the front panel of the WMY 770 Z.
Input of those operating parameters that cannot be continuously measured or calculated.

1770 Main measurement variable:
This determines the main display variable, its measuring range and the signal output range (0/4 ... 20 mA)

2770 Alarm relay:
The alarm relais are assigned to a variable corresponding to the selector. In addition, the corresponding switching hysteresis as well as the max/min safety factor can be selected here (the alarm relais can be assigned to both the main measurement variable and also for auxiliary display variables).

3770 Basic calibration:
The data for the sensor in use (frequency/moisture content/temperature) have to be stored before the moisture variables provided by the display selector can be calculated.
In cases where an entire measuring line is supplied (WMY 770 Z with sensor DY 70, 73 Z, 76 NZ), all of the basic calibration data for the sensor are already entered at the factory.
If a unit is uncalibrated, 4 dashes (----) appear in the display.

Auxiliary point calibration:
If a basic calibration has already been carried out can be used to perform a one-point or two-point recalibration.

2682 Temperature compensation (selector):
Like in the "simulation/special function" level, the operating mode of temperature measurement and temperature compensation can be established here.

2687 Temperature compensation I:
Input of the individual compensation factors for an ambient temperature of -20°C.

2688 Temperature compensation II:
Input of the individual compensation factors for an ambient temperature of +60°C.

4770 Liquid calibration:
This is where data for specific substances are stored, such as saturation factors (C_s) and related temperatures (T), or merely K factors (Henry's constant). This data can be selected directly for over 80 liquids.

5770 Autocal, high pressure calibration
The function level is used to activate and deactivate the automatic zero point calibration. Automatic zero point calibration is set to active at the works (switched on).
Saturation factors for measurement at high pressures in gases can furthermore be entered here. Without entering a factor the general gas law applies with regard to calculating the moisture variables.

6670 Simulation:
For test and service purposes, for monitoring externally connected devices (controllers, printers display instruments etc.).
- Simulation and calculation of various moisture variables
- Switching to special operating modes:
- temperature measurement and temperature compensation

7770 Pressure measurement (Option):
Scaling the signals of an active or passive pressure sensor for moisture measurement in gases at variable pressures.

The function levels can be addressed in any arbitrary sequence. Normally, each individual function is programmed at the works and specified when ordering.
Standard programming has been used as the basis where no particular specifications are made (see "Standard" in the programming tables for HYGROLOG WMY 770 Z).
The code is your key which opens the door to the various function levels. Apart from the first digit, the code numbers of the HYGROLOG WMY 770 Z are identical to the device designation, thereby making them particularly easy to remember.

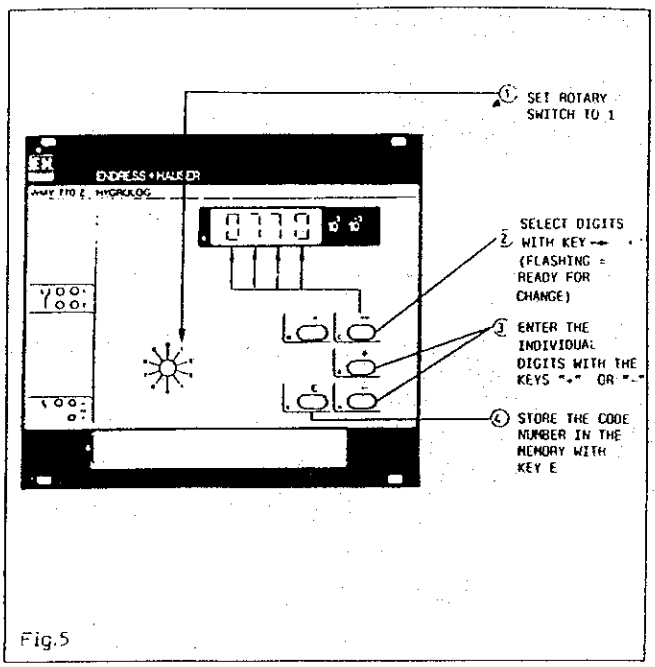


Fig.5

3.1 The Basic Function Level, Code 0770

HYGROLOG WMY 770 Z and ALPHASENSOR DY 73 Z is a universal measuring instrument which can be easily adapted at any time to new measuring tasks.
In the basic function level, you can read off the important operating parameters for HYGROLOG WMY 770 Z.
With the code 0770 you can also set fixed values.
This particularly aplies to temperature and absolute pressure when, for instance, a corresponding measured value is not available.

The most important modes of operation are:

Display of main measured value

Display of measurement variable selected
Changing the measurement variable:
Refer to page 10: function level main measurement variable, measuring signal outputs

Display of auxiliary variables corresponding to the display selector n (see page 5)

Display of process temperature in °C
Entry of a fixed temperature value in °C, however only when no temperature measurement is available.
Refer to page 39: function level simulation.

Display of operating pressure in bar (absolute)
Entry of a fixed pressure value in bar, however only when no pressure measurement is available.
Refer to page 41: function level pressure measurement

K Display of Henry's constant
Entry of a Henry's constant, however only when operation is not carried out in conjunction with a C_s value table. If you operate the HYGROLOG WMY 770 Z with one of the 82 possible C_s value tables or with a manual table, the Henry's constant is displayed which results from the process temperature and with which the device is currently operating.
Refer to page 30: function level fluid calibration.

τ Display of a time constant in seconds for integration (damping) of measuring signal outputs.

Autocal Display of a new zero reference point frequency when the device has implemented automatic zero point correction. If automatic zero point correction has not been carried out, 4 horizontal dashes appear in the display. Final acceptance of an automatic zero point calibration.
Refer to page 36: function level Autocal

Display of an error code of highest priority in the case of malfunctions. When there is no malfunction, E— appears in the display.
See page 60: error code table.

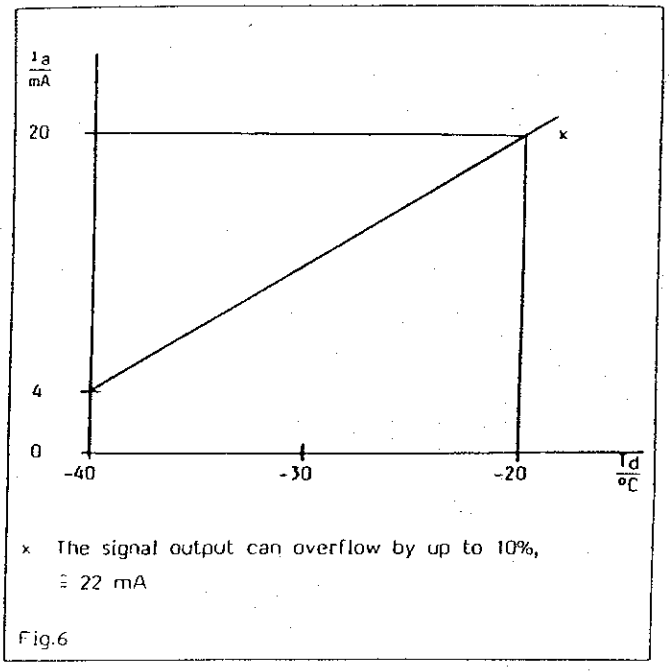
HYGROLOG WMY 770 Z

Function Level:
0770, Basic Level (see Symbols on Front Panel)

Switch-position	Max. value / Standard / Min. value	Individual function description
0		Display main measured value (main measured value routed to signal outputs)
1	9999 0 0	Input: 0770, Code basic level (only necessary for input in switch positions 4, 5, 6 and 7)
2	10 7 1	Display selector n: **1** f: ppm, cm^3/m^3 **3** f: g/m^3 **5** e: mbar **7** T_d: °C **9** $T-T_d$: °C **2** C: ppm, mg/kg **4** x: g/kg **6** U: % **8** T: °C **10** f: Hz
3		Display: Measured value from selector n
4	180,0 20,0 −70,0	Display: Process temperature in °C Input: Process temperature in °C, however only if no temperature measurement is available (see 6770 simulation)
5	 1,0 	Display: Process pressure in bar Input: Process pressure in bar, however only if no pressure measurement is connected (see 7770 pressure measurement)
6	100,0 1,0 1,0	Display: K factor Input: K factor, (e.g. Henry's constant), however only if no C_s value table is stored (see 4770 liquid calibration)
7	300 1 0	Display: Time constant T in s Input: Time constant T in s (0: without exponential averaging)
8		Display: New zero point frequency of moisture sensor (however only when an automatic zero point calibration has taken place).
9	E699 E... E...	Display: Error code in case of faults (fault with highest priority)

3.2 Function Level Main Measurement Variable - Measuring Signal Output Code 1770

With the selector in the function level, main measurement variable, select the measurement variable which is optimally adapted to the measuring task.
Then determine the required measuring range and assign it proportionally or also inversely proportionally to the measuring signal outputs. (For voltage output refer to page 12).
The measuring signal outputs are most commonly used with the signal range from 0/4 ... 20 mA or 0/2 ... 10 V.
A particular feature is that 2 measuring ranges can be freely defined for the selected main measurement variable. The two measuring ranges must have the same starting point. Refer to system specification for specification for possible maximum or minimum measuring ranges.
"Min", "max" or "hold" may be selected for the case of fault.



x The signal output can overflow by up to 10%, ≙ 22 mA

Fig.6

Example 1:

Main measurement variable:	Dewpoint temperature in °C
One measuring range	-40 ... 20°C
Current output	4 ... 20 mA max. in case of fault

Procedure: Measuring signal outputs

1. Set multi-function switch to position ⊷

2. Enter 1770, store with key "E".
   The function level: main measurement variable, measuring range, measuring signal output, is activated and can be programmed.

3. Switch position 2:
   Enter 7, store with key "E", the main measurement variable corresponds to the selector: dewpoint temperature in °C.

4. Switch position 3:
   Enter -40, store with key "E".
   The initial value for the measuring range 1 is determined at -40°C dewpoint temperature.

5. Switch position 4:
   Enter -20, store with key "E": The final value of the measuring range is determined at -20°C dewpoint temperature.

6. Switch position 6:
   Enter 4, store with key "E"; 4 mA is the initial value of the measuring range and corresponds to -40°C dewpoint temperature.

7. Switch position 7:
   Enter 20, store with key "E". 20 mA is the upper end of the measuring range and corresponds to -20°C dewpoint temperature.

8. Switch position 8:
   1st digit from left: set 0 (= one measuring range) and 2 nd digit from left: set H (= high status in case of fault) and store with key "E".
   Set multi-function switch to position 0.

For HYGROLOG WMY 770 Z, the dewpoint temperature in °C is now selected as the main measurement variable as well as the measuring range -40 ... -20°C and current output range 4 ... 20 mA. In case of fault, the current and voltage outputs reverts to > 100% (22 mA, 11 V).

Example 2:

Main measurement variables:	Dewpoint temperature in °C
Measuring range 1	-40 ... -20°C
Measuring range 2	-40 ... +20°C
Current output	4 ... 20 mA, hold in case of fault

Procedure: Measuring signal outputs

1. Set multi-function switch to position ▬O .

2. Enter 1770, store with "E".

3. Switch position 2:
   Enter 7, store with key "E", the main measurement variable is set corresponding to the selector dewpoint temperature in °C.

4. Switch position 3:
   Enter -40, store with key "E". The initial value of the measuring range is defined at -40°C dewpoint temperature.

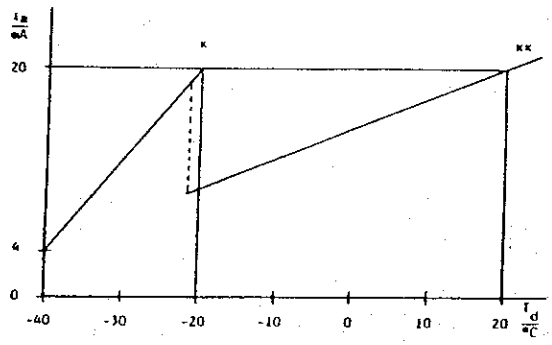
5. Switch position 4:
   Enter display -20, store with key "E". The final value of the first measuring range is defined at -20°C dewpoint temperature.

6. Switch position 5:
   Enter +20, store with key "E". +20°C dewpoint temperature corresponds to the upper limit of the second measuring range.

7. Switch position 6:
   Enter 4, store with key "E"; 4 mA is the initial value of the first measuring range (virtually also of the second range) and corresponds to -40°C dewpoint temperature

8. Switch position 7:
   Enter 20, store with key "E". 20 mA coresponds to -20°C dewpoint temperature, the limit of the first measuring range and +20°C dewpoint temperature, the limit of the second range.

9. Switch position 8:
   1st digit from right: set 1 (≙ 2 measuring ranges)
   2nd digit from right: set - (≙ hold) and store with key "E".
   Caution: In the case of two measuring ranges, alarm relay 2 identifies the measuring range and is therefore no longer available for limit value signalling.



x On reaching the limit value from below, the measuring signal output switches over to the second range exactly at the limit value (here -20°C dewpoint temperature) and assumes a certain current value depending on range 1 and range 2.
Switch-back from range 2 to range 1 takes place with a hysteresis of 10% of the first range (here: measuring range 1 ≙ 20 K, 10% of which ≙ 2 K switch-back at -22°C).
Alarm relay 2 switches exactly at these points, thereby providing distinct measuring range identification.

xx The signal output can overflow up to 10%, ≙ of 22 mA

Fig.7

Set multi-function switch in position "0". The main measurement variable, the two measuring ranges and the signal range are now defined for HYGROLOG WMY 770 Z.

Significance:	1st digit from right: (measuring ranges)	0 ≙ one measuring range 1 ≙ two measuring ranges
	2nd digit from right: (behaviour of signal outputs in case of fault)	H ≙ 22 mA, 11 V (high) L ≙ 0 mA, 0 V (low) - ≙ last measured value (hold)

Measuring range 1 is normally defined as the operation measuring range since all standard measured values occur within this range. Measuring range 2 can be defined as the error range since no measured values normally occur within this range apart from, for example, in the case of fault or during the start-up phase of a process.
This facility is of particular advantage when both measuring ranges are recorded with a 2-channel line recorder for instance.
The wiring between the HYGROLOG WMY 770 Z and the corresponding recorder should then be arranged as follows:

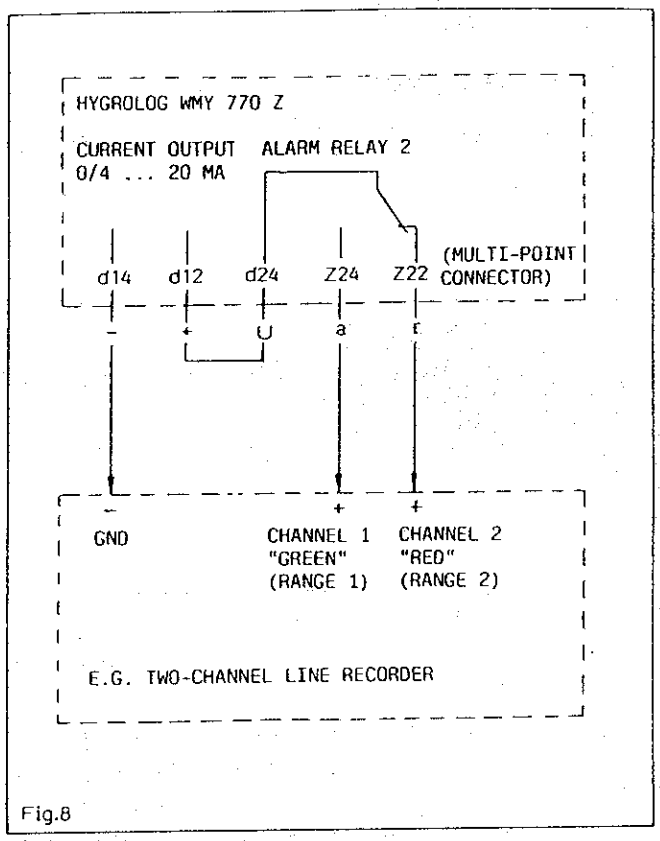


Fig.8

Voltage output

In addition to the current output, each HYGROLOG WMY 770 Z additionally features a voltage output.
The voltage output can assume 0V and max. 10 V, or after 10% overflow max. 11 V.
A voltage of 0 - 10 V therefore corresponds to the relevant selected measuring range.
Please note that the voltage output is proportional to the current output. For example, if you have assigned a current signal range of 4-20 mA to a defined measuring range, analogously, the corresponding voltage range is 2-10 V.
If you have defined 2 measuring ranges for the current output, then this also applies to the voltage output.
Alarm relays 2 can also be used for measuring range identification with respect to the voltage output.

Setting the voltage output:

The voltage output can be set only indirectly via the current output. For this purpose, you must simply convert the voltage signal range to the proportional current signal range as already described for the current output.

Scaling

Scaling of a non-calibrated plotter or indicating instrument can be implemented as follows via the measuring signal outputs (current and voltage) on the HYGROLOG WMY 770 Z:

Zero Point:
A current value between 0-8 mA ≙ 0-4 V can be defined for the zero point.

100% Point:
The 100% point may be assigned to a value within the range of 12 ... 22 mA ≙ 6 ... 11 V.
Also in this case proceed as described at the beginning of this chapter.

HYGROLOG WMY 770 Z

Function Level:
1770, Measuring Signal Outputs (Main Measurement Variable, Measuring Ranges)

Switch-position	Max. value / Standard / Min. value	Individual function description
0		Display main measured value (main measured value routed to signal outputs)
1	9999 / 0 / 0	Input: 1770, code for the function level: measurement variable, measuring ranges... (for scanning or input)
2	10 / 7 / 0	Display selector n: (0: inactive) 1 f: ppm, cm^3/m^3 3 f: g/m^3 5 e: mbar 7 T_d: °C 9 $T-T_d$: °C 2 C: ppm, mg/kg 4 x: g/kg 6 U: % 8 T: °C 10 f: Hz
3	Dynamic / −80°C / Dynamic	Start of measuring range (absolute value from n) (common start value for two measuring ranges)
4	Dynamic / +20°C / Dynamic	Measuring range end value of measuring range 1 (absolute value from n) simultaneous automatic change-over point for two measuring ranges
5	Dynamic / +60°C / Dynamic	Measuring range end value of measuring range 2 (absolute value from n) this switch position can be skipped if only one measuring range is required.
6	8,00 / 0,00 / 0,00	Electrical start value of current output for selected measuring range (possible adjustment range: 0...8 mA)
7	21,00 / 20,00 / 12,00	Electrical end value of current output for selected measuring range(s) (possible adjustment range: 12...21 mA)
8	H1 / H0 / L0	Mode for signal outputs: **1. digit f. r.: 0**: one measuring range, **1**: two measuring ranges **2. digit f. r.: H**: larger 100% display in case of fault, **L**: 0% display in case of fault, **−**: last plausible measured value as fixed value
9	E699 / E... / E...	Display: Error code in case of fault (fault with highest priority)

3.3 Function Level Alarm Relay, Code 2770

Every HYGROLOG WMY 770 Z features 2 independent alarm relays. Each relay has a potential-free change-over contact which is directed towards the outside.
You can arbitrarily define the relay assignment corresponding to the variables specified in the selector.
The switching point, however, must be within the functional range of the HYGROLOG WMY 770 Z. For moisture content this corresponds to a range from -120°C dewpoint temperature to +60°C dewpoint temperature and for temperature from -60°C to +90°C. The selected measuring range for the main measurement variable is of no significance in this case. You can of course define a hysteresis in absolute values (depending on the selected variable) for each relay. In this way, in addition to the measuring signal outputs, you also have available with each HYGROLOG WMY 770 Z two fully independent 2-point controllers. A further advantage facility is that the max./min. safety mode can be freely selected. The visual display has the following significance:

H: Max. safety mode:
The relay deenergizes if the limit value is exceeded
L: Min. safety mode:
The relay deenergizes if the value drops below the limit value.

