

Annex no. 5

User Manual Statements

Microwave Moisture and Density Measuring System

MW-T

Technical Manual

Version 1.6

TEWS Elektronik GmbH & Co KG

Sperberhorst 10, 22459 Hamburg

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1. Version Control

Version	Date	Comment / Modification
1.0	2008-09-08	First edition
1.1	2008-10-13	Figures "MW-T views: front, sides, bottom" and "Wiring overview MW-T measurement system" edited
1.2	2008-12-03	Figure „Antenna views: front, left side“ included; chapter 11.1. „Scope of supply...“ edited; pinning of connector „AIN“ edited; technical data of inputs/outputs edited
1.3	2009-10-22	Chapter 9 „Installation Advices“ revised; additional connector „DIN2“ for input of conveyor signal included
1.4	2010-01-04	115VAC supply included
1.5	2011-11-07	Chapter 4 -Interfaces corrected; Chapter 9 – antenna „Dual Vivaldi“ included
1.6	2013-08-28	FCC declaration

2. Declaration of Conformity

For the product denoted in the following way:

Machine Type: Microwave Moisture and Density Measuring System MW-T
equipped:

antennas "dual Vivaldi", light barriers "RL29/55/73c/136",
LED signal tower "960 000 02", Pt100 sensor "TMR31", IR sensor "DYNMID10LT",
Ethernet cable

it is hereby certified, that it corresponds to the essential safety regulations which are required according to the guidelines of The Approximation of Law of the Member States concerning Electromagnetic Compatibility 2004/108/ EG and Low Voltage Directives 20 06/95/EG.

For the evaluation of the certificate regarding to the electromagnetical compatibility, the following norms were referred to:

EN 55011 A2 (2007)

EN 61326-1 (2006)

EN 61000-4-2 (2001)

EN 61000-4-3 (2006) + A1 (2008)

EN 61000-4-4 (2004)

EN 61000-4-5 (2006)

EN 61000-4-6 (2007)

EN 61000-4-11 (2004).

For the evaluation of the certificate regarding to the safety requirements, the following norm was referred to:

EN 61010-1 (2002).

Construction:

Measuring unit MW-T, 2 antennas, 3 light barriers, IR sensor, PT100 sensor and LED Signal tower on a table.

Cable for the antennas: coaxial cable "S04272B", 3m

Cable for the light barriers: 10m+2m, unscreened

Cable for the LED signal tower: 2m, unscreened

Cable for the IR sensor: 10m, screened

Cable for the PT100 sensor: 2m, screened

Ethernet cable: 10m, screened

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

- (1) this device may not cause harmful interference, and**
- (2) this device must accept any interference received, including interference that may cause undesired operation.**

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A. Tews, business owner

Hamburg, September 2013

3. Intended Use, Safety Precautions and Warnings

3.1. *Intended Use*

The equipment delivered is intended only for use for the purpose described in the offer or order confirmation in observance of the technical data. Other types of use are not permissible. Proper function and operational safety of the unit can be guaranteed only when the usual general safety precautions and national regulations as well as the special safety precautions in these operating instructions are observed.

To comply with EMC and safety standards the unit must be connected to a non-fused earth conductor.

The measuring device MW-T is meant to be used in dry rooms. It must not be used outdoors.

3.2. *Reduction of Safety*

This unit was built and tested in conformance with EN61010-1 (2002) "Safety requirements for electrical equipment for measurement, control and laboratory use" and was shipped from the factory in a technically perfect and safe condition.

When it is suspected that safe operation of the unit is no longer possible without hazard, shut down and mark to prevent further use. The safety of the user can be endangered by the unit when, for example:

- Visible damage is present,
- The unit no longer operates as specified,
- The unit has been stored for a longer period under unsuitable conditions,
- The unit has been subjected to adverse transport conditions,
- The unit contains loose parts.

In cases of doubt, always send the unit in to the manufacturer for service or repair.

3.3. *Modifications*

Unauthorized conversions or modifications performed without our permission are prohibited for safety reasons.

It is only permissible for trained personnel authorized by us to open the unit or perform any type of setting, maintenance or repair work. **Before any installation, maintenance or modification work disconnect your system from the supply network.**

Never try to open or repair the power supply, line filter or overvoltage protection module.

3.4. *Operation*

Ensure that this equipment is operated only by skilled personnel familiar with the unit to prevent malfunctions and damage to the measuring system and in production.

3.5. *General Operating Instructions*

Only the original accessory parts and spare parts may be used together with the measuring device MW-T.

Defective fuses may only be exchanged by trained electricians. The fuses may only be replaced by ones with the same parameters.

The MW-T is designed to be mounted at a wall. In particular, the control cabinet cannot be operated while standing.

If the outer plugs are not plugged in, in any case, while in operation or during storage and transport, the safety caps should be fastened. Only in this way the guaranteed protection for the control cabinet can be maintained, as well as preventing the plugs from becoming dirty.

No harsh cleaning products, or those containing solvents, may be used to clean the MW-T.

4. Technical Data

Environmental Conditions:

Temperature Range (operational)	0°C..+40°C
Temperature Range (Storage/Transport)	-20°C..+60°C
Relative Humidity	max. 85% (non condensing)
Degree of protection	IP54
Safety class	1

Mechanical Parameters MW-T:

Dimensions (HxBxT) (Enclosure without handles)	600x540x350 mm³
Weight	50kg

Interfaces:

"USB"	2x USB1.1 (non-insulated), max. cable length = 3m
"LAN"	1x 10/100baseT (electrically insulated)
"Ser.Interface" (For service purposes only.)	alternatively 1x RS232/422/485 (electrically insulated) standard baud rates: 300..115200

Inputs/Outputs:

Digital inputs "DIN1"	3x, "0"=-3V..+5V "1"=+15V..+30V, input current 5mA, non-insulated
Digital input "DIN2"	1x, "0"=0..+10V "1"=+16.8V..+30V, input current 10.5mA, insulated
Digital outputs "DOUT"	4x, 24V active, max. 0.5A per output, max. 1A total, non-insulated
Analog inputs "AIN"	3x, 4..20mA, input Ri=80Ohm + 0.7V, Umax=35V, non-insulated
Analog outputs "AOUT"	4x, 4..20mA, load<350Ohm, electrically insulated

Optionally, the number of the inputs and outputs can be furthered.

Optionally, the inputs and outputs can be electrically insulated.

