



DECKMA
HAMBURG

PRELIMINARILY

INSTRUCTION MANUAL TMD-90 Series

TURBIDITY MONITORING DEVICE



- TMD-90 Series
- Auto Clean
- Installation

We help to protect the Environment





Usage of this instruction manual

This instruction manual will guide you how to use the TMD-90. The instruction manual is split into sections. Every section handles a specific part of the TMD-90. The first section gives you general information about safety before using and servicing the TMD-90. Please take notice on this section.

You will also find information about the construction and the installation of TMD-90. The programming mode is explained in detail at the end of the instruction manual.

This instruction manual also contains information about the service support and our contact details. The symbols below will accompany for a better understanding.

Disposal



The crossed-out waste container icon on waste electrical or electronic device indicates that this device must not be disposed of with household waste at the end of its life. There are collection points available in your area for free. The addresses can be obtained from your municipality or local administration. You can also email us at post@deckma.com to find out further return options provided by our company.

Separate collection of waste electrical and electronic equipment (WEEE) is intended to prevent the re-use, recycling other forms of use of WEEE as well as to avoid adverse effects on the environment and human health from the disposal of potentially hazardous substances contained in devices.

Symbols

- This symbol is used for giving general advices.
- i This symbol is used to clarify a recommendation.
- ⚡ This symbol is used for giving advices about servicing.
-  This symbol is used to draw warning against hand injuries.
-  This symbol is used to show electrical voltage warnings.
-  This symbol is used to draw attention to hot surfaces.
-  This symbol is used for giving general warnings.
-  This symbol is used to draw attention to hazardous substances.



Safety hazard

Mechanical Risks

 Risk of hand injuries	While closing the front cover hand injuries could be possible.
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Electrical Risks

 Electrical voltage warnings	Incorrect commissioning and wiring, touching live parts, and cable breakage or faulty components can lead to electrical hazards.
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Thermal Risk

 Risk of scalding	High temperatures can occur on the surface of the measuring cell. Hot water may spill and cause scalding.
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Chemical Risk

 Risk of chemicals	Material used during cleaning and maintenance can cause eye and skin irritation.
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Risk reduction

Risks	Recommended reduction	Risk level (1)Low – (3)High
Risk of hand injuries.	While opening and closing the front cover care must be taken.	1
Electrical risks.	Works on the units should be only be done by a qualified person. Keep Terminal Cover closed at all times.	3
Risks of scalding.	It is recommended to wear protective clothing in the form of heat-resistant gloves and protective goggles, if high temperature sample is present.	1
High temperature risks.	Do not open the cell cap until the sample water has cooled down sufficiently. Stop any sample water flow prior to opening the head screw.	2
Unexpected movement of the wiper piston.	Close pressurized air supply before working on the Autoclean System or dismantling the Autoclean System.	2
Chemical Risk.	Material used for Cleaning and Maintenance may cause eye and skin irritation. Cleaning solution may cause health problems if ingested.	1
Risk of environmental damage.	Use instrument strictly within its specification. Keep instrument properly maintained.	1
Risk of health damage.	Do not touch or ingest any residue from sample stream.	2



IMPORTANT NOTICE

Replacement components

General

All monitors in our range are inspected and tested to meet DECKMA HAMBURG requirements at our factories prior to delivery.

In normal use the units should operate correctly and without fault over a long period of time requiring only small amounts of maintenance to be carried out as outlined in the instruction manual.

Service Exchange Units

In the event of a monitor malfunction due to electrical or electronic component failure it is our recommendation that a service exchange unit be ordered.

The defective instrument should be returned to our works within 30 days of supplying the service exchange unit, then only the repair charge is payable. Otherwise the whole cost of a service exchange unit becomes payable.

This procedure is by far the easiest and most cost-effective way of ensuring reliable and continuous operation of the instrument.

Remark

The TMD-90 is constructed in such a way, that exchanging the Measuring Cell with a calibrated Measuring Cell is considered a calibration of the instrument. The Measuring Cell contains all relevant parts.

If for some reasons the Computer Unit needs to be changed, it has made sure, that the memory card will remain on board for at least 18 months. The new Computer Unit will carry its own memory card. The old card can be inserted into the new unit only for reading. Writing is only possible with the card delivered with the new Computer Unit. For details see section 14.

Memory Card

Warranty

Our warranty terms are 12 months after installation but maximum 18 months after delivery ex works. The maker undertakes to remedy any defect resulting from faulty materials of workmanship except wearing parts.

The maker's obligation is limited to the repairs or replacement of such defective parts by his own plant or one of his authorized service stations.

The purchaser shall bear the cost and risk of transport of defective parts and repaired parts supplied in replacement of such defective parts.

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ANY DISMANTLING OR BREAKING OF A SEAL WILL VOID THE WARRANTY.



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Revision

Document-Name	Revision No.	Notation	Date
TMD-90 Series	R03_20230608	Preliminarily	12.06.2023



1. Introduction

The TMD-90 Turbidity Monitoring Device has been designed specifically for measurement of turbidity (NTU) in water. The TMD-90 has been constructed using technology of the DECKMA HAMBURG OMD series industrial instruments and 15ppm Bilge Alarm Monitors, that have a specification and performance which exceeds the requirements of the International Maritime Organization specifications for 15ppm Oil-in-Water Monitors contained in Resolution MEPC. 107 (49).

The TMD-90 unit is supplied with 2 works-adjusted alarms at 50 NTU. Other set points are possible (e.g. 200 NTU) and can be adjusted on site at any time by using the buttons at the front panel.

If an alarm set point is exceeded, the alarms are visible at the front panel and the appropriate relays are switched. In case of malfunction the “**SYS LED**” at the front panel will change from blinking green to permanent red, and both alarm relays will switch to alarm position.

An analog 0(4) - 20 mA signal output is available for driving a recorder or external meter.

TMD-90 Series generally consist of a Computer Unit, a Measuring Cell, and further equipment (e.g. Valve Assembly, Electrical Valve, Flow Control, and Automatic Cell Cleaning Device).

The Computer Unit contains the display PCB with the data logger and the terminals for external connections.

The Measuring Cell is built out of an anodized all-aluminum body with inlet and outlet block made from stainless steel. This rugged cell contains optics and electronics and is connected with the Computer Unit via a plugged data cable. The Measuring Cell is mounted onto a valve support, which holds the valve assembly, too. An electric Switchover Valve controls sample water and clean water usage. This assembly is connected to the measuring cell by a push-in connector.

The Measuring Cell should be positioned vertical.

The TMD-90 units can be mounted on wall or as bulkhead installation. It is also possible to split the computer unit from the Measuring Cell if the available space is not sufficient. Optionally a connection cable for up to 5 m distance from Computer Unit to Measuring Cell is available.



If the instrument is operated at high voltages, additional care has to be taken to provide reliable ground connections. Ground (PE) must be connected direct to the PE terminal or, if this is not sufficient according local rules, to the computer housing (PE bolt inside, right side).



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Electrical connections are made through the metric cable gland openings prepared underneath the instrument. Not all openings may be free. The electrical connections are located inside the computer housing.

The Units must be connected to the mains supply via a suitable rated and approved fused isolator unless such fusing / isolation is provided by associated equipment. When fitted, the isolator should be close, readily accessible and marked as to function.

Close the terminal cover completely after electrical installation. Water and humidity inside the instrument may result in corrosion and malfunction.

Mount the TMD-90 Series instruments by means of M6 or M8 screws on to a rigid vertical surface or frame and preferably with the display panel of the monitor at user convenience. For service and maintenance, sufficient space to all sides should be available.

Care must be taken at mounting of the pipes connections to avoid any torsion of the housing and damage of the instrument.



2. Important Notes

- a) This equipment must be installed and operated in strict accordance with the instructions contained in this instruction manual. Failure to do so will impair the protection provided.
- b) Installation and servicing must be undertaken by a competent and suitably skilled person.
- c) The equipment must be connected to the ground PE, yellow/green Terminals according relevant requirements.
- d) The unit must be isolated from the electrical supply before any maintenance of the equipment is attempted.
- e) All national or local codes of practice or regulations must be observed and, where applicable, are deemed to take precedence over any directive or information contained in this instruction manual.
- f) In case of freezing conditions, the Measuring Cell should be emptied completely. Some components mentioned in this instruction manual may not be present on the instrument on site, and/or the instrument may have additional components.
- g) Technical specifications are subject to change without notification.
- h) If uncertain how to proceed, contact the maker.



3. Principle of operation

3.1 Touch Panel

The OMD-24 Series Touch Display consists of several buttons and LEDs. Each button/LED has its own specific function. (For more information, see 21. Appendix I.).