Example:	Realy 1	Relay 2
Switching point:	T_d = 20°C	T = 40°C
Hysteresis:	Δ s = 5 K	Δ s = 3 K
Safety mode:	max.	min.

Procedure: Alarm Relays

1. Set multi-function switch to position ⊶O
2. Enter 2770, code for alarm relay and store with key "E".
3. Switch position 2: (applies to relay 1)
   With keys "+" and "-" set display to 7 = dewpoint temperature, store with key "E".
4. Switch position 3:
   With keys "+" and "-" set display to +20, store with key "E".
5. Switch position 4:
   Using the control keys, enter the numerical value for the required hysteresis (5 K) and store with key "E".
6. Switch position 5: (applies to relay 2)
   With keys "+" and "-" set display to 8 = temperature, store with key "E".
7. Switch position 6:
   Enter numerical value for required change-over point of relay 2 (+40°C) and store with key "E".
8. Switch position 7:
   Using the control keys, enter the numerical value for the required hysteresis (3 K) and store with key "E".
9. Switch position 8:
   With keys "+" and "-", set first digit from right to "H" and store with key "E".

   Relay 1, max. safety mode

   With keys ⇦ select second digit from right and set to "L" with the keys "+" and "-" and store with key "E".

   Relay 2, min. safety mode

   Both relays are now set practically as a 2-point controller to different variables with varying switching hysteresis and in a different safety mode.

   For details, refer to "alarm relay" (from page 15).

Attention:

If you have determined two measuring ranges, alarm relay 2 indicates the measuring range and can no longer be programmed separately. (Page 12)

HYGROLOG WMY 770 Z

Function level:
2770, Alarm Relay

Switch-position	Max. value / Standard / Min. value	Individual function description
0		Display main measured value (main measured value routed to signal outputs)
1	9999 / 0 / 0	Input: 2770, Code for function level Alarm relay... (for enquiry or input)
2	10 / 7 / 0	Alarmselector n for relay 1: (0: inactive) 1 f: ppm, cm^3/m^3 3 f: g/m^3 5 e: mbar 7 T_d: °C 9 T-T_d: °C 2 C: ppm, mg/kg 4 x: g/kg 6 U: % 8 T: °C 10 f: Hz
3	Dynamic / T_d −80°C / Dynamic	Switching point for relay 1 (absolute value from n for relay 1)
4	Dynamic / 1 / Dynamic	Switching hysteresis Δs for relay 1 (absolute value from n for relay 1)
5	10 / 7 / 0	Alarmselector n for relay 2: (0: inactive) 1 f: ppm, cm^3/m^3 3 f: g/m^3 5 e: mbar 7 T_d: °C 9 T-T_d: °C 2 C: ppm, mg/kg 4 x: g/kg 6 U: % 8 T: °C 10 f: Hz
6	Dynamic / T_d +20°C / Dynamic	Switching point for relay 2 (absolute value from n for relay 2) Caution: In the case of two measuring ranges, relay 2 serves the purpose of measuring range identification (see 1770)
7	Dynamic / 1 / Dynamic	Switching hysteresis Δs for relay 2 (absolute value from n for relay 2)
8	..HH / ..HL / ..LL	Max-min-safety mode for relay 1, 2 Relay 1: first digit from right Relay 2: second digit from right H: max. safety mode L: min. safety mode
9	E699 / E... / E...	Display: Error code in the case of fault (fault with highest priority)

3.4 Function Level Basic Calibration, Code 3770

Each ALPHASENSOR DY 73 Z has its own individual characteristic curve: frequency as a function of moisture content, which must be entered in the device prior to commissioning. At the works, the characteristic curve is represented as a frequency over the dewpoint temperature (absolute moisture variable). To facilitate calibration of the HYGROLOG WMY 770 Z, it is sufficient to define a number of measuring points in the device. By means of a special interpolation algoritm these points are then used to form a characteristic curve which links the points on the shortest possible path at a minimum change in inclination. Up to 12 calibration points can be programmed with each point being identified with a number.

Important Note:

If less than 12 calibration points are available for basic calibration, then it is important to ensure that any further points which may have been entered beforehand are deleted by entering the frequency 0.0 Hz.

Auxiliary Point Calibration:

Auxiliary point calibration (see page 17) can be implemented after the HYGROLOG WMY 770 Z has been subject to the basic calibration:
The various calibration points can be entered in any sequence. The points are automatically sorted before the device itself defines the complete curve.
Points at which the frequency = 0 Hz is specified are considered as deleted and are not used to complete the calibration curve.

Calibration points are specified in the calibration tables supplied with the sensors. However, calibration points for an ALPHASENSOR DY 73 Z can be determined just as well on site in conjunction with a calibration instrument WSX ... .
The only condition is that a point comprises a value pair frequency-moisture. All the variables specified in the selector can be taken as the moisture variable. Depending on the chosen moisture variable for a point, information regarding absolute pressure or temperature can be additionally programmed.
It is not necessary to convert points which have been entered, the HYGROLOG WMY 770 Z automatically calculates the actual calibration curve when the multifunction switch is set in the basic setting "zero". Due to the curve progression of an ALPHASENSOR DY 73 Z, it is advisable to calibrate at least 6 points over the entire range. For detail description of procedure, refer to table "basic calibration". (Works specification sheet, see page 27).

Temperature compensation

When operating with temperature compensation the temperature calibration values must also be entered.
In addition to that the correction values for -20°C and +60°C are to be entered.
All required data can be seen in the data sheet for the sensor (calibration data sheet, see page 27). Further details can be seen on page 24 to 26.

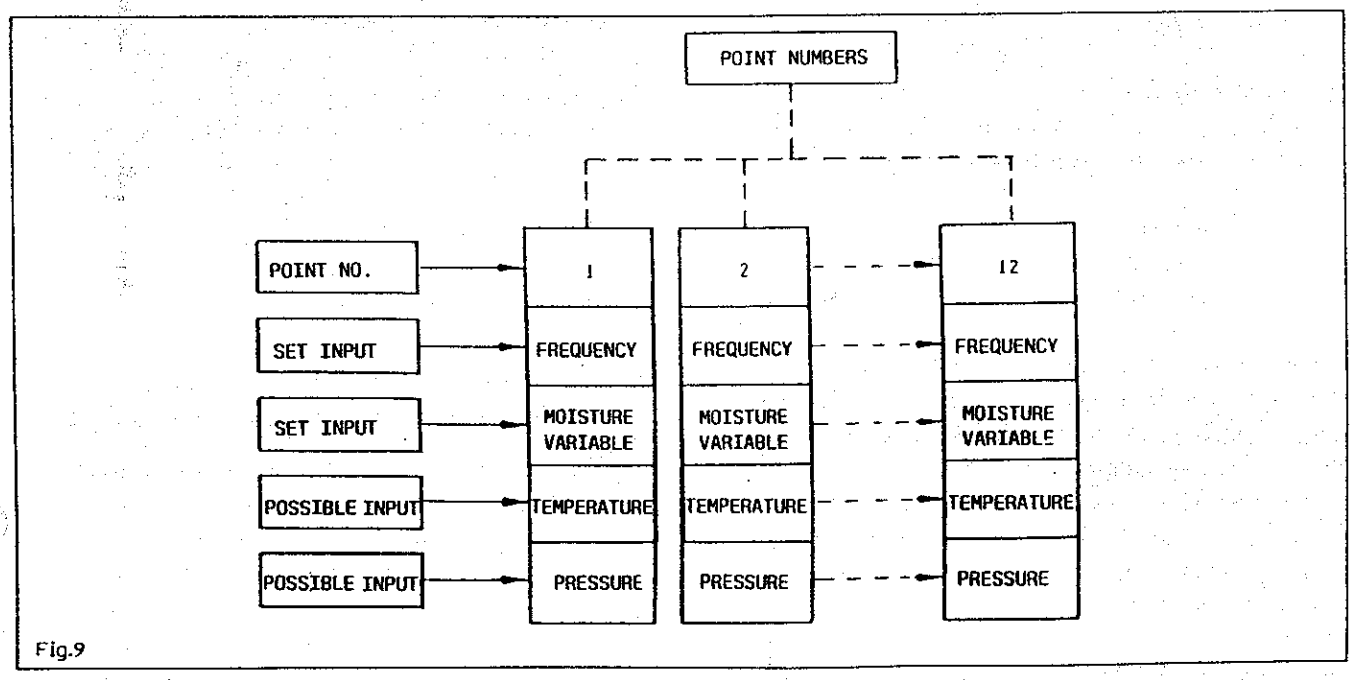


Fig.9

Procedure: Basic Calibration

1. Set multi-function switch to position ▬○
2. Enter 3770, code for function level basic calibration and store with key "E".
3. Switch position 2:
   With keys "+" and "-", set display to 7 = dewpoint temperature, store with key "E".
4. Switch position 8:
   Type of calibration 0: enter basic calibration with keys "+" and "-" and store with key "E".
5. Switch position 3:
   With keys "+" and "-", enter point number, e.g. 1 and store with key "E".
6. Switch position 4:
   Enter the numerical value for the frequency (e.g. 173) and store with key "E".
7. Switch position 5:
   Enter numerical value for dewpoint temperature, e.g. -60 and store with key "E".
8. Switch position 6:
   Enter numerical value for standard temperature T = 20°C and store with key "E".
9. Switch position 7:
   Enter numerical value for nominal pressure p = 1 bar and store with key "E".
10. Switch position 3:
    Press key "+" (display = 2, ≙ second point) store with key "E".
11. Switch position 4:
    Using the "+" and "-" keys, enter the numerical value for frequency (e.g. 166.5) and store with key "E".
12. Switch position 5:
    Enter numerical value for dewpoint temperature, e.g. -50 and store with key "E".

Having stored the corresponding specifications regarding temperature and pressure for the second point, begin once again at switch position 3 to switch position 7 until you have entered all available points. Any other points which may still be stored must be deleted by entering the frequency "0". If you then set the multi-function switch to position "0", the HYGROLOG WMY 770 Z automatically calculates the curve progression in the display range from -120 to +60°C T_d.

Auxiliary Point Calibration, Code No. 3770

Auxiliary point calibration is a particularly practical facility which can be used to examin or correct a sensor characteristic curve which has already been stored. One or two auxiliary points can be used for correction purposes if, for example, during inspection of the measuring instrument HYGROLOG WMY 770 Z, with a calibration instrument WSX 160 (moisture generator, reference range approx. -60...0°C T_d); or a reference instrument HYGROLOG WMT 261 (automatic psychrometer), a deviation is found in the display.
All that is necessary to implement auxiliary point calibration is that the HYGROLOG WMY 770 Z is firstly subject to basic calibration and operation is still carried out with the corresponding sensor. With an auxiliary point calibration, the absolute position of a stored sensor characteristic curve is changed, however not its specific shape.
Practical applications have shown that the shape of an ALPHASENSOR does not change even under severe conditions provided the measuring element is not chemically or mechanically damaged. In conjunction with automatic zero point calibration and an auxiliary point calibration in the vicinity of the upper limit value of the entire measuring range, the requirements regarding recalibration are more or less reduced to an "offset" and an "amplification setting". Please note in this respect that the entire measuring range of the sensor is normally proportional to -100 ... +20°C dewpoint temperature and has nothing to do with part measuring range which you may have defined. (Total display range: -120 ... +60°C T_d).
An auxiliary point always consists of a value pair, comprising the frequency of the ALPHASENSOR and the moisture value of the reference instrument.
It is not necessary for the moisture value or the moisture variable to be identical to the main measurement variable of the HYGROLOG WMY 770 Z. Conversion takes place automatically.

Limit Conditions

To enable the HYGROLOG WMY 770 Z to decide whether the calibration curve is to be changed "down" or "up" with an entered auxiliary point, the following applies:

"Lower point": Measuring frequency > 100 Hz ≙ point No.1*
"Upper point": Measuring frequency < 20 Hz ≙ point No.2*

Minimum frequency spacing: 10 Hz
Minimum moisture intervall: corresponding to 20 K T_d

* Please note the following: For the sake of simplicity during auxiliary point calibration, you should always designate the "lower point" with 1 and the "upper point" with 2. After a basic calibration, the auxiliary point 1 is initially assigned to the "autocal" point and auxiliary point 2 to +20°C T_d.

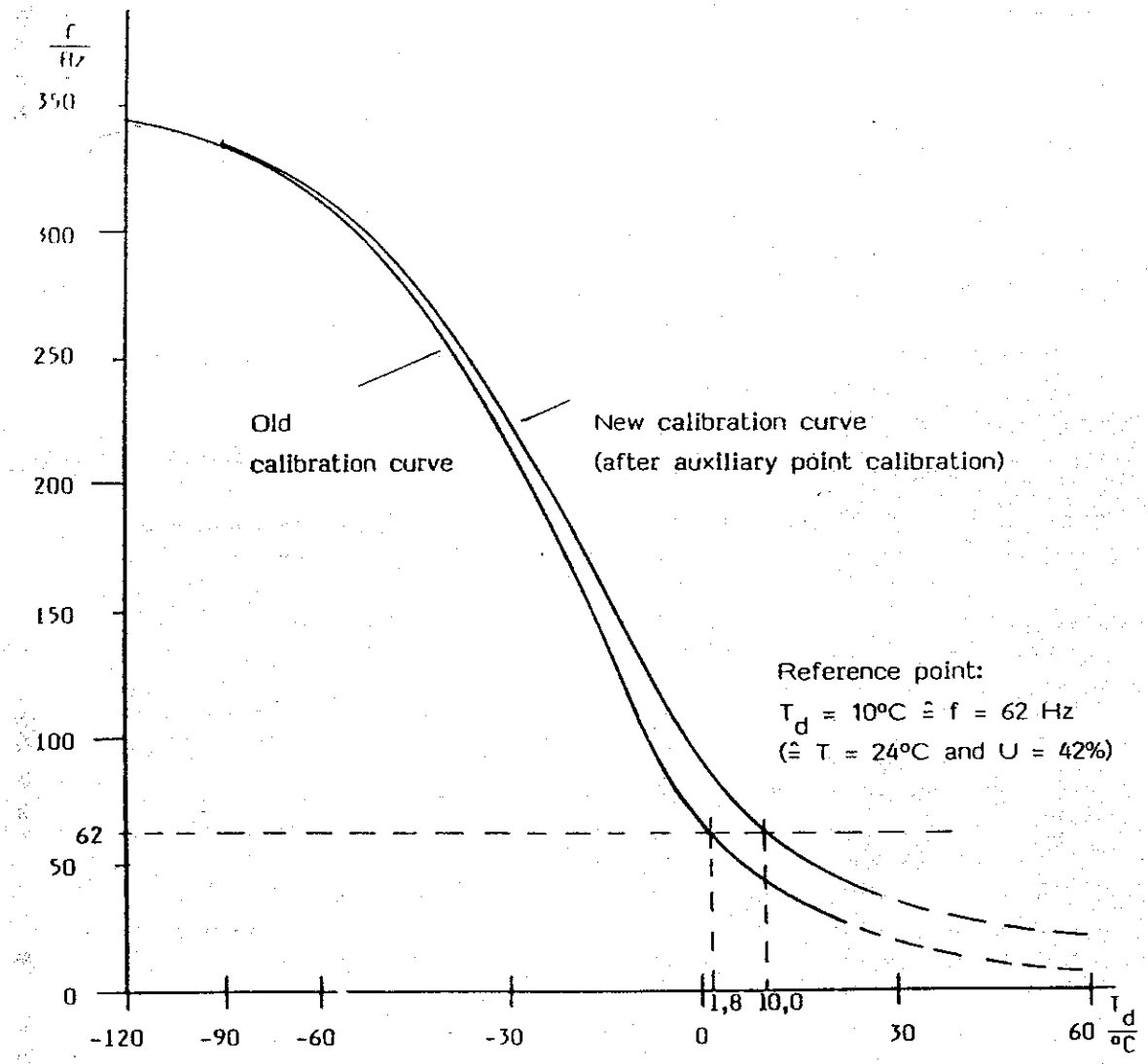
Example: Auxiliary Point Calibration (upper point)

HYGROLOG WMY 770 Z Display: T_d = 1.8°C ≙ f = 62 Hz

Reference point:

HYGROLOG WMT 261 Display: T = 24°C, U = 42%

Application: For large measuring ranges, or when high moisture content values are predominantly measured.



After entering the reference point with T = 24°C and U = 42% at f = 62 Hz, the HYGROLOG WMY 770 Z operates with the new calibration curve (the customer-specific measuring range remains unchanged, e.g. -50 ... 0°C T_d). The new curve rotates about the electric zero point which, in the case of HYGROLOG WMY 770 Z, is always identical to the "autocal" point. The "autocal" point is initially set at the works to -90°C T_d.

Fig.10

Procedure: Auxiliary Point Calibration (upper point)

1. Set multi-function switch to position ⊸○ .

2. Enter 3370, code for function level basic calibration and store with key "E".

3. Switch position 2:
With keys "+" and "-" set display to 6 = relative humidity and store with key "E".

4. Switch position 8:
Type of calibration : set 1 = auxiliary point calibration with keys "+" and "-" and store with key "E".

5. Switch position 3:
With keys "+" and "-" enter 2, point number for the upper point and store with key "E".

6. Switch position 4:
Enter the numerical value for frequency, e.g. 62 Hz, and store with key "E".

7. Switch position 5:
Enter the numerical value for the relative humidity, e.g. 42% and store with key "E"

8. Switch position 6:
Enter the numerical value for the temperature, e.g. 24°C and store with key "E".

9. Switch position 7:
Enter numercal value for pressure (here nominal pressure p = 1 bar absolute) and store with key "E".

If you now set the multi-function switch to position "0", the HYGROLOG WMY 770 Z automatically calculates a new calibration curve. The progression of the new calibration curve begins at the electrical zero point (point of rotation at -90°C T_d) and passes through the reference point entered for relative humidity and temperature.
The specified example of an auxiliary point calibration corresponds to a change in amplification and is preferably used for inspection or correction in the case of extremely large measuring ranges or when measuring high moisture contents.

