



Crest Ultrasonics Corp.
Scotch Road • P O BOX 7266
Trenton, NJ 08628.

POWERSONIC[®]

MW-GT/GTI/GPI/GPS

Ultrasonic Generator Instruction Manual.



Manufacturing, service and sales:

Martin Walter

Ultraschalltechnik AG

Hardtstraße 13

D-75334 Straubenhardt

Phone: +49 (0) 70 82 - 79 15 0

Fax: +49 (0) 70 82 - 79 15 15

email: info@walter-ultraschall.de

web: www.walter-ultraschall.de

Crest Ultrasonics Corp.

Scotch RD

Mercer County Airport

Trenton, NJ 08628.

Phone: 609-883-4000

Fax: 609-406-7046

web: www.Crest-Ultrasonics.com



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Trenton, NJ 08628.



Introduction

Dear customer,

We thank you for buying a Martin Walter ultrasonic generator POWERSONIC® – series.

The product you acquired is part of the most innovative class of devices in the field of ultrasonic technology and provides a maximum in performance and extras.

By its modular design, great flexibility and reliability are achieved.

For instance, individual modules can be retrofitted or exchanged, with each module being a completely independent part.

Even if a generator or oscillator fails, the system is still working with the remaining generators and oscillators without any problems.

The electronic amplitude and power stabilization guarantee a very high process reliability and constant cleaning quality.

Before putting the ultrasonic generator into operation please read the following operation and safety information carefully!

Information in this document can be changed, improved or supplemented without further notice.

Documents of third parties possibly enclosed are for information only. We do not take any responsibilities for correctness or completeness of their contents.

If you require further information not contained in this guide please call our technical assistance at any time.

Crest Ultrasonics Corp.

Martin Walter Ultraschalltechnik AG



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1 EXPLANATION OF SYMBOLS.



Warning regarding risk of personal injury or damage to the equipment.

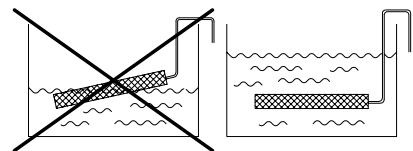
2 SAFETY INFORMATION

Please read the following safety information carefully before operating the ultrasonic generator. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

- The correct use of the ultrasonic generator is described in this documentation and must be followed.
- Installation of the ultrasonic generator must be done by a skilled and qualified electrician. You have to comply with the relevant national standards for safety and mechanical and electrical installation.
- Operation of the ultrasonic generator must be done by trained staff.
- The technical details of the ultrasonic generator, must be respected.
- Adequate ventilation of the ultrasonic generator has to be guaranteed.
- The ultrasonic power supplied to the bath liquid is transformed into heat. With insufficient heat dissipation, it can result in hot steam or ignition, depending on the cleaning agent !

 ***Danger of fire or explosion***

-  Do not operate the ultrasonic generator and the transducer without bath liquid.
The transducer must be completely immersed.



-  Only use bath liquids permitted for use with ultrasonic technology, regarding their possible environmental effects and their inflammability.

-  Unplug or disconnect the system properly before maintenance or repair.



3 WARRANTY

Extent and period of validity of the warranty are written in the Terms of Delivery (GTB) or in the sales contract (Confirmation of Order).

The version valid at delivery is decisive. We cannot take any responsibilities for damages of the ultrasonic generator or transducer due to one or several of the following reasons:

- Improper operating. First of all, please read this manual completely.
- Improper use, not corresponding to its purpose.
- Improper changes, repairs, or modifications or changes, repairs, or modifications without prior consent of the producer.
- Extreme external effects (e.g. impact, fall, humidity, dirt, etc.).
- Insufficiently trained and non-qualified operating or service staff.
- Not complying with the respective safety regulations.



4 GENERAL INFORMATION

4.1 Purpose

The POWERSONIC® – series ultrasonic generators and transducers have been developed especially for industrial cleaning.

Along with the use in cleaning, special applications in the field of mixing and separating are possible (e.g. emulsifying, dispersing, disintegrating).

For special applications, it is necessary to consult the system manufacturer.

These units are intended to use in industrial environment. Because of possible occurring conducted or radiated noise, the electromagnetic compatibility cannot be guaranteed in other environments.

The ultrasonic generator is specially matched to the properties of the corresponding transducers. Generators and transducers are to be replaced only with the same types.

Attention !

For all applications, the transducer must be completely immersed in liquid, which must be able to absorb the supplied ultrasonic energy (heat) and to dissipate it !

 **Depending on the fluid, danger of fire or explosion is possible. Consult with Supplier before use.**

4.2 Cleaning Liquid

The type of used cleaning liquid depends on the material of the cleaning goods and the dirt. Please contact your application supplier or cleaning agent supplier.

 **You must not use flammable or explosive cleaning liquid.**

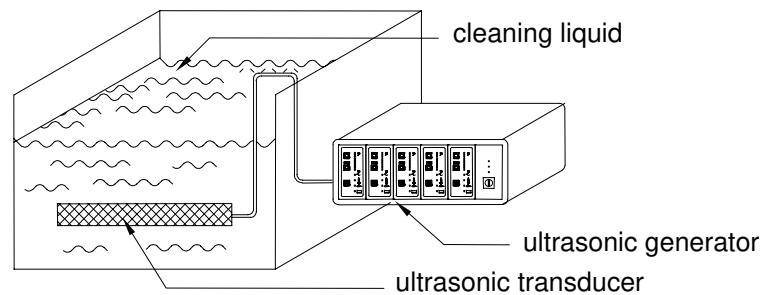
With use of insanitary cleaning agents you must consult corresponding safety instructions.

Please pay attention to the standards and consult your application supplier.



4.3 Operation

An ultrasonic system basically has three components:



- ultrasonic generator
- ultrasonic transducer
- tank with cleaning liquid

The ultrasonic generator transforms the line voltage with 50 or 60 Hz to a frequency corresponding to the operative frequency of the transducer. Usually this frequency is between 20 kHz and 45 kHz and for special applications 132 kHz.

The resulting electric oscillations are supplied to the transducer by a cable.

The transducer transforms these electric oscillations to mechanic sound waves. So, the liquid is set in motion.

Each wave leads to alternating phases of high and low pressure according to the transducer expanding and contracting.