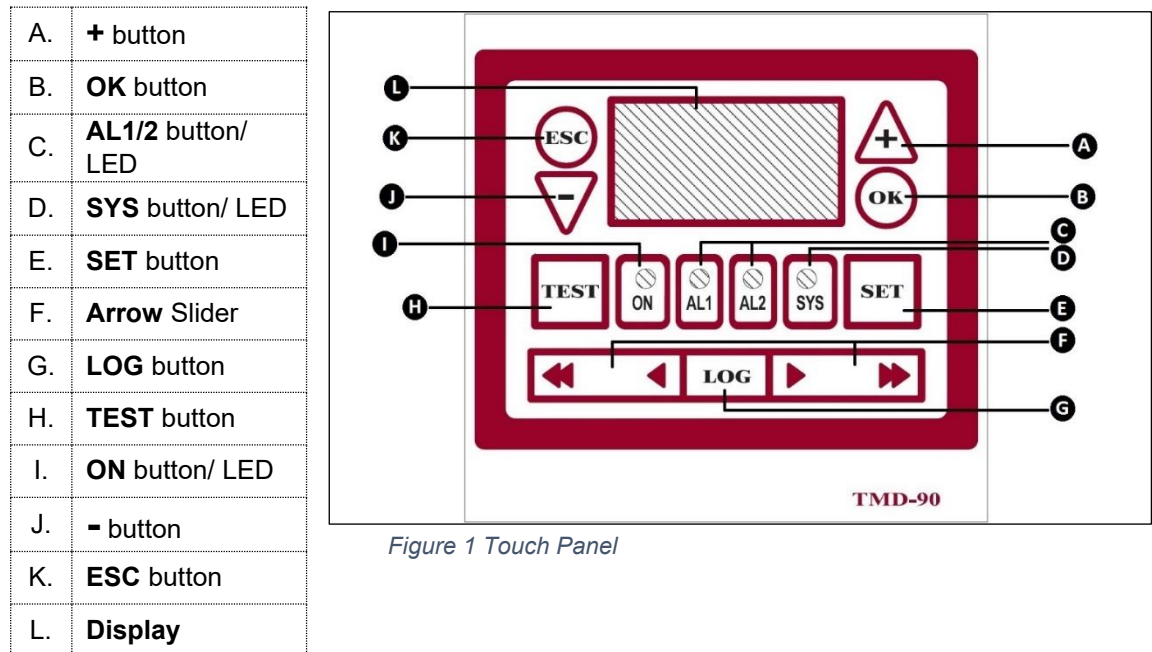


Figure 1 Touch Panel

3.2 Measuring Principle

An optical sensor array measures a combination of light scattered by 90° and absorbed by turbidity droplets in the sample stream. The sensor signals are processed by a microprocessor to produce linearized output.

If an alarm (set point from 0.1 to 198 NTU) occurs, the two turbidity alarm relays are activated after the adjusted time delay.

The microprocessor continuously monitors the condition of the sensor components and associated electronics to ensure that calibration accuracy is maintained over time and extremes of environmental conditions.

3.3 Display Visualization

The display visualizes the turbidity content status of the units. Using the buttons, it is also possible to see information about the settings.



3.4 Alarms

The units contain two independent turbidity alarm circuits. From the manufacturing both alarms are set to 10 NTU. The set points can be changed according to the requirements on site, to any point between 0.1 NTU and 198 NTU. The adjustment can be done in the programming mode as described in the appendix (See section 21.2.3 Functional Buttons AL1/ AL2/ SET).

The alarm circuits contain two independent alarm delays, which can be set separately works adjusted to 10 NTU. In the programming mode also, the individual adjustment of the time delays for the alarms can be set from 1 to 540 sec.

In Addition to the alarm LEDs each alarm circuit is equipped with a relay with potential free alarm contacts. These contacts can be used for external processing of the signal or for control of further functions.

Both alarm circuits are also related to a red alarm LED on the front panel. If the unit is not in alarm condition the red alarm LED is off. If the unit is in alarm condition the red LED is on. In case, that the measurement achieves the alarm set point but is within the alarm delay, the red alarm LED will flash. In case of system malfunction a **"SYS"** LED will indicate some type of internal fault of the unit. This LED is flashing green in normal conditions and is red in alarm conditions.

If a malfunction of the power supply occurs, all two relays (both alarm relays will switch to alarm condition. (See Section 22. Appendix II. for an easily understandable example). If the unit is off, the two relays will be in alarm condition.

3.5 Adjustment

The alarm set points are set to 10 NTU (works adjustment). A customer calibration on board is not possible. This has to be done by the manufacturer or persons authorized by the manufacturer.

The units contain two alarm delays. Alarm 1 is to be used for signing purpose and the delay can be set from 1 sec. to 9 min. Alarm 2 is limited to control overboard discharge. The Alarm 2 delay can be set from 1 sec. to 10 sec. max.

The "Zero" point is also works calibrated and is adjustable to ± 5 NTU.

On site by using the programming mode (See Section 21.2.3 Functional Buttons AL1/ AL2/ SET) and clean water you can adjust following settings.

3.5.1 Offset

The "offset" of the unit can be set to ± 5 NTU. For more information see section 21.2.3 Functional Buttons AL1/ AL2/ SET.



3.5.2 Gain

The “Gain” setting is defined in reference to the international turbidity standard “Formazin”, The “Gain” is adjustable from min. 0.8 up to 4.0.

3.5.3 Active Current Interface 0(4) – 20mA

The active current interface represents a combination of measurements and interpretations. The active current interface is adjustable 0 to 20 mA or 4 to 20 mA. This complies the turbidity content from 0 to 50 NTU. In case of malfunction e.g. “EE” means 20 mA.

The maximum open-load voltage is about 5 V and it is strongly recommended not to exceed a burden of 150 Ω external load.

3.5.4 Output Range

By setting the “Output Range” the NTU value associated with an output signal of 20mA or 4mA for zero NTU, the output signal increases linearity with the measured NTU value.

Settings	Min.	Max.	Default.
Offset	-5 NTU	+5 NTU	0.0 NTU
Gain	0.8	4.0	1.0 (=100%)
Active Current Interface	0 - 20 mA	4 - 20 mA	0 – 20 mA
Output Range	5 NTU	199 NTU	50 NTU

Table 1 Output Range

3.6 Inputs

The unit also contains four active inputs, which can be used separately as well.

- Optionally there is an active input for external flow switch (FLOW). The Unit will be in alarm condition, whenever Terminals are open/ disconnected. Normally this input is delivered with a link.

3.7 Automatic Cell Cleaning Device

The Automatic Cell Cleaning Device is a useful addition to the TMD range of monitoring equipment. It was developed in order to ease the task of routine cleaning as described in the manuals and to ensure that the measuring system of the monitoring equipment is kept in good working order.

Auto Clean System provides a truly Automatic Cell Cleaning Device which is designed to run only when the system is on. The Auto Clean System consists of:

- Cylinder/ wiper piston assembly for physical cleaning of the sample cell.
- Air Regulation Filter Unit (different makes and types may be used).



- c) Auto Clean logic control with valve. It determines the frequency of the cleaning cycles.

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The Automatic Cell Cleaning Device does not replace the operator maintenance schedule but can reduce the maintenance workload.

3.8 EV (Electric clean water Valve)

The TMD-90 EV is designed with an Electric Switchover Valve to switch the instrument from the sample stream to supply of clean, oil free water. Whenever fresh water is allowed to flow to the Measuring Cell, the TMD-90 EV will switch over to alarm condition and it will continue to display the measurement result. The TMD-90 EV setup replaces the manual valve setup for the standard TMD-90, and allows remote flushing.

3.9 Features

TMD-90 Series Features	TMD-90	TMD-90A	TMD-90 EV
Solid suppression capability	✓	✓	✓
Low maintenance	✓	✓	✓
Easy installation	✓	✓	✓
Constant readiness	✓	✓	✓
Automatic Supply Voltage Selection	✓	✓	✓
Low spare part stock holding	✓	✓	✓
Calibrated Measuring Cell	✓	✓	✓
Easy settings via menu	✓	✓	✓
Works adjustment	✓	✓	✓
Auto Clean System		✓	
Robust Construction	✓	✓	✓

Table 2 Features

3.10 Specification internal Clock

The TMD-90 Series records Date, Time, Alarm Status, and “Input Status”. To do so, the instrument has an internal clock. The internal clock circuitry is “state of the art”, with only a few ppm derivations over the entire range of operational conditions. The instruments are adjusted within ± 2 minutes of GMT (Greenwich Mean Time) in production and can be set via the display at any time.



3.10.1 Internal Back-Up Lithium Thionyl Chloride Battery

Further the PCB of the computer unit is equipped with an internal back-up lithium thionyl chloride battery, for the internal clock, if the computer unit is out of power.

The internal lithium battery of the TMD-90 computer unit has a low self-discharge (<1% per year) and should have a calculated lifetime over 20 years, if handled properly.



In case the lithium thionyl chloride battery fails, it must be replaced by a qualified technician in our factory. Please do **not** exchange the lithium battery by yourself. The battery cannot be replaced with a standard battery.

See Section Disposal for more information.



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4. TMD-90

The TMD-90 is the standard version of the TMD-90 Series. The TMD-90 consists of Computer Unit and a Measuring Cell, which is equipped with two handles to control sample water flow and clean water usage.