Procedure: Automatic Zero Point Calibration and Auxiliary Point Calibration (upper point)

Please note in the case of this type of calibration that the automatic zero point calibration must be active (see **5770, switch position 8**).
If automatic zero point calibration is already activated, you can skip the points 1 - 3 listed below.

1. Set multi-function switch to position ⊸○ .

2. Enter **5770**, code for function level "autocal" (and high pressure calibration) and store with key "E".

3. Switch position 8:
Operating mode 1: With the keys "+" and "-" enter "autocal" activated and store with key "E".

4. Switch position 0:
An automatic zero point calibration can now be supplemented by means of zero gas. If automatic zero point calibration does not take place, it can be assumed that the residual moisture content of the zero gas was higher than the calibrated zero point and is therefore correct.

5. Set multi-function switch to position ⊸○ .

6. Enter **3770**, code for function level basic calibration and store with key "E".

7. Switch position 2:
With keys "+" and "-" set display to the corresponding calibration selector and store with "E".

8. Switch position 8:
Operating mode: 1 = enter auxiliary point calibration with keys "+" and "-" and store with key "E".

9. Switch position 3:
With keys "+" and "-" enter point number for upper auxiliary point and store with key "E".

10. Switch position 4:
Using the control keys, enter the numerical value for frequency of the sensor and store with key "E".

11. Switch position 5:
Enter numerical value of calibration selector and store with key "E" (moisture value).

12. Switch position 6:
    Enter numerical value for temperature during auxiliary point calibration and store with key "E".

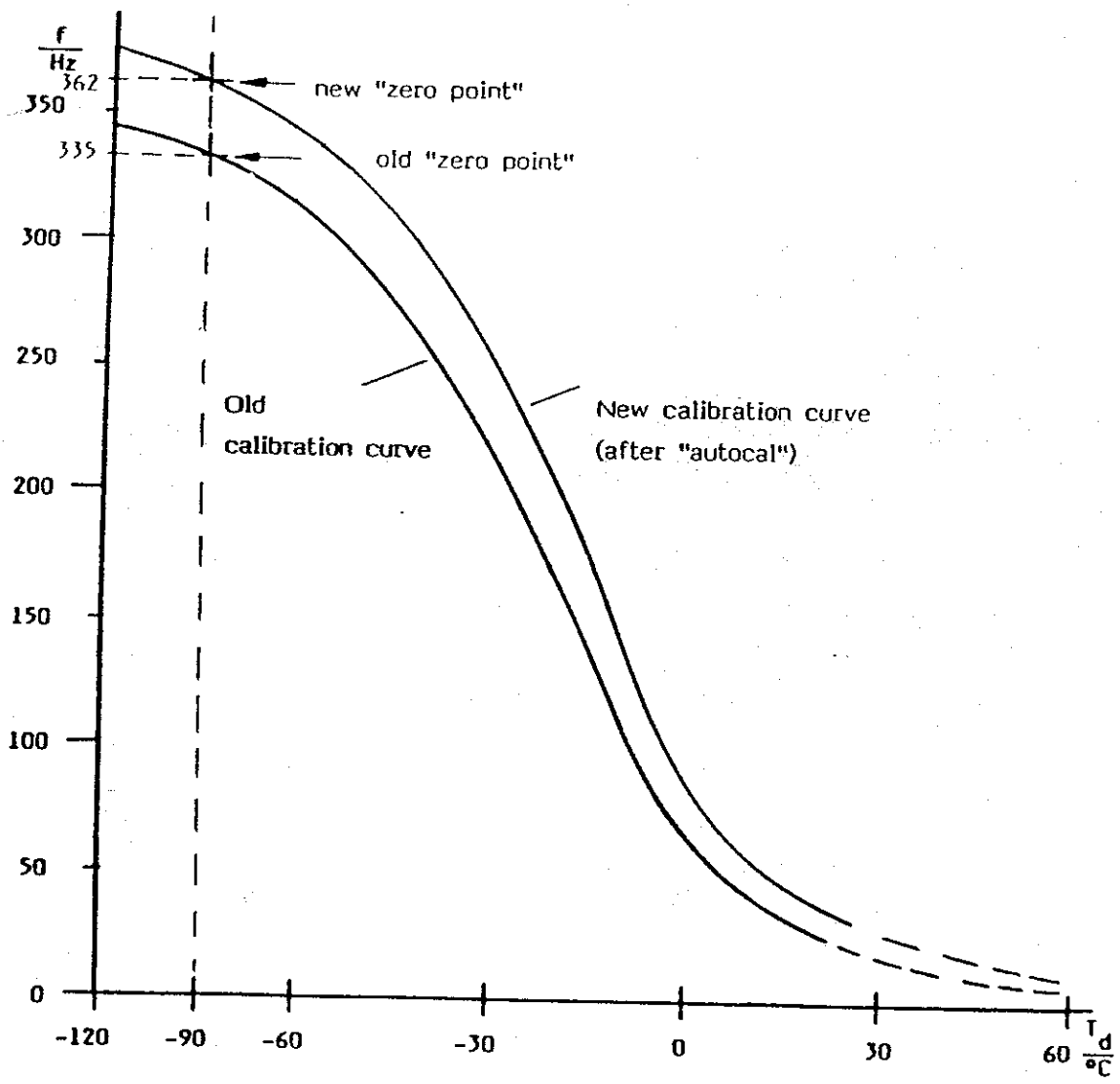
13. Switch position 7:
    Enter numerical value for absolute pressure during auxiliary calibration and store with key "E".

14. Switch position 0:
    Auxiliary point calibration is completed.

Example: Automatic Zero Point Calibration (Autocal)
HYGROLOG WMY 770 Z

Display before "Autocal": 335 Hz ≙ electric zero
Display after "Autocal": 362 Hz ≙ electric zero

Application: For small and extremely small measuring ranges or wherever low moisture contents are predominantly measured.

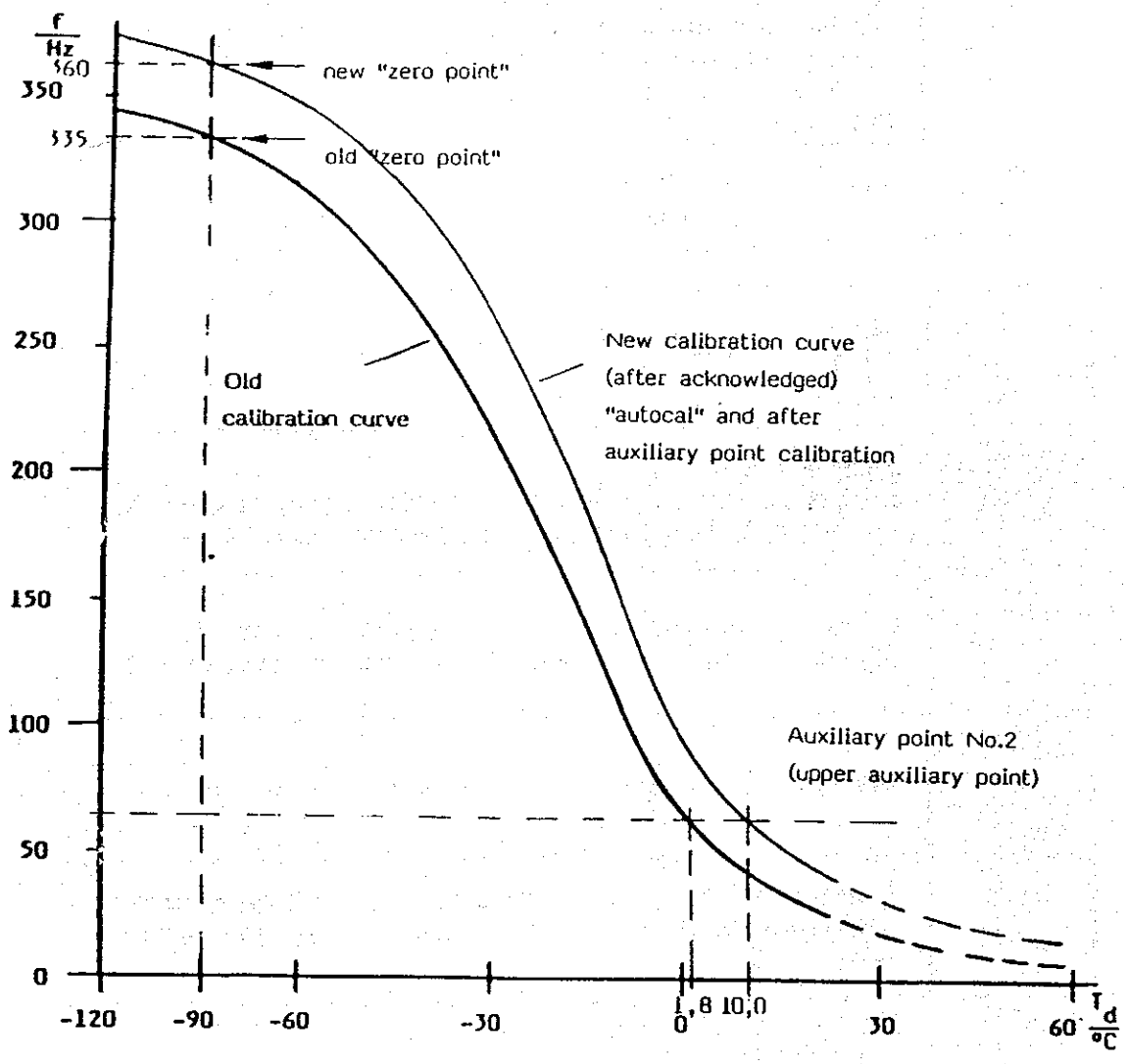


The electric zero point is initially defined corresponding to -90°C T_d (approx 0.1 ppm at 1 bar) for HYGROLOG WMY 770 Z and ALPHASENSOR DY 73 Z. An "autocal" is initiated whenever a sensor frequency is applied to the HYGROLOG WMY 770 Z which is higher than the "old zero point frequency". This can be the case either during normal operation or also after being subjected to "zero gas". Autocal corresponds to a change in the basic capacitance of the sensor and causes a continuous curve shift (also see 5770)

Fig.11

Example: Automatic zero point calibration (autocal) and auxiliary point calibration (upper point, No.2)

Application: This is the most practical possibility for checking or correcting a sensor characteristic curve while measuring **small, medium** and **high** moisture contents.
In place of "autocal" you can also calibrate a "lower auxiliary point", No.1)



After the HYGROLOG WMY 770 Z has implemented an automatic zero point calibration, you must firstly acknowledge this (see **770** autocal) before you initiate an auxiliary point calibration. In the case of an upper auxiliary point (No.2), if necessary, the new calibration curve rotates about the **"autocal"** point. **Caution:** The electric zero point results from calibrating a lower auxiliary point (No.1) and an upper auxiliary point (No.2) (refer to Limit Conditions Page 17).

Fig.12

HYGROLOG WMY 770 Z

Function Level:
3770, Basic Calibration

Switch-position	Max. value / Standard / Min. value	Individual function description
0		Display main measured value (after a basic calibration, the curve progression of the centre is firstly calculated based on the entered points before the main measured value, provided this value has already been defined, is displayed)
1	9999 / 0 / 0	Input: 3770, Code for function level: Basic calibration → switch position 8 = 0 Auxiliary point calibration → switch position 8 = 1
2	7 / 7 / 1	Calibration selector n: **1** f: ppm, cm^3/m^3 **3** f: g/m^3 **5** e: mbar **7** T_d: °C **9** $T-T_d$: °C **2** C: ppm, mg/kg **4** x: g/kg **6** U: % **8** T: °C **10** f: Hz
3	12 (2) / 1 (1) / 1 (1)	Point numbers For basic calibration, up to max. 12 points can be entered and up to 2 (in brackets) points for auxiliary point calibration.
4	999,9 / 0,0 / 0,0	Frequency value for basic or auxiliary point calibration in Hz (a point is considered as deleted at a frequency value of 0.0)
5	Dynamic / 0,0 / Dynamic	Moisture value for basic or auxiliary point calibration from n.
6	180,0 / 20,0 / −70,0	Temperature value for basic or auxiliary point calibration from n (a temperature of 20°C is automatically set if no temperature value is entered)
7	500,0 / 1,0 / 0,0	Pressure value (absolute) for basic or auxiliary point calibration from n (a pressure of 1 bar is set automatically if no pressure value is entered)
8	1 / 0 / 0	Selector for calibration mode 0: Basic calibration 1: Auxiliary point calibration
9	E699 / E... / E...	Display: Error code in the case of fault (fault with highest priority)

3.5 Function levels for temperature compensation Code No. 2687 and 2688

Automatic temperature compensation is carried out with the data stored in levels 2687 and 2688. The temperature measurement with the Pt 100 ensures that sensors DY 70, 73 Z, 76 NZ always have the actual process temperature at their disposal. The data from function levels 2687 and 2688 together with the actual process temperature guarantees precise calculation of the selected moisture parameters in the entire temperature range thereby eliminating the physical influence of temperature.
It is for that reason not necessary to control or heat the measuring element continually, this retains the full in-line application in Ex-Zone 0.

One differentiates between 2 types of temperature compensation:

a) STANDARD COMPENSATION
b) INDIVIDUAL COMPENSATION

In level 2687 the selection is made for temperature compensation with standard values or with individual sensor data.

The STANDARD COMPENSATION allows for the selection of 3 different fixed values.
For every set of fixed values, the fixed temperature compensation parameter in the WMY 770 Z are stored.
These parameters are used for the exact calculation of the moisture value in changing temperatures.

Entries in function level 2687 (switch position 2):

"1" = fixed value set no. 1
"2" = fixed value set no. 2 } STANDARD COMPENSATION
"3" = fixed value set no. 3

With the selection of 1 ... 3 the different fixed values for the standard compensation are activated.
The fixed value sets are selected according to sensor type and sensor characteristics, according to the listing on the calibration data sheet for the sensor (see page 27).
For the INDIVIDUAL COMPENSATION, sensor specific data is entered. The specifications of the individual compensation are determinated by calibrating the sensor at different temperatures.
The individual compensation is also selected in function level 2687 (switch position 2) with entry "4". However, the individual factors must be entered manually.

6 values (factors in level 2687 and level 2688) are memorized (see calibration data sheet, e.g. page 27).

These values are based on a temperature of -20°C in level 2687 and +60°C in level 2688 and represent the basis to calculate the temperature compensation within the specific temperature range of the sensor.

Procedure to adjust the temperature compensation

STANDARD COMPENSATION

1) Activation of the temperature compensation

Switch position	Entry	Display
	(Confirm every input with "E" key)	
	Code: Function level simulation 2686 (or 6770)	2686
	0 = with temperature measurement and temperature compensation	0

2) Adjustment of the standard compensation

Switch position	Entry	Display
	Confirm every input with "E" key)	
	Code: Function level "2687" temperature compensation	2687
	Enter of standard compensation no. 1 ... 3 (See specification sheet) e.g. "1"	1
	End	

INDIVIDUAL COMPENSATION

1) Temperature compensation activation

Switch position	Entry (Confirm every input with "E" key)	Display
	Code: Function level simulation 2686 (or 6770)	2686
	0 = with temperature measurement and temperature compensation	0

2) Entry or activation of the compensation factor

Switch position	Entry (Confirm every input with "E" key)	Display
	Code: 2687	2687
	4 = individual compensation	4
	Factor for -75°C dewpoint temperature (factory setting 1.075) e.g. 1.161 (see data sheet)	1.161
	Factor for -20°C dewpoint temperature (factory setting 1.075) e.g. 1.083	1.083
	Factor for -20°C dewpoint temperature (factory setting 1.100) e.g. 1.139	1.139
	Factor for 0°C dewpoint temperature (factory setting 1.150) e.g. 1.167	1.167
	Factor for 0°C dewpoint temperature (factory setting 0.900) e.g. 1.111	1.111
	Factor for 0°C dewpoint temperature (factory setting 0.900) e.g. 0.652	0.652
	Code: function level 2688	2688
	Value do displace the cal.curve (factory setting 1.6.3) e.g.16.3	16.3
	Factor for -75°C dewpoint temperature (factory setting 0.939) e.g. 0.838	0.838
	Factor for -30°C dewpoint temperature (factory setting 1.939) e.g. 0.808	0.808
	Factor for -20°C dewpoint temperature (factory setting 1.000) e.g. 0.858	0.858
	Factor for -10°C dewpoint temperature (factory setting 1.000) e.g. 0.801	0.801
	Factor for 0°C dewpoint temperature (factory setting 0.980) e.g. 0.783	0.783
	Factor for 10°C dewpoint temperature (factory setting 1.100) e.g. 0.749	0.749
	Display: fault code (fault with greatest priority)	E - - -

Display of main value
(selected in function
level 1770)

This completes the data entry to the temperature compensation.
The next page shows a typical calibration specification sheet.
The specifications for the BASIC CALIBRATION are entered in function level 3770. Enter values for the TEMPERATURE COMPENSATION in levels 2687 and 2688 as seen besides.