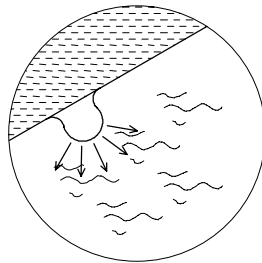
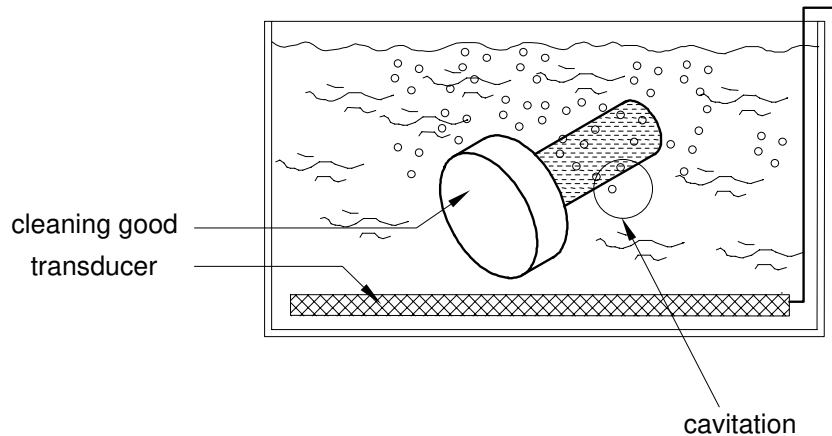
On contracting, which means the phase of low pressure, you can find innumerable small vacuum bubbles in the liquid due to its restricted tractability.

These small cavities collapse during the following expanding of the transducer which means the phase of high pressure. They implode.

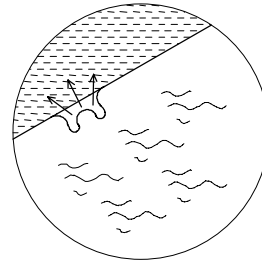
This phenomina is called cavitation.



General Information



low pressure
(starting of cavitation)



high pressure
(implosion of cavitation bubble)

Around the cavitation bubble, local high pressures develop considerable turbulences as well as fluid motions due to the sudden implosion.

These events are the actual criteria to remove dirt particles from the surface of the cleaning goods.

Cavitation bubbles mainly arise at the interface between the liquid and the object to be cleaned. That is exactly where they are desired.



cavitation bubble



4.4 Types of Ultrasonic Transducers

Several different transducers can be used:

Immersible Transducer

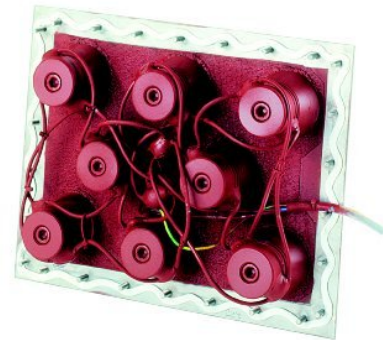
The immersible transducer is a completely encapsulated oscillating element radiating in one direction only.

The transducer can also be attached at the side of the cleaning bath.



Plate Type Transducer

The plate type transducer is a part of the cleaning tank and is fit to the wall or bottom of the tank. The plate type transducer has one radiation direction only, as well.



PushPull® - Transducer

The PushPull®-transducer (patented) is a high performance oscillating element with two driver heads, with following features:

- a homogeneous sound field encircling the transducer allows a high sound density
- useable in vacuum low pressure
- useable near the boiling temperatur of the cleaning liquid
- a remarkable compact type of construction (space-saving)
- easy to retrofit
- an extraordinary long life





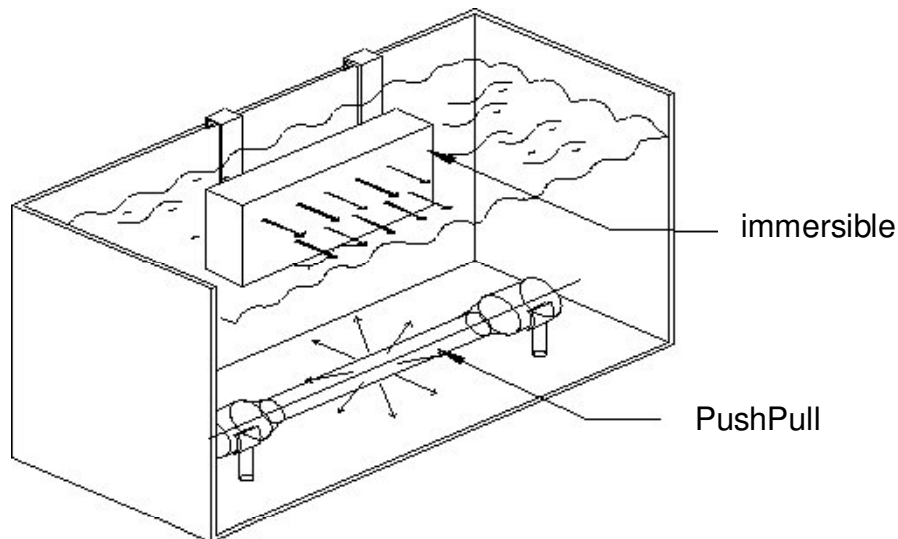
General Information

SinglePush®-Transducer

The SinglePush®-transducer is a high performance oscillating element with one driver head. The SinglePush®-transducer has the same features like the PushPull®-transducer.



General installation (example):





4.5 Transducer Properties

4.5.1 Immersible- and Plate Type- Transducers

The POWERSONIC® generators for immersibles or plate type transducers automatically provide constant HF-output power to the transducer. The output power is independent from changing conditions, such as liquid level, temperature variations, viscosity changes of the liquid or varying loads in the tank. This feature is essential for continued optimum and repeatable cleaning results.

4.5.2 Push-Pull® and SinglePush®- Transducers

The POWERSONIC® generators for Push-Pull® and SinglePush®-transducers offer an even more sophisticated control. This includes, for example, dry running detection and protection for use in low pressure or vacuum applications. This is achieved by a built-in, combined output power and amplitude control which automatically adopts the relevant control features depending on the conditions to which the transducer is exposed.

For example, if the transducer is used in a liquid at a temperature well below its boiling point, at normal atmospheric pressure (1 bar) the generator supplies constant power to the transducer.

If the transducer is placed in a liquid at a temperature relatively close to its boiling point, with ambient pressure below normal ($< 1 \text{ bar}$) or in a vacuum application, then the generator applies automatically amplitude control.

This means, the generator supplies the exact maximum effective output power which under these conditions can optimally be delivered into the cleaning liquid, the amplitude is kept constant.

If under these conditions the generator would try to maintain just constant power as set, the cleaning results would be worse. The output power forced to the transducer could not be passed to the liquid. The necessary contact between transducer and liquid would be lost.

Because of this, the generator will in fact have to reduce the output power to a acceptable level, the number of illuminated LED's on the front panel is reduced.



5 INSTALLATION

5.1 Placing and Mounting

The ultrasonic generator has to be installed or placed in an area not exposed to humidity, contamination and / or aggressive vapours.
For unsuitable environment conditions the generator can be assembled in a cabinet, possibly with an air condition unit (option).

⚠ In order to ensure sufficient ventilation, unrestricted air flow has to be maintained to the air inlet at the front of the generator case as well as to the air outlet at the rear. Behind the cases there must be a clearance of minimum 150 mm. At the 28TE case the air inlet is at the bottom.

5.2 Transducer Connection

Only one transducer can be connected to one generator module. The generator module is factory preset to the matched type of transducer, e.g. immersible or push-pull.