4.1 Specification TMD-90

Range:	200 NTU (600 NTU extended version)
Resolution:	0.1 NTU
Accuracy:	Up to ± 5 NTU or 10%
Response Time:	< 5 sec.
Linearity:	better than ± 2 %
Display:	Yellow Graphic Display
Datalogging System	Yes
Power Supply:	24 V AC or DC $\pm 10\%$
Consumption:	< 5 VA
Alarm Points 1, 2:	Adjustable, (Works adjustment 10 NTU)
Alarm 1 Operating Delay: (for annunciation purpose)	Adjustable between 1 – 540 sec. (Works adjustment 2 sec.)
Alarm 2 Operating Delay: (for control purposes)	Adjustable between 1 – 540 sec. (Works adjustment 10 sec.)
Alarm Indication: (Alarm 1, 2, System Fault)	Red LEDs
Alarm Contact Rating: (Alarm 1, 2)	Potential free 1 pole changeover contacts, 3 A / 240 V AC
Output Signal:	0 – 20 mA or 4-20 mA selectable, ext. Load < 150 Ω
Sample Pressure:	0 – 10 bar recommended rang of installation range
Sample Flow:	Typ. 2 l/min
Sample Temperature:	+ 1 to + 65° C
Ambient Temperature:	+ 1 to + 55° C
Size: Computer Unit Measuring Cell	185 mm W x 210 mm H x 65 mm D 140 mm W x 160 mm H x 65 mm D
Weight:	2.5 kg
Degree of Protection:	IP 65
Pipe Connections:	R ¼" Female
➔ Technical specifications are subject to change without notification.	

Table 3 Specification TMD-90



4.2 Construction TMD-90

The TMD-90 consists of a Computer Unit and a Measuring Cell.

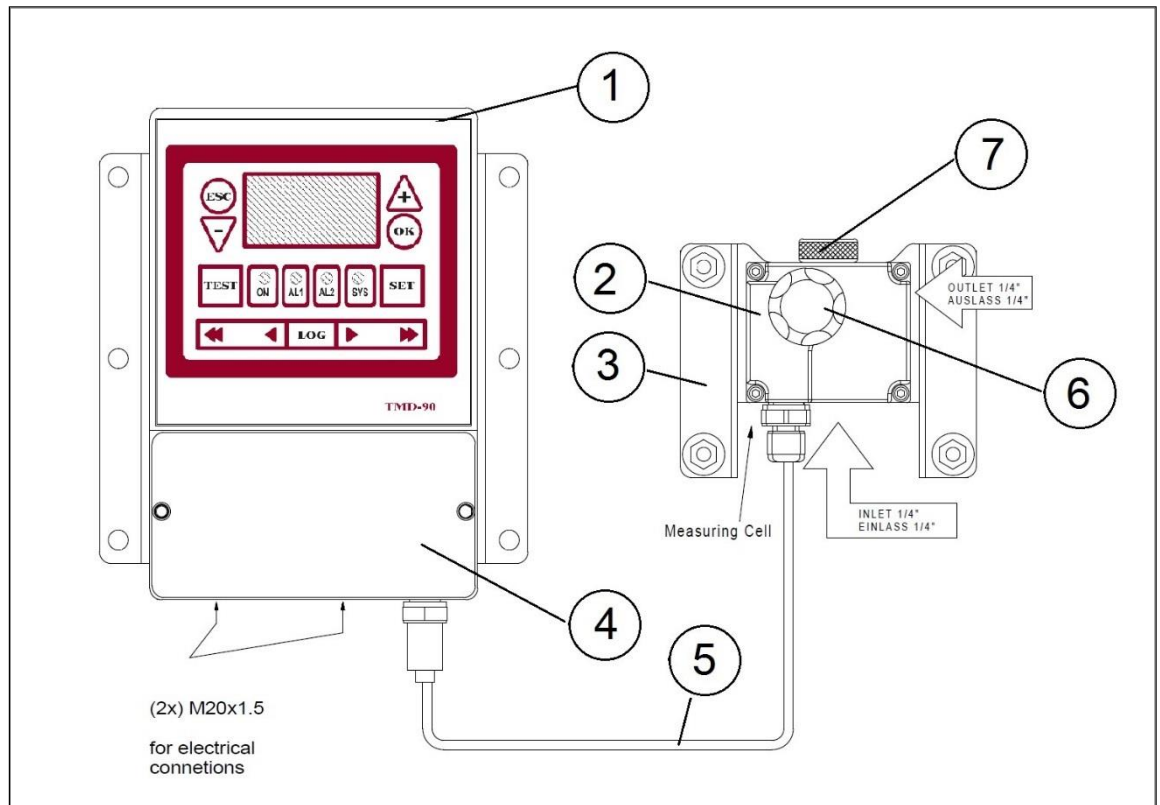


Figure 2 Construction TMD-90

- | | |
|---------------------------|------------------------|
| 1. Computer Unit | 5. Communication Cable |
| 2. Measuring Cell | 6. Desiccator Cap |
| 3. Measuring Cell Support | 7. Cell Cap |
| 4. Terminal Cover | |





4.4 OMD-24 Cabling



The following figures illustrate a bottom view of the TMD-90 Computer Units as delivered.

Use the M20 opening for the power supply voltage. Remove the plastic screw to attach the cable gland. Further openings can also be used with a cable gland.

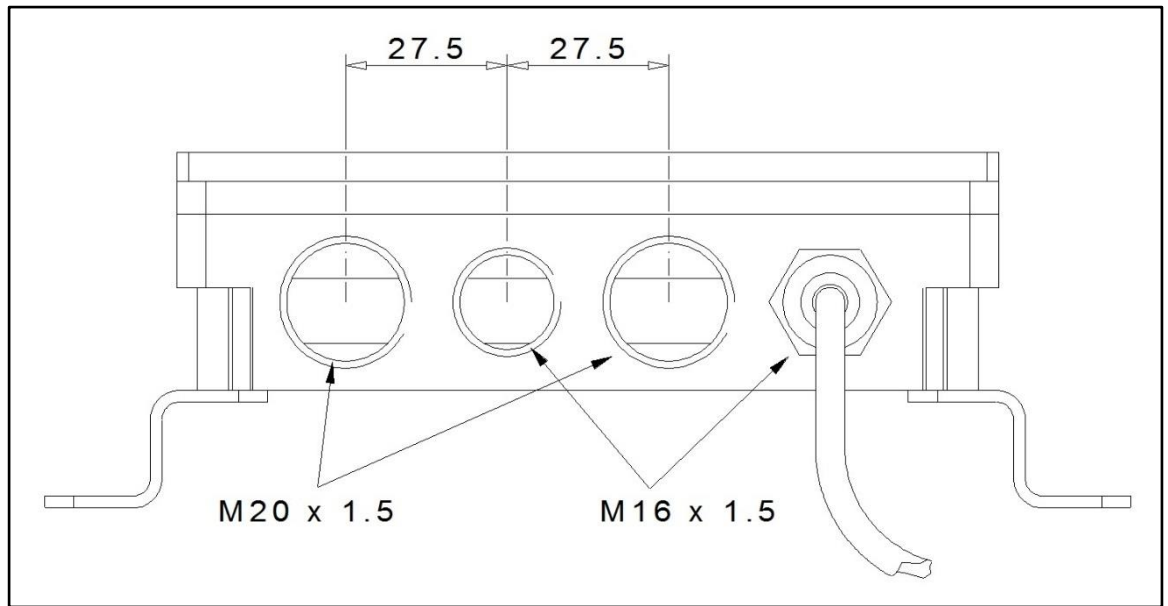


Figure 4. Bottom View: TMD-90



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5. TMD-90A

The OMD-24 A is prepared with an Automatic Cell Cleaning Device for Auto Clean operation.



5.1 Specification TMD-90A

Range:	200 NTU (600 NTU extended version)
Resolution:	0.1 NTU
Accuracy:	Up to ± 5 NTU or 10%
Response Time:	< 5 sec.
Linearity:	better than ± 2 %
Display:	Yellow Graphic Display
Datalogging System	Yes
Power Supply:	24 V AC or DC $\pm 10\%$
Consumption:	< 5 VA
Alarm Points 1, 2:	Adjustable, (Works adjustment 10 NTU)
Alarm 1 Operating Delay: (for annunciation purpose)	Adjustable between 1 – 540 sec. (Works adjustment 2 sec.)
Alarm 2 Operating Delay: (for control purposes)	Adjustable between 1 – 540 sec. (Works adjustment 10 sec.)
Alarm Indication: (Alarm 1, 2, System Fault)	Red LEDs
Alarm Contact Rating: (Alarm 1, 2)	Potential free 1 pole change over contacts, 3 A / 240 V AC
Output Signal:	0 – 20 mA or 4-20 mA selectable, ext. Load < 150 Ω
Sample Pressure:	0 – 10 bar recommended rang of installation range
Sample Flow:	Typ. 2 l/min
Sample Temperature:	+ 1 to + 65° C
Ambient Temperature:	+ 1 to + 55° C
Size: Computer Unit Measuring Cell Auto Cell Cleaning Device	185 mm W x 210 mm H x 65 mm D 140 mm W x 160 mm H x 65 mm D 140 mm W x 240 mm H x 120 mm D
Weight:	5 kg
Degree of Protection:	IP 65
Air Supply	4 – 10 bar
Air Pressure Regulator	Typical set to 4 bar
Pipe Connections:	R ¼" Female
➔ Technical specifications are subject to change without notification.	