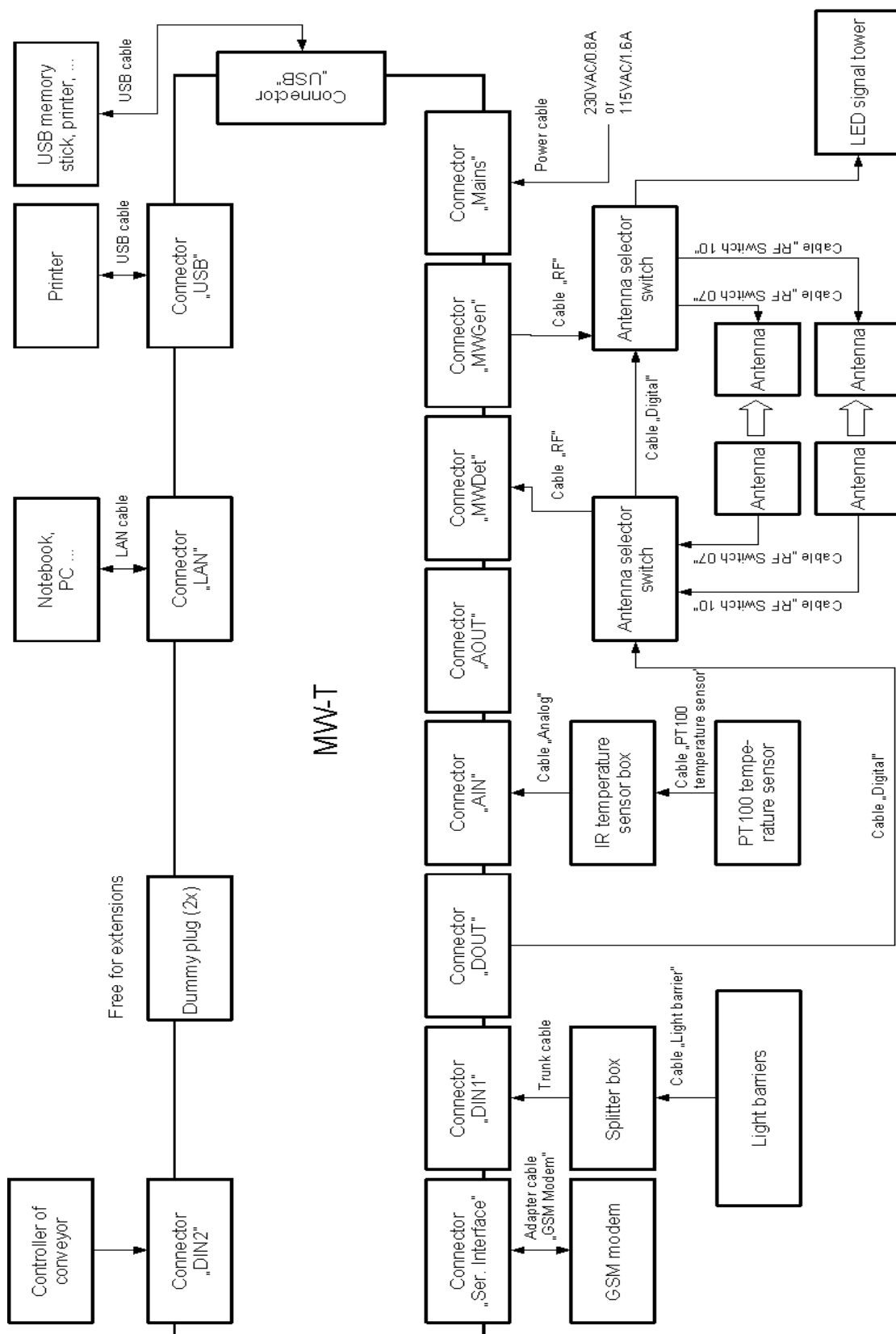
EMC/Electrical Safety:	according to EN 61326-1 / EN 61010-1
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Power Supply:

Cabinet, total	version dependend: 230VAC or 115VAC, 50/60Hz, max. 180W, fuse: 3,15A (230VAC) or 6,3A (115VAC), time-lag
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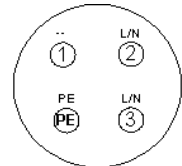
External components (light barriers, IR-sensors, ..)	24VDC, max. 1A, are supplied by the MW-T, fuse: 1A time-lag
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5. Wiring Overview



6. Allocation of the Connectors

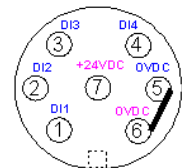
Name	Type	Usage	Pin	Signal	Signal usage
„Mains“	C16-m-4pin	Mains connection	1	-	not in use
			2	L/N	outer or neutral conductor
			3	L/N	outer or neutral conductor
			PE	PE	protective earth conductor



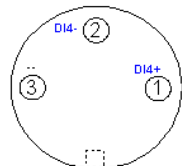
„Mains“ connector
(exterior view)

Fig.: Allocation of the mains connector of the MW-T

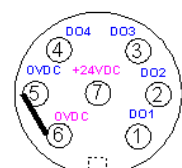
Name	Type	Usage	Pin	Signal	Signal usage
„DIN1“ „Light Barrier“	M16-m-7pin	Light barriers (24V logic)	1	DI1	Digital input 1
			2	DI2	Digital input 2
			3	DI3	Digital input 3
			4	-	-
			5	0VDC	Ground (Signal)
			6	0VDC	Ground (Supply)
			7	+24VDC	Supply +24V (fused)
„DIN2“ „Conveyor“	M16-m-3pin	Ext. control signal (24V logic)	1	DI4+	Digital input 4, positive pole
			2	DI4 -	Digital input 4, negative pole
			3	-	-
„DOUT“ „Antenna Switch“ „Signal Tower“	M16-f-7pin	Antenna selector sw. LED signal tower (24V logic)	1	DO1	Digital output 1
			2	DO2	Digital output 2
			3	DO3	Digital output 3
			4	DO4	Digital output 4
			5	0VDC	Ground (Signal)
			6	0VDC	Ground (Supply)
			7	+24VDC	Supply +24V (fused)
„AIN“ „Temp. Sensor“	M16-m-8pin	Temperature sens. (4..20mA signal)	7	AI1	Analog input 1, positive pole
			3	AI2	Analog input 2, positive pole
			5	AI3	Analog input 3, positive pole
			2	-	not in use
			4	-	not in use
			1	0VDC	Ground (Signal)
			6	0VDC	Ground (Supply)
			8	+24VDC	Supply +24V (fused)
„AOUT“ „Analog Output“	M16-f-8pin	analog measurement values [moisture, density, temperature] (4..20mA signal)	7	AO1	Analog output 1
			3	AO2	Analog output 2
			5	AO3	Analog output 3
			2	AO4	Analog output 4
			4	-	not in use
			1	0VDCISO	Ground (Signal)
			6	0VDCISO	Ground (Supply)
			8	+24VDCISO	Supply +24V (fused, insulated)



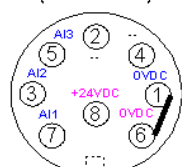
„DIN1“ connector
(exterior view)



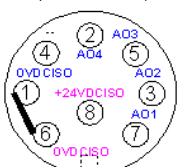
„DIN2“ connector
(exterior view)



„DOUT“ connector
(exterior view)



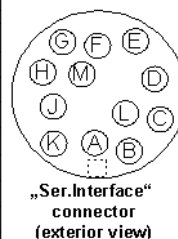
„AIN“ connector
(exterior view)



„AOUT“ connector
(exterior view)

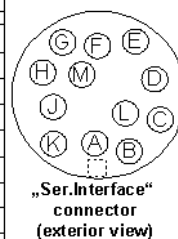
Fig.: Allocation of the digital/analog signal connectors of the MW-T

Name	Type	Usage	Pin	Signal	Signal usage
„Ser.Interface“ „RS232“	M16-f-12pin	Serial interface (RS232)	A	DCD	DataCarrierDetect Input
			B	RxD	ReceiveData Input
			C	TxD	TransmitData Output
			D	DTR	DataTerminalReady Output
			E	GND	Signal Ground
			F	DSR	DataSetReady Input
			G	RTS	RequestToSend Output
			H	CTS	ClearToSend Input
			J	RI	RingIndicator Input
			L	0VDCISO	Ground (Supply)
			M	+24VDCISO	Supply +24V (fused, insulated)



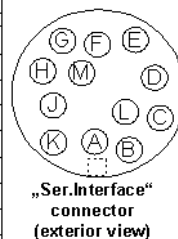
**Fig.: Allocation of the Ser.Interface connector of the MW-T
(configuration as RS232 interface)**

Name	Type	Usage	Pin	Signal	Signal usage
„Ser.Interface“ „RS422“	M16-f-12pin	Serial Interface (RS422)	A	TxD A	TransmitData A Output
			B	RxD A	ReceiveData A Input
			C	DTR A	DataTerminalReady A Output
			D	CTS A	ClearToSend A Input
			E	GND	Signal Ground
			F	TxD B	TransmitData B Output
			G	RxD B	ReceiveData B Input
			H	DTR B	DataTerminalReady B Output
			J	CTS B	ClearToSend B Input
			L	0VDCISO	Ground (Supply)
			M	+24VDCISO	Supply +24V (fused, insulated)



**Fig.: Allocation of the Ser.Interface connector of the MW-T
(configuration as RS422 interface)**

Bezeichnung	Typ	Verwendung	Pin	Signalname	Signalbedeutung
„Ser.Interface“ „RS485“	M16-f-12pin	Serial Interface (RS485)	A	TxD A	TransmitData A Output
			B	RxD A	ReceiveData A Input
			C	-	-
			D	-	-
			E	GND	Signal Ground
			F	TxD B	TransmitData B Output
			G	RxD B	ReceiveData B Input
			H	-	-
			J	-	-
			L	0VDCISO	Ground (Supply)
			M	+24VDCISO	Supply +24V (fused, insulated)



**Fig.: Allocation of the Ser.Interface connector of the MW-T
(configuration as RS485 interface)**

7. Wiring Diagrams

7.1. Connecting Light Barriers

Up to four light barriers may be connected in the following way to the MW-T as needed. The light barriers used work according to the reflection principle. This means that across every light barrier there is a reflector. This reflector beams back the light sent out by the light barrier. If the beam of light is broken the light barrier detects this and sends a message to the MW-T. The relationship of the light barriers to a digital port number takes place through their connection to the splitter box. This means Port 1 on the splitter box corresponds to the signal "DI1" on the digital input "DIN" of the MW-T; Port 2 with "DI2" and so forth...

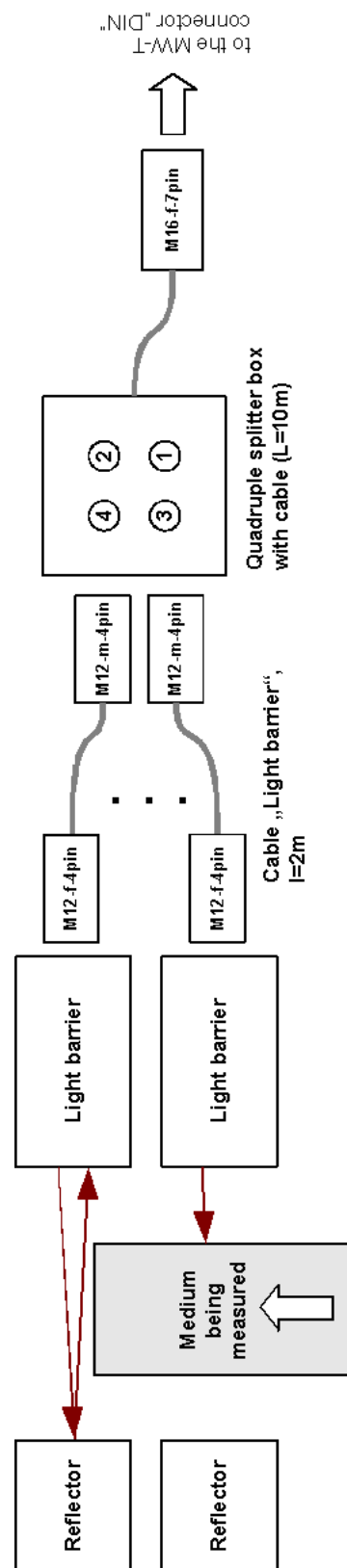


Fig.: Connection of light barriers

7.2. Connecting Temperature Sensors

In order to obtain the product or environmental temperature, temperature sensors can be attached to the MW-T. In doing so, the connection of such sensors occurs over the analog interface "AIN".