Kalibrationsdatenblatt

Beispiel:

Datum: 06.07.87 ALPHASENSOR DY 73 Z

GRUNDKALIBRATION Nr.:106227

P.Nr.	Frequenz/Hz	Taupunkt/C	Temperatur/C
1	268.5	-90.0	+20.1
2	259.1	-73.6	+20.1
3	253.5	-65.5	+20.0
4	246.8	-56.6	+20.0
5	236.2	-46.2	+20.0
6	203.0	-30.0	+20.0
7	147.9	-19.6	+20.0
8	85.0	-5.3	+20.0
9	58.7	+4.3	+20.0
10	35.4	+16.9	+20.0
11	0.0	+0.0	+20.0
12	0.0	+0.0	+20.0

TK-KOMPENSATION

Position			
1	Code	2687	2688
2		4	16.3
3		1.161	0.835
4		1.083	0.808
5		1.139	0.858
6		1.167	0.801
7		1.111	0.783
8		0.652	0.749

FALLS SICH DAS GEHAUSE NACH DEM FESTEN EINSCHRAUBEN NICHT IN DER RICHTIGEN POSITION BEFINDET, WIE FOLGT VORGEHEN:
- GEHAUSEDECKEL ABSCHRAUBEN- VERDRAHTUNG DER ELEKTRONIK LOSEN
- SCHRAUBE DES ELEKTRONIKEINSATZES LOSEN, DIESEN HERAUSNEHMEN
- DIE DREI MUTTERN IM GEHAUSEUNTERTEIL LOCKERN, GEHAUSE UND TYPENSCHILD IN DIE RICHTIGE POSITION DREHEN- 3 MUTTERN WIEDER ANZIEHEN
- ELEKTRONIKEINSATZ EINSCHRAUBEN, VERDRAHTEN GEMASS EINKLEBSCHEMA
- DECKEL ZUSCHRAUBEN

IF THE HOUSING HAS NOT THE CORRECT POSITION AFTER TIGHTENING, PROCEED AS FOLLOWS:
- UNSCREW HOUSING COVER, REMOVE COVER
- REMOVE CONNECTIONS TO ELECTRONIC INSERT
- UNSCREW THE ELECTRONIC INSERT,REMOVE INSERT
- LOOSEN THE TREE NUTS IN THE UPPER PART OF THE HOUSING AND TURN HOUSING AND TYPE PLATE TO THE CORRECT POSITION
- TIGHTEN THE THREE NUTS- SCREW THE ELECTRONIC INSERT, CONNECT ACCORDING TO WIRING DIAGRAM- REPLACE COVER AND SCREW TIGHTLY

DANS LE CAS OU APRES FIXATION DU CAPTEUR, LE BOITIER NE SE TROUVE PAS DANS LA POSITION SOUHAITEE, PROCEDER COMME SUIT:
- DEVISSER LE COUVERCLE DU BOITIER
- ENLEVER LES RACCORDEMENTS DE L'ELECTRONIQUE
- ENLEVER LA VIS DE MAINTIEN DE L'ELECTRONIQUE, RETIRER CELLE-CI
- DESSERRER LES TROIS ECROUS DE LA PARTIE INFERIEURE DU BOITIER, TOURNER CELUI-CI AINSI QUE LA PLAQUE SIGNALETIQUE DANS LA POSITION SOUHAITEE- RESERRER LES TROIS ECROUS
- REMETTRE L'ELECTRONIQUE, REFAIRE SON RACCORDEMENT SELON SCHEMA
- REVISSER LE COUVERCLE

HYGROLOG WMY 770 Z
Function level: 2687, temperature compensation I (compensation data for temperature T = -20 °C

Switch position	Max. value / at factory / Min. value	Individual function description
0		Display main measured value (The analog output corresponds to the main measured value)
1	9990 0 0	Input: 2687, code for function level temperature compensation I
2	4 1 1	Input: selection for mode of temperature compensation 1...3: standard compensation (fixed values) 4: individual compensation (enter data in level 2687 and 2688)
3	20.00 1.075 -2.00	Input: correction factor for dewpoint temperature -75 °C (ambient temperature T = -20 °C)
4	20.00 1.075 -2.00	Input: correction factor for dewpoint temperature -30 °C (ambient temperature T = -20 °C)
5	20.00 1.100 -2.00	Input: correction factor for dewpoint temperature -20 °C (ambient temperature T = -20 °C)
6	20.00 1.150 -2.00	Input: correction factor for dewpoint temperature -10 °C (ambient temperature T = -20 °C)
7	20.00 0.900 -2.00	Input: correction factor for dewpoint temperature 0 °C (ambient temperature T = -20 °C)
8	20.00 0.900 -2.00	Input: correction factor for dewpoint temperature 10 °C (ambient temperature T = -20 °C)
9	E699 E... E...	Display: fault code (fault with greatest priority)

HYGROLOG WMY 770 Z

Function level: 2688, temperature compensation II (compensation data for temperature T = 60 °C

Switch position	Max. value / at factory / Min. value	Individual function description
0		Display main measured value (The analog output corresponds to the main measured value).
1	9999 0 0	Input: 2688, code for function level temperature compensation II
2	50,0 °C 16,3 °C -50,0 °C	Input: value for displacing the calibration curve in °C
3	20.00 0.939 -2.00	Input: correction factor for dewpoint temperature -75 °C (ambient temperature T = 60 °C)
4	20.00 0.939 -2.00	Input: correction factor for dewpoint temperature -30 °C (ambient temperature T = 60 °C)
5	20.00 1.000 -2.00	Input: correction factor for dewpoint temperature -20 °C (ambient temperature T = 60 °C)
6	20.00 1.000 -2.00	Input: correction factor for dewpoint temperature -10 °C (ambient temperature T = 60 °C)
7	20.00 0.980 -2.00	Input: correction factor for dewpoint temperature 0 °C (ambient temperature T = 60 °C)
8	20.00 1.100 -2.00	Input: correction factor for dewpoint temperature 10 °C (ambient temperature T = 60 °C)
9	E699 E... E...	Display: fault code (fault with greatest priority)

3.6 Function Level Liquid Calibration, Code No. 4770

With HYGROLOG WMY 770 Z and ALPHASENSOR DY 73 Z, you can measure the water content in 82 liquid substances since all the data necessary for this purpose are already stored.
If your liquid substance is not specified in the following table (Page 31 - 33), you can also enter all the corresponding data manually in the device.
Since, for all practical purposes, liquids cannot be compressed, the mass ratio or the concentration C in ppm or mg/kg can preferably be used to specify the water content.

An important prerequisite for moisture measurement in liquid media is that **"Henry's law"** can be applied.
Generally, the following applies:

1. The substance has a certain saturation value C_s for water at a certain temperature T.

2. The substances must not be conductive or electrically polar.

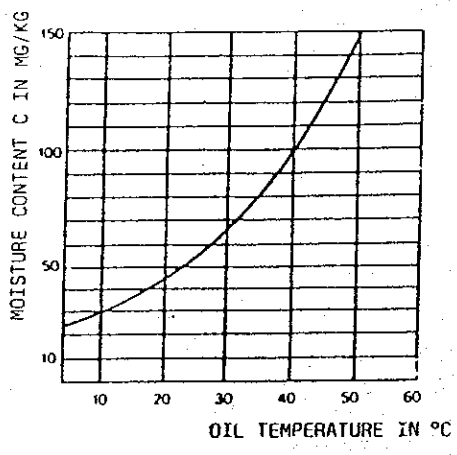
3. The saturation value C_s should be below 10 000 mg/kg.

4. In the case of extremly moist substances, halogenes, mainly fluorine and chlorine should not exceed 10 ppm.

The possible measuring range values are generally referred to the saturation value C_s at the maximum occuring process temperature T.
Please note that essentially moisture measurement in liquids is not dependent on the temperature only in the case of the group of alkanes (saturated hydrocarbons with a simple chain of carbon atoms). In these cases, it is generally sufficient to program the Henry's constant.

$$K = \frac{C_s}{e_i}$$ **(refer to basic function level 0770)**

Moisture measurement in most other substances is temperature dependent i.e. the saturation value C_s does not increase or decrease proportionally to the saturation vapour pressure e_i and must be correspondingly compensated by the WMY 770 Z.
If this type of substance is not stored in the HYGROLOG WMY 770 Z, you can store a specific C_s value table here instead of the Henry's constant.



TYPICAL SATURATION CURVE FOR TRANSFORMER OIL:
TRANSFORMER OIL CORRESPONDS TO TABLE NO.42
IN THE WMY 770 Z (SELECTOR 42).

Fig.13

1. A Known Substance

Tables with up to 5 saturation and temperature values are stored for 82 substances in each HYGROLOG WMY 770 Z. These tables are made available for determining the measuring range as described in the following example:

Example: Moisture measurement in transformer oil
Saturation value C_s = 70 ppm (or mg/kg)
Saturation temperature T = 30°C

Procedure:

1. Set multi-function switch to position ⊸O .

2. Enter 4770, code for function level liquid calibration and store with key "E".

3. Switch position 2:
Selector to 42, corresponds to transformer oil at C_s = 70 ppm and T = 20°C, and store with key "E".

4. Switch position 6:
With keys "+" and "-" enter 1 ≙ C_s table and store with key "E".

If you now set the multi-function switch to position "0", you can select as the next step the function level main measurement variable measuring signal output, code No.1770 and define your required measuring range etc. in the normal way.

Liquid Calibration

Saturation values C_s for liquid substances for temperatures from 0...50 °C

Liquid/Chemical formular	Selektor	0°C	10°C	20°C	30°C	40°C	50°C
Ethylbutylacetate $CH_3CO.O.C_4H_9$	1			5700			
Ethyl benzene $C_6H_5.C_2H_5$	2		275	373	502		
Ethyl cyklopentane $C_5H_7.C_2{}^2H_5$	3		71	119	186		
1-ethyl-2-pentylcyklopentane $C_5H_6.C_2H_5.C_5H_{11}$	4		103	168	273		
Ethyl dychloride (1.2 dichlorethene CHC_2 $Cl.CH_2Cl$	5			1500			
Benzene Kp. 80 - 110 °C	73			40			
Benzene Kp.100 - 140 °C	74			40			
Benzol C_6H_6	6		454	639	870	1178	1570
Bicyklo (2.2.1) hepta-2.5-diene	7			295	383		670
Butadiene C_4H_6	78		500	730			
Butane C_4H_{10}	12		34	71	122	149	
n-butylacetate $CH_3.CO.O.C_4H_9$	8			13700			
Butylbenzene $C_6H_5.C_4H_9$	9		234	331	448		
Sec-butylbenzene $C_6H_5.C_4H_9$	10		226	317	426		
Tert-butylbenzene $C_6H_5.C_4H_9$	11		205	292	389		
Butylcyklopentane $C_4H_9.CH.(CH_2)_4$	13		56	95	151		
Chlorobenzene $C_6H_5.Cl$	69			40			
Chloroform (trichlormethane)	14			600			
Cumene $C_6H_5.CH\ (CH_3)_2$	15	156	219	303	407	550	710
Cyclohexane C_6H_{12}	16		67	122	194	317	490
Cyclohexene C_6H_{10}	45		252	317	424	562	
Cyclopentane C_5H_{10}	46		86	142	249	398	
Decalin	17			63	105	164	
Diethyl benzene $C_6H_4\ .\ (C_2H_6)_2$	18	159	226	319	431	574	756
Diethyl ether $C_2H_5.O.C_2H_5$	44						
Dichloropropane $C_3H_6Cl_2$	77						2700
Diisobutylene $C_5H_7\ .\ (CH_3)_3$	19		145	191	274		
2.3-dimethyl butane $C_4H_{10}.(CH_3)_2$	20	29	58	110	192	323	516
2.3-dimethyl-1-butene $C_4H_6.(CH_3)_2$	21				459		
2.6-dimethylheptane $C_7H_{14}.(CH_3)_2$	22		53	91	160	301	465
2.4-dimethylhexane $C_6H_{12}.(CH_3)_2$	23		53	98	180		
2.7-dimethyloctane $C_8H_{16}.(CH_3)_2$	24		48	87	152		
7.8-dimethyltetradecane	25			77	134	219	344
Di-n-propylether $C_3H_7.O.C_3H_7$	26			6800			
Heptane C_7H_{16}	27	27	54	96	172	308	480

Liquid Calibration

Saturation value C_s for liquid substances for temperatures from 0...50 °C

Liquid/chemical formular	Selektor	0°C	10°C	20°C	30°C	40°C	50°C
1-heptene C_7H_{15}	28		186	249	375		
Hexadecane $C_{16}H_{34}$	29			69	123	209	332
Hexane C_6H_{14}	30			101	179	317	
1-Hexene C_6H_{12}	31				477		
Hexylcyclopetane C_5H_9 . C_6H_{13}	32		52	84	141		
Isobutylacetate $CH_3CO.O.C_4H_9$	33			8000			
Isoprene	81			662			
p-isopropyltoluol $C_6H_4.CH_3.C_3H_7$	35		223	305	415		
Isopropylcyklopentane $C_5H_9.C_3H_7$	34		59	102	159		
Carbonic acid CO_2	82	570	760	1000			
2-methylbutane $C_4H_9.CH_3$	37	32	59	112			
2-methyl-2-butene $C_4H_7.CH_3$	38			435			
Methylenechloride (dichloromethane) CH_2CL_2	36			1700			
3-methyloctane $C_8H_{17}.CH_3$	39		50	87	155		
1-methyl-2-phenylcyklopentane	46		105	173	289		
2-methylhexane $C_6H_3.CH_3$	41		56	103	182		
2-methyloctane $C_8H_{17}.CH_3$	40		52	90	156		
Methylcyklohexane $C_6H_{11}.CH_3$	47		61	116	179		
Nitrobenzene $C_6H_5.NO_2$	70			3000			
Regular petrol Kp. 65 - 95 °C	72			40			
Octane C_8H_{18}	48		51	160	184	315	507
Pentane C_5H_{12}	52			94	192	350	
N-pentane C_5H_{12}	54			83		350	
1-phenyl-5-methyl-1-cyklopentane	49				306		
2-phenyl-2,4,6-trimethylheptane	50		96	154	252		
Propane C_3H_8	51		53	140	200	258	
Propylene C_3H_7	53			416	779		
Propylidencyklopentane	55				383		
Sulphur dioxide SO_2	43			2000			
Carbon disulphide CS_2	71			9000			
Styrene $C_6H_5.CH:CH_2$	79			345			
Terpentine oil Kp. 150 - 180 °C	76			60			
Carbon tetrachloride $C Cl_4$ (Tetrachloromethane)	56			80			
Tetrachloroethylene $C Cl_2:C Cl_2$	68			20			
Tetraline	64			7200			

Liquid Calibration

Saturation values C_s for liquid substances for temperatures from 0...50 °C

Liquid/Chemical formular	Selektor	0°C	10°C	20°C	30°C	40°C	50°C
Toluene $C_6H_5.CH_3$	63		316	460	615	750	965
Transformer oil	42	19	28	45	70	100	160
Trichloroethane	66			90			
Trichloroethylene $C\,Cl_2{:}CHC_2$	67			20			
1.3.5-trimethyl-2-allybenzene	57			246	331	438	
1.3.5-trimethyl-2-ethylbenzene $C_6H_2.(CH_3)_3.C_2H_5$	61			259	350	461	
1.3.5-trimethylbenzene $C_6H_3.(CH_3)_3$	58			291	393	519	
2.2.3-trimethylbutane $C_4H_7.(CH_3)_3$	59	27	57	160	184	315	507
2.2.4-trimethylpentane $C_5H_9.(CH_3)_3$	60	31	59	115	201	332	538
1.3.5-trimethyl-2-propylbenzene $C_6H_2.(CH_3)_3.C_3H_7$	62			255	343	455	
m-xylene $C_6\,H_4.\,(CH_3)_2$	65		289	402	536		
Kerosine	80			100			
Decaline	75			50			

Liquid Calibration, Unknown Substance

Point No.	1	2	3	4
Saturation value C_s	33 ppm	58 ppm	112 ppm	198 ppm
Saturation temperature T	0°C	20°C	40°C	60°C

Procedure:

1. Set multi-function switch to position ⊸O.

2. Enter 4770, code for liquid calibration and store with key "E".

3. Switch position 2:
   Enter with keys "+" and "-" 0 ≙ application specific C_s-table, and store with key "E"

4. Switch position 6:
   Enter with keys "+" and "-" 1 ≙ C_s-values, and store with key "E"

5. Switch position 3:
   With keys "+" and "-" enter 1 = 1 st point and store with key "E".

6. Switch position 4:
   Enter the numerical value for the corresponding temperature, e.g. 0°C and store with key "E".

7. Switch position 5:
   Enter the numerical value for the corresponding temperature, e.g. 0°C and store with key "E".

You have now entered the first point of your application specific C_s value table. For the second point, start once again at switch position 3 until you have entered all available points of your C_s value table.

Then set the multi-function switch to position 0, in the next step, you can now define the required measuring range in the function level main measurement variable measuring signal output, code No. 1770.

HYGROLOG WMY 770 Z

Function Level:
4770, Liquid Calibration

Switch-position	Max. value / Standard / Min. value	Individual function description
0		Display main measured value (main measured value routed to signal outputs)
1	9999 0 0	Inputs: 4770, Code for function level: Liquid calibration Main measurement variable 2 C: ppm, mg/kg Henry's constant → switch position 6 = 0 C_S tables → switch position 6 = 1 (for scanning or input)
2	82 0 0	Selector for C_S value tables 0: User-specific C_S table 1...82: Standard C_S tables
3	5 0 0	Point numbers Min. 1 and max 5 points can be entered in the case of a user-specific C_S table
4	9999 101 0	Input: C_S value in ppm (mg/kg) of a point 1...5 Display: (only when switch position 6: = 1) 1. Standard C_S value however only when: switch position 2: >0 and switch position 3: =0 2. Application-specific C_S value points however only when: switch position 2: =0 and switch position 3: = 1...5
5	180 20 −50	Temperature value to corresponding C_S value of a point 1...5
6	1 0 0	Selector for operating mode: 0: Henry's constant (temperature-independent) 1: C_S values (temperature-dependent)
7	50 28,97 2,02	Input: Mol units in g, only necessary for main measurement variable 4 ×: g/kg
8	200 −80	Display: Max. occurred temperature (initial reset to the lowest value by depressing the button »E«)
9	E699 E... E...	Display: Error code in the case of fault (fault with highest priority)

3.7 Function Level Autocal, High Pressure Calibration

Autocal

HYGROLOG WMY 770 Z features an automatic zero point calibration facility. The automatic zero point calibration can take place as part of normal operation, on the other hand it can also be specifically implemented.

Its functional principle is as follows:

As soon as a frequency of the moisture sensor which is higher than the zero point frequency is applied to the HYGROLOG WMY 770 Z this new higher frequency is adapted as the new electrical zero point. However, for safety reasons and in order to avoid unwanted change of tings, this takes place after a waiting time of approx. 1 minute.

A higher frequency in the zero point - which can also be specifically checked with "zero gas", is generally the result of lower sensor capacitance. This is in turn the case when the dielectric of the sensor incorporates molecules thereby taking up space for polar water molecules. Normally, such effects only occur in the case of heavily poluted media.

A new calibration curve is obtained over the entire display range of the HYGROLOG WMY 770 Z as a result of an automatic zero point calibration. The correction over the entire curve progression approximately corresponds to the reduced available capacitance of the sensor.

Please note the following with regard to automatic zero int calibration:

1. The electrical zero point at which an automatic zero point calibration is initiated is initially programmed ex works corresponding to -90°C dewpoint temperature.

2. Completed automatic zero point calibration is indicated in the switch position 8 "autocal" by means of a frequency display. The displayed frequency corresponds to the new zero point frequency. Displaying four dashes indicates that automatic zero point calibration has still not taken place.

3. HYGROLOG WMY 770 Z calculates the new curve with the aid of correction factors based on the original calibration curve. All base points of the basic calibration, as well as any auxiliary points are retained.

4. The old base points are overwritten and any auxiliary points deleted not before final acknowledgement (Code 5770, switch position 6).