5.2 Construction TMD-90A

The TMD-90A consists of a Computer Unit, a Measuring Cell, which is equipped with an Automatic Cell Cleaning Device. Additionally, the components are mounted onto three separate supports.

The Automatic Cell Cleaning Device is electrically inserted between the Computer Unit and the Measuring Cell. The cable length is limited to 1,5 m. The cable is connected to the Measuring Cell as well as to the Automatic Cell Cleaning Device.

The Automatic Cell Cleaning Device additionally needs a sufficient supply of dry, clean instrumentation air.

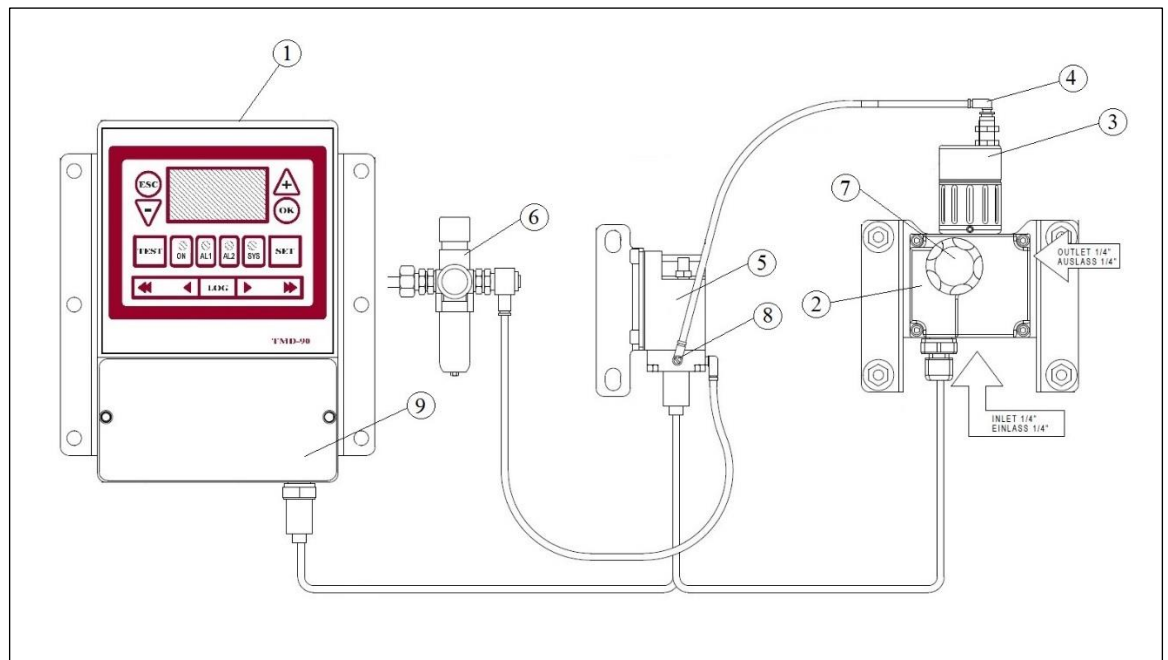


Figure 5 Construction TMD-90A

1. Computer Unit
2. Measuring Cell
3. Autoclean
4. Air Supply for Controller
5. Autoclean Controller
6. Air Supply for Controller
7. Desiccator Cap
8. Air Regulator
9. Terminal Cover



5.3 Installation TMD-90A

Computer Unit and Measuring Cell assembly should be mounted close to each other. Please refer to the following drawing for mounting dimensions.

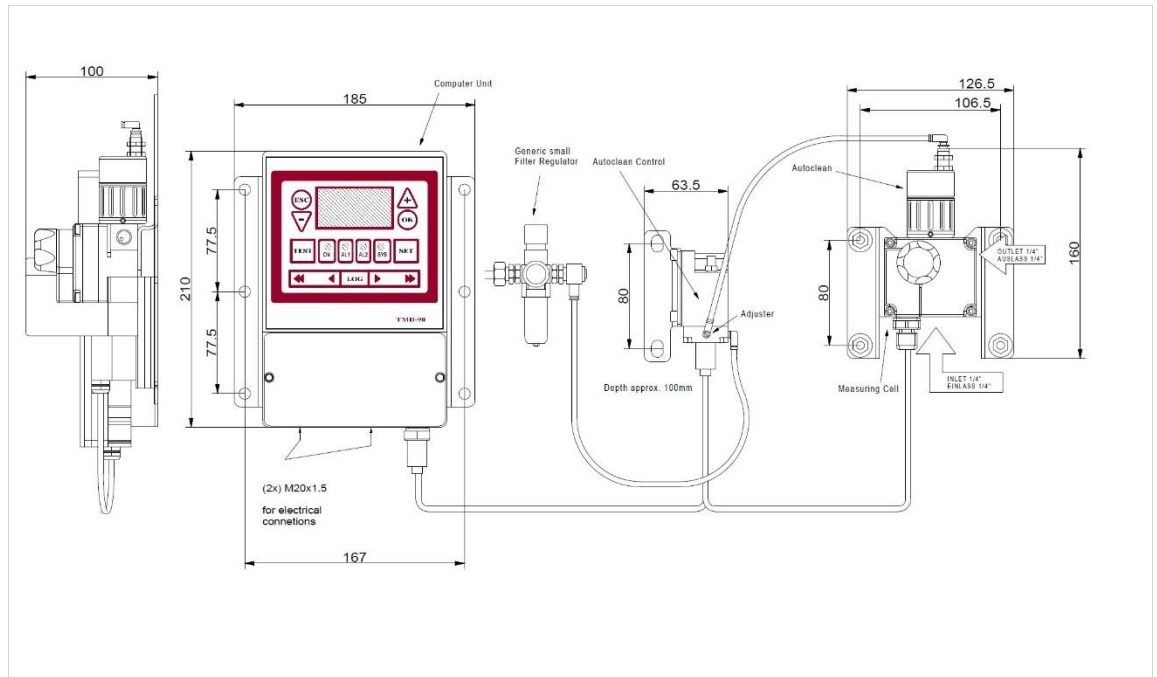


Figure 6 Installation TMD-90A



5.4 Piping Air Supply *(TMD-90 A only)*

For Air Regulation connect the air pipe to the Unit and the Measuring Cell. The air supply should be set to typically 4 bar.

5.5 Automatic Cell Cleaning Device

(TMD-90 A only)

The Automatic Cell Cleaning Device allows routine cleaning of the Sample Glass Tube. The Automatic Cell Cleaning Device is driven pneumatically. The cleaning mechanism: a wiper moves through the Sample Glass Tube and removes deposits from the Sample Glass Tube surface. This unit facilitates cleaning of the Measuring Cell without the need of removing the Cell Cap. Regular use of this device can reduce difficulties in operation of the monitor due simply avoiding fouling of the Sample Glass Tube and all the inconvenience this can cause.

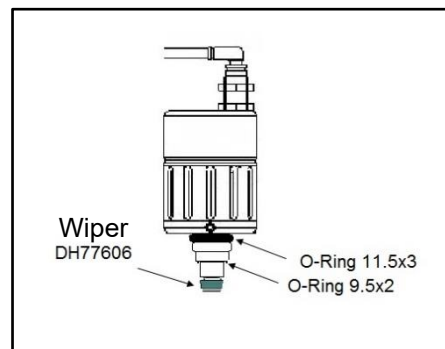


Figure 7 Automatic Cell Cleaning Device, pneumatically operated

5.5.1 Flow rate adjustment on Auto Clean System

Flow rate is regulated by using a small O-Ring inside the cleaning device. There is a groove for an O-Ring. (For more information, see section 10.3 Flow).