In principle, there is a difference between temperature sensors which operate without touching (IR Sensors) and touching sensors (PT100 sensors). Through the non-touch sensors, the temperature of a moving product, for example, can be measured. The environment temperature can, in contrast, better be measured through PT 100 sensors.

The IR sensors as well as the PT100 sensor operate over a 4..20mA interface in order to reveal the temperature values. With the described method, it is possible to connect up to three IR-Sensors and additionally a PT100 sensor to the MW-T. The assignment of the individual sensors to an analog input port occurs directly in the IR sensor or at the PT100 sensor in its connection cable.

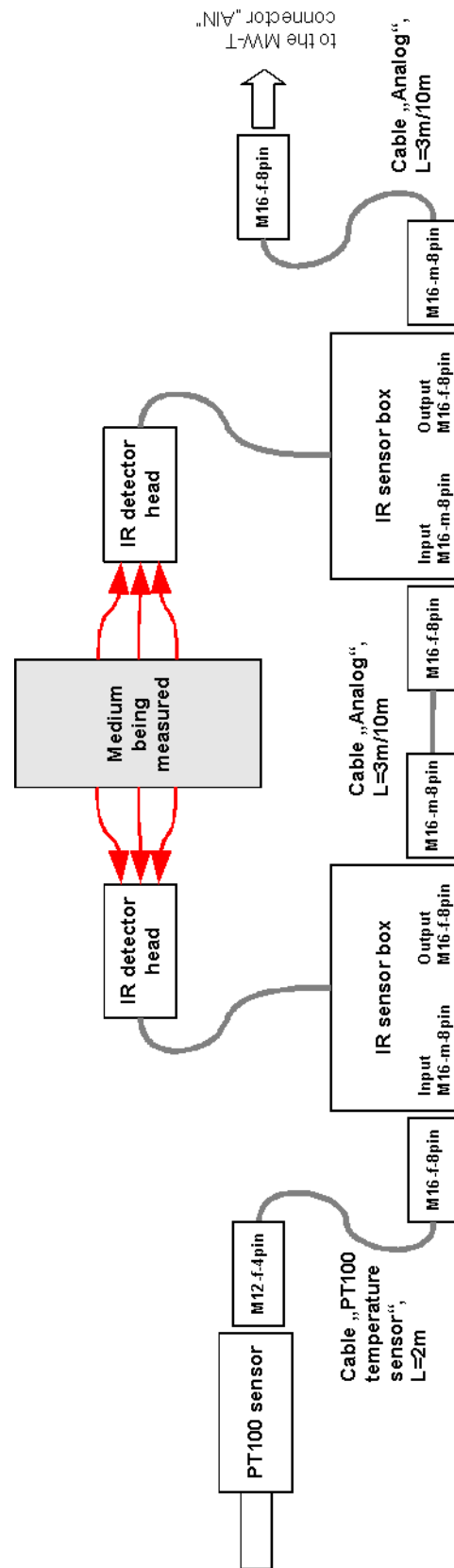


Fig.: Connection of temperature sensors

7.3. Connecting Antenna Switches

In standard operation, one receiving antenna and one sending antenna are attached over the connectors MWDet and MWGen to the MW-T. The medium to be measured is transilluminated and the according moisture and density values are calculated by the MW-T.

If a measurement at different locations on the material has to be measured, a second antenna pair can be used. In this case, the antennas are connected to the MW-T by two so-called „Antenna Selector Switches“. The following figure shows an example of this.

The antenna switches are controlled by the signal „DO4“ of the digital output port „DOUT“ of the MW-T.