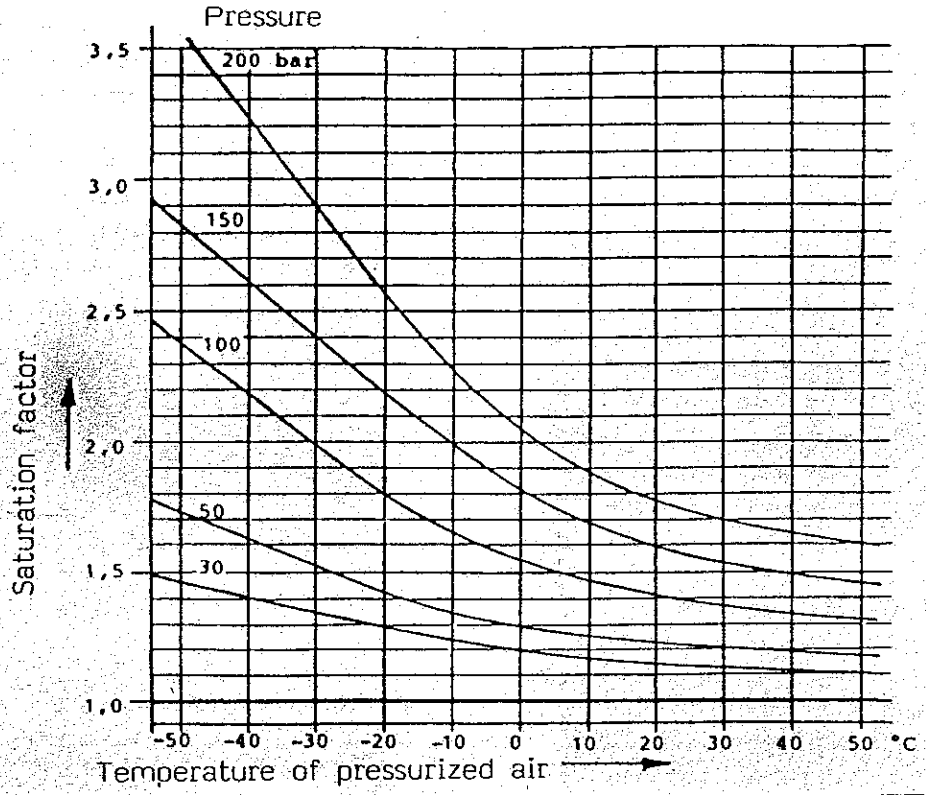
Application

Automatic zero point correction or zero point monitoring can be practically applied particularly in the case of small and extremely small measuring ranges.
For large measuring ranges, you can implement complete sensor recalibration in conjunction with an "upper auxiliary point" at an adequate degree of accuracy.
Refer to next page for typical examples for automatic zero point calibration (and auxiliary point calibration).

High Pressure Calibration

To facilitate calculation of the moisture content, the HYGROLOG WMY 770 Z initially uses the ideal gas law as basis. However, these laws do not apply with measuring gases under high pressure. The saturation factor must also be taken into consideration in order to determine the water vapour pressure. A saturation factor depends on the prevailing absolute pressure and on the temperature of the carrier gas. All HYGROLOG WMY 770 Z units are designed in such a way that up to 5 saturation factors with the corresponding temperature for a pressure of 100 bar may be entered. Initially, the HYGROLOG WMY 770 Z calculates the saturation factor for a pressure of 100 bar as a function of temperature or dewpoint temperature. The actual pressure applied is then interpolated or extrapolated with a linear equation. As a result, each point is referred to a pressure of 100 bar. A point is identified by a number with the saturation factor as well as the corresponding temperature. Entered points are adopted as soon as the multifunction switch is returned to position 0. You can of course also overwrite an entered point or completely delete a point by entering 0 for the saturation factor.
The following figures show a diagram of saturation factors over compressed air temperature and a characteristic for 100 bar stored in a HYGROLOG WMY 770 Z. (Tables for other gases on request)

Typical example of saturation factors over temperature for compressed air at various pressure.



Typical example of a saturation factor table stored in the HYGROLOG WMY 770 Z over 5 base points at 100 bar (interpolation below 100 bar, extrapolation above 100 bar).

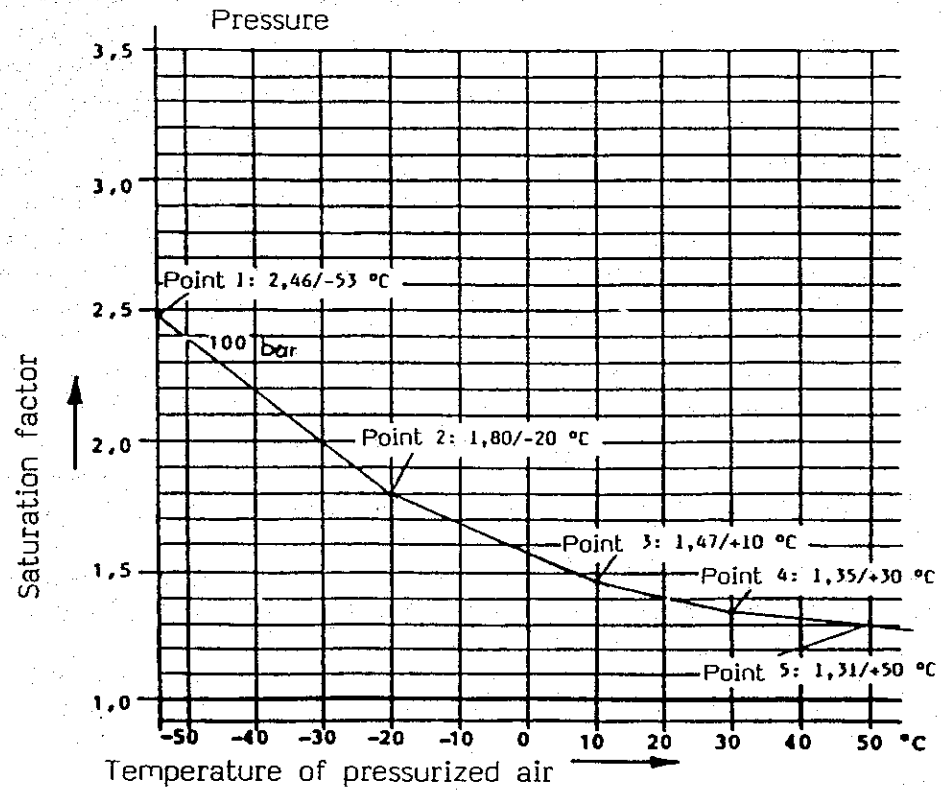


Fig.14

HYGROLOG WMY 770 Z

Function Level:
5770, Autocal, High Pressure Calibration

Switch-position	Max. value / Standard / Min. value	Individual function description
0		Display main measured value (main measured value routed to signal outputs)
1	9999 0 0	Input: 5770, Code for function level: Autocal and high pressure calibration
2	5 0 0	Saturation factor Input: point number, min. 1 and max. 5 points can be entered
3	99,99 1 0	Input: saturation factor for p = 100 bar (absolute)
4	180°C 20°C −50°C	Input: temperature value for saturation factor (for p = 100 bar, absolute)
5	1 0 0	Operating mode for pressure measurement: 0: no external pressure measurement (see 0770) 1: with external pressure measurement (see 7770)
6	2000 Hz .... 0 Hz	Autocal (automatic zero point calibration) Display: Frequency in Hz, on completion of Autocal. Input: The new zero point is adopted in switch position 0 by depressing button »E«.
7	2000 Hz .... 0 Hz	Display: Frequency in Hz, old zero point Input: The old zero point is adopted in switch position 0 by depressing button »E«.
8	1 1 0	Operating mode for Autocal: 0: Autocal inactive 1: Autocal active (works setting, active at corresponding to −90°C T_d)
9	E699 E... E...	Display: Error code in case of faults (fault with highest priority)

3.8 Function Level Simulation, Code 6770

The function level simulation is preferably used for test, commissioning and service purposes.
Basically you can simulate any status and therefore check all connected peripheral systems such as controllers, printers, display instruments, recorders etc.
In the function level simulation you can also simulate a certain moisture status and subsequently interrogate the same status at a different moisture variable. In addition to the output facility for the characteristic curve over 4 different time grids, a change-over switch is also provided for special modes of operation:

a) With temperature measurement and temperature compensation
b) With temperature measurement, without temperature compensation
c) With temperature compensation, with fixed temperature compensation
d) Without temperature compensation and without temperature measurement

Simulation

In the function level simulation you can set the selector n from 1 ... 11:

1 f : ppm, cm³/m³
2 C : ppm,mg/kg
3 f : g/m³
4 x : g/kg
5 e : mbar
6 U : %
7 T_d : °C
8 T : °C
9 ΔT : T - T_d
10 f : Hz (moisture sensor)
11 p : bar

Characteristic Curve Output

A characteristic entered by interpolation points may be recordered slowly or fastly via the current or voltage output (switch position 7)
- plotter recorder: slow output
- oscilloscope: fast output

The characteristic curve is recorded over the entire display range of -120 ... +60°C dewpoint temperature.
Large marking takes place at intervals of 20°C dewpoint temperature. In addition, each entered interpolation point is indicated by means of a small marking.

Temperature Measurement

If you use HYGROLOG WMY 770 Z with a moisture sensor without temperature measurement (e.g. ALPHASENSOR DY 63), you can appropriately program the device in order to suppress the corresponding error signal.
Apart from this, you can also define whether standard temperature compensation is to be active or not for the connected moisture sensor.
If no temperature sensor is connected, you can enter a fixed value for temperature in the basic function level Code **0770** switch position 4.

Automatic Zero Point Calibration

Please note that HYGROLOG WMY 770 Z implements an automatic zero point calibration when you simulate a higher frequency than the frequency assigned to the electrical zero point. The electrical zero point is initially set ex factory at -90°C dewpoint temperature.
For safety reason, automatic zero point calibration is only effective after a delay of approx. 60 s so that the new zero point is set successively after a further 120 s.

HYGROLOG WMY 770 Z

Function Level: 6770, Simulation

Switch-position	Max. value / Standard / Min. value	Individual function description
0		Display main measured value (main measured value routed to signal outputs)
1	9999 / 0 / 0	Input: 6770, Code for the function level: Simulation (and for special mode of operation: temperature measurement and compensation)
2	11 / 7 / 1	Simulation selector n: (11 p: bar) 1 f: ppm, cm^3/m^3 3 f: g/m^3 5 e: mbar 7 T_d: °C 9 $T-T_d$: °C 2 C: ppm, mg/kg 4 x: g/kg 6 U: % 8 T: °C 10 f: Hz
3	Dynamic / 7 / Dynamic	Display: Dew point temperature in °C Input: Simulation variable, however possible only when the button »E« is depressed beforehand.
4	10 / / 1	Display selector n: 1 f: ppm, cm^3/m^3 3 f: g/m^3 5 e: mbar 7 T_d: °C 9 $T-T_d$: °C 2 C: ppm, mg/kg 4 x: g/kg 6 U: % 8 T: °C 10 f: Hz
5	Dynamic / / Dynamic	Display: Measured value, corresponding to the display selector n selected by you
6	3 / 0 / 0	Special operating mode for temperature measurement and compensation 0: with temperature measurement and compensation 2: with temperature measurement without compensation 1: without measurement, fixed value for compensation (see 0770) 3: without measurement, without compensation (see 0770)
7	2000 / / 0	Sensor characteristic curve output (e.g. on recorder) Time grid: button »+« 3 min, beginning with f_{max} button »—« 6 min, beginning with f_{max} button »E« 12 min, beginning with f_{max} Stop: button »→«
8	20 / / −80	Sensor characteristic curve output: (e.g. on oscilloscope) Start: depress button »E«
9	E699 / E... / E...	Display: Error code in the case of fault (fault with highest priority)

3.9 Function Level Pressure Measurement, Code 7770

With HYGROLOG WMY 770 Z and ALPHASENSOR DY 73 Z you can measure moisture in gases in various moisture measuring variables (see page 3). The ALPHASENSOR measures water vapour partial pressure, therefore the display of

moisture content f in ppm or cm³/m³ and of the **water vapour content x in g/kg**

is pressure-dependent. If the operating pressure deviates from the normal pressure but remains constant, programming in the basic function level, code 0770, switch position 5 is sufficient .
However, in conjunction with pressure measurement, the HYGROLOG WMY 770 Z also calculates the correct moisture value at variable pressures.
You can connect both an active or a passive pressure measurement facility to the HYGROLOG WMY 770 Z (see page 53).
Please note that the pressure data is fed to the HYGROLOG WMY 770 Z via the serial interface. You can also obtain the corresponding module from E+H. (Circuit board, 12 TE, E+H-Part No. 208 176-0000).
Connection see page 52,53,54.

Example

Main measurement variable:	Moisture content f in ppm
Measuring range:	0 ... 10 ppm
Operating pressure p_{abs}:	5 ... 25 bar
Current output:	4 ... 20 mA

Procedure: Pressure Measurement

1. Set multi-function switch to position ⊶○

2. Enter **7770**, Code for function level pressure measurement and store with key "E".

3. Switch position 2:
   Using the keys "+" and "-", enter the numerical value of the initial value for pressure measurement (e.g. 5 bar) and store with key "E".

4. Switch position 3:
   Using the keys "+" and "-", enter the numerical value of the final value for pressure measurement (e.g. 25 bar) and store with key "E".

5. Switch position 4:
   Set display with keys "+" and "-" to 1: 4-20 mA and store with key "E".

6. Switch position 1:
   Enter **5770**, Code for function level autocal ... and store with key "E".

7. Switch position 5:
   With keys "+" and "-" set display to 1: = external pressure measurement, and store with key "E".

If you now turn the multi-function switch to position 0, HYGROLOG WMY 770 Z directly displays the moisture content f in ppm within the pressure range from 5 - 25 bar.
Please note that an error message is always sent when the operating mode 1 (4 - 20 mA or 2 - 10 V) is selected in switch position 4 and at the same time a current less than 3 mA flows.

HYGROLOG WMY 770 Z

Function Level:
7770, Pressure Measurement

Switch-position	Max. value / Standard / Min. value	Individual function description
0		Display main measured value (main measured value routed to signal outputs)
1	9999 / 0 / 0	Input: 1. 5770, Code for function level Autocal ... (for this purpose, a 1 ▲ operating mode external pressure measurement must be initially programmed in switch position 5). 2. 7770, Code for function level pressure measurement
2	500 / 0 / 0	Scaling for initial value in bar (0/4 mA or 0/2 V corresponding to...bar)
3	500 / 100 / 0	Scaling for final value in bar (20 mA or 10 V corresponding to...bar)
4	1 / 0 / 0	Operating mode: 0: 0...20 mA, or 0...10 V 1: 4...20 mA, or 2...10 V (error message when J < 3 mA)
5	350 / 1 / 0	Display: Momentary pressure in bar
6	20 / / 0	Display: Current proportional to pressure in mA (of active or passive pressure measurement)
7	10 / / 0	Display: Voltage proportional to pressure in V (of active or passive pressure measurement)
8	4095 / / 0	Display: Scale divisions proportional to pressure (max. 4095 divisions at 20 mA)
9	E699 / E... / E...	Display: Error code in the case of fault (fault with highest priority)

4. Technical data

4.1 HYGROLOG WMY 770 Z

Mechanical configuration	RACKSYST cassette in accordance with DIN 41494, D = 160 mm, H = 100 mm
Plug-in connector	multi-point male connector strip in accordance with DIN 41612, Part 3, form F
Cassette width	28 HP
Front panel	black plastic with blue control panel, with grip and inscription strip
Dimensions	see Figure 15
Protection class in accordance with DIN 400050	front panel IP 20 housing IP 20
Weight	approx. 2.5 kg
Permissible ambient temperature	-20 ... +50°C
Storage temperature	-20 ... +85°C
Mains connection	220 V +15%-10%, 50...60 Hz
AC voltage options*	24 V, 110 V, 115 V, 127 V, 230 V, 240 V, each $\pm \frac{15}{10}$%, 50 .... 60 Hz
DC voltage options*	20 ... 28 V
Power consumption	approx. 15 VA
Inputs	galvanically isolated from remaining circuit
Ignition protection class	EEx ia 2c T6
Connectable sensors	DY 70, 73 Z, 76 NZ
Option	- DY 40, 40 Z (only in conjunction with Ex-separator ZB 180 Z) - Transmitter for pressure measurement with power supply unit, sensor supply and second measuring signal output (pressure module)
Supply voltage for sensor	U_L < 15.8 V
Supply current for sensor	I_K < 132 mA
Connecting cable to sensor	3-core installation cable (max 25 Ohm per core)
Signal transmission	PFM (pulse frequency modulation)
Outputs:	analog outputs with - AC supply: galvanically isolated from sypply voltage - DC supply: connected to minus pole of supply
Current output	0 - 20 mA, R_i max. 500 Ohm 4 - 20 mA, R_i max. 500 Ohm Also at test sockets in front panel. (Generally, the initial current value can be freely selected between 0 and 8 mA and the final current value between 12 and 22 mA).

Dimensions HYGROLOG WMY 770 Z in mm

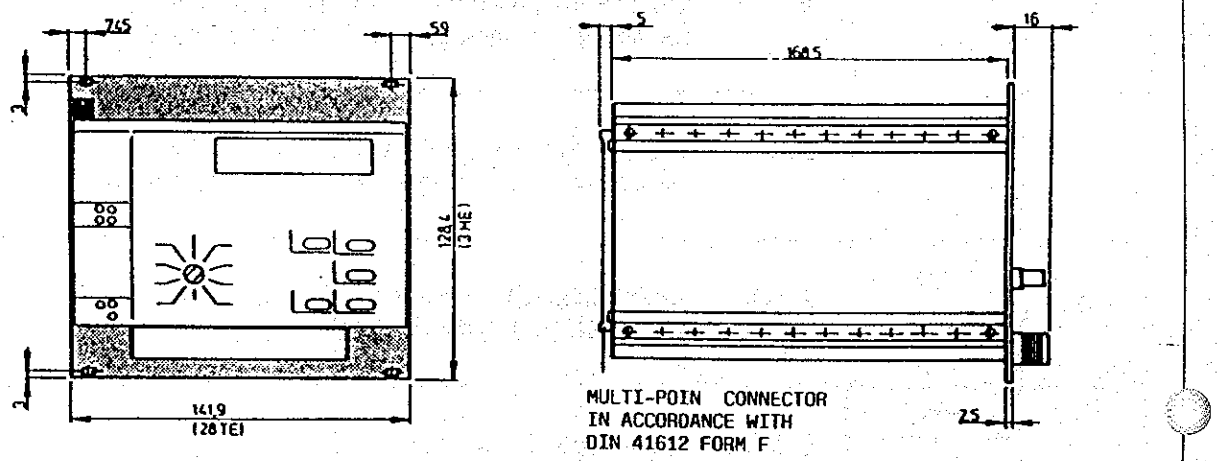


Fig.15

Analog voltage output	0 - 10 V, R_i min 10 kOhm (The voltage output is proportionally linked to the current output and cannot be adjusted separately. Required deviating voltage output signals can be correspondingly defined via the current output)
Integration time for output signals	Time constant τ ,variable between 1 s and 300 s
Relay output	2 independent relays each with 1 potential-free changeover contact for limit value signalling and 2-point control
Max.contact ratings	U: 250 V, I: 4 A, P: 500 VA, cos φ >0.7 1000 W at 48 V, 50 W or max. at 250 V
Safety mode	selectable min. or max. safety mode
Switching hysteresis (Δ s):	selectable in absolute values
Function display for alarm (switch signals)	4 LEDs on front panel
Error signalling	1 relay with potential-free change-over contact
Fault indicator	red LED on front panel
Moisture content, temperature programming and diagnostic display	4-digit LED display, red digit height 10 mm
Setting elements	1 multi-function switch and 5 programming keys
Measuring range	function range -120 ... +60°C dewpoint temperature -50 ... +90°C temperature
Effective measuring ranges	refer to sensor specification
Smallest possible measuring ranges	corresponding to 1 K dewpoint temperature
Error limits	≤ 0.5% referred to selected final measuring range value
Option serial data transmission	V 24 interface

4.2 ALPHASENSOR DY 73 Z, Ex Zone 0

Connecting housing	aluminium with 1 cable gland socket connection WADI A, PG 16
Measuring surface	gold, Al_2O_3,Al
Sensor	1.4571, ceramic, NiMo alloy
Thread	G 1/2 DIN ISO 228
Dimensions	see figure besides
Mounting accessory	O-sealing ring, fluor caoutchouc, already fitted
Protection class	IP 55
Weight	approx. 0.3 kg
Permissible ambient temperature	-60 ... +70°C
Nominal range	-20 ... +50°C
Storage temp. range	-60 ... +70°C
Permissible operating pressure	p_{abs}: 0 ... 350 bar
Helium leakage rate	≤ 10^{-7} mbar l/s
Max. permissible flow rate	
- in gases	50 m/s at 1 bar 5 m/s at 10 bar 0.5 m/s at 100 bar
- liquids	0.1 m/s
Signal transmission	PFM (pulse frequency modulation on 3-core line)

Measuring ranges

- Dewpoint temperature T_d	-100 ... +20°C
- Moisture content f or C	0 ... 25000 ppm
- Absolute moisture f	0 ... 20 g/m³
- Water vapour content	0 ... 20 g/kg
- Water vapour partial pressure e	0 ... 25 mbar
- Relative humidity U	0 ... 50%
- Dewpoint temperature difference $\Delta T = T - T_d$	> 10 K
- Process temperature T	-60 ... +90°C

Protection class (EEx is II C T 6)

Calibration error	< 1°C dewpoint temperature at T_U = 23°C
Repeatability	< 1°C dewpoint temperature at T_U = 23°C
Dependence on temperature	< 0,2°C/°C

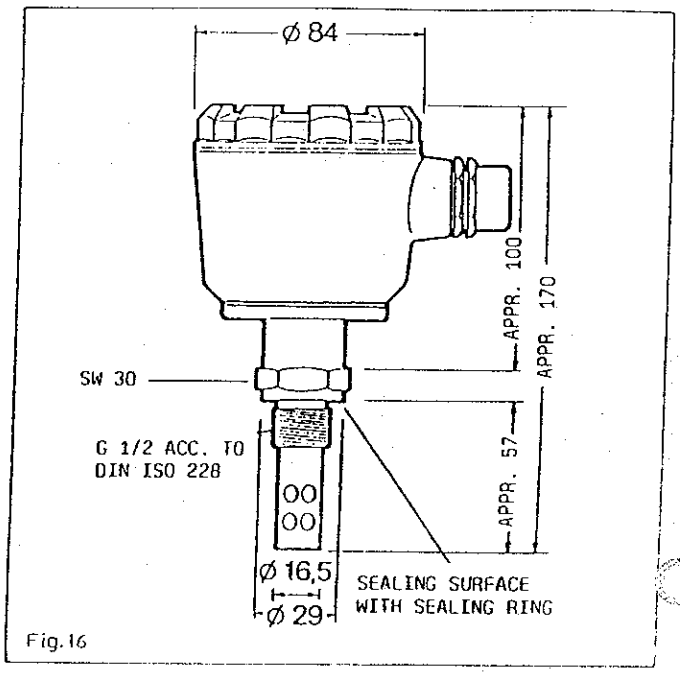


Fig.16

Drift	< 4 K/a
Option	HAN 7D connection Protective tube with fine filter

4.3 Moisture Sensor DY 70, (Non Ex)
Natural Gas Sensor DY 76 NZ, Ex Zone 1

Connection housing	aluminium with 1 cable gland [illegible]tion WADI A, PG 16
Measuring surface	gold, Al_2O_3, Al
Sensor	1.4571, ultrapure aluminium
Thread	G 1/2 DIN ISO 228
Dimensions	see figure besides
Mounting accessory	O-sealing ring, fluor caoutchouc, already fitted
Protection class	IP 55
Weight	approx. 0.3 kg
Permissible ambient temperature	-60 ... +70°C
Nominal range	-20 ... +50°C
Storage temperature range	-60 ... +70°C
Permissble operating pressure	p_{abs} : 0 ... 200 bar
Helium leakage rate	$\leq 10^{-7}$ mbar l/s
Max. permissible flow rate	
- in gases	50 m/s at 1 bar 5 m/s at 10 bar 0.5 m/s at 100 bar
- in liquids	0.1 m/s
Signal transmission	PFM (pulse frequency modulation on 3-core line)
Measuring ranges	
- Dewpoint temp. T_d	-100 ... +20°C
- Moisture content f or C	0 ... 25000 ppm
- Absolute moisture f	0 ... 20 g/m³
- Water vapour content x	0 ... 20 g/kg
- Partial pressure e	0 ... 25 mbar
- Relative humidity U	0 ... 50%
- Process temperature T	-60 ... +90°C
- Dewpoint temp. difference $\Delta T = T - T_d$	> 15 K
Protection class	(please consult PTB certificate)
Calibration error	< 1°C dewpoint temperature at T_U = 23°C
Repeatability	< 1°C dewpoint temperature at T_U = 23°C
Dependence on temperature	< 0.2°C/°C

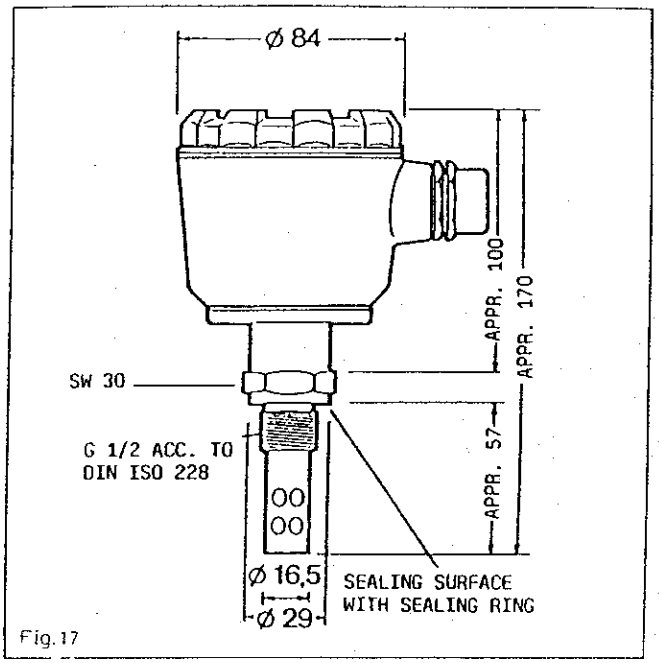


Fig.17

Drift	< 4 K/a
Option	HAN 7 D connection Protective tube with fine filter

4.4 Option pressure module

Mechanical plug-in board with construction dimensions according to DIN 41494 (T = 160, H = 100) and male contact blade strip to DIN 41612, Form F. Needed space: 12 PU (61 mm).

5. Installtion options HYGROLOG WMY 770 Z

Housing variantes

HYGROLOG WMY 770 Z also belongs to the family of ultramodern RACKSYST instruments.
For this reason, HYGROLOG WMY 770 Z is best placed in a 19" rack in which up to 3 instruments can be installed in a space-saving arrangement.
RACKSYST offers the most versatile facilities with regard to:

- power supply
- combination options
- Ex protection
- connection systems

However, other inexpensively priced options to house a HYGROLOG WMY 770 Z are also available, including a

- 1/2 19" wide desktop unit or a
- 1/2 19" wide control panel plug-in unit or a
- 1/2 19" wide portable housing

The specific application or the locally prevailing conditions finally determine the housing in which a HYGROLOG WMY 770 Z is optionally mounted.
You will find details on the following pages.

5.1 Installation Options

19" RACKSYST-rack system for accommodating up to 3 HYGROLOG WMY 770 Z modules.
Order No. 917 583-0000 (with accessories in accordance with customer requirements without instruments)

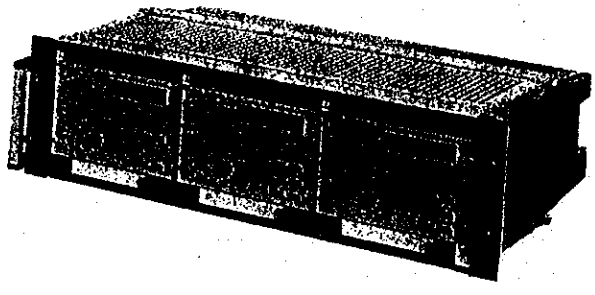


Fig.18

Protective housing for field installation
Made of sheet steel with Plexidur viewing window, protection class IP 55 for accommodating one 19" RACKSYST rack with up to 3 HYGROLOG WMY 770 Z modules.
Order No. 206 847-0000 (including mounting elements, without instruments).

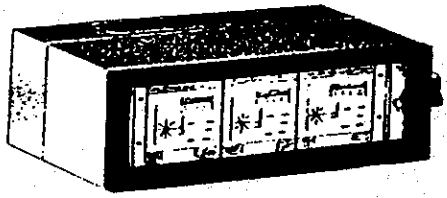


Fig.19

Option Housing Variantes

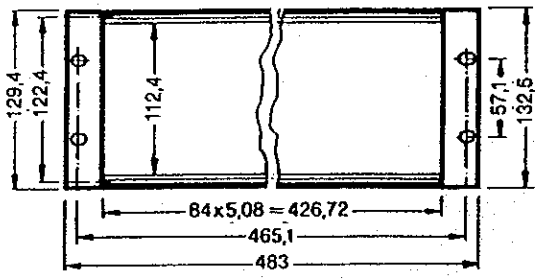
1) RACKSYST-RACK for max 3 WMY 770 Z modules

Dimensions	see besides

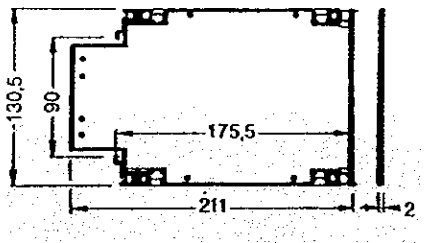
2) Field housing

Mechanical construction	cast-alu
Protection class	IP 65
Dimensions	- internal: 42 PU wide 3 PU high - external: see besides
Connection	max. 40 terminals
Cable glands	2 x PG 16, 2 x PG 29
Power pack (fitted in a field housing - if required)	U_i: 24...240 V, 50...60 Hz U_A: 24 + 15 dc I_{max} 1 A
Weight	approx. 12 kg

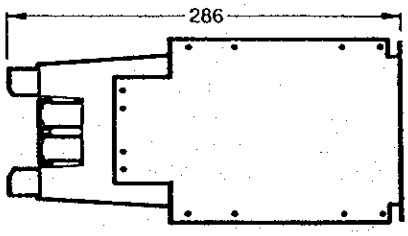
RACK: VIEWED FROM THE FRONT



SIDE VIEW OF SOLDERED CONNECTION, TERMIPOINT,WIRE WRAP VERSION



SIDE VIEW OF FLAT PIN; SCREWED TERMINAL VERSION



REMOTE VERSION

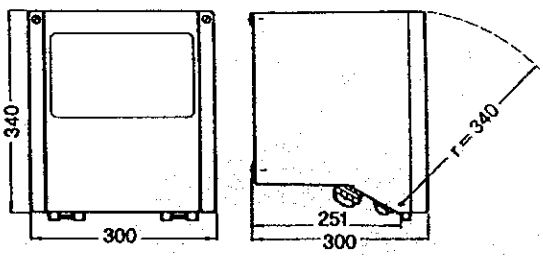


Bild 20

Protective housing for field installation, seewater-proof cast aluminium with polycarbonate viewing window, protection class IP 65, for accommodating one HYGROLOG WMY 770 Z.
Order No. 917 837-0000 (without instruments)

Desktop housing, anodized, blue plastic-coated aluminium housing, protection class IP 20
Order No. 917 875-0000 (without instrument)

Control panel rack, same as desktop housing, but with mounting bracket (without feet)
Order No. 917 876-0000 (without instrument)

Portable housing, same as desktop housing but with plug connectors for power supply and sensor, without signal outputs (TSP).

Protective housing

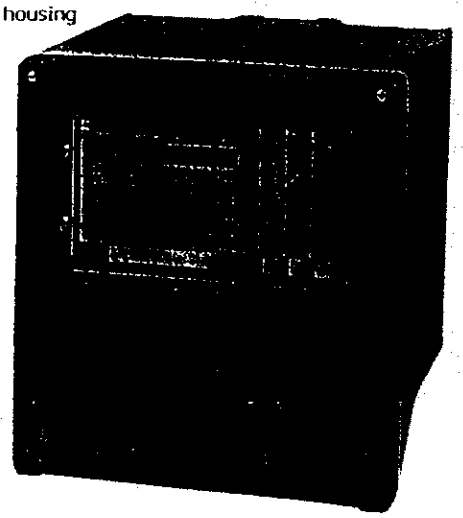


Fig.21

Desktop housing

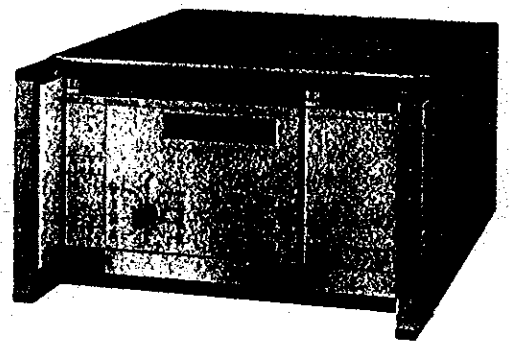


Fig.22

Desktop housing Dimensions

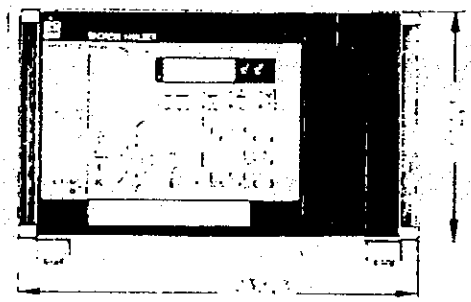


Fig.23

Desktop housing, control panel rack Side view

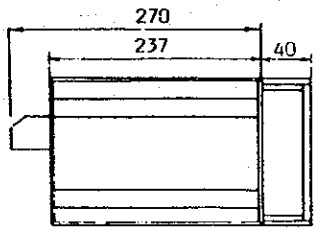


Fig.24

Control panel rack

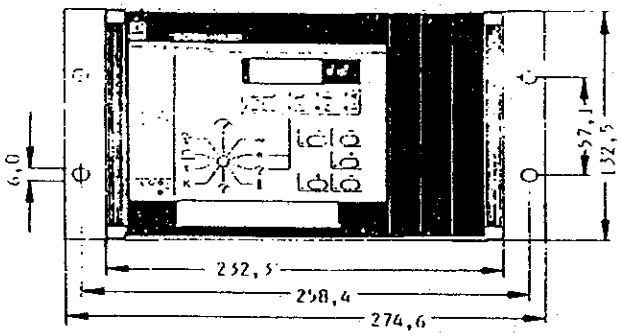


Fig.26

Cutout for panel mounting

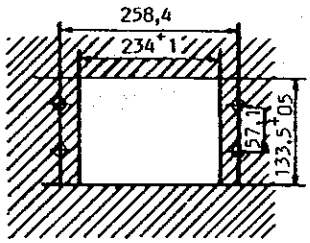


Fig.25

6. Electrical Connection

6.1 Connection of HYGROLOG WMY 770 Z

To facilitate electrical connection, the HYGROLOG WMY 770 Z features a male multi-point connector strip in accordance with DIN 41612, form F with coding holes; connector assignment and wiring of the femal multi-point connector in the 19" rack, see page 51.

6.2 Connection of table-top housing and panel mounting housing

Both housings are internally completely wired. The electrical connection is made by the terminal row at the rear side of the housing (see page 52).

6.3 Connection of RACKSYST 19" RACK

The 19" Rack is wired to connection elements corresponding the different version. The wiring is normally according the application. Further information on wiring please see connection details, which are with the equipment.

6.4 Connecting voltage supply

Note the mains voltage specified on the side panel of the HYGROLOG WMY 770 Z. A special fused protection facility for the power supply is not necessary since fine-wire fuses are integrated in the device, (see page 52)
In the case of AV voltage supply, the entire circuit is galvanically isolated from the mains.
For DC voltage supply, the circuit zero of the instrument (⊥) is connected to the minus pole of the supply voltage.

6.5 Connecting cable to the sensor

A 3-core cable is used as connecting line between HYGROLOG WMY 770 Z and DY 70,73,76 NZ (a 2-core cable, see page 51 is used for the option DY 40 E and Ex isolator ZB 180 Z).

A screened cable must be used when expecting strong interfering signals in Ex application. An unscreened cable can be used for non-Ex applications, however the connection d4/za must then be grounded.
Please consult the PTB certificate for max. values of capacitance and inductivity in Ex areas.
The max. resistance per individual core in the connecting line may be 25 Ohm (given a wire cross section of 0.75 mm² this corresponds to a length of approx. 1000 m).

Attention
With option DY 40 E (non Ex) or DY 40 EZ in connection with Ex isolator ZB 180 Z (Ex zone 1) a zener diode 6.8 V, 1.3 W (E+H part no. 013 357-999) must be installed, see page 51.

6.6 Connecting display instruments, controllers, process control computers, etc.

Input and output circuits are galvanically isolated from each other in the same way as the mains voltage is isolated from the output current circuits for AC voltage operation; this therefore renders unnecessary additional isolating amplifiers. Current output and voltage output are both referred to "circuit zero" and are not galvanically isolated. The voltage output is short circuit-proof. The current output is no-load proof, however, a load of < 500 Ohm must be connected if you wish to measure the current at the test sockets in the front panel.

6.7 Connecting control and alarm facilities

The two relays for the independent limit values for alarm and the relay for the error message each feature a potential-free change-over contact.
Note the function of the limit switches dependent on the input signal, safety mode and switch hysteresis and the max. contact load. The relay for fault signalling de-energizes in the case of fault.