5.6 Cabling OMD-24 A

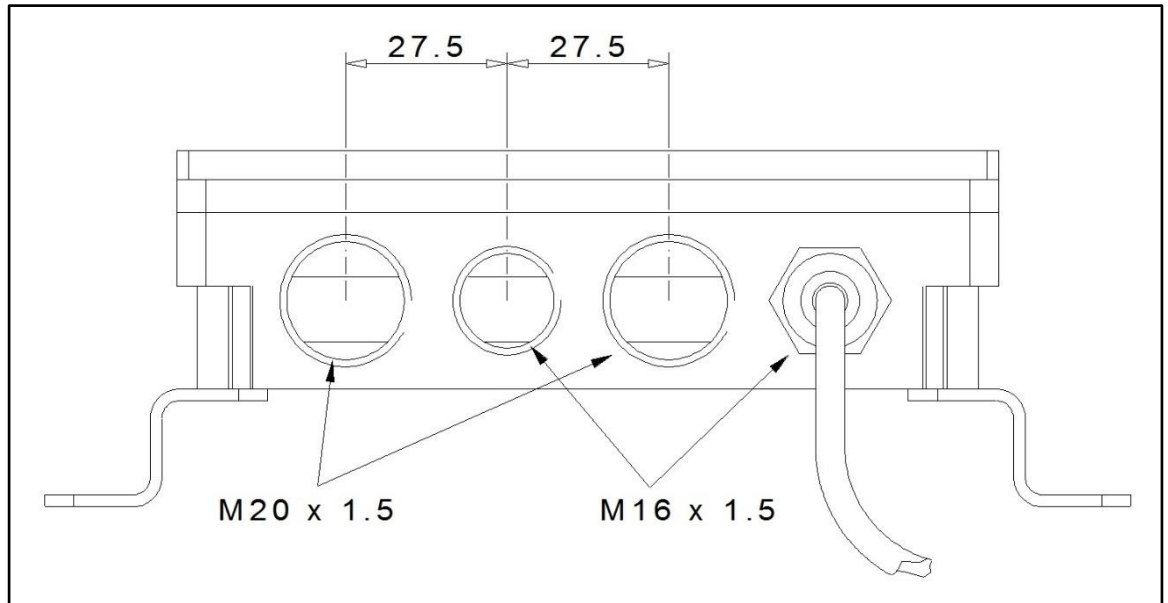


Figure 8. Bottom View: OMD-TMD-90 A

The TMD-90 A is connected with a y-cable to the Measuring Cell and the Autoclean system.



6. TMD-90 EV

The TMD-90 EV is designed with an Electric Switchover Valve to switch the instrument from sample stream to supply of clean, oil free water. The instrument will switch over to alarm condition but will also continue to display the measurement result. The Electric Switchover Valve also allows remote flushing.



6.1 Specification TMD-90EV

Range:	200 NTU (600 NTU extended version)
Resolution:	0.1 NTU
Accuracy:	Up to ± 5 NTU or 10%
Response Time:	< 5 sec.
Linearity:	better than ± 2 %
Display:	Yellow Graphic Display
Datalogging System	Yes
Power Supply:	24 V AC or DC $\pm 10\%$
Consumption:	< 5 VA
Alarm Points 1, 2:	Adjustable, (Works adjustment 10 NTU)
Alarm 1 Operating Delay: (for annunciation purpose)	Adjustable between 1 – 540 sec. (Works adjustment 2 sec.)
Alarm 2 Operating Delay: (for control purposes)	Adjustable between 1 – 540 sec. (Works adjustment 10 sec.)
Alarm Indication: (Alarm 1, 2, System Fault)	Red LEDs
Alarm Contact Rating: (Alarm 1, 2)	Potential free 1 pole change over contacts, 3 A / 240 V AC
Output Signal:	0 – 20 mA or 4-20 mA selectable, active current loop, ext. Load < 150 Ω
Sample Pressure:	0 – 6 bar recommended rang of installation range
Sample Flow:	Approx. 0.1 - 3l/min
Sample Temperature:	+ 1 to + 65° C
Ambient Temperature:	+ 1 to + 55° C
Roll:	Up to 45°
Size: Computer Unit Measuring Cell	185 mm W x 210 mm H x 65 mm D 140 mm W x 160 mm H x 120 mm D
Weight:	2.5 kg
Degree of Protection:	IP 65
Pipe Connections:	R ¼" Female
➔ Technical specifications are subject to change without notification.	



6.2 Construction TMD-90 EV

The OMD-24 EV consists of a Computer Unit, a Measuring Cell, which is equipped with an Electric Valve Assembly.

The Electric Valve controls sample water flow and clean water usage. The Electrical Valve can be controlled from the Computer Unit.

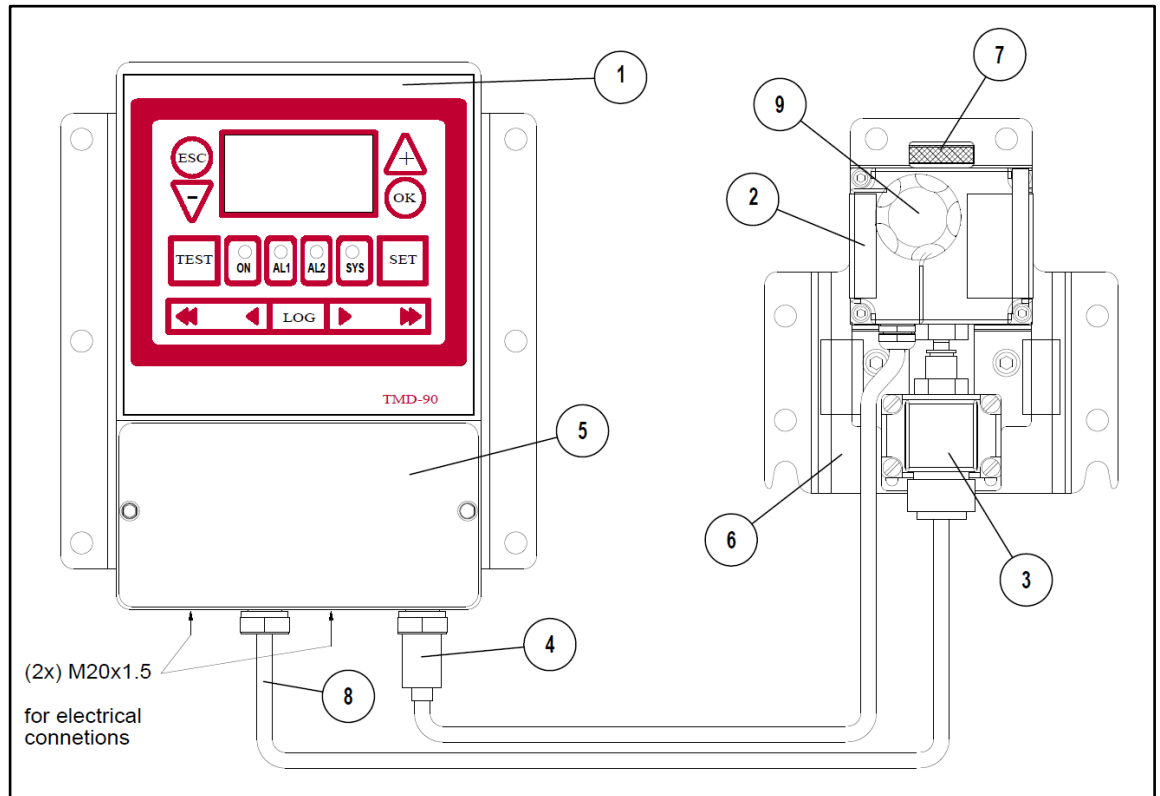


Figure 9 Construction TMD-90 EV

- | | | | |
|----|---------------------|----|----------------|
| 1. | Computer Unit | 6. | Valve Support |
| 2. | Measuring Cell | 7. | Cell Cap |
| 3. | Electric Valve | 8. | Valve Cable |
| 4. | Communication Cable | 9. | Desiccator Cap |
| 5. | Terminal Cover | | |



6.3 Installation TMD-90 EV

Please refer to the following drawing for mounting dimensions.

The Connector on top of the valve must not be removed under any circumstances, as that requires the breaking of the seal.