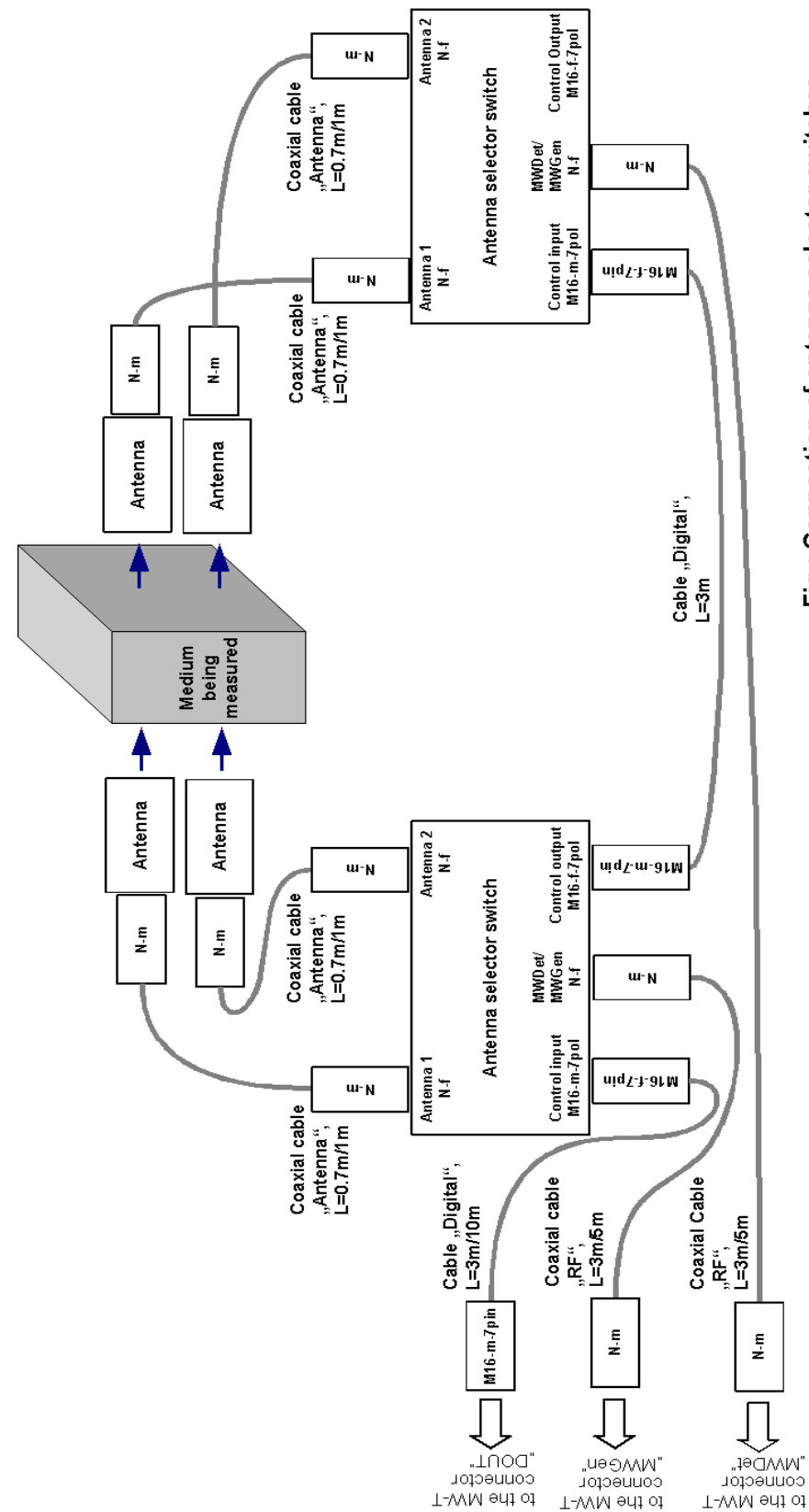


Fig.: Connection of antenna selector switches

7.4. Connecting a LED Signal Tower

The MW-T is equipped with an 8.4" touch display. By this display the measurement values and announcements are shown to the operator. The readability of the information on the display is naturally restricted to relatively small distances. For a signalling over larger distances, a LED signal tower can be connected to the MW-T through the "DOUT" connector. If the "DOUT" connector is already being used through the connection of an antenna switch, the signal tower can be connected to the control output of the second switch.

The LED signal tower uses in general the signals "DO1".."DO3" of the digital output "DOUT".

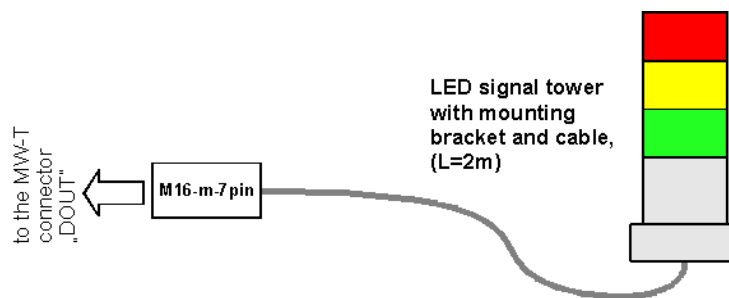


Fig.: Connection of a LED signal tower

7.5. Connecting a GSM Modem

It is possible to connect a GSM modem to the MW-T through the 'Ser. Interface' connector. In order to do this, the „Ser.Interface“ port of the MW-T must be set to operation type RS232. Operation type RS232 is the standard setting in distributing the MW-T.

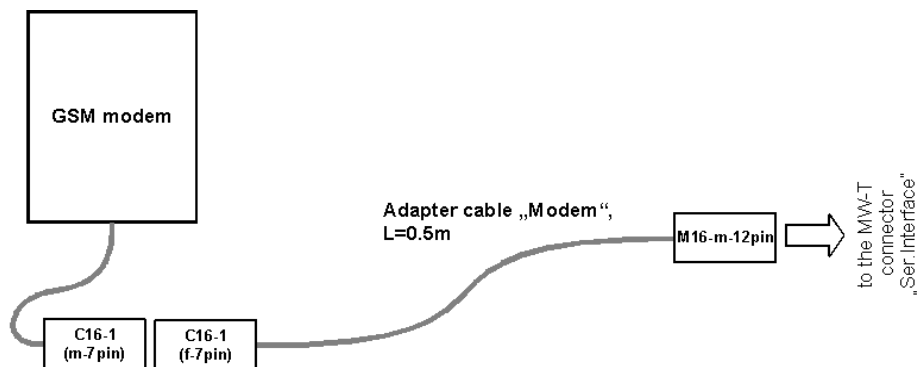


Fig.: Connection of a GSM modem

8. Mechanical Drawings

8.1. MW-T, views: front, side, bottom

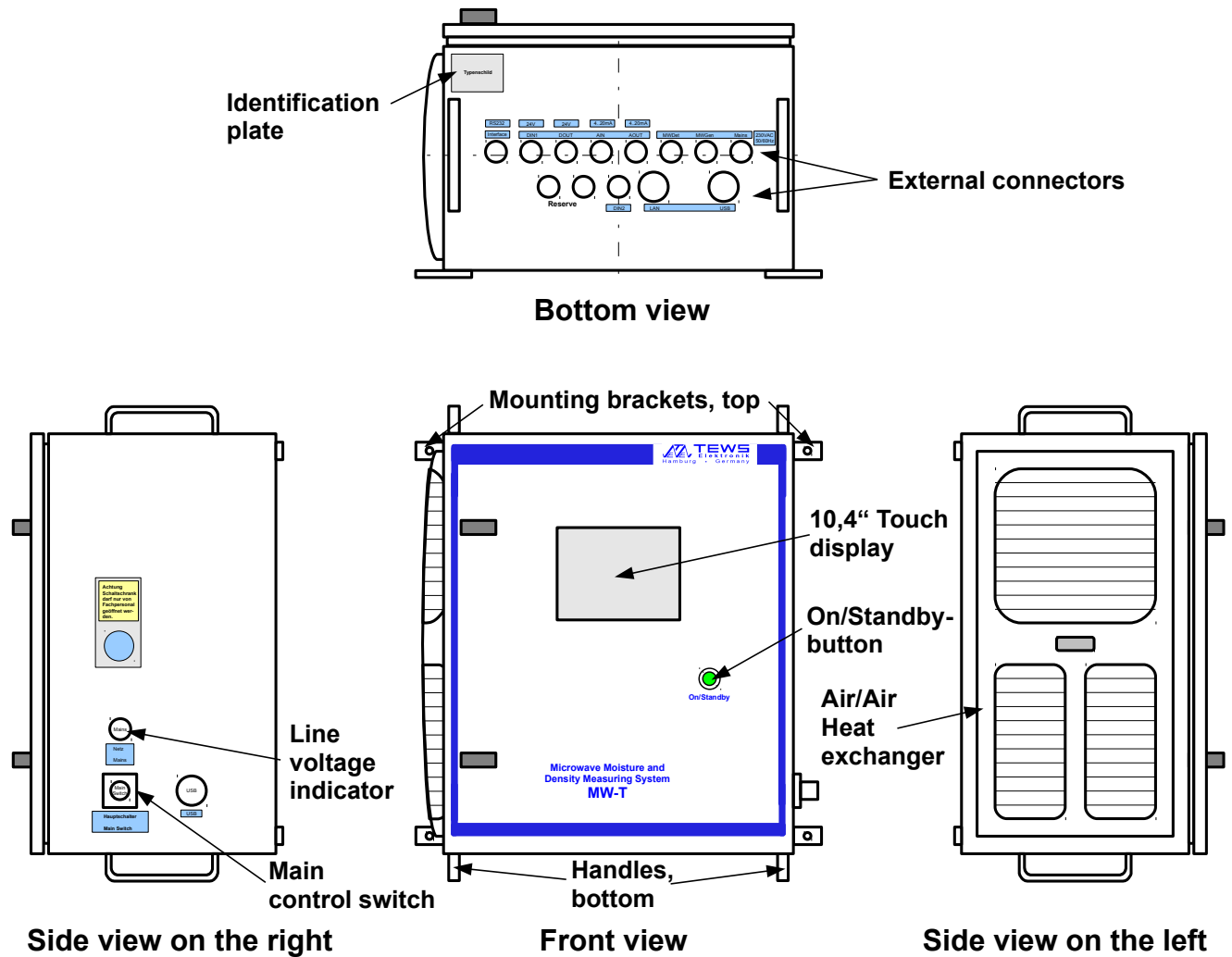


Fig.: MW-T views: front, sides, bottom

8.2. MW-T, Mounting View

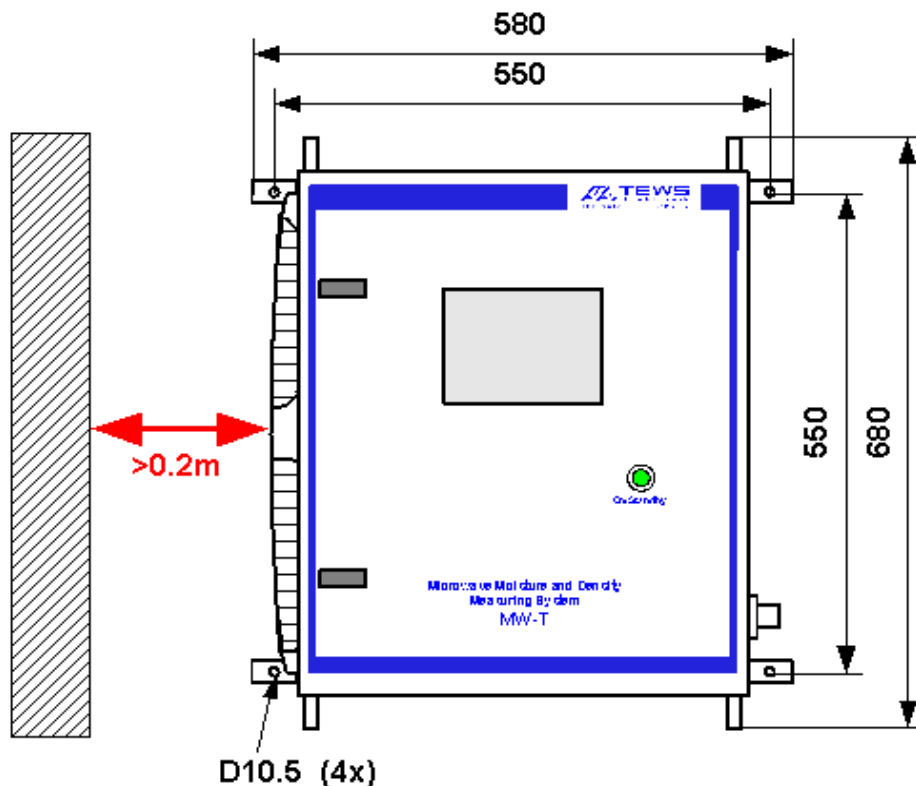


Fig.: MW-T, Mounting and dimensions

9. Installation Advices

The MW-T is meant to be mounted on its rear panel. To this end, it is equipped with four mounting brackets which each comprise a hole with a 10.5 mm diameter.

In order to guarantee adequate cooling, all sides of the control cabinet must remain free, with the exception of the rear panel. Especially, the distance of the heat exchanger installed on the left side of the MW-T to walls or any other machine may not be less than 0.2 m (see figure in ch. 8.2).

The ventilation slots of the installed heat exchanger must not be closed up under any circumstances.

On the bottom side of the MW-T, there are connectors for the connection of external components such as antennas, light barriers etc. Here, adequate space for the cables must be provided. Wiring must be arranged.

In order to ensure a high level of accuracy of the MW-T measuring system, the installation of the antennas must be given special attention:

- The antennas should be placed centric to the measurement object.
- Behind or next to the antennas a space of at least 0.5m must be maintained free from objects and people (see following figure).

- The antennas should be mounted at a place with low mechanical vibration.
- The width of the mounting rods should not be bigger than 40mm.

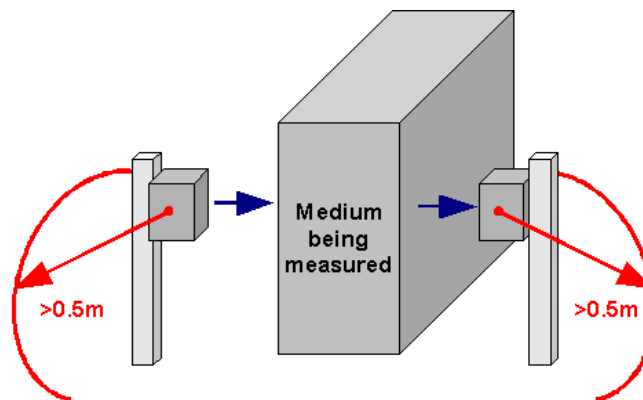


Fig.: Mounting of the antennas

To achieve a high accuracy of the MW-T measurement system, the exact alignment of the antennas and light barriers has to be determined by tests. The alignment of the components depends on the measurement object and the environment.

Below a typical installation for measuring products in C48 cardboard boxes is shown. The distances defined in the following figure are guidelines.

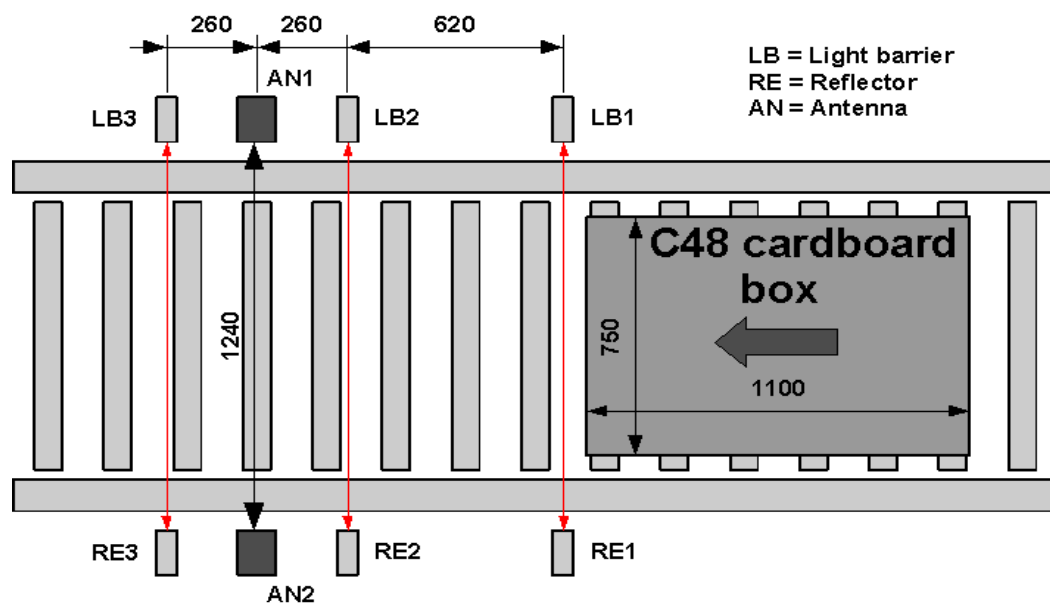


Fig.: Typical installation of antennas and light barriers for products in C48 cardboard boxes

If the installation place is a roll conveyor, the antennas should be in a line with one roll.

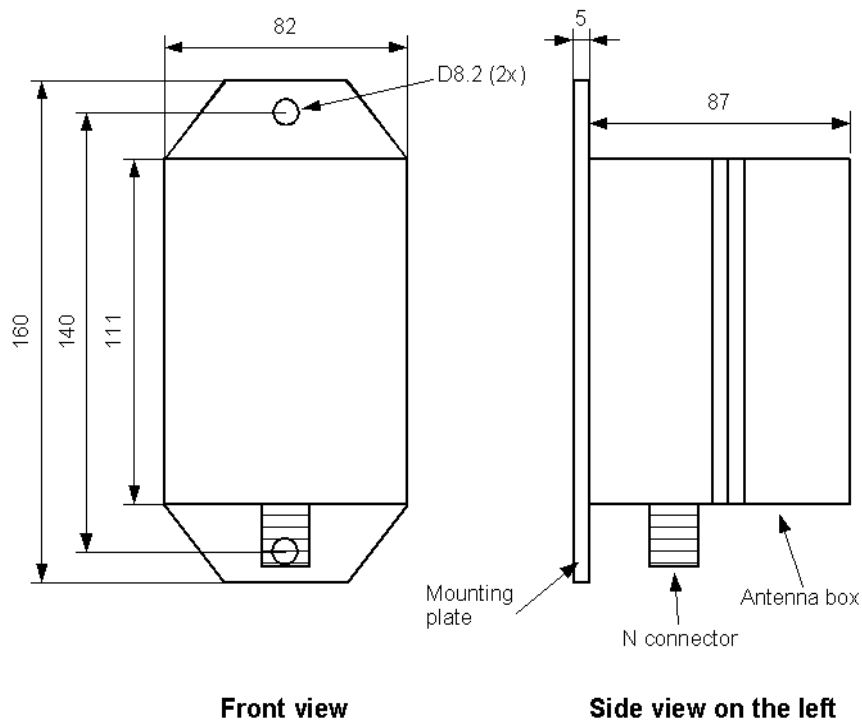


Fig.: Antenna views „Vivaldi“: front, left side

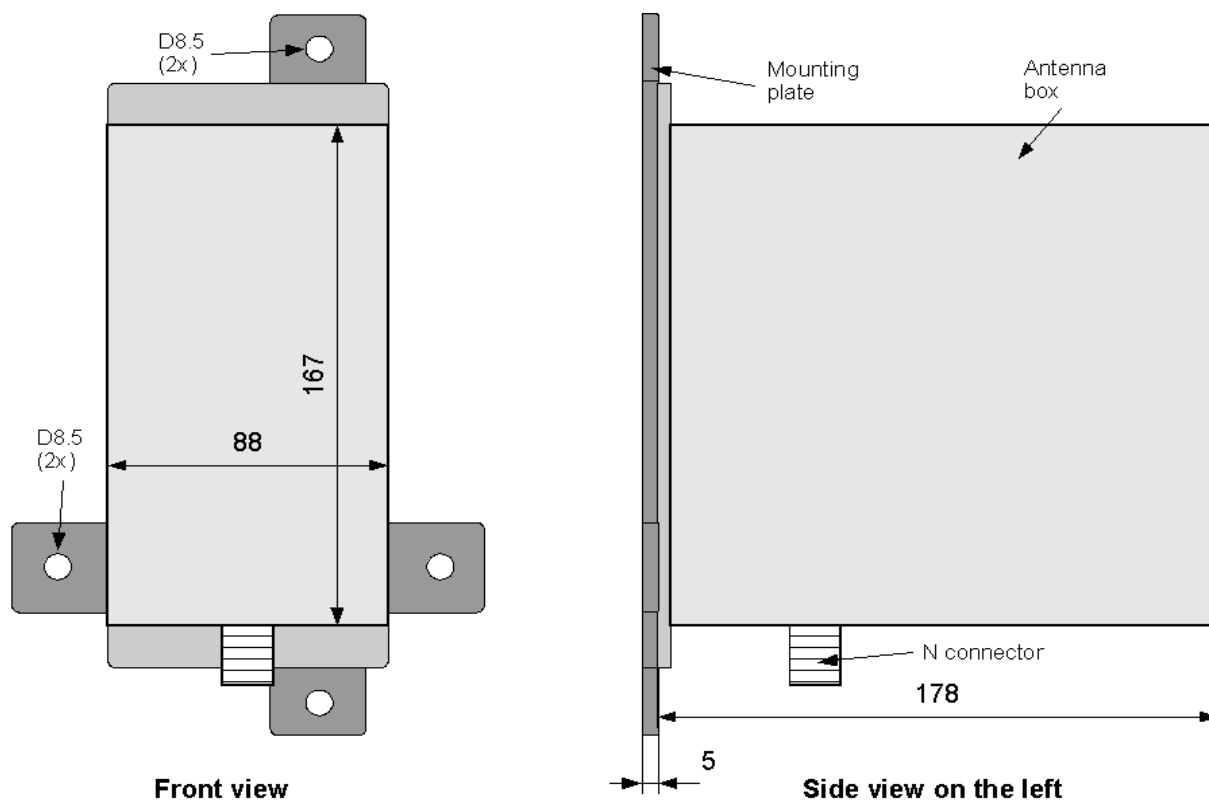


Fig.: Antenna views „Dual-Vivaldi“ (front, left side)

10. Service and Maintenance

Through the air-air heat exchanger built into the left side-wall of the MW-T, an adequate cooling of the machine is guaranteed.

According to the cleanliness of the air in its environment, the heat exchanger must be checked for pollution at regular time intervals (at least once a month). This may only be carried out by qualified electricians after the power supply of the control cabinet has been **switched off!**

The cleaning of the heat exchanger should be performed in the following way:

- Carefully remove the cover of the heat exchanger.
- Release the cable of the temperature control unit on the cover.
- Clean the heat exchanger by applying compressed air into the air outlet.
- Reattach the cable of the temperature control unit.
- Clip on the cover of the heat exchanger until it catches.

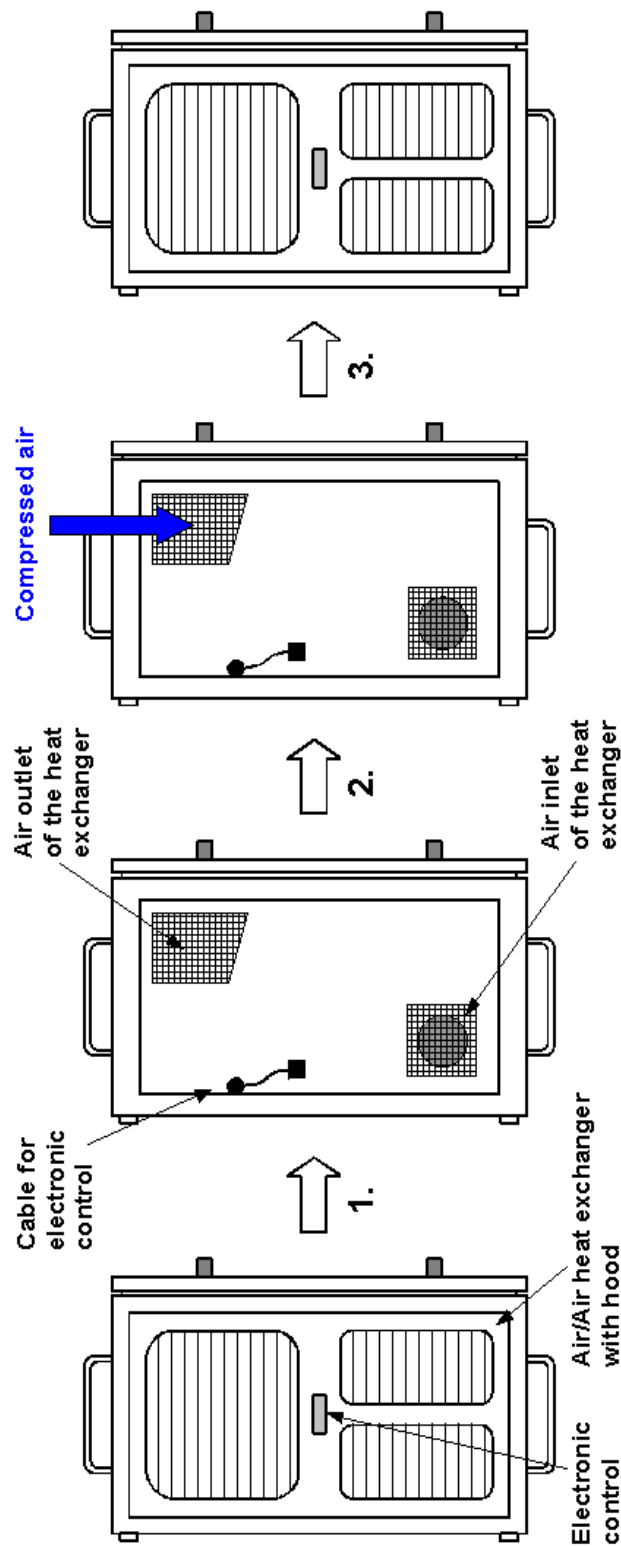


Fig.: Cleaning of the Air/Air heat exchanger

11. Scope of Supply, Options, Additional Equipment

11.1. Scope of Supply of the measuring system MW-T

The following individual components belong to the scope of supply of the measuring system MW-T:

- MW-T measuring unit
- 2 antennas
- 2 coaxial cables "RF", Choice of length: 3 m..5 m
- 3 light barriers incl. reflectors, splitter box and connection cable
- IR temperature sensor incl. connection cable
- PT100 temperature sensor incl. connection cable.

11.2. Additional Options of the MW-T

The MW-T is equipped in general with various interfaces (see section 3. Technical Data). Optionally, the MW-T can be equipped with additional interfaces.

- Additional analog inputs : 4x, 4..20mA
- Additional analog outputs : 4x, 4..20mA
- Additional digital outputs : 4x, 24V, 500mA
- Additional digital inputs : 4x, 24V, 5mA
- Additional electrical insulation of inputs and outputs

Further options can be delivered upon request.

11.3. Accessory for the Measuring System MW-T

In addition, further components can be attached to the MW-T besides the antennas which are part of the scope of supply. These additional components are available as accessory.

- Additional pair of antennas with antenna switching units and cables
- Infrared temperature sensor incl. connection cable
- PT100 temperatur sensor incl. connection cable
- Label printer
- Self adhesive thermo labels, roll (dimensions up to max. 102mm x 127mm)
- LED signal tower, 3 colors, including connection cable

Additional equipment can be delivered upon request.

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