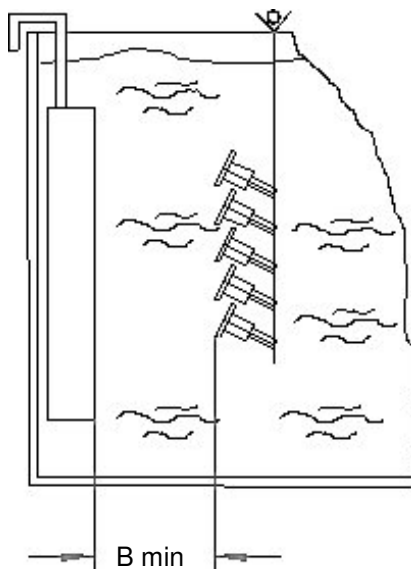
When installing different types of generator modules and / or different transducers, it has to be ensured, that type and power rating of transducer match the respective generator module.

⚠ Use only shielded wires to connect generator and transducer.



5.3 Information about Transducer Installation

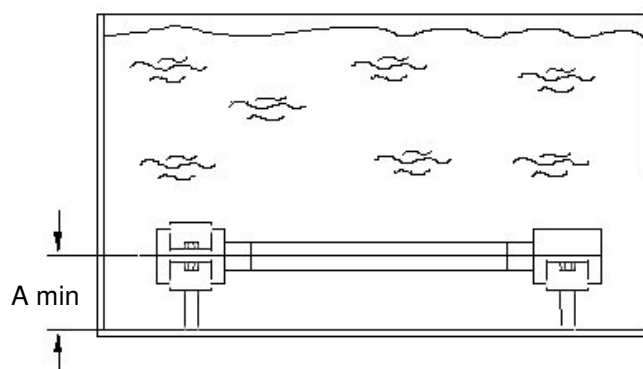
5.3.1 Immersibles and Plate Type- Transducers



min. distance to cleaning goods: $B_{min} = 200 \text{ mm}$

5.3.2 PushPull® - and SinglePush®- Transducers

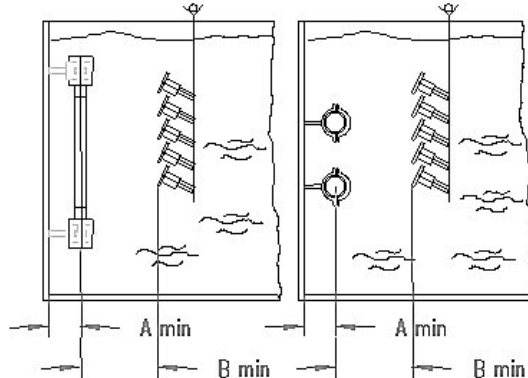
Bottom Mounting



min. distance to bottom: $A_{min} = 120 \text{ mm}$



Vertical Mounting, Horizontal Mounting Wall Mounting



min. distance to side walls
min. distance to cleaning goods
min. distance to other transducers

Amin = 120 mm
Bmin = 200 mm
Cmin = 120 mm

PushPull®- and SinglePush®-transducers can be installed 'free hanging', too. So you have a very simple possibility to upgrade a cleaning tank.

Caution

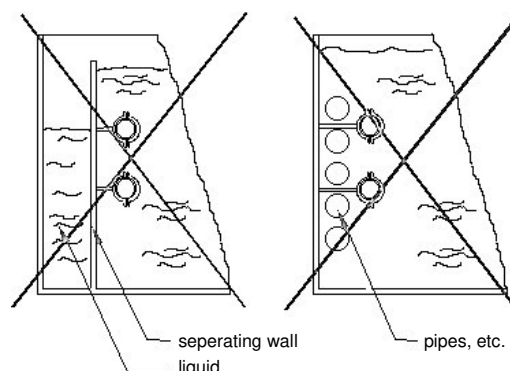
 The PushPull®-transducer must be fixed only at the driver heads with one fixed bearing and one moving bearing.

 The SinglePush®-transducer must be fixed at the driver head with a fixed bearing only.

 SinglePush®-transducers with a length of 495 mm and more must be fixed vertical only.

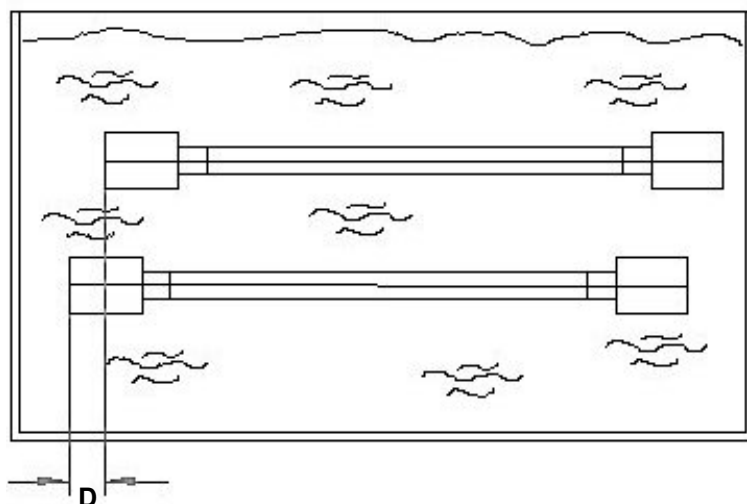
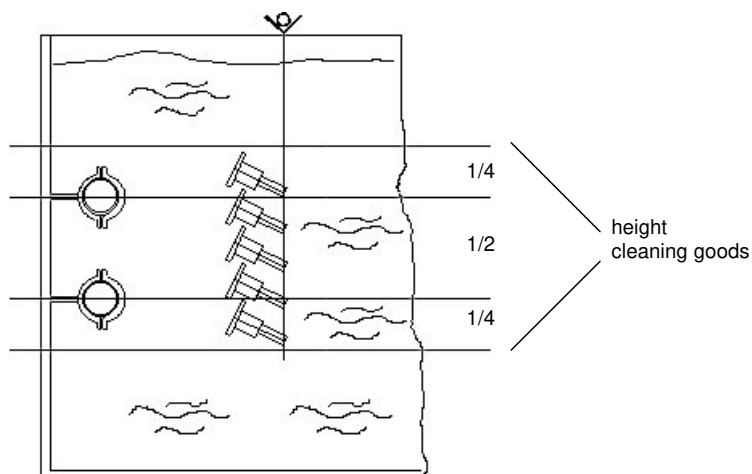
Optimized reflexion of the sonic waves

You only can achieve the maximum reflexion of the sonic waves, if you have air behind the side walls and there are no overflow tank, fittings or similar acoustic damping objects between the Push-Pull®-transducer and the side walls installed.





Location of the Cleaning Goods



The transducers are to be installed staggered so that the individual waves can overlap.

25 kHz - transducers:	$D \approx 50 \text{ mm}$
30 kHz - transducers:	$D \approx 40 \text{ mm}$
40 kHz - transducers:	$D \approx 30 \text{ mm}$
45 kHz - transducers:	$D \approx 30 \text{ mm}$



6 MAINTENANCE



Before performing any maintenance or repair unplug and disconnect from mains properly.

6.1 Generator Modules

The generator modules are maintenance free.

Check power cords and transducer connections regularly.

To ensure sufficient cooling of the generators, the air inlet of the case must be regularly checked for dirt disposal and cleaned if necessary.

6.2 Transducers

The transducers are exposed to extreme dynamic load and have therefore to be checked regularly (at least every month) for damage or loose parts. Additional to this, remove dirt from the surfaces regularly.

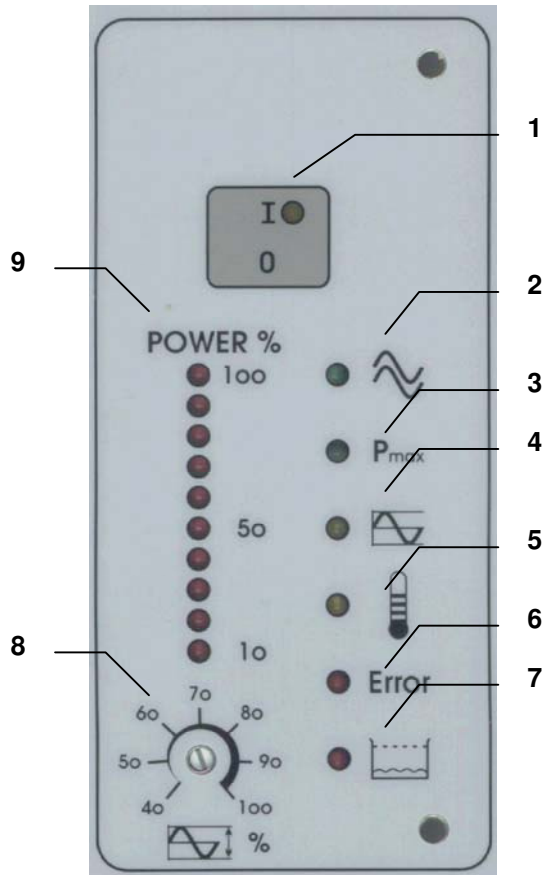
Possible damages due to wear may be:

- cracks in the supply wire or transducer chassis
- cavitation pores *)
- loose thread joints

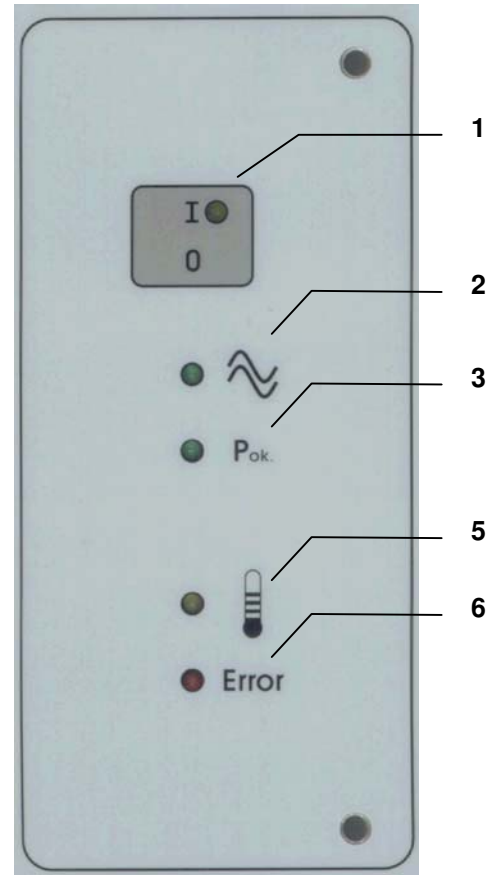
*) With cavitation, material of the transducer will be removed from its surface. You can see cavitation pores. This is a physical process and not a malfunction of the transducer.

6.3 Cleaning liquid

The cleaning liquids are to be checked, purified or replaced according to the manufacturer's recommendations.

**7 OPERATION****7.1 Controls and Indicators**

front view GTI / GPI



front view GT

Pos.	Name	Description
1	on/off-button with LED	ultrasonic on / off, LED lights when ultrasonic is 'on'
2	HF - indicator	HF-output voltage present
3	P _{ok} - indicator	max. output power present
4	amplitude - indicator *1)	amplitude limiting operation
5	temperature - indicator	unit too hot
6	ERROR - indicator	error message: generator, wiring or transducer failure
7	liquid level - indicator *2)	liquid level too low
8	output power adjustment *3)	output power adjustment 40% ... 100%
9	output power - display	output power indicator in steps of 10%

*1) generator type GPI only

*2) with connected an enabled level sensor only (option)

*3) with 'internal adjustment' enabled only (option)



Caution

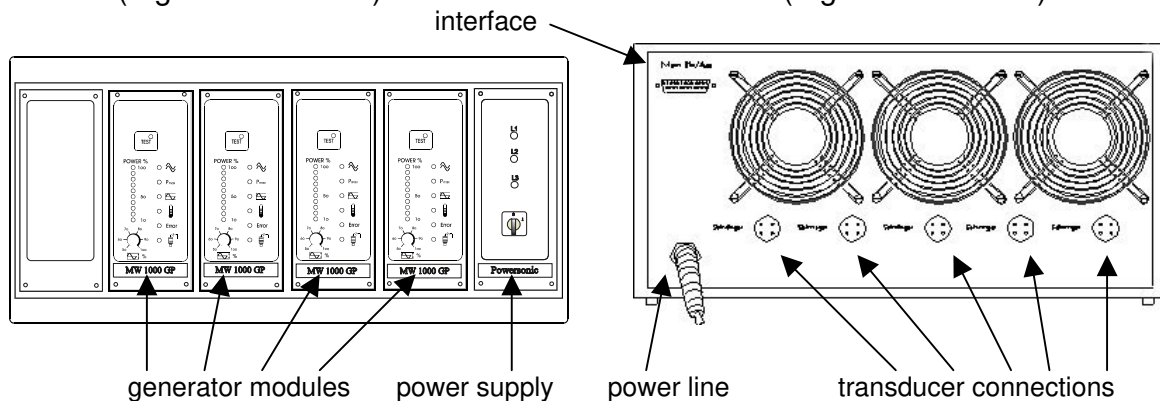
⚠ Only switch on generator if all modules are properly fixed and connected to the transducer system.

⚠ Before operation of the system, the proper connection of the generators and the transducers to protective earth (PE) must be checked.

7.2 View

front view (e.g. 84 TE - case)

back view (e.g. 84 TE - case)



The 28 TE - and 42 TE cases are similar.

7.3 Setting-Up Operation

With switching on the line power the generator modules are ready for operation.

28 TE - case: Switch on module with the green rocker switch.
If the green operating light is on, the module is in stand-by mode.
The fan must operate.