Operation of relays depending on hysteresis and fail-safe mode

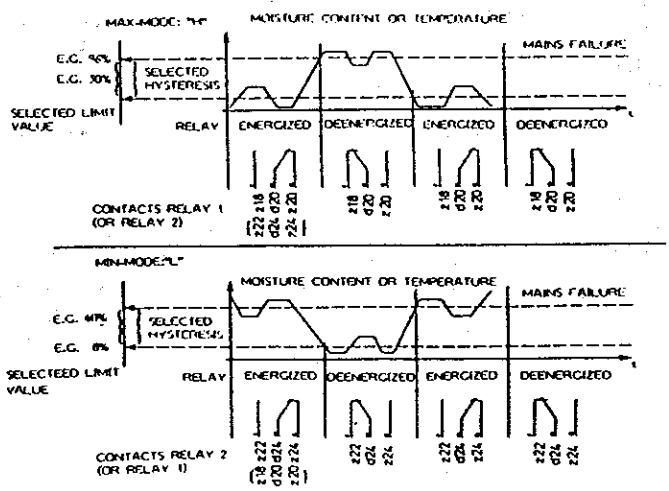


Fig.27

6.8 Connection HYGROLOG WMY 770 Z

Looking at the male terminal on the HYGROLOG WMY 770 Z i.e. the connecting side of the female strip in the rack.

Together with the Ex isolator ZB 180 Z and suitable sensor when using moisture sensor DY 40 Z a diode 6.8 V, 1.3 W (e.g. E+H order no. 013 357-0000) must be installed into the connecting line "d2" (cathode/ring on instrument).

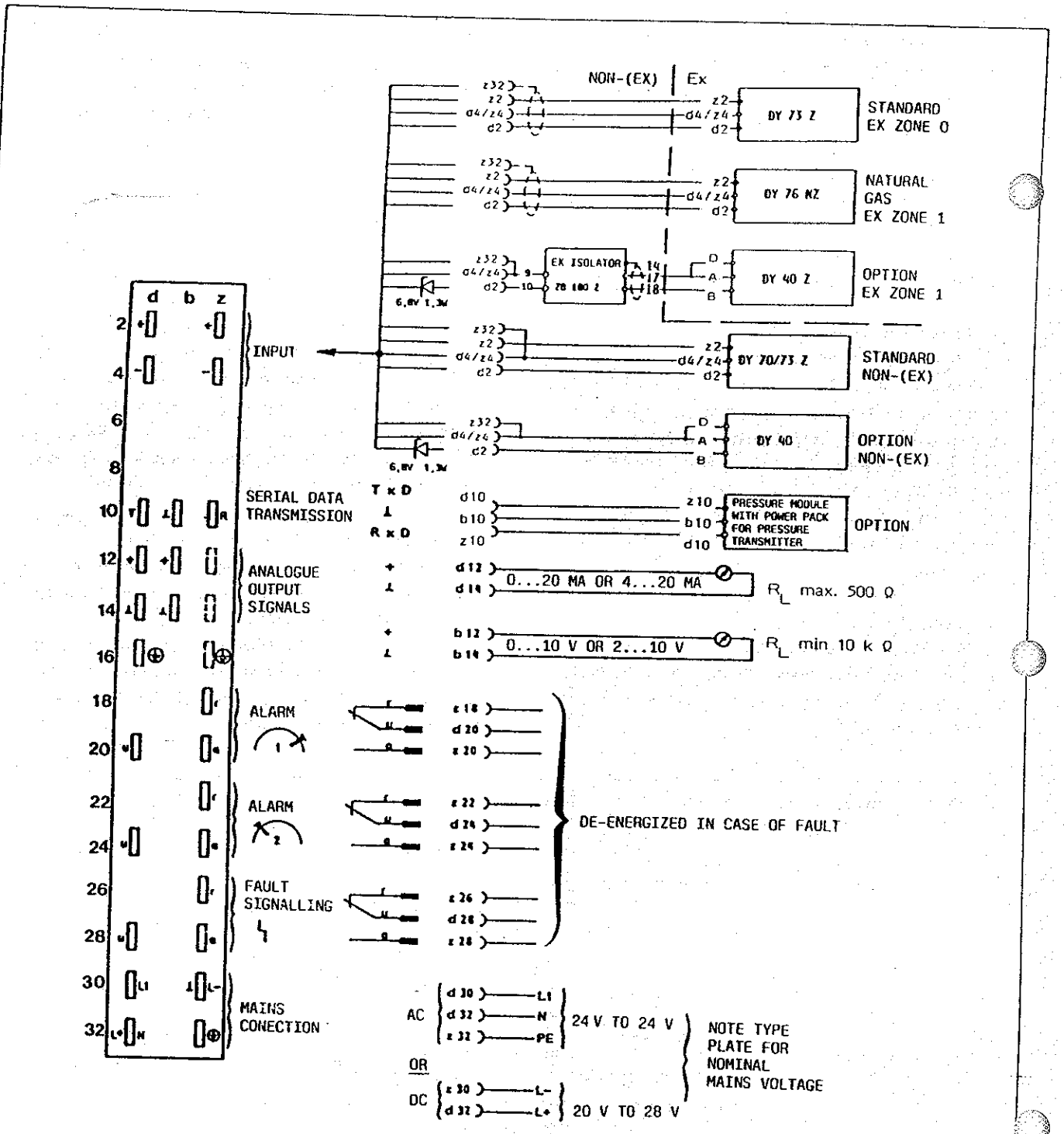
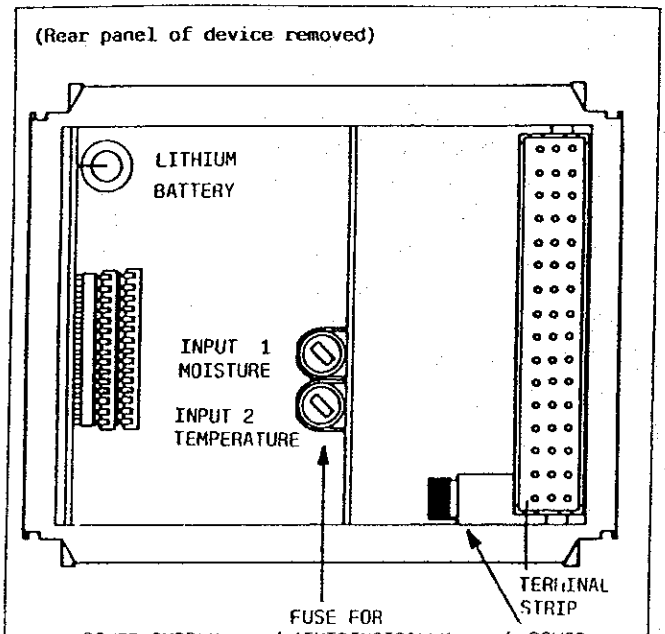


Fig.28

Fuses

HYGROLOG WMY 770 Z is equipped with the following fuses depending on the selected supply voltage:



POWER SUPPLY	FUSE FOR (INTRINSICALLY SAFE) INPUT CIRCUIT	POWER FUSE
220 V...240 V, 50/60 Hz	63 mA	125 mA
110 V...127 V, 50/60 Hz	125 mA	315 mA
24 V 50/60 Hz	630 mA	1,0 A
24 V DC VOLTAGE	630 mA	- - - -
	MEDIUM-BLOW	

Fig.29

6.9 Connection of table housing and control panel housing for HYGROLOG WMY 770 Z housing

Both housings have connecting elements on the rear wall; these connections are clearly marked.

Table top housing

The table top housing has plug or screw connections for the signal line as well as a Europa card location for the power supply.

Control panel housing

The control panel housing has screw terminals for all connections.

Attention

1. Voltage supply
   Both versions are delivered for AC supply
2. Sensor cable non-screened
   Earth terminal ⏚ and terminal d4/z4 must be connected with non-screened cable
3. Sensor cable, screened, for Ex application screen must be connected with earth terminal ⏚

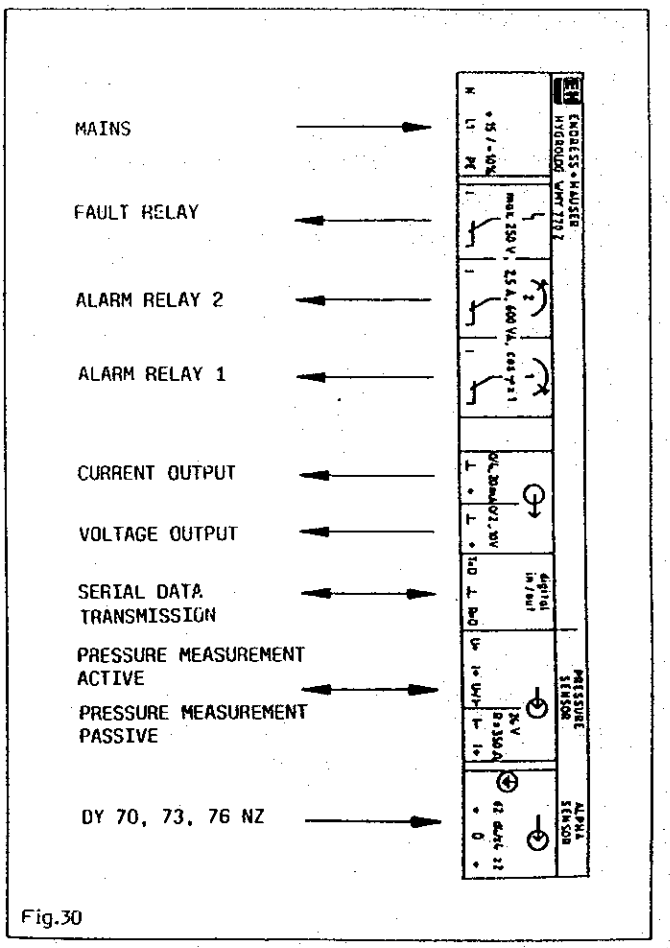


Fig.30

6.10 Module for pressure measurement

The pressure module is a plugable PC-board 12 HP width, with front plate and is used for the compensation of pressure dependent moisture values in combination with pressure measurement (see page 41,56).

The pressure module can be pluged into the table-top or panel-mounting housing as these are just fitted with the necessary connectors. The pressure measurement signal is fed to the terminals "pressure sensor", depending on the connection and the switching position of the miniature switches at the pressure module (see picture beside) there are 3 possibilities:

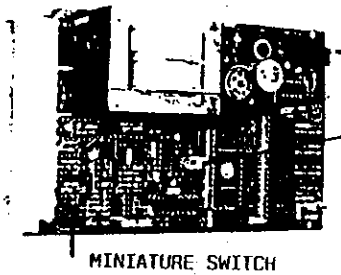
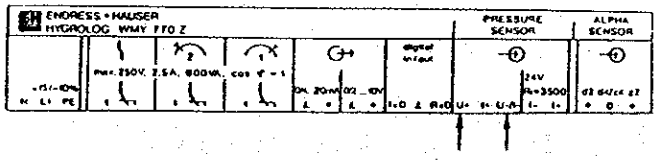


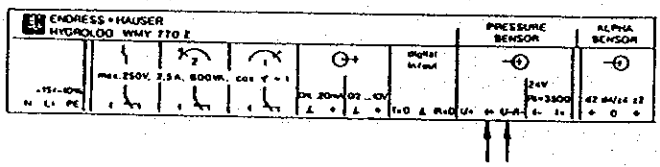
Fig.31

- Pressure signal "DC-current" of an active pressure measurement (0 ... 10 V DC)
  Miniature switch open



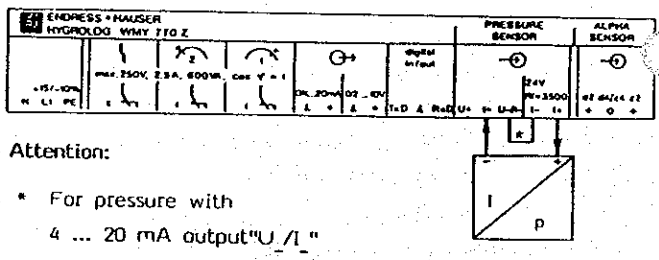
Connection Sensor

- Pressure signal "DC-current" of an active pressure measurement (0/4...20 mA DC)
  Miniature switch closed



Connection Sensor

- Pressure signal "current" of a 2-wire pressure transmitter (4 ... 20 mA passive)
  Miniature switch closed



Attention:

* For pressure with 4 ... 20 mA output "U/I" and "I" must be bridged.

Viewing the contact blades of the male multi-point connector of the pressure-module or the connection side of the female multi-point connector in the rack

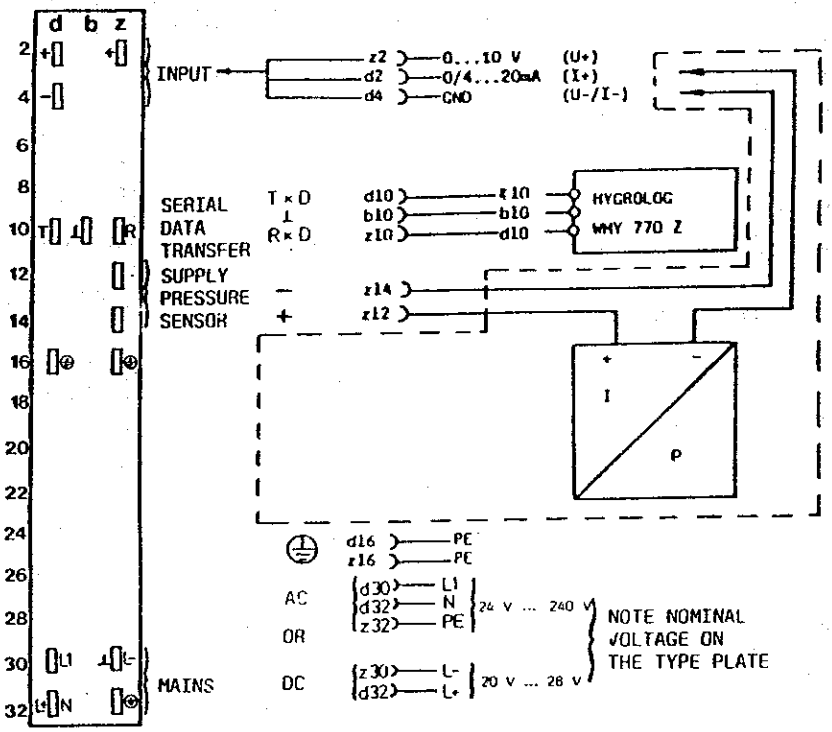


Fig.32

6.11 Connection Portable Housing for HYGROLOG WMY 770 Z (NON - EX)

Apart from the front panel, the portable housing is a completely sealed housing. It is particularly suitable for laboratory applications or for sporadic measurements in the field. Plug connectors are provided for sensor input and mains. (The signal outputs are not routed to the outside). With the aid of a selector switch, 2 sensors can be connected if only frequency measurement is to be carried out.

ALPHASENSOR DY 73 Z — jack sensor input

d2 ← PFM moisture → 3
d4/z4 ← GND → 2
z2 ← PFM temperature → 5

Moisture sensor DY 40/60 — jack sensor input

B ← PFM Moisture → 1
A+C ← GND → 3

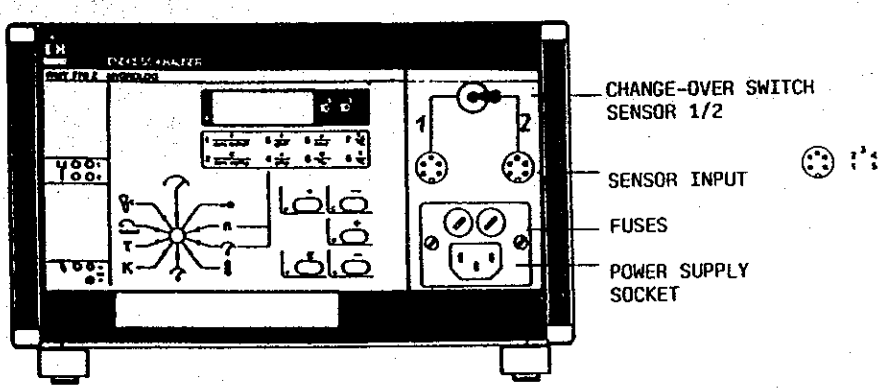


Fig.33

6.12 Connection ALPHASENSOR DY 73 Z

Each ALPHASENSOR DY 73 Z can be equipped at works or subsequently, with a *Harting* connector instead of the *WADI* screw fitting. This connector is particularly suitable wherever it is necessary to release the electrical connection for application reasons for instance.

Please note
Each ALPHASENSOR DY 73 Z is supplied by intrinsically safe circuits. Particularly when carrying out measurements in Ex locations, the specified contact assignment must be maintained due to the stipulated distances.

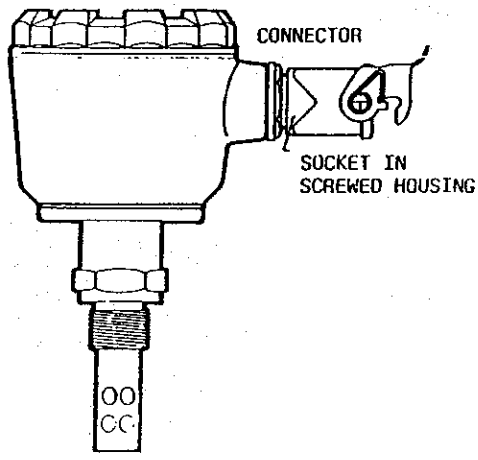
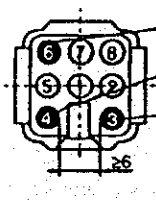


Fig.34

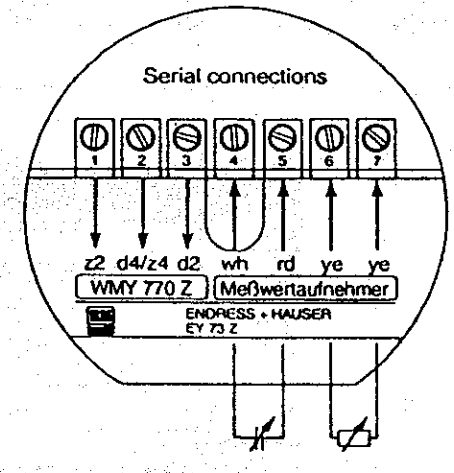
Contact arrangement



Plug	Serial connections ALPHASENSOR DY 73 Z
6	2
4	3
3	1

6.13 Connection Electronic insert EY 73 Z

After removing the cover of the housing the electonic insert with its terminals is accessible.
Figure 36 shows the connections.



z2 (1), d4/z4 (2), d2 (3) } external connection to the HYDROLOG WMY 770 Z

wh (4), rd (5) } internal connection to the humidity chip

ye (6), ye (7) } internal connection to the platinum thermometer (PT 100)

7. Installation

7.1 ALPHASENSOR DY 73 Z

Installation Options

With ALPHASENSOR DY 73 Z (and ALPHASENSOR DY 63 Z) you can easily measure the moisture content in gases and liquids without any problem (for liquids, see page 30 - 35).

Measurement is independent of pressure, temperature, flow rate etc. since the system is based on absolute measurement.

The momentary capacitance of the ALPHASENSOR with the resulting frequency is a measure for the momentary predominating water vapour partial pressure. From the water vapour partial pressure derives:

Quantity of water vapour per volume or dewpoint temperature.

As a result, temperature or pressure compensation is necessary only in the cases above mentioned:

Temperature compensation by fixed value or temperature measurement:	- "Absolute moisture" f in g/m³ - Relative humidity U in % - Moisture content in ppm, in mg/kg (This variable is generally used to specify the moisture content in liquids and is therefore also product-dependent.
Pressure compensation by fixed value pr pressure compensation:	- Moisture content f in ppm, in cm³/m³ - Water vapour content x in g/kg

In addition to the moisture measuring element (ALPHACHIP) the ALPHASENSOR DY 73 Z also features a temperature measuring element (Pt 100), thereby ensuring that all **temperature-dependent** moisture variables are correctly displayed without the necessity of taking further measures. For **pressure-dependent** variables, you can set a fixed value on the HYGROLOG WMY 770 Z with regard to constant pressures, or in the case of variable pressures you can connect a pressure sensor or a complete pressure measuring system via a module which is also obtainable from E+H (Type Pressure module 1).

Installation Position ALPHASENSOR DY 73 Z

Please note that the optimum installation position of the ALPHASENSOR DY 73 Z is vertical, i.e. the measuring element should face downwards and the connection head upwards. In the case of condensation in a pipeline, this arrangement ensures natural drying without moisture storage. The connection head corresponds to protection class IP 55, however, when installed outdoors, an additional covering is recommended.

The ALPHASENSOR DY 73 Z is sealed by means of an O-ring inserted at the works in the screw fitting and not by means of the thread. Correspondingly, the screw socket provided by the customer must have a sufficiently smooth flat surface (R_t = 6.3). The thread is designed to withstand operating pressures up to 350 bar.

ALPHASENSOR DY 73 Z

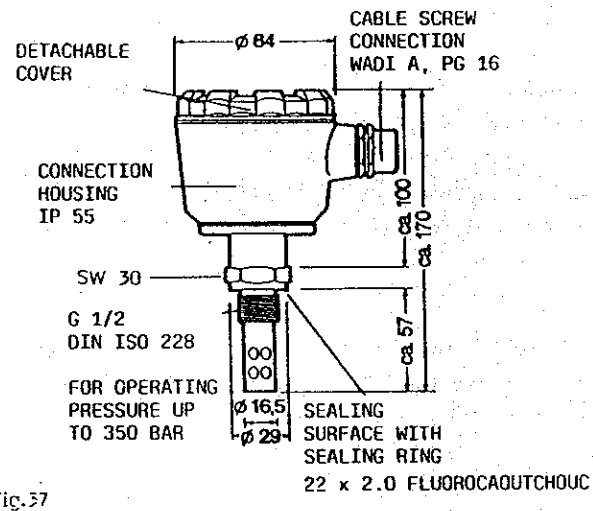


Fig.37

Example of a screw connection socket provided by the customer.

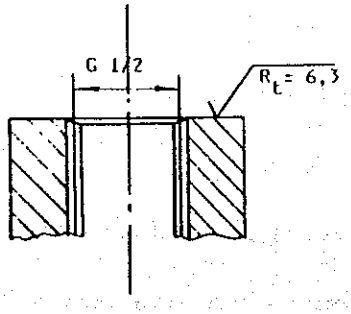


Fig.38

Tightening Torque

To install, firstly tighten the ALPHASENSOR DY 73 Z as far as it will go by hand. The unit should then be secured by tightening at the hexagon (30 mm) to a torque of 50 Nm.

7.2 Inline Measurement

All ALPHASENSOR DY 73 Z units can be used at operating pressures ranging from 0-350 bar (absolute).
In the interest of your safety, we test every ALPHASENSOR DY 73 Z at the works up to a pressure of 525 bar.

In addition to low-cost installation, inline measurement also offers the following advantages:

- Measurement of moisture content under operating conditions
- Faster compensation times with regard to changes in moisture variables and therefore faster indication
- Less susceptile to faults, e.g. leakages
- Practically no maintenance required

The figure beside shows the typical installtion of an ALPHASENSOR DY 73 Z in a pipeline.
A diffusor should be provided if this installation arrangement is not possible due to the diameter of the pipe being too small or an excessively high flow rate.

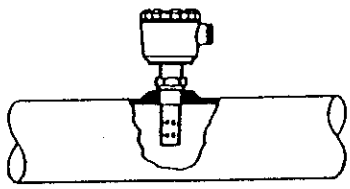


Fig.39

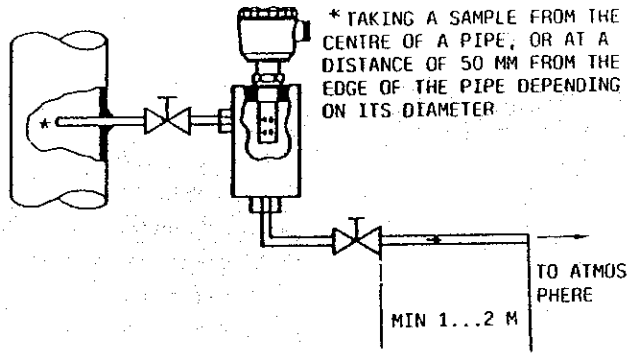


Fig.40

7.3 Bypass Measurement under Pressure

Moisture measurement in the bypass is always necessary when at the point of measurement

- the flow rate is too high
- the pressure is too high
- the temperature is too high
- the medium to be measured is contaminated with solids (e.g. corrosion residue) which must be removed by a filter.

etc.

In a bypass system, you always obtain satisfactory measuring results when here the same conditions prevail with regard to moisture content as in the main line.
Summarizing this means:

1. The operating pressure should also be applied in the bypass.
   For this reason, you must take particular care to ensure that the dynamic flow resistance is not too high.
   At a flow rate of approx. 200 l/h this is ensured in a standard piping arrangement with 6 x 1 mm special steel pipe and our sensor chamber with 6 mm notched ring screw fitting (see figure).

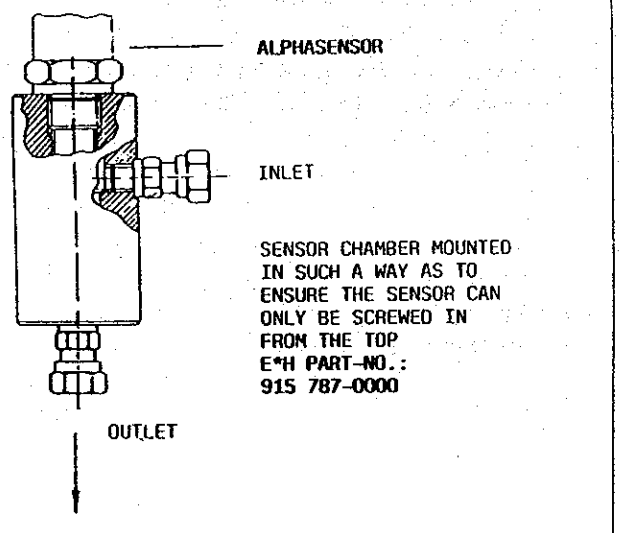


Fig.41

2. It must be possible to establish quickly a new moisture balance in the bypass system.
   This is particularly the case when the inner pipe wall, the transitions and screw fittings do not act as moisture storages.
   A new balance (through adsorption or desorption) and therefore moisture display with the least possible delay also decisively depends on the material used.
   For these reasons, only stainless steel 1.4571 should be used for a bypass piping system.

3. A bypass system must be sealed tight to avoid helium leakage. Often the moisture contents in the inside of a bypass system amount to less than 1/1000 or even less than 1/10 000 referred to the ambient moisture (atmospheric humidity).
   For this reason, even the smaller leakages can result in considerable interference even if a certain pressure is applied in the bypass.

4. "Back-diffusion" must also be avoided. A pipeline of at least 1 - 2 m in length must also be arranged after the sensor chamber in a bypass system not under pressure before blow-out into the atmosphere in order to prevent "back diffusion" of the ambient moisture to the sensor.

5. A multistage release system (pressure reduction) is often necessary for high pressure applications.
   Depending on the pressure differential and gas flow during each release procedure, heat is obtained from the environment, resulting in possible excessive under-cooling of the fittings down to below the dew point so that icing can form.
   Generally, you can prevent disturbances of this type with a subsequently connected coiled cooling pipe.

Coiled cooling pipe E+H Part No. 915 779-0000

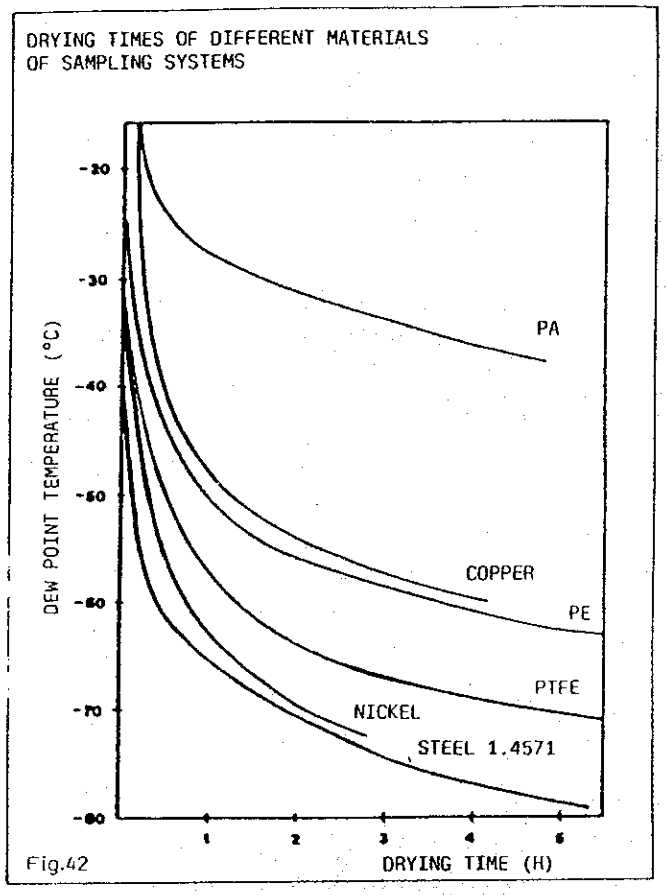


Fig.42

7.4 Depressurized Bypass Measurement

Depressurized measurement should be preferred if under operating conditions at increased pressure the

a) dewpoint temperature difference $\Delta T = T_d - T$ is less than 10 K,
   or
b) pollution gas percentage (corrosive gases/halogenes) is extremely high.

This does not change the composition of a gas, but the ratio pollution parts to gas volume, namely by pressure reduction factor.
Please also note in this respect that a coiled cooling pipe for temperature compensation is also mounted between the pressure reducer and sensor chamber.

If no overpressure is applied under operating conditions, you can achieve the necessary gas flow, for example, with the aid of a diaphragm pump.

8. Accessories for moisture measurement

a) Special Steel Fine Filter

To protect against abrasive solid particles, each ALPHASENSOR can be equipped at the works or also subsequently with a protective tube including fine filter, mesh width 10 micrometer.

b) Gas Filter

Gas filters made of PVC or special steel with interchangeable filter cartridges can be used to protect the moisture sensors in the bypass in the case of gases with excessive dust accumulation. The special steel version should always be used for extremely low moisture contents, e.g. due to possible leaks.

c) Mist Separator

If the gas contains mist (e.g. glycol, oil etc.) a special mist separator is available to filter these substances (E+H Part No. 915 804-0000).

Sample Extraction with Diaphragm pump

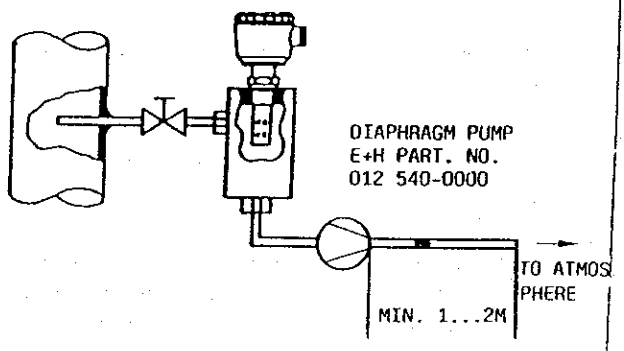
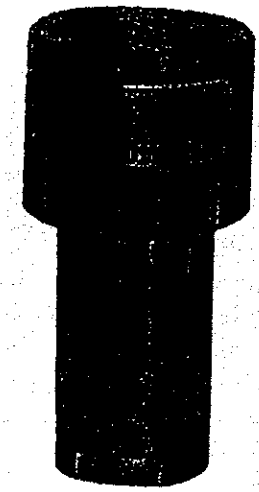


Fig.43

Gas Filter



95SC

Measuring System with accessories for bypass installation

1 FINE MESH FILTER
2 COOLING COIL
3 SENSING CHAMBER
4 ROTAMETER WITH CONTROL VALVE
5 DIAPHRAGM PUMP

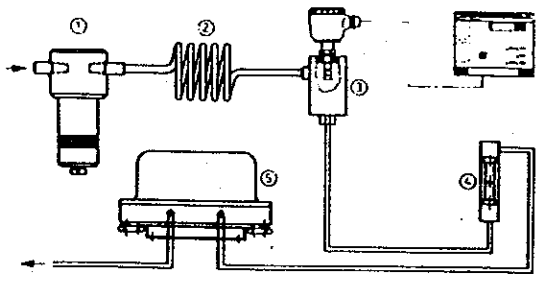


Fig.45

Sample Extraction with Mist Separator

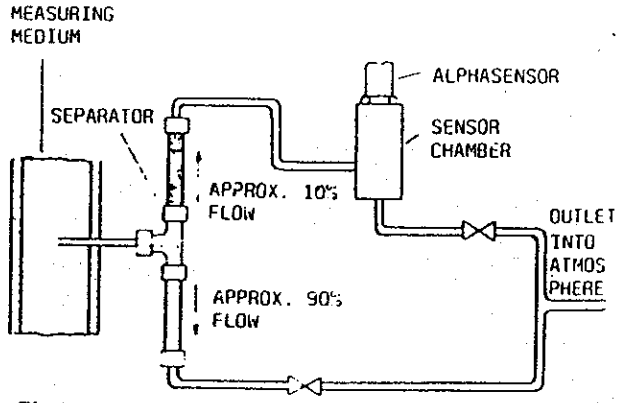


Fig.46

9. Fault Code Table

HYGROLOG WMY 770 Z and moisture sensor are a measuring system with encompassing self monitoring features. If a fault occurs which influences the operation, a fault indication appears over the fault relay and the LED. The analogue output follows the program as entered in operating level 2770.
If the multi-function switch is set to position 9, the instrument indicates a fault.
The following explains the meaning of an indicated fault code.

If the indicated fault code is not indicated or if the remedies are not successful, please get in touch with the E+H service department.

The column "Level" shows in which function level an erroneous setting is to found

Fault code	Level	Meaning - Measures
E 401		no signal from the moisture sensor - check electronic connection between HYGROLOG WMY 770 Z and moisture sensor
E 402	6770	no signal from temperature sensor - check electronic connection between HYGROLOG WMY 770 Z and moisture sensor. DY 40/DY 60: These sensors have no temperature measurement in level 6770, switch position 6, switch off
E 403		no signal from moisture sensor and temperature sensor - see E 401/E 402
E 404	7770	no signal from the external pressure measurement - check external pressure measurement This code is only displayed when function level "Autocal" (Code 7770), switch position 5 operating mode "1", pressure measurement, is programmed.
E 405		process temperature higher than 90°C - subject moisture sensor only to max. temperatures of 70°C (DY 73) or 50°C (DY 70) ... send sensor for check to E+H
E 406		dewpoint temperature higher than process temperature
		a) condensate at the sensor element - dry sensor, avoid condensate
		b) call up sensor frequency (switch position "2", enter "10" and press "E", switch position "3": display shows frequency): If the frequency is smaller than 20 Hz the sensor element has a short circuit; contact the E+H service department.
	3770	c) calibration values have been entered incorrectly - compare memorized values in level 3770 with calibration sheet and correct if necessary
E 407		temperature measurement faulty - check connections 6 and 7 (yellow wires) at the sensor; send sensor if required to E+H
E 601	1770	extension for the current output too large, i.e. smallest possible measuring span (0/4 ... 20 mA) is 1°C for T_d, ΔT or T or 0.1% for U (realtive humidity) - change measuring span according to tolerances above
E 602		dewpoint temperature distance of the entered auxiliary points is smaller than 20 K:
	3770	a) check entry of auxiliary points
		b) repeat reference measurement for auxiliary point calibration with another dewpoint temperature, so that a 20 K distance is maintained

E 603		frequency distance of entered auxiliary points smaller than 10 Hz or frequency of "lower" auxiliary point (low dewpoint temperature) is smaller than frequency of "higher" auxiliary point.
	3770	a) check entry of auxiliary points b) repeat reference measurement for auxiliary calibration so that distance of 10 Hz is maintained.
E 604		frequency of "lower" auxiliary point (low dewpoint temperature) smaller than 100 Hz
	3770	a) check entry of auxiliary point b) repeat reference measurement for auxiliary calibration with lower dewpoint temperature, so that sensor frequency is at least 100 Hz
E 605	3770	incomplete basic calibration - less than three (3) calibration points stored - proceed "basic calibration"
E 606	3770	incorrect basic calibration - verify data input of calibration sheet

10. Maintenance

The maintenance of the microprocessor-controlled measuring system is limited to the cleaning of the sensor element, which must be carried out from time to time. The cleaning intervals depend on the application and the degree of pollution in the material.
Next to these measures a factory recalibration is recommended every 1/2 to 1 year.

11. Cleaning of polluted elements

A polluted sensor element may under certain circumstances react very slowly to changes in moisture. This is particularly true in trace moisture applications where a moisture equilibrium comes about very slowly. Oily and hydroscopic build-up is particularly critical.
If such pollution cannot be prevented the following methods of cleaning are available.

With the described cleaning methods it should be noted that the protective cap shall not be removed from the sensor.

1. Rinsing with destilled water, max. 10 min at room temperature

2. Rinsing with practically all pure hydrocarbons (gasoline, benzole, hexane etc. But if possible, not with chlorinated hydro carbons).

3. Rinsing with acetone, max. 15 min (PA-quality required).

4. Ultrasonic cleaning and other mechanical cleaning processes are not permitted.

5. After individual cleaning with the above liquids the sensor element must be dried (either at room air or with clean, oilfree pressurized air with attached protective cap).

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