

# **Addendum to Operating Manual**

## **AS-active-probe**

**AS-N3DM x+y+z syn-out**

**AS-L3DM x+y+z syn-out**

**AS-V3DM x+y+z syn-out**



Made in Germany

# 1. Description

## 1.1 General Description of Operation



*Figure 1 overall view AS-N3DM x+y+z syn-out*

The probes are 3-axis measurement systems, which allow to measure the three axes of the magnetic field. The measurement of the axes can be carried out separate of each other.

With the maximum measurement ranges of  $\pm 2000$  mT (AS-N3DM x+y+z syn-out),  $\pm 200$  mT (AS-L3DM x+y+z syn-out) or  $\pm 20$  mT (AS-V3DM x+y+z syn-out) respectively the probes are suitable for the measurement of strong as well as weaker magnetic fields.

The probes are compatible with the other probes from our program of AS-active-probes. Thereby they can be used with all devices which are intended to connect an AS-active-probe. The probes can be used together with the Teslameter FM 302 or the AS-Adapter 3.

The AS-active-probes are active measuring-probes for measuring magnetic flux density. In contrast to most other available probes, the AS-probes contain an active electronic so that a calibrated analog signal is available at the plug. These probes are premium transducers for measuring steady and alternating fields.

## 1. Description

The 3-axis probes contain 3 sensors for the measurement of the 3 axes of the magnetic flux density within the probe head. With the dimension of merely 6 mm x 6 mm x 100 mm the probe head has a very compact size and is appropriate for the measurement even at small spaces.

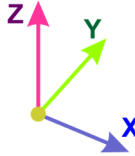


Figure 2 the three axes

For the simultaneous output of the single axis signals the probe cable is split into three probe connectors. Every probe connector contains the active electronic for the respective single axis.



Figure 3 the three probe connectors



**Always all three probe plugs have to be connected and powered (connected instrument switched on) to ensure proper function and to maintain specification of measurement values.**

## 1. Description

With the three single axis probe connectors it is also necessary to use three single axis instruments or one 3-channel instrument to process the single axis signals delivered by the probes. The following devices from our program can be used:

- 3 pieces of Teslameter FM 302
- 1 piece of AS-Adapter 3

See also the chapters to the usage of the 3-axis AS-active-probes at page 8ff.

### 1.2 Measurement Direction and Polarity

Each of the three axes behave like a single-axis probe. That means that they can just detect fields in parallel to their respective measurement direction. If the axis is positioned with an angular to the field, the displayed value is lower than the actual field. The display value results from the following relation:

$$B_{display} = B_{real} \cdot \cos \alpha$$

From the measurement of all three axes (X, Y, Z) the actual total field can be reconstructed.

Additionally in single axis measurement the direction of the field is displayed by the sign of the measured value. The direction for a positive display value is indicated by the arrows of the axis at the probe head.



*Figure 4 marking of measurement direction on the probe*

## 1. Description

### 1.3 Calculation of the Total Field

The probes just deliver the single axis signals. A generation of the total signal is not performed. If needed, the calculation has to be done in further external processing according to the following formula.

$$B = \sqrt{B_x^2 + B_y^2 + B_z^2}$$

## 2. Technical Advice

### 2.1 General Notices



Constant field and alternating field may not overload the sensors. This would result in distorted measurement results.

### 2.2 Ground Connection / Earthing



The ground connections of the three probe connectors are connected with each other.

Attention should be paid that in the probe there is a connection between GND, probe head, connector shield, connector housing and cable. Possibly an isolated installation of the probe and/or the probe connector is necessary to prevent an unintended connection between measuring GND and protective earth.

### 2.3 Heating due to Eddy Currents



When measuring fields of  $B > 20$  mT and  $f > 10$  kHz, the brass probe should not be operated for more than 1 minute in order to prevent excessive heating of the brass tube with the Hall elements inside!

### 2.4 Minimum Operation Conditions (EMC)



The presence of strong HF fields can result in distorted measurement results. A field strength of 3 V/m should not be exceeded.

### 2.5 Mounting



The probe head must not be clamped at the first 20 mm.

### 2.6 Connection of Probe Plugs



Always all three probe connectors have to be connected and powered (connected instrument switched on) to ensure proper function and maintain specification of measurement values.

### 3. Items Supplied

- AS-active-probe
- operating manual
- factory calibration certificate with traceability to national standards (PTB)
- zero chamber (optional)
- linearity curve (optional)

## 4. Operation

### 4.1 General

Every single axis of the probe behaves like a normal single axis probe. The full bandwidth of the probe is available.

### 4.2 Usage of the 3-axis AS-active-probes with the Teslameter FM 302

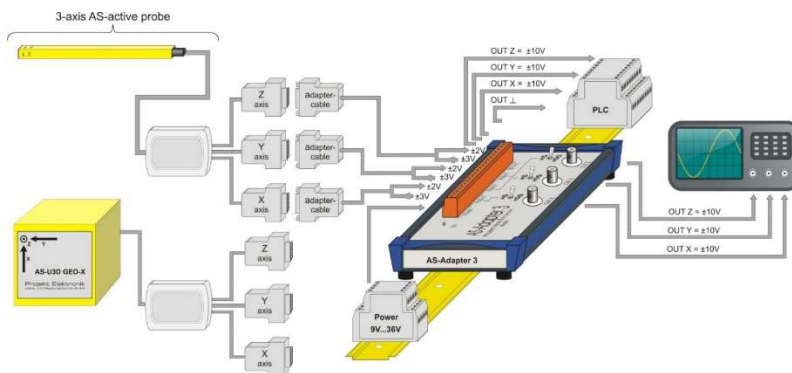
For every of the three single axis a separate Teslameter FM 302 is necessary. In normal case the plug of the probe electronic is simply connected to the Teslameter. The measurement can be started immediately.

For the measurement all functions of the Teslameter FM 302 can be used. With the Teslameter FM 302 the constant component of the field (FM 302 – measurement mode DC) as well as the RMS-value of the alternating component (FM 302 – measurement mode AC) can be determined.

Also all extended possibilities of the Teslameter FM 302 like calibrated analog output, control via USB interface or power supply with power adapter are usable in that way.

For the connection with a computer an USB cable is necessary for every of the three Teslameter FM 302. These are included in delivery of the Teslameter FM 302. At the computer there will be a separate virtual serial port for every device.

### 4.3 Usage of the 3-axis AS-active-probes with the AS-Adapter 3



*Figure 5 connection to AS-Adapters 3*



## 4. Operation

The plugs of the probe electronics are connected to the AS-Adapter 3. The necessary adapter cables are included in delivery of the AS-Adapter 3.

### 4.4 Mounting of the Probe Head

The body of the probe head consists of a square brass profile of 6 mm x 6 mm. For mounting the probe head can be e.g. clamped in an appropriate mounting hole.

The sensors are located at the front end of the probe head. Therefore, there should be applied no pressure at this area of the probe head.



**The probe head must not be clamped at the first 20 mm.**

### 4.5 Overload

The used sensors have a limited measurement range. Signals with more than  $\pm 2500$  mT at an AS-N3DM x+y+z syn-out, more than  $\pm 250$  mT at an AS-L3DM x+y+z syn-out or more than  $\pm 25$  mT at an AS-V3DM x+y+z syn-out will result in an overload of the single sensors. The entire field of alternating field and constant field has to be considered.



**Constant field and alternating field may not overload the sensors. This would result in distort measurement results.**

A damage of the sensors does not occur by the overload.

In case of doubt e.g. with complex alternating fields the signal should be checked with an oscilloscope at the analog output of the Teslameter FM 302.

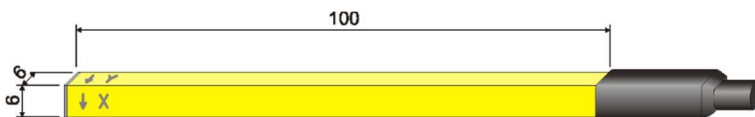
### 4.6 Minimum Required Field

The low end of the usable range is limited by non-linearity, offset error, zero drift, and noise. These values are stated in the technical data of the respective probe.

With the optionally available zero chamber an offset adjustment can be performed. This is especially advised before the measurement of small fields.

## 5. Technical Data

### 5.1 3-axis Probe 2000 mT (AS-N3DM x+y+z syn-out)



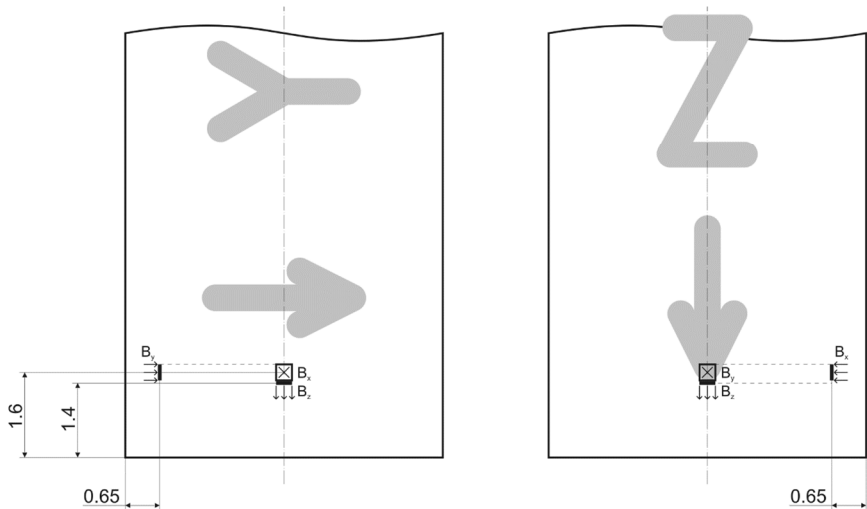
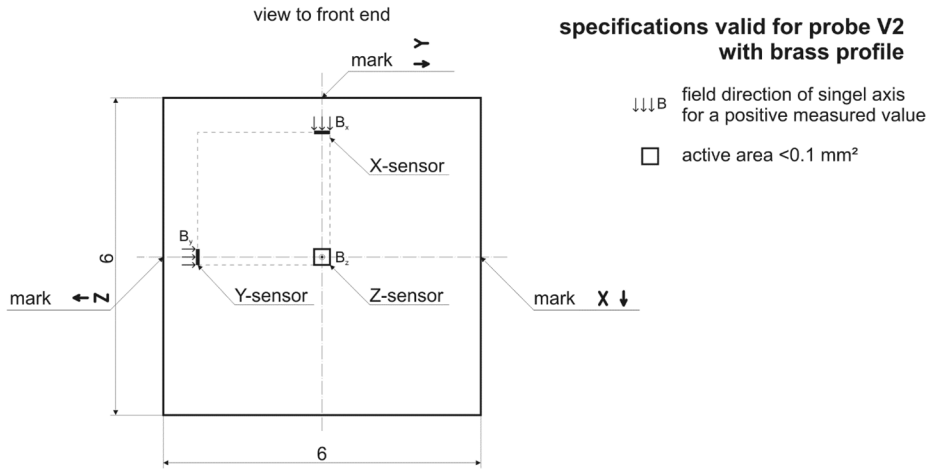
*Figure 6 3-axis Probe AS-N3DM x+y+z syn-out for  $\pm 2000$  mT*

Transfer factor	
with FM 302	$\pm 2$ V / 20 mT; $\pm 2$ V / 200 mT; $\pm 2$ V / 2000 mT
with AS-Adapter 3	$\pm 10$ V / 200 mT; $\pm 10$ V / 2000 mT
Sensor volume	see drawing page 11
Effective sensor area	$< 0.1$ mm <sup>2</sup> per axis
Perpendicularity of the sensors	$\pm 3^\circ$
Bandwidth (-3 dB)	DC – 10 kHz
Rise time (X, Y, Z)	$< 30$ $\mu$ s
Linearity error (X, Y, Z)	$< 0.5$ % $\pm 0.2$ mT (at 23 °C $\pm 1$ °C)
Temperature coefficient (X, Y, Z)	max. -0.05 %/K, typ. -0.03 %/K (0 to 50 °C)
Zero drift (X, Y, Z)	max. $\pm 0.020$ mT/K, typ. $\pm 0.010$ mT/K (DC)
Noise (X, Y, Z)	typ. 21 $\mu$ T <sub>RMS</sub> (10 Hz – 10 kHz) typ. 18 $\mu$ T <sub>PP</sub> (DC – 10 Hz, 50 s)
Probe head	brass 6 mm x 6 mm x 100 mm without cable transition and cable
Length of cable	1.5 m
Operation temperature	+5 °C to +50 °C
Storage temperature	-10 °C to +60 °C
Max. relative humidity	70 % at +35 °C
Power	$\pm 3$ V through FM 302, AS-Adapter 3 or PLC
Connector	15 pol. SubD
Output impedance	$< 1$ $\Omega$

**Technical data are subject to change without prior notice!**

# 5. Technical Data

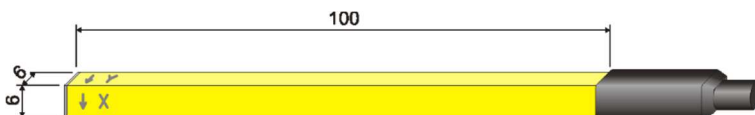
## 5.2 Position of the Active Areas AS-N3DM x+y+z syn-out



*Figure 7 position of the active areas AS-N3DM x+y+z syn-out*

## 5. Technical Data

### 5.3 3-axis probe 200 mT (AS-L3DM x+y+z syn-out)



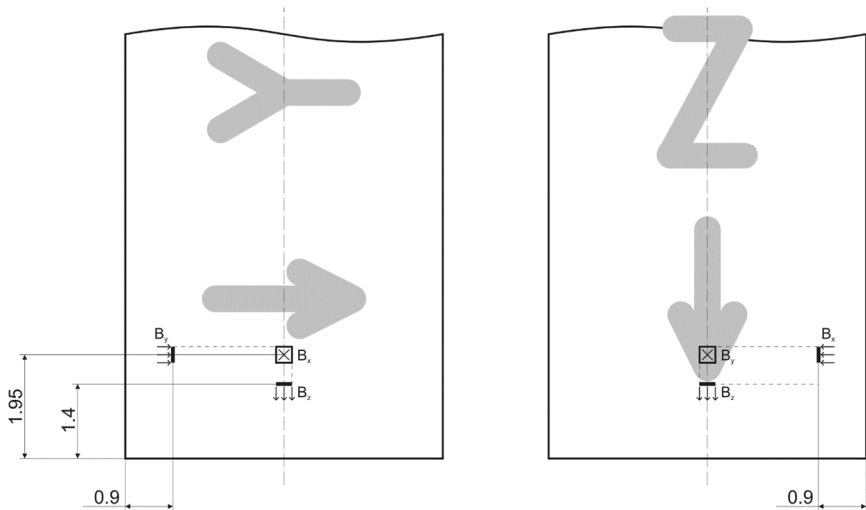
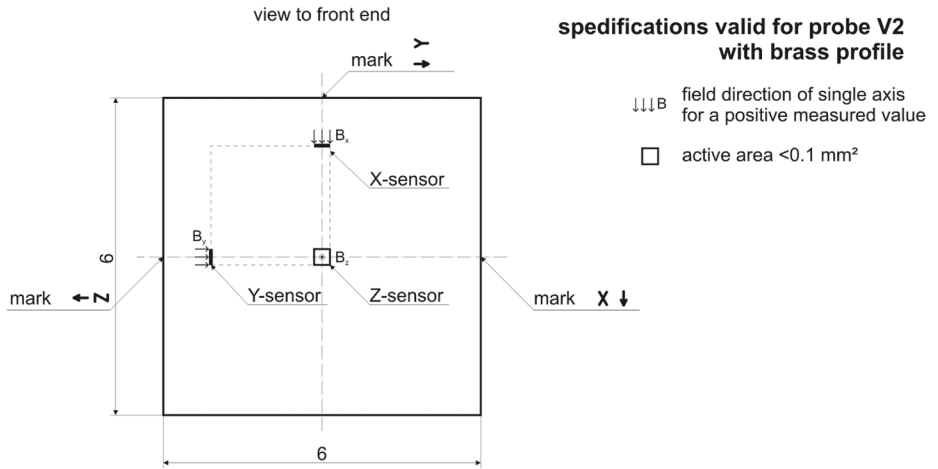
*Figure 8 3-axis probe AS-L3DM x+y+z syn-out for  $\pm 200$  mT*

Transfer factor	
with FM 302	$\pm 2$ V / 2 mT; $\pm 2$ V / 20 mT; $\pm 2$ V / 200 mT
with AS-Adapter 3	$\pm 10$ V / 20 mT; $\pm 10$ V / 200 mT
Sensor volume	see drawing page 13
Effective sensor area	$< 0.1$ mm <sup>2</sup> per axis
Perpendicularity of the sensors	$\pm 3^\circ$
Bandwidth (-3 dB)	DC – 10 kHz
Rise time (X, Y, Z)	$< 30$ $\mu$ s
Linearity error (X, Y, Z)	$< 0.5$ % $\pm 0.1$ mT (at 23 °C $\pm 1$ °C)
Temperature coefficient (X, Y, Z)	max. -0.05 %/K, typ. -0.03 %/K (0 to 50 °C)
Zero drift (X, Y, Z)	max. $\pm 0.010$ mT/K, typ. $\pm 0.005$ mT/K (DC)
Noise (X, Y, Z)	typ. 14 $\mu$ T <sub>RMS</sub> (10 Hz – 10 kHz) typ. 34 $\mu$ T <sub>PP</sub> (DC – 10 Hz, 50 s)
Probe head	brass 6 mm x 6 mm x 100 mm without cable transition and cable
Length of cable	1.5 m
Operation temperature	+5 °C to +50 °C
Storage temperature	-10 °C to +60 °C
Max. relative humidity	70 % at +35 °C
Power	$\pm 3$ V through FM 302, AS-Adapter 3 or PLC
Connector	15 pol. SubD
Output impedance	$< 1$ $\Omega$

**Technical data are subject to change without prior notice!**

## 5. Technical Data

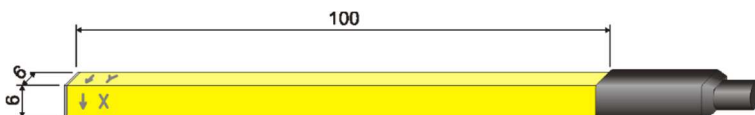
### 5.4 Position of the Active Areas AS-L3DM x+y+z syn-out



*Figure 9 position of the active areas AS-L3DM x+y+z syn-out*

## 5. Technical Data

### 5.5 3-axis probe 20 mT (AS-V3DM x+y+z syn-out)



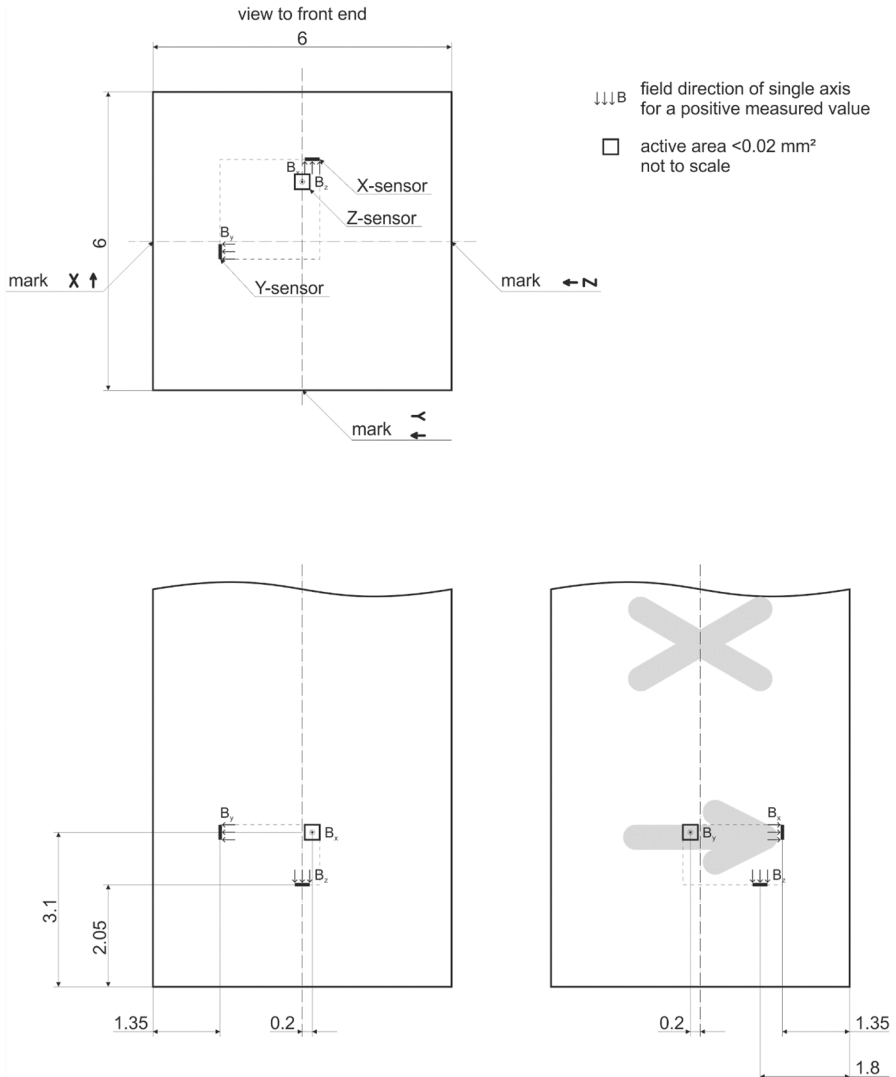
*Figure 10 3-axis probe AS-V3DM x+y+z syn-out for  $\pm 20$  mT*

Transfer factor	
with FM 302	$\pm 2$ V / 200 $\mu$ T; $\pm 2$ V / 2 mT; $\pm 2$ V / 20 mT
with AS-Adapter 3	$\pm 10$ V / 2 mT; $\pm 10$ V / 20 mT
Sensor volume	see drawing page 15
Effective sensor area	$< 0.02$ mm <sup>2</sup> per axis
Perpendicularity of the sensors	$\pm 3^\circ$
Bandwidth (-3 dB)	DC – 1 kHz
Rise time (X, Y, Z)	$< 300$ $\mu$ s
Linearity error (X, Y, Z)	$< 0.5$ % $\pm 10$ $\mu$ T (at 23 $^\circ$ C $\pm 1$ $^\circ$ C)
Temperature coefficient (X, Y, Z)	max. $\pm 0.06$ %/K, typ. $\pm 0.03$ %/K (0 to 50 $^\circ$ C)
Zero drift (X, Y, Z)	max. $\pm 2$ $\mu$ T/K, typ. $\pm 1$ $\mu$ T/K (DC)
Noise (X, Y, Z)	typ. 5 $\mu$ T <sub>RMS</sub> (10 Hz – 1 kHz) typ. 2 $\mu$ T <sub>PP</sub> (DC – 10 Hz, 50 s)
Probe head	brass 6 mm x 6 mm x 100 mm without cable transition and cable
Length of cable	1.5 m
Operation temperature	+5 $^\circ$ C to +50 $^\circ$ C
Storage temperature	-10 $^\circ$ C to +60 $^\circ$ C
Max. relative humidity	70 % at +35 $^\circ$ C
Power	$\pm 3$ V through FM 302, AS-Adapter 3 or PLC
Connector	15 pol. SubD
Output impedance	$< 1$ $\Omega$

**Technical data are subject to change without prior notice!**

## 5. Technical Data

### 5.6 Position of the Active Areas AS-V3DM x+y+z syn-out



*Figure 11 position of the active areas AS-V3DM x+y+z syn-out*

rotated compared to AS-N3DM x+y+z syn-out and AS-L3DM x+y+z syn-out

## 6. EU Declaration of Conformity

### EU Declaration of Conformity

Name of manufacturer	Projekt Elektronik Mess- und Regelungstechnik GmbH
Manufacturer's address	Am Borsigturm 54 D-13507 Berlin Germany Tel.: +49 30 - 43 03 22 40 Fax.: +49 30 - 43 03 22 43 <a href="http://www.projekt-elektronik.com">http://www.projekt-elektronik.com</a> Email: <a href="mailto:info@projekt-elektronik.com">info@projekt-elektronik.com</a>
declares that this product AS-active-probe	Series F878
Short description	It is a 3-axis measurement system which allow to measure the three axes of the magnetic field separate of each other.
under EMC guidelines,	2014 / 30 / EU
and RoHS directive	2011 / 65 / EU
complies with the following standards and/or standardizing documents	EN 61326 – 1:2013
Supplemental information	As to the restrictions regarding EN 61000-4-3 see also Minimum Operation Conditions (EMC) page 6

Berlin, 02. June 2020

Dipl.-Ing. Hartmut Heinze  
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