42 TE - case: Switch on modules with the green rocker switch.
If the green operating light is on, the modules are in stand-by mode.
The fans must operate.

84 TE - case Switch on modules with the rotary switch turn to '1'.
If all three phase operating lights are on, the modules are in stand-by mode.
The fans must operate.



7.4 Options

7.4.1 External Power Adjustment

Output power adjustment between approx. 40% and 100 % with applying of a control voltage (4V to 10V).

7.4.2 Inverting enable / disable ultrasonic input control

Ultrasonic 'ON' with open switch of control input 'ultrasonic on / off'.

The generator can be configured to immediate ultrasonic enabled at mains switched on.

7.4.3 Inverting of the ERROR-signal

Relais switch at ERROR condition open (normal closed).

7.4.4 On/Off - Button Lock

General button lock against accident or unauthorised enabling of ultrasonic. With locked button, the generator can be only enabled with the remote signal.

Additional to that, the On/Off-Button can be locked with another remote signal (see technical details). So, you can allow or inhibit operation of the front button with a PLC or similar.

7.4.5 Sensing of Liquid Level

With connection of a external sensor the liquid level can be monitored. The generator sets an ERROR-signal at low level signal of the sensor, the 'ERROR'-LED and the low level - LED light up, ultrasonic switches off.

**7.5 Error fixing**

error	possible cause	fixing
amplitude-LED (4), (GPI only)	transducer not immersed completely	immerse transducer completely, there must be enough liquid over transducer
	vacuum in cleaning tank	no error
temperature-LED (5)	environment temperature too high	reduce environment temperature
	bad ventilation	clean air inlet
	lazy fan	repair by manufacturer
ERROR-LED (6)	operation at bad conditions:	
	- wrong transducer type connected	connect matched transducer, number of stacks and frequency of generator and transducer must be the same
	- bad operation conditions (temperature of cleaning liquid, cleaning solvent, ...)	change conditions, small changes (e.g. temperature change of 5K, or solvent concentration change of 0,1%) can change conditions a lot
	- cleaning liquid not degased	degas cleaning liquid
	- too much turbulences in cleaning tank	reduce cleaning good movement disable ultrasound during tank filling
	transducer not immersed completely, low level of cleaning liquid	immerse transducer completely, there must be enough liquid over transducer
	transducer not connected properly	check connections
	transducer wiring shorted	check wiring
	transducer shorted	change transducer, repair at factory
	power stage of generator failed	repair at factory
	low voltage power supply	check power supply for low voltage or temporarily failing
low level-LED (7)	level indicator enabled GPI only: automatic sensing liquid level	check liquid level
operation light failing	missing power supply	check power supply neutral line (N) must be connected (84TE-case only)
	pre-fuse failed	check pre-fuse
	fuse of responding phase blew	change fuse; is it blowing again, the generator must be checked at factory
application does not clean properly generator doesn't operate at full power	cleaning liquid not degased	degas cleaning liquid
	too much turbulences in cleaning tank	reduce cleaning good movement disable ultrasound during tank filling
	transducer not immersed completely	immerse transducer completely, there must be enough liquid above transducer
loud, screaming noise during operation	noise radiation of cleaning tank caused by interferences	quick fix: reduce output power, change liquid temperature, change solvent concentration, quietise tank walls outside (min. 3cm foam, e.g. Armaflex), reinforce sidewalls of tank

**How to determine Error Reasons at System Failure:**

Please disconnect transducer from generator and enable ultrasound. If green HF-LED ($\approx$ -symbol) lights up and yellow amplitude-LED is blinking (GPI only), the generator is most probably not the failure reason.

If possible, please take following steps:

- connect second transducer of same type
 → if generator does not operate properly, the generator is probably the failure reason or generator and transducer are not matched; operating conditions can be the failure reason, too
- shake transducer
 → if you can hear a clacking noise, the PZT's are broken, the transducer must be repaired at factory
- measure capacity and resistance of transducer
 unstable values or big differences point to invaded liquid, broken wiring or broken PZT's.
- perform a high voltage test
 disconnect transducer and perform high voltage test at transducer (connection box or plug, between transducer wires AC1000V/50Hz)
 Caution: transducer case is connected to minus-potential (blue resp. brown wire)
 → if arcing happens, humidity is invaded or PZT's failed; further the wiring can be lazy, too. This can be checked by disconnecting the wire and repeat the high voltage test.

Table: capacity (measured at approx. 1kHz) and resistance of transducers (approx. values)

Immersibles and Plate-Type Transducers								
Module	MW 500	MW 600	MW 1000	MW1200	MW1500	MW2000	MW3000	Resistance
25 kHz	--	56nF	84nF	98nF	126nF	168nF	252nF	560k
40 kHz	--	36nF	60nF	72nF	90nF	120nF	180nF	560k
132 kHz	25nF	--	--	--	--	--	--	560k
PushPull®- transducers (all types)								
25 kHz	36nF							560k
30 kHz	20nF							infinite
40 kHz	5nF							infinite
45 kHz	5nF							infinite
SinglePush®- transducers (all types)								
25 kHz	18nF							560k
30 kHz	10nF							infinite

**8 APPENDIX****8.1 Technical Data**

The Technical Data are valid for a single module.

Connecting to the line power, you must consider the total power consumption per case.

Application Ultrasonic cleaning, mixing and separating applications for industrial use

Concept module 14 TE resp. 28 TE / 4 HE for mounting in 19"-case

module type	transducer type
GT / GTI	Immersible/plate or tank type transducers
GPI	PushPull®- transducers
GPS	SinglePush®- transducers

Output and Power Supply

HF-voltage to drive matched ultrasonic transducers

frequency approx.: 25 kHz, 30 kHz, 40 kHz, 45 kHz, 58kHz, 132 kHz, 192kHz.

module	max. output power (RMS)	max. line power consumption
MW 500	500 W	600 VA
MW 600	600 W	660 VA
MW 1000	1000 W	1100 VA
MW 1200	1200 W	1320 VA
MW 1500	1500 W	1650 VA
MW 2000	2000 W	2200 VA
MW 3000	3000 W	3300 VA

power control: $\pm 5\%$

duty cycle: 100% (continuous operation)

Power supply / max. wattage / max. line current:

28 TE case: AC 200/240V $\pm 10\%$, 47...63Hz, 1~, N, PE- 2200VA / 5A / 500w

42 TE case: AC 200/240V $\pm 10\%$, 47...63Hz, 1~, N, PE- 3300VA / 8A / 1000w

84 TE case: AC 230V/400V $\pm 10\%$, 47...63Hz; 3~, N, PE- 8250VA / 3x 16A



Front panel controls

On/Off-Button	enable / disable ultrasonic
potentiometer	output power adjustment 40% ... 100% (desired value)

Interface

input control:	enable / disable ultrasonic switch to GND (potential free), approx. 5V / 2mA ultrasonic 'on' at signal to GND (Option: ultrasonic 'on' at signal open)
input control:	on/off-button lock switch to GND (potential free), approx. 5V / 2mA button locked at signal to GND
input control:	external level sensor (option) switch to GND (potential free), approx. 5V / 2mA 'ERROR'-condition is detected at open switch (standard configuration: level sensor disabled)
input control analog:	desired value (set value) of output power (option) analog voltage 4V ... 10V → 40% ... 100% output power, referred to GND, input resistance $R_i \geq 10k\Omega$ (standard configuration: internal power adjustment)
alarm output:	ERROR relay potential free switch, max. 30V, 0,1A switch closed at ERROR condition (Option: switch open at ERROR condition)
output signal:	actual value of output power: output power 0% ... 100% → analog voltage 0V ... 10V max. 5mA, referred to GND

All connections of the interface are protected up to DC 30V



Isolation

between	- line power and output - interface and output - line power and interface
---------	---

isolation voltage:	AC 250V
moisture degree:	2
overvoltage categorie:	II

The minus-pin of output and GND of remote are connected to protection earth (PE).

Enviroment Conditions (Module)

max. temperature:	+10°C ... +40°C (50F ... 104F)
max. storage temperature:	- 20°C ... +85°C (- 4F ... 185F)
humidity:	max. 70%, non condensing
IP-class (IEC529/IP):	IP 20

Enviroment Conditions (Transducers)

max. temperature of cleaning liquid:	
Immersible:	+ 0°C ... +85°C (32F ... 185F)
Plate type transducer:	+ 0°C ... +85°C (32F ... 185F)
PushPull®-transducer:	+ 0°C ... +85°C (32F ... 185F)
SinglePush®-transducer:	+ 0°C ... +70°C (32F ... 158F)
max. storage temperature: - 20°C ... +85°C (- 4F ... 185F)	
max. pressure:	
Immersible:	ca. 1bar (0,1 MPa)
Plate type transducer:	ca. 1bar (0,1 MPa)
PushPull®-transducer:	max. 10bar (1 MPa)
SinglePush®-transducer:	max. 10bar (1 MPa)
IP-class (IEC 529 / IP):	IP 68



Connections

power supply, single phase	SCHUKO-plug DIN 49441 cord length approx. 1,5m
power supply, three phase	power plug CEE-Norm 7 / VII, 16A cord length approx. 1,5m
HF connection	GT/GTI AMP 097 – series, SUHNER or AMPHENOL MHV series. GPI/GPS AMP C16-1 – series
Interface	SUB-D 25-pin, female

8.2 Dimensions and Weights

8.2.1 Modules



14 TE - Module



28 TE - Module

module-type	height	width	weight approx.
MW 300-2000 GT/GTI/GPI/GPS, 1ph.	4 HE	14 TE	4,0 kg
MW 3000 GTI, 3ph.	4 HE	28 TE	6,0 kg

**8.2.2 Cases**

case (empty case)	height	width	depth	min. back clearance	weight approx. (w/o modules)
28 TE	194 mm	184 mm	397 mm	150 mm	1,5 kg
42 TE	222 mm	236 mm	411 mm	150 mm	2,0 kg
42 TE with MB *)	222 mm	271 mm	411 mm	150 mm	2,2 kg
84 TE	222 mm	449 mm	411 mm	150 mm	2,5 kg
84 TE with MB *)	222 mm	484 mm	411 mm	150 mm	2,8 kg

*) MB: mounting brackets for 19"- rack installation

Case Assembly

case		
28TE	42TE	84TE
one module 14TE	two modules 14TE or one Modul 28TE	five modules 14TE or two modules 28TE

The max. connection values of the cases must be considered.

**8.2.3 US-transducers****Immersible Transducers (standard sizes)**

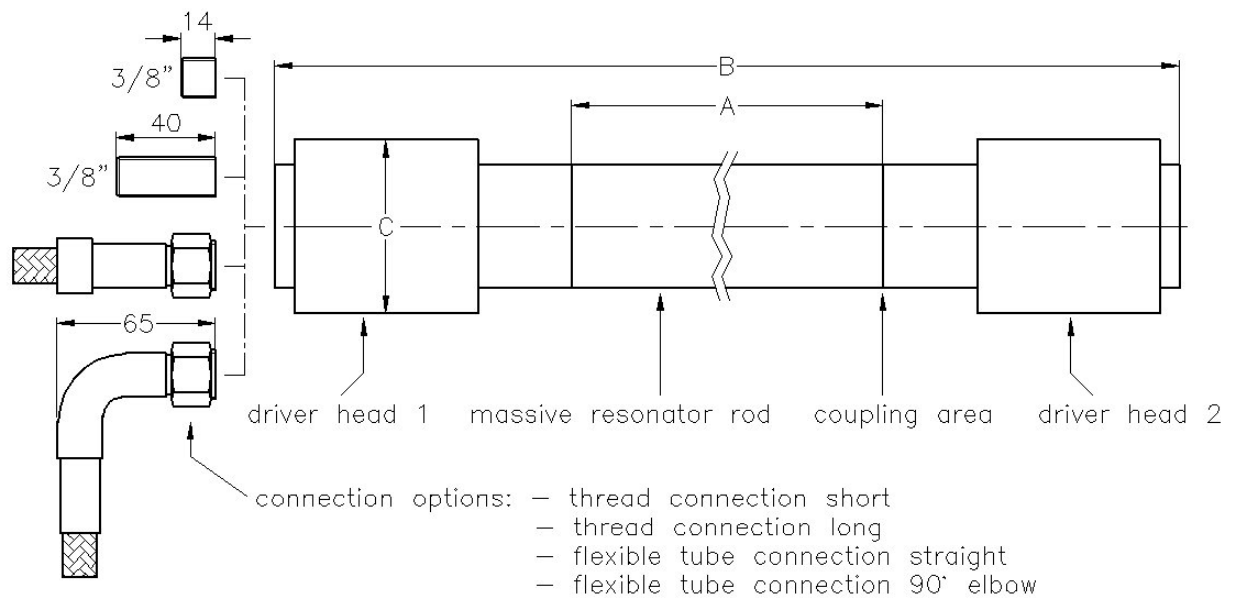
type 25kHz	no. of stacks	type 40kHz	no. of stacks	output power / W	dimensions (in mm) length / width / height
TS 06.25.415.325	8	TS 06.40.415.325	12	600	415 x 325 x 90
TS 10.25.415.325	12	TS 10.40.415.325	20	1000	415 x 325 x 90
TS 10.25.775.205	12	TS 10.40.775.205	20	1000	775 x 205 x 90
TS 12.25.415.415	14	TS 12.40.415.415	24	1200	415 x 415 x 90
TS 15.25.445.445	18	TS 15.40.445.445	30	1500	445 x 445 x 90
TS 15.25.775.355	18	TS 15.40.775.355	30	1500	775 x 355 x 90
TS 20.25.595.415	24	TS 20.40.595.415	40	2000	595 x 415 x 90
TS 30.25.895.445	36	TS 30.40.895.445	2x 30	3000	895 x 445 x 90

Plate Type Transducers (standard sizes)

type 25kHz	no. of stacks	type 40kHz	no. of stacks	output power / W	dimensions (in mm) length / width
PS 06.25.325.235	8	PS 06.40.325.235	12	600	325 x 235
PS 10.25.325.235	12	PS 10.40.325.235	20	1000	325 x 235
PS 06.25.415.325	8	PS 06.40.415.325	12	600	415 x 325
PS 10.25.415.325	12	PS 10.40.415.325	20	1000	415 x 325
PS 06.25.475.325	8	PS 06.40.475.325	12	600	475 x 325
PS 10.25.475.325	12	PS 10.40.475.325	20	1000	475 x 325
PS 10.25.595.415	12	PS 10.40.595.415	20	1000	595 x 415
PS 12.25.595.415	14	PS 12.40.595.415	24	1200	595 x 415
PS 06.25.595.235	8	PS 06.40.595.235	12	600	595 x 235
PS 10.25.595.235	12	PS 10.40.595.235	20	1000	595 x 235
PS 10.25.775.335	12	PS 10.40.775.335	20	1000	775 x 335
PS 12.25.775.335	14	PS 12.40.775.335	24	1200	775 x 335
PS 15.25.775.335	18	PS 15.40.775.335	30	1500	775 x 335
PS 20.25.775.335	24	PS 20.40.775.335	40	2000	775 x 335
PS 10.25.775.595	12	PS 10.40.775.595	20	1000	775 x 595
PS 12.25.775.595	14	PS 12.40.775.595	24	1200	775 x 595
PS 15.25.775.595	18	PS 15.40.775.595	30	1500	775 x 595
PS 20.25.775.595	24	PS 20.40.775.595	40	2000	775 x 595
PS 30.25.775.595	36	PS 30.40.775.595	2x 30	3000	775 x 595
PS 06.25.775.205	8	PS 06.40.775.205	12	600	775 x 205
PS 10.25.775.205	12	PS 10.40.775.205	20	1000	775 x 205
PS 10.25.895.415	12	PS 10.40.895.415	20	1000	895 x 415
PS 12.25.895.415	14	PS 12.40.895.415	24	1200	895 x 415
PS 15.25.895.415	18	PS 15.40.895.415	30	1500	895 x 415
PS 20.25.895.415	24	PS 20.40.895.415	40	2000	895 x 415
PS 30.25.895.415	36	PS 30.40.895.415	2x 30	3000	895 x 415
PS 10.25.895.445	12	PS 10.40.895.445	20	1000	895 x 445
PS 12.25.895.445	14	PS 12.40.895.445	24	1200	895 x 445
PS 15.25.895.445	18	PS 15.40.895.445	30	1500	895 x 445
PS 20.25.895.445	24	PS 20.40.895.445	40	2000	895 x 445
PS 30.25.895.445	36	PS 30.40.895.445	2x 30	3000	895 x 445
PS 10.25.985.355	12	PS 10.40.985.355	20	1000	985 x 355
PS 12.25.985.355	14	PS 12.40.985.355	24	1200	985 x 355
PS 15.25.985.355	18	PS 15.40.985.355	30	1500	985 x 355
PS 20.25.985.355	24	PS 20.40.985.355	40	2000	985 x 355
PS 30.25.985.355	36	PS 30.40.985.355	2x 30	3000	985 x 355



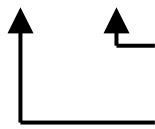
PushPull®-Transducers



type / frequency	resonator length A	transducer length B	driver head diameter C
198-25 kHz	198 mm	438 mm	70 mm
297-25 kHz	297 mm	537 mm	70 mm
495-25 kHz	495 mm	735 mm	70 mm
693-25 kHz	693 mm	933 mm	70 mm
891-25 kHz	891 mm	1131 mm	70 mm
1089-25 kHz	1089 mm	1329 mm	70 mm
1287-25 kHz	1287 mm	1527 mm	70 mm
240-30 kHz	240 mm	420 mm	55 mm
320-30 kHz	320 mm	500 mm	55 mm
400-30 kHz	400 mm	580 mm	55 mm
480-30 kHz	480 mm	660 mm	55 mm
560-30 kHz	560 mm	740 mm	55 mm
640-30 kHz	640 mm	820 mm	55 mm
720-30 kHz	720 mm	900 mm	55 mm
122-40 kHz	122 mm	277 mm	48 mm
183-40 kHz	183 mm	338 mm	48 mm
302-40 kHz	302 mm	457 mm	48 mm
427-40 kHz	427 mm	582 mm	48 mm
255-45 kHz	255 mm	410 mm	48 mm
365-45 kHz	365 mm	520 mm	48 mm
417-45 kHz	417 mm	572 mm	48 mm

**8.3 Connections****8.3.1 Interface (25-pin SUB-D female plug)**

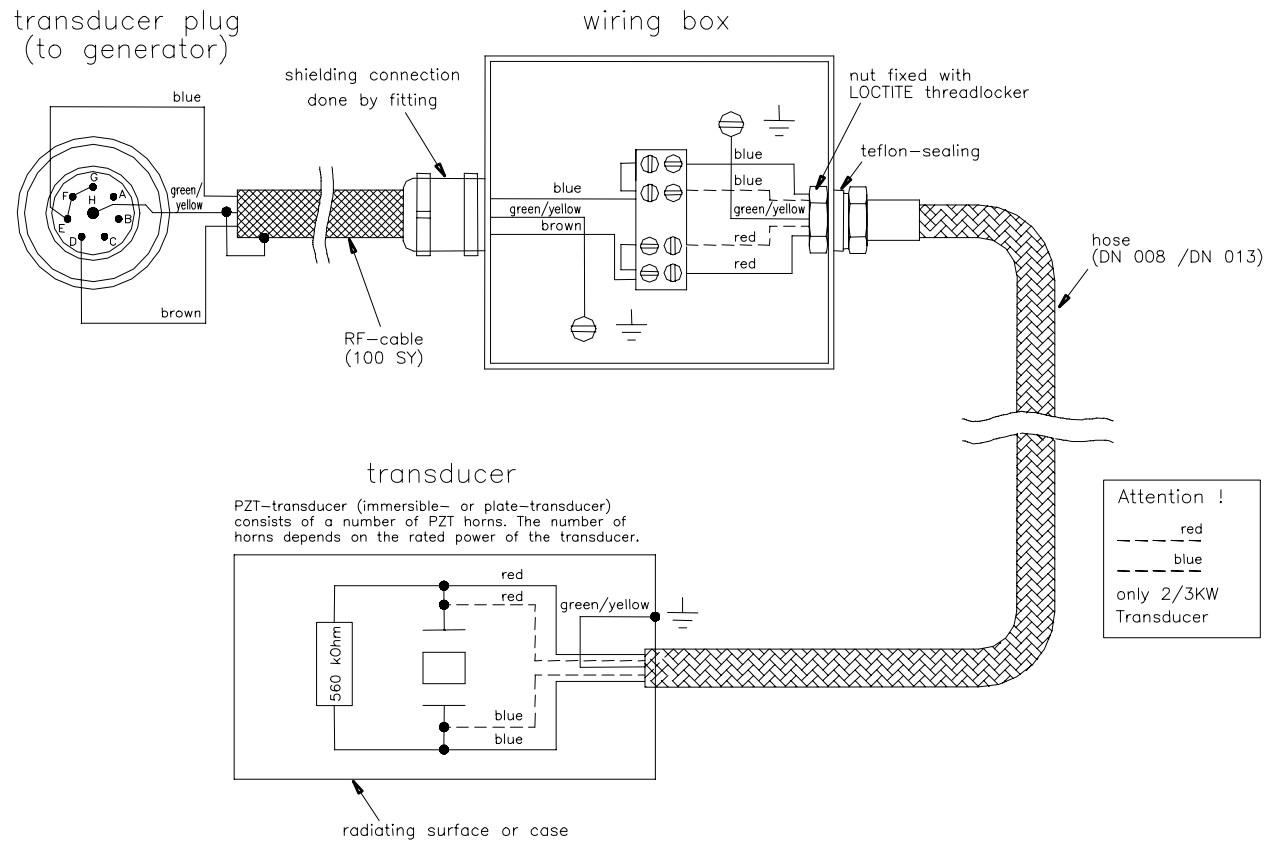
pin 14TE	pin 28TE	pin name	funktion	description
1	2	FS_M1	remote module 1	input control: ultrasonic enable / disable connect potential free switch to GND, approx. 5V/2mA standard: US 'on' at signal to GND option: US 'on' at signal open
2	4	FS_M2	remote module 2	
3	-	FS_M3	remote module 3	
4	-	FS_M4	remote module 4	
5	-	FS_M5	remote module 5	
6	7	AN_IN_M1	power control module 1	input control: desired output power (option) voltage 4V...10V → 40%...100% output power input resistance $R_i \geq 10 \text{ k}\Omega$, max. 30V standard: internal power adjustment
7	9	AN_IN_M2	power control module 2	
8	-	AN_IN_M3	power control module 3	
9	-	AN_IN_M4	power control module 4	
10	-	AN_IN_M5	power control module 5	
11	11	LUE2	error relay common	alarm signal: 'ERROR' relay potential free, max. AC24V/DC30V, 0,1A standard: closed at ERROR condition (n.o.) option: open at ERROR condition (n.c.)
12	13	LUE1_M1	error relay module 1	
13	15	LUE1_M2	error relay module 2	
14	-	LUE1_M3	error relay module 3	
15	-	LUE1_M4	error relay module 4	
16	-	LUE1_M5	error relay module 5	output signal: actual value of output power 0%...100% output power → voltage 0V...10V, max. 5mA
17	18	P_OUT_M1	output signal module 1	
18	20	P_OUT_M2	output signal module 2	
19	-	P_OUT_M3	output signal module 3	
20	-	P_OUT_M4	output signal module 4	
21	-	P_OUT_M5	output signal module 5	control input: liquid level control connect potential free switch to GND, approx. 5V/2mA standard: level sensor disabled option: level sensor enabled: low level signal at open switch
22	22	EXT_T	external level sensor	
23	23	REM_LOC	on/off-button lock	control input: on/off-button lock (front panel) connect potential free switch to GND, approx. 5V/2mA key lock enabled at signal to GND
24	24	GND		Ground
25	25	GND		Ground


 pin no. at assembly of the 42TE and 84TE cases
 with generators series MW 3000 GTI (module width 28TE)
 pin no. at assembly of the 28TE, 42TE and 84TE cases
 with generators series MW 600-2000 GT / GTI / GPI / GPS (module width 14TE)

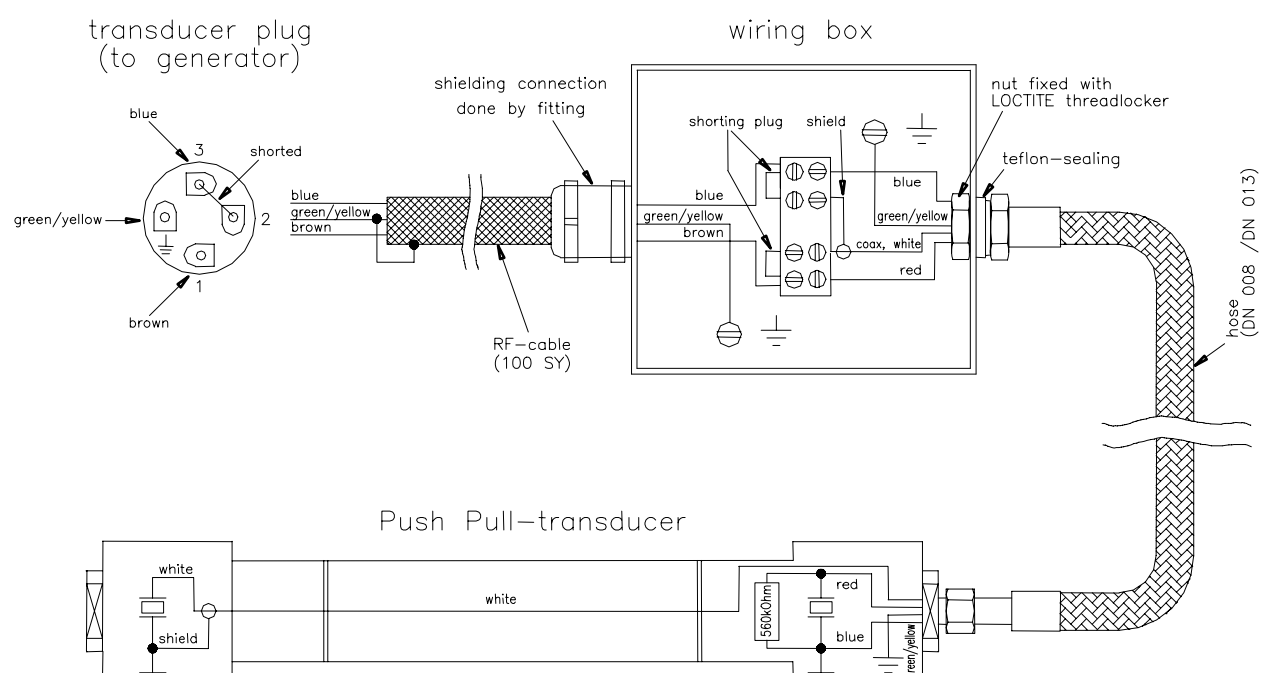
- all inputs and outputs are protected up to DC 30V
- non-listed connections resp. the connections of non-assembled modules are not connected
- ground potential 'GND' is connected to protective earth (PE)



8.3.2 Immersibles



8.3.3 PushPull®-Transducers, SinglePush®-Transducers





NOTES

9 NOTES

[illegible]