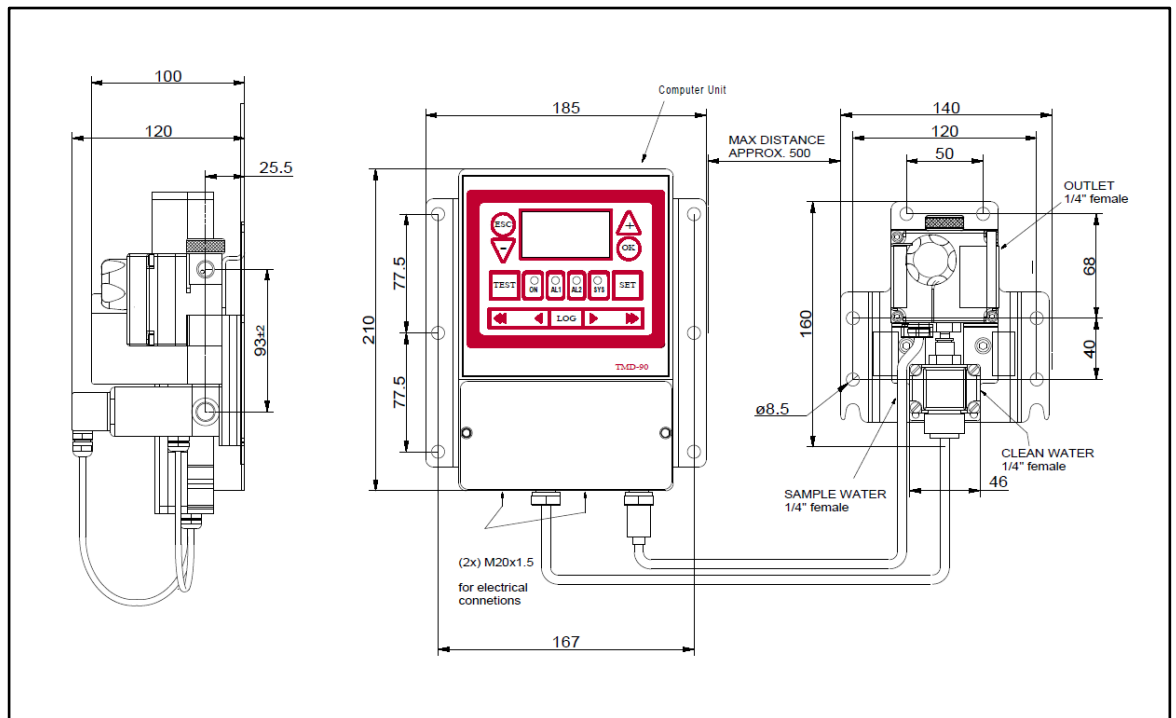


Figure 10 Installation TMD-90 EV



6.4 Cabling TMD-90 EV

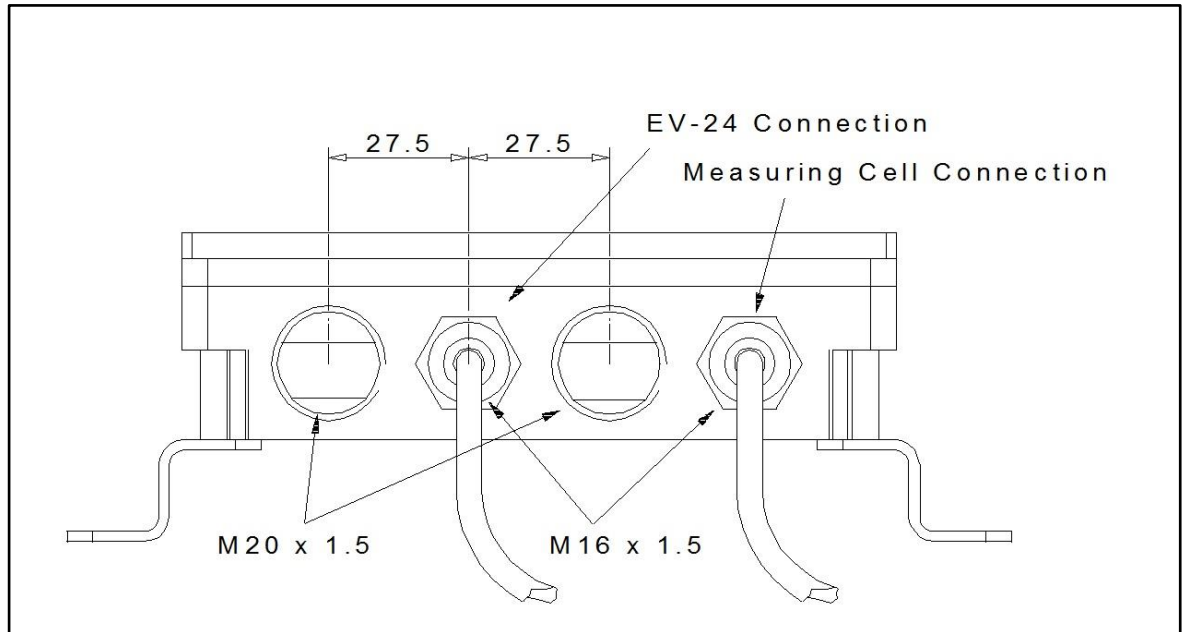


Figure 11. Bottom View: TMD-90 EV



7. Piping

Connect the Monitor to the sampling point employing 6 mm OD copper or stainless-steel pipe. The sample point should be located on a vertical section of the piping to minimize the effects of any entrained air. The tapping point should be at a level above the outlet of the monitor to ensure the sample cell is flooded at all times. Recommended sample flow rate is approx. 2 liters per minute.

If connection to a vertical section of the piping is impractical, the tapping may be made into the side of a horizontal pipe. Avoid top or bottom entry.

7.1 Piping TMD-90 Series

Connect the TMD-90 Monitor to the sample point and to 6 mm OD copper or stainless-steel pipe. Both inputs have 1/4" female threads. Connect the Sample line to input of the TMD-90/ TMD-90 A. The sample point should be located on a vertical section of piping to minimize the effects of any entrained air. The tapping point should be at a level above the outlet of the monitor to ensure a proper sample flow rate. It is recommended to install the clean water line next to the TMD-90/ TMD-90 A Unit.



8. Terminal description

➔ (See Section 2. *Important Notes concerning wiring*).

Electrical connections are made through the metric cable gland openings prepared underneath the instrument. The electrical connections are located inside the computer housing.

The Units must be connected to the mains supply (24V AC/DC) via a suitable rated and approved fused isolator unless such fusing / isolation is provided by associated equipment. When fitted, the isolator should be close, readily accessible and marked as to function.

Close front cover completely after electrical installation. Water and humidity inside the instrument may result in corrosion and malfunction.

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Care has to be taken to provide reliable ground connections. Ground (PE) must be connected direct to the PE terminal or, if this is not sufficient according local rules, to the computer housing (PE bolt inside, terminal cover).

The following figures illustrate a bottom view of the TMD-90 Computer Units as delivered.

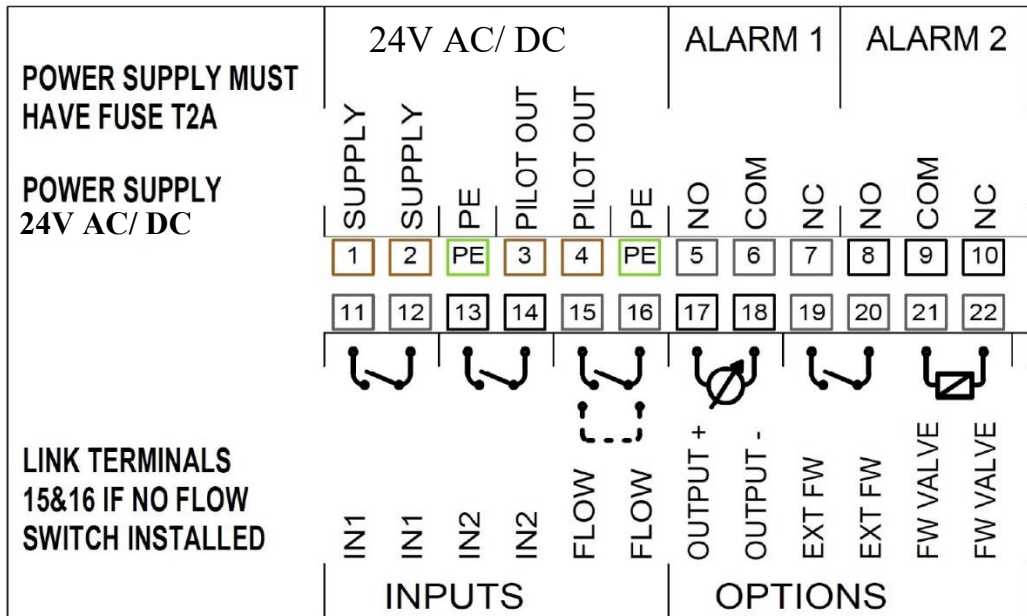
Use one of the M20 opening for the power supply voltage. Remove the plastic screw to attach the cable gland. Further openings can also be used with a cable gland.



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Alarm contacts description is in alarm (non-energized) condition.

Terminals	Nomination
1-2	Power Supply
3-4	Pilot Voltage Output (Same as Power Supply)
5-7	Potential free Output Alarm 1 (Change over contact)
8-10	Potential free Output Alarm 2 (Change over contact)
11-12	Input 1 (open=0 closed=1)
13-14	Input 2 (open=0 closed=1)
15-16	Input Flow Direction Switch (Deckma Delivery)
17-18	(Optional) Signal Output 0 (4) to 20 mA
19-20	Input External Fresh Water Usage
21-22	Output External Fresh Water Valve (Deckma Delivery)

Alarm contacts description is in alarm (non-energized) condition.

Figure 12 Connection Example



Precise wiring details will vary dependent upon the control system. Alarm 1/2 can be used for control purposes.

Electrical connections are made to the terminal blocks inside the computer housing. Wires are connected to the terminals by pushing a suitable screwdriver into the clamp holes to release the internal spring-loaded clamps. After the wire is inserted to the terminal and the screwdriver is removed, the wire is fixed.

Care has to be taken to provide reliable ground connections. Ground (PE) can be connected directly to the terminal.

Terminals 1&2 are reserved for power supply input. Up next is the first ground connection PE.

The instrument provides a pilot voltage output at Terminals 3&4. This is internally connected to the power supply input. The pilot voltage can be used to supply additional external circuitry, e.g. alarm lamps or electrical valves. Up next is the second Ground (PE), which is connected to the Ground (PE).

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Please note: any device connected to the pilot voltage output must be rated for the voltage the instrument is supplied with. Do not use the pilot voltage for driving motors, heaters or other high load devices. The pilot voltage is intended for alarm purposes only. The Terminals 5 – 10 are for alarm 1&2. The switch over contact relays are reserved for alarm 1 and alarm 2, respectively. These are free switch over contacts. **NO** means “**Normally Open**”, **COM** means “**Common**”, and **NC** is “**Normally Close**”. The Terminals 5 – 7 are changeover contacts for the potential free output alarm 1. Terminal 5 is NO, Terminal 6 is COM, and Terminal 7 is NC. The Terminals 8 – 10 are also changeover contacts for the potential free output alarm 2. Terminal 8 is NO, Terminal 9 is COM, and Terminal 10 is NC.

The terminals 11&12 (IN1) and 13&14 (IN2) are inputs. The status of IN1 and IN2 are permanently stored in the memory card (open $\triangleq$ 0, shortened $\triangleq$ 1). Use dry contacts.

Terminals 15&16 are the input for an optional external flow switch. Use a dry contact. The Unit is delivered with a link as standard. If the Terminals are open, the unit will be in alarm condition.

Terminals 17&18 are for signal output of 0(4) to 20 mA. These are active outputs with an open-load voltage about 5 V. And it is recommended not to exceed the 150 Ω external load. The signal output is adjustable 0 to 20 mA or 4 to 20 mA and complies the turbidity content from 0 to 50 NTU default. The output range is adjustable 0-5 NTU up to 0-199 NTU. In case of malfunction e.g. EE means 20 mA.

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Note: For any input it has to be used a potential free relay switch for the link to electrically insulate the TMD-90 from any external voltages. Generally, the inputs and the current output share a common potential (Terminals: 12, 14, 16, 18, 20).



8.1 External Control System

Further it is possible to install an external Flowmeter in terminal (15-16). The information about the flowing condition will be recorded into the memory card.

On request an external FW Valve can be installed (Terminal 21-22) for flushing the Measuring Cell with fresh water (for more information see page 56).



9. Power Supply

→ (See Section 2. Important Notes).



The unit is designed for a power supply of 24 V AC or DC. The power supply must have a fuse rated no more than T2A.

Power consumption of the TMD-90 EV is increased by approx. 10 VA to about 15 VA while the Clean Water Valve is energized (clean water flushing).



10. Commissioning

For operating and servicing, please carefully read the instruction manual and ensure, that the safety recommendations are considered. Read important notice as well. Ensure that wires are correctly connected to the terminal blocks inside the computer housing and ensure that the connection to the Measuring Cell is in place (refer to *Figure 2 Construction TMD-90* to *Figure 5 Construction TMD-90A*, respectively). On completion of the installation, cabling, and piping, carry out the following checks:

10.1 Electrical and Piping

- a) Check that the power supply is connected to the terminals 1 & 2 of the terminal blocks.
- b) Check that the grounding (PE) has been made. Refer to the relevant regulations.
- c) Check all piping connections and rectify as appropriate.
- d) Check the sample supply and the fresh water supply.

For instruments equipped with an Automatic Cell Cleaning Device (see *Figure 5 Construction TMD-90A*), check the following points:

- e) Check, that the Cell Cleaning Device is fitted correctly.
- f) Check, that the push in connectors and hoses are fitted correctly (Automatic Cleaning System only).
- g) Check that the Air Supply Regulator is set to 4bar about.

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During the installation of the unit it is recommended to wear safety boots, due to weight.



10.2 Instrument Start-Up Sequence

Switch on:

- a) Power Supply (24V)
- b) Sample Flow
- c) Air Supply 4 - 10 bar (Automatic Cell Cleaning Device for TMD-90 A)

Make sure, that the Power LED, green (see **Fehler! Verweisquelle konnte nicht gefunden werden.**) is illuminated and the display is showing the “initializing display” for about 10 sec. After that time, it will change to the “normal operation” display autonomously, showing the actual measurement result and relevant status information (see Figure 13/Figure 14) respectively.



Figure 13 “Initializing” Display:

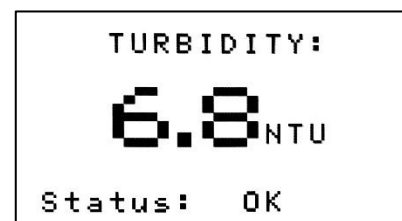


Figure 14 “Normal Operation” Display:



It is recommended to let fresh water run for about 10 minutes. For more information see 12.2 Cleaning Process.

10.3 Flow rate Adjustment

The flow rate is not influencing the accuracy of the instrument. The adjustment is only important for the time delay between the sample point and the monitor. The flow rate can be adjusted to compensate environmental changes and pump aging e.g.

Measure the amount of water flowing through the instrument. Flow rate should be approximately 2l/ min.

Flow rate adjustments can be made by Cell Cap, or the Automatic Cell Cleaning Device.



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Adjust the flow rate through the unit by using the O-Rings in the normal Cell Cap.

Low Flow: Let all three O-Rings inside the cap.

Medium Flow: Take out the inside O-Ring 4.5x2.

High Flow: Let the Main O-Ring 11.5x3 only, as figured below.

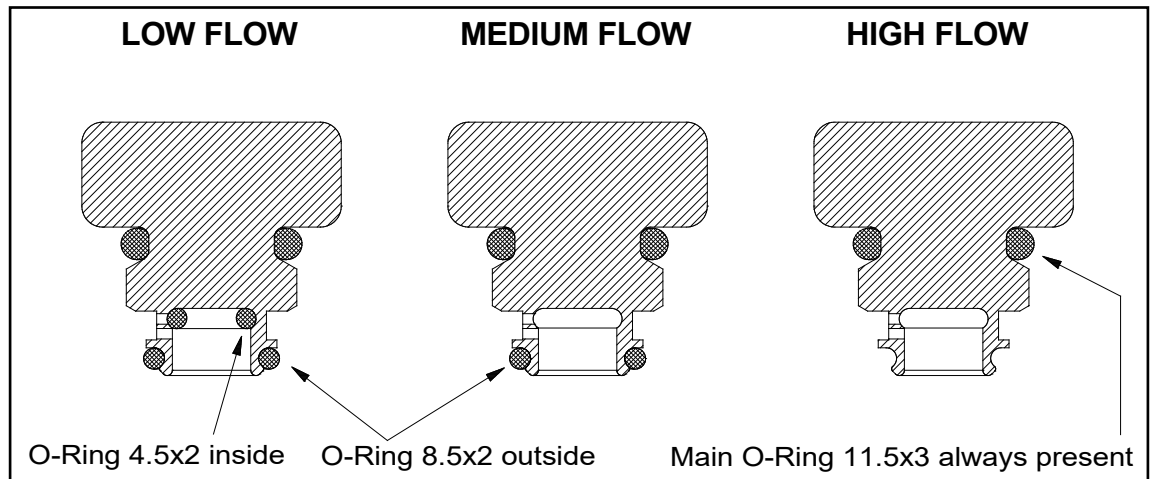


Figure 15 Flow Rate Adjustment Cell Cap

For instruments equipped with an Automatic Cell Cleaning Device a high or a low flow rate can be adjusted.

Low Flow: Let the smaller O-Ring 9.5x2 inside the MCU/ Auto Clean

High Flow: Remove the smaller O-Ring 9.5x2.

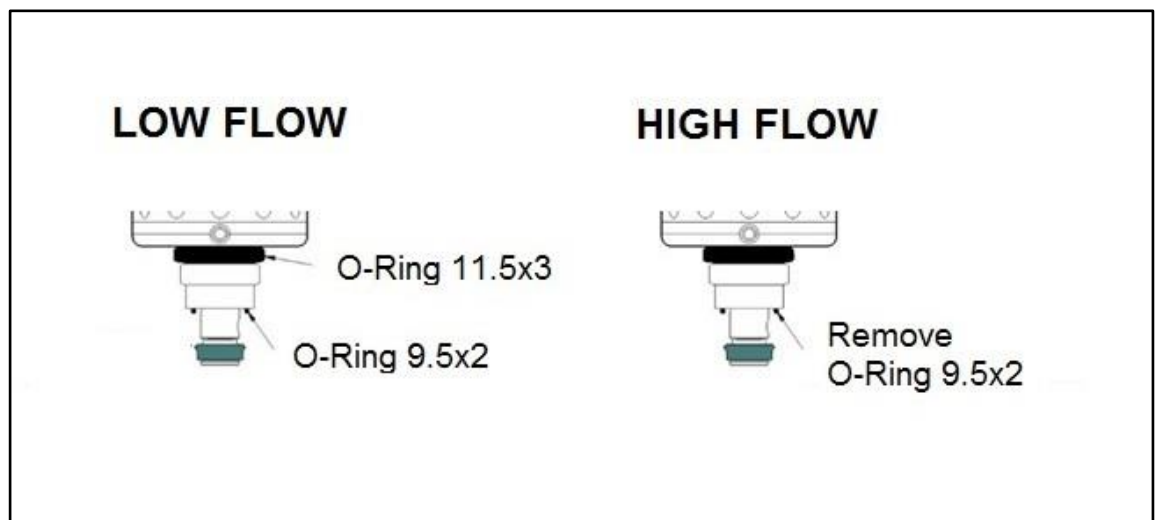


Figure 16 Flow Rate Adjustment Automatic Cell Cleaning Device



10.4 System Settings (refer to Fehler! Verweisquelle konnte nicht gefunden werden.)

At commissioning, alarm set points and alarm delays can be set. The signal output can be modified to 0 – 20 mA or 4 – 20 mA. Equally range of 0...50 NTU can be set to the external requirements of the instrument. The offset can be applied of ± 5 NTU. Further the "Gain" can be adjusted from min. 0.8 up to 4.0 and the settings can be reset to the factory default values, if needed.

For more information about the Settings, see 21.2.3 SET.

Functional Buttons AL1/ AL2/

10.5 Auto Clean Control Unit (TMD-90 A only)

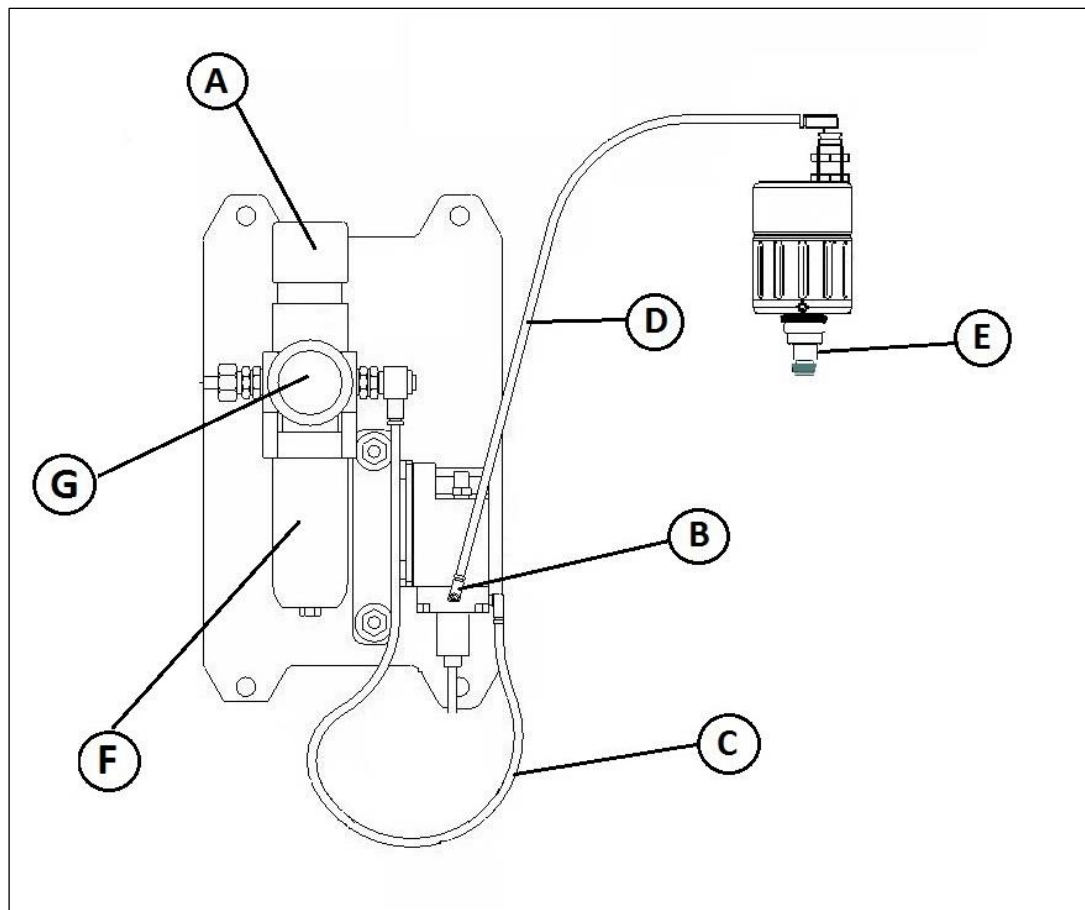


Figure 17 Auto Clean Control Unit

- | | |
|---------------------------|---|
| A. Air Regulator | E. Wiper Piston magnetically coupled |
| B. Air Flow Adjuster | F. Transparent Bowl (Filter with water separator) |
| C. Air Regulator Hose | G. Ø 40mm Pressure Gauge |
| D. Air Flow Adjuster Hose | |



The Automatic Cell Cleaning Unit will not work without sufficient supply of pressurized instrumentation air. Make sure, that an air supply is installed. Further check, that the pipes are fixed correctly. Set the Air Regulator (A) output pressure to a pressure of approximately 4bar. Too high-pressure settings can cause unnecessary wear. Low pressure may make operation unreliable. The Air Maintenance Unit consists of a transparent bowl (F), a pressure regulator (A) and a Pressure Gauge (G).

10.5.1 Pressure Regulation

1. Pull the knob upwards.
2. Rotate the knob and set the pressure
3. Lock the set pressure by pushing the knob down.

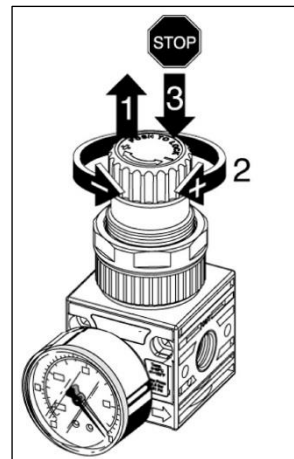


Figure 18 Pressure Regulation

10.5.2 Using standard drainage SS

- When the push button is positioned as in step **A**, drainage is semiautomatic, draining condensate when bowl is depressurized and locking up when bowl is pressurized. Push up the button to drain when bowl is pressurized.
- Then, rotating the button anticlockwise, drainage valve is manually closed, both when bowl is pressurized and depressurized, step **B**.

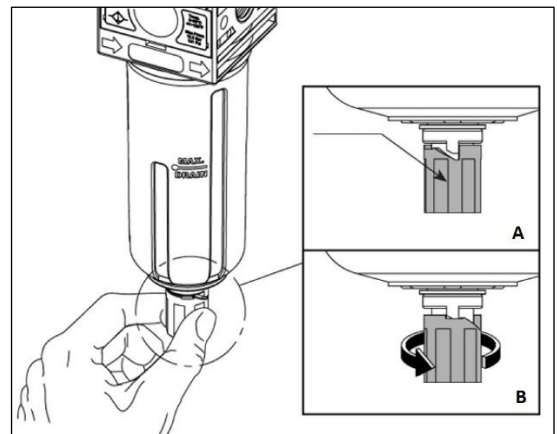


Figure 19 Using standard drainage



Please do not hesitate to contact DECKMA Hamburg GmbH for additional support.

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Output pressure set at the Air Regulator can be only reduced, if the cleaning sequence is activated repeatedly.

Open the air flow adjuster counter-clockwise about typically two revolutions with a screwdriver. Auto Clean should be activated repeatedly, while adjusting the air flow adjuster. The wiper piston should gently run up and downwards. Be careful, if the air pressure is too high, wiper piston will dash.



11. TMD-90 Operating instructions

When turbid water flows through the instrument the turbidity will be measured and the display will show the actual value of turbidity.

If the turbidity exceeds an adjusted threshold (works adjustment 10 NTU), the corresponding alarm indicator will be blinking during the selected time delay. Before it changes to steady red light and the associated alarm relay will operate. Both alarm circuits work independently.

Additionally, both, alarm status, turbidity value and important data will be recorded in data logger every 15 seconds.

11.1 Cleaning Options for Autoclean Systems (TMD-90 A only)

It is also recommended to use the Automatic Cell Cleaning device to clean the Measuring Cell.

Cleaning of the Sample Glass Tube could be simplified with an Automatic Cell Cleaning Device.

Using the Automatic Cell Cleaning Device:

The Automatic Cell Cleaning Device can be set to cleaning intervals from a minimum of 1 minute to maximum of 8 hours (See 21.2.2 Functional Button "ON"). This cleaning sequence can be set from the display at all time. Even if the cleaning interval has been set before and is not finished. The setting of cleaning interval will initiate a cleaning cycle and store the setting.

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It is recommended to assist the Automatic Cell Cleaning Device manually, cleaning the Sample Glass Tube at regular maintenance schedule, or as necessary.



12. Operator Maintenance

→ (See Section 2. Important Notes).

WEEKLY INTERVALS: 12.1 to 12.5 Data Logger Checking

MONTHLY INