META

MMW-9R

NON CONTACTING MOISTURE MEASURING GAUGE

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NON CONTACTING MOISTURE MEASURING GAUGES MMW-9R

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CERTIFICATION OF COMPLIANCE

CUSTOMER : FRAUNHOFER INSTITUTE. PHYS.

PROZESSTECHNIK / .

CUSTOMER P/N : .296905

MODEL NUMBER : MMW-9R

DESCRIPTION : NON CONTACTING MOISTURE

MEASUREMENT GAUGE

QUANTITY: 1X parts

Seller certifies that the articles described herein shall be free from defects in workmanship. They have been inspected and are in full accordance with the applicable requirements, specifications and drawings of said purchase order.
We certify that inspection evidence, including test data necessary to substantiate this certifications is available in our files.

FOR META   *DATE*

.   / .   4 DEC 2014

CE-CONFORMITY

GENERAL

META measuring equipment complies with the EMI-guidelines.

Throughout production and associated tests special attention is focussed on EMI and the most contemporary guidelines applied to protect and prevent the apparatus against EM-radiation.

The equipment connected to the heads also influences the EMI-behaviour of the heads and special consideration has to be taken pertaining :

DIGITAL DATA-LINES :

Connection of measuring equipment with external devices such as printers , digital processors etc. must always be established via shielded cables.

It is recommended to attach the shield on one side with earth.

SIGNAL-LINES :

Signal conductors between head and measuring equipment should be held as short as necessary.

In normal case the line length should not exceed the 10 meters.

For all signal lines shielded connections are prescribed.

It is not allowed to install signal lines along with mains and especially with ac-carriers.

NEGATIVE INFLUENCES ON THE GAUGE :

In applications where strong electromagnetic fields surround the measuring gauge deviations of the specified measuring results could be expected.

SAFETY

WARNINGS

- Avoid banging and knocking the electronics/sensors

    ⇒ Damage to or destruction of the electronics/sensors

- Power supply must be connected in accordance with the safety regulations for electrical equipment

    ⇒ Danger of injury

    ⇒ Damage to or destruction of the sensor safety

- Protect the cables against damage

    ⇒ Failure of the measuring device

PROPER USE

- The MMW-9R gauges are designed for use in industrial areas.
- They are used for machine supervision and for measuring and testing in process quality assurance.
- The systems may only be used in such way that does not endanger persons or cause damage to the machine due to malfunctions or total failure of the system.
- Additional precautions for safety and damage prevention must be taken for safety-related applications

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APPLICATIONS

META´s measuring gauges of type MMW are designed for measuring the moisture content of paper, cardboards, wood, textile, non woven, mineral fibre plates, construction materials, food etc.

The measuring gauges are designed to be also used without special signal processing units thus facilitating the system integration.

Specifications*	MMW-9R
Measuring range	<=4000 g/m2 *
Measuring principal	continuous
Supply Voltage	24 VDC
Transmitter-Receiver Clearance (stand off distance)	54 mm
Uncertainty	2σ = 0.5% H20 on 1 sec
Outputs	2X (0-10V)
Protection Class	IP 54
Ambient Conditions	up to 40°(no cooling), 0-95 % rH
Weight	ca 9 kg
dimensions (WxHxD) [mm]	335 X 245 X 180

* For higher contents contact factory

* META reserves the right to change these specifications without notice

PRINCIPLE OF OPERATION

Water shows clearly defined resonance bands in the microwave zone of the electromagnetic spectrum.

MMW-measuring gauges exploit this feature in order to establish exactly density independent moisture content measurement of materials in on-line modus measuring contact-free.

The method used relies on measuring the absorption and polarization of the microwaves when passing through material.

For this purpose and in order to further minimize material dependence the measurement is accomplished over a broad band of frequencies (frequency sweep).

Both absorption and polarization are functions of the dielectric properties and the density of the material. By combining both measuring parameters a density independent measurement is achieved.

The MMW-9R gauge consist of the sender/receiver unit integrated on one side. In case on the other side is a reflector located the measurement applies is reflexion. If no reflector exists the measurement applies is backscattering.

The method shows a low sensitivity to material variations as well as to web oscillations of low magnitude as it is usually encountered in production lines.

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GAUGE INSENSITIVITY

The gauge shows an insensitivity to various web properties and fillers and especially :

- pH
- web speed
- clay
- cellulose
- ink
- CaCo3
- China Clay
- fibre orientation

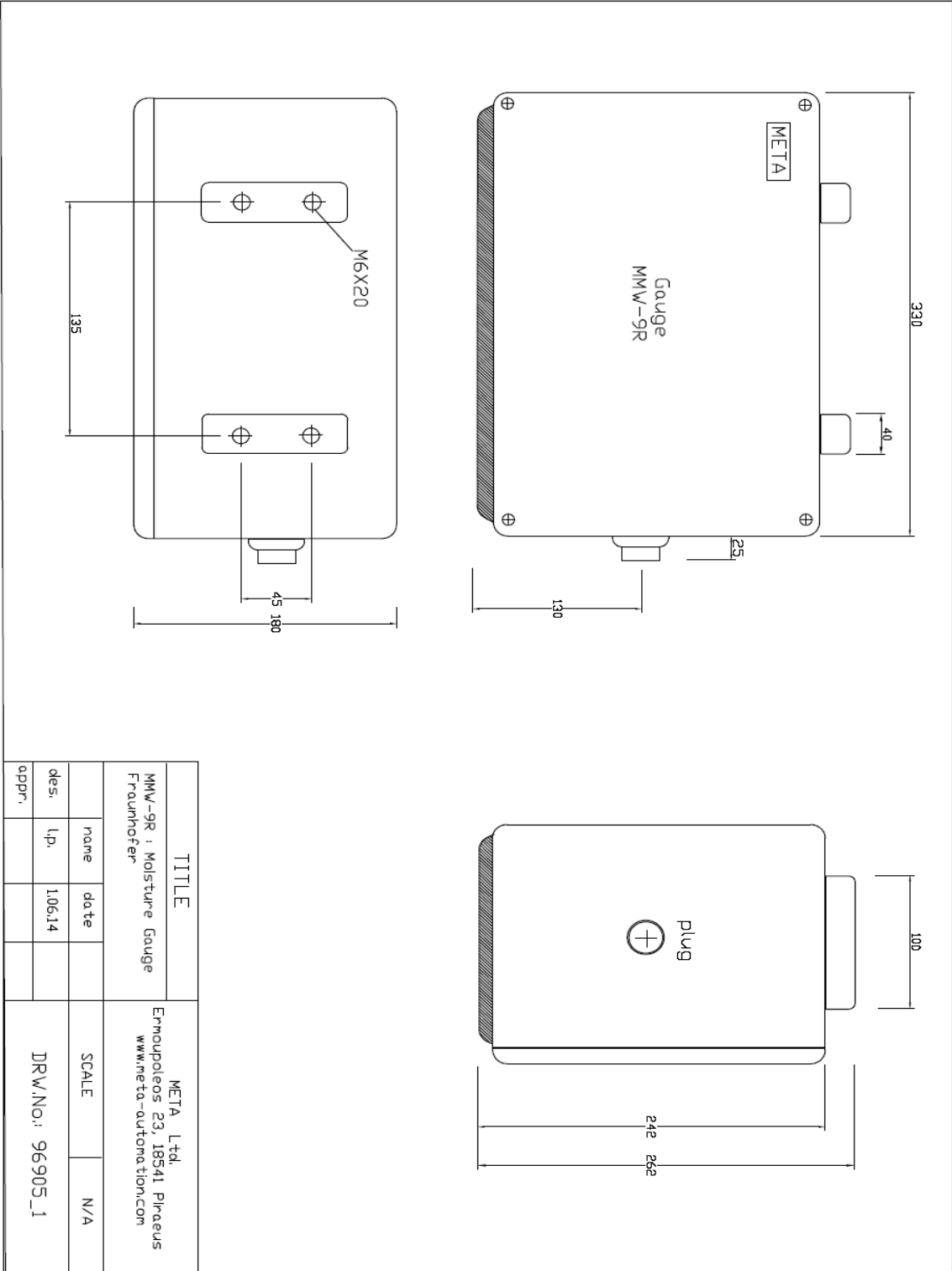The gauge is sensitive in terms of decreasing of measuring accuracy against :

- carbon black
- TiO2
- metal components

In those applications special calibration has to be carried out.(contact factory).

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MECHANICAL DIMENSIONS

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WIRING - SIGNAL ALLOCATION

Connector pin allocation:

- ground, gauge internally grounded
- blue, 0 Vdc, power supply
- red, 24Vdc, power supply
- green, +10V VR
- black, +10V VC
- gray, 0 VR
- violet, 0V VC

TITLE: HMV-9R : Signal Allocation

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	name	date	SCALE	N/A
l.p.		1.06.07		
des.				
appr.				

DRW.No.: 96419_2
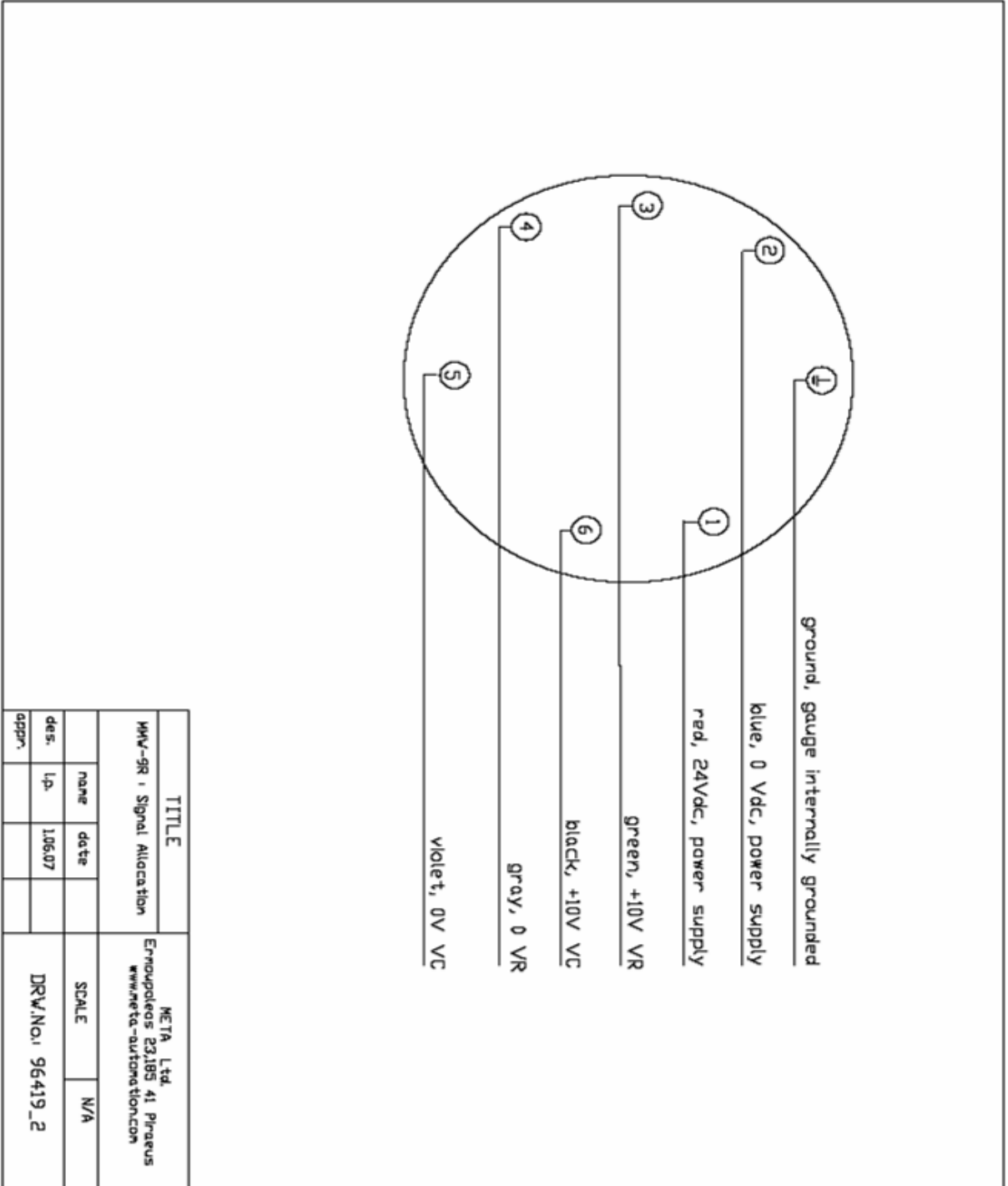
CALIBRATION

Calibration of the gauge is achieved using up to 12 samples of the material
to be measured in a well distributed manner within the range (e.g. minimum-maximum
water content to be covered). The gauge comes to the end-user precalibrated.
Nevertheless a roughly linear characteristic can also be applied in cases
where a rather qualitative measurement of moisture is required.
Besides calibration a periodical standardization is recommended to avoid possible
systematic errors or errors due to changed production conditions.
The standardization consists in practice in fixing the zero offset (gauge trimm) of gauge.
Due to the fact of the variety of materials they can be measured the standardization is
performed using a polished aluminium-standard, positioned in the stand-off distance of the
gauge in 90 grad to the radiation. On the standard the gauge must read

VR = 7.3 V

VC = 1.25 V

(small variations from these values allowerd)
Following treatment is recommended:

LINEARIZATION :

In a practical implementation the calibration curve obtained on the basis of textiles
samples sent can be fitted to a parabolic function as stated below

$$R = 1.88056 + 23.09922 * X - 14.61594 * X^2$$

X is the independent variable containing the voltage values (VR / VC) and R the
temperature-uncompensated moisture in [%]

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SIGNAL TREATMENT :

MMW-9 gauge delivers two (2) preprocessed and "ready for use" signals

Signal "VR" and "VC" corresponding to absorbption resp. polarization .

A temperature signal must be provided to compensate for temperature changes.

From these both signals the value "R" is derived which corresponds to moisture content

R = f (H2O %)

To extract the R value from preprocessed values , the following Pseudo Code has to be applied

---

STEP 1 : READ VR , READ VC // 0 – 10 V

STEP 2 : SIGNAL CONSOLIDATION

//Apply applying moving average on readings VR and VC as below (recommended)

FOR I=1, 10, I++

{

   VR [N] = {VR [N] + VR [N – 1] x (N – 1) } / N   // N=1 – 10,

   VC [N] = {VC [N] + VC [N – 1] x (N – 1) } / N   // N=1 - 10 ,

}

STEP 3 : SIGNAL OUTPUT :

R = VR [N] / VC [N]

B = (9.77×10^{-4}) * T+ 0.026   // T is the temperature in [oC]

MOI = A x R + B   // A-Values, [0 – 1]

END

VR[N], VC[N] : denote the actual values and

VR[N], VC[N] : denote the consolidated values

A : Span (Values 0 ./. 1) , B : Zero (in case temperature compensation is not necessary)

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POWER SUPPLY REQUIREMENTS

User-side the power supply must be secured by fuse (1A) according to following requirements

Supplying voltage :

24 Vdc ,

stabilized

Current   requirements:

Electronic : 750 mA, Maximum

OPERATOR UNIT OMS-9 (OPTION)

The operator unit OMS-9 provides an easy tool to take one or more gauges

into operation.

The unit assists the operator

1.To monitor the actual moisture values

2.To calibrate the gauges

3. To control the process using the actual moisture content as process

    variable.

For unit operation only the *keyboard arrows* are used as well as the *alphanumerical keys*

once the operator changes current values.

Each input becomes valid by quitting with *ENTER-key.*

Use *ESC-key* to return to previous level.

After the unit is switched on the station shows the welcome-screen.

The use of the *down_arrow* displays the MENU

The operator station provides 3 screens which are explained below:

1. SCREEN

F1:MOISTURE VALUES

This screen accessible by pressing the *F1_key*, displays:

MOIST [gr/m2] : the actual moisture value in gsm. *OUTPUT-VALUE*

MEAN [gr/m2] : the mean value of moisture calculated out of 100

samples   *OUTPUT-VALUE*

MOIST[%] : the actual moisture value in percentage of total weight

                                                 OUTPUT-VALUE

BDRY[gr/m2] : The Bone Dry weight of the web material

to be measured   *INPUT-VALUE*

The input is mandatory in order for the unit to display the right moisture content in [%].

STATUS : The measuring status is *displayed*   *OUTPUT-VALUE*

      4000 = gauge in measuring state

      900 = gauge in calibration state

      4001 = Measuring fault due to calibration

(by going into calibration procedure again, the fault will be reset or by going to the commissioning screen and zero the STDR value).

TARGET [gr/m2] : Don't' care   *INPUT-FIELD*

This input is only for process control purposes.

TOL [+/-] : Don't' care   *INPUT-FIELD*

This input is only for process control purposes.

DEV : Don't care   *OUTPUT-FIELD*

This output is only for process control purposes and shows the achieved 2σ once control has been activated.

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2.SCREEN

F2 : CALIBRATION

This screen is accessible by pressing the *F2_key*.

In order to have access to that screen, the system asks for permission (password).

Master password is 100 .

Via that screen the calibration of the gauge is possible.

NOTE : The gauge MMW-2/MMW-9 are sensitive to water.

In order to simplify the calibration procedure a water depended calibration is designed. A

grade-depended calibration is possible but for OMS-9 not provided.

One has simply to calibrate the gauge in moisture respective water in gr/m2.

Once the calibration is finished the operator can adjust to different grades

using only the span and zero values (A and B).

The calibration can be realized in very fine steps by using up to 12 samples.

In practice that is not necessary, so one can use 6 or less samples depending on the

required accuracy of measurement.

The calibration comprises following steps:

1. Insert the sample of well known bone dry weight

(that is the absolute dry weight) and the moisture content in gr/m2 water weight.

2. Insert at OMS-9

SMPL NO : the number of the first sample 0   *INPUT FIELD*

Note: For the first sample always input 0.

SMPL MOIST : the moisture content in gr/m2 of the sample   *INPUT FIELD*

CAL[Y=1 / N= 0] : In order to take the particular sample into the calibration table insert 1.
INPUT FIELD

After quit the input with *ENTER-key* the calibration starts.

Wait a few seconds till again the calibration input turns to 0.

The station is now ready to calibrate for new sample.

For the new sample insert the next ascending number and repeat the steps for that screen

again.

Note: For calibration at least 2 samples are required.

To avoid jeopardizing always start with 0 and proceed in ascending sample enumeration.

The valid calibration values are shown at that screen below (using the

Down-arrow.)

U0, U1, U2 etc are the head voltages for the corresponding moisture contents in gr/m2

M0, M1, M2 etc.

To check the calibration is important to know that more moisture corresponds

to a greater voltage value.

The maximum voltage value is 27648.

Any value above shows disfunctioning of the unit and will set the system in

Status=4001.

3. <u>SCREEN</u>

F3: COMMISSIONING

This screen accessible by pressing the *F2_key*.

In order to have access to that screen the system asks for permission (password).

Master password is 100 .

There are different INPUT-/OUTPUT-displays to modificate existing system parameters.

For an OMS-9 as stand alone measuring station following fields are valid :

<u>MOISTURE</u> : display of moisture content in gr/m2   *OUTPUT-FIELD*

<u>VOLTAGE</u> : actual measurement voltage from gauge   *OUTPUT-FIELD*

<u>A</u>: A Span parameter for measurement can be inserted   *INPUT-FIELD*

<u>B</u>: A Zero parameter for measurement can be inserted   *INPUT-FIELD*

(use Left-/Right-/Down Arrow)

Note : Using the A and B parameters a grade-depended measurement treatment is

possible. At this stage OMS-9 does not provide the facility of

Grade management.

<u>STATUS</u> :the current system status   *OUTPUT-FIELD*

(refer to calibration section for meaning of status-displays)

<u>N</u> : Insert 1000   *INPUT-FIELD*

<u>K1</u> : Insert 0.001   *INPUT-FIELD*

<u>STDR</u> : A zero resets the measurement in case of faults   *INPUT-FIELD*

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APPENDIX : DRAWINGS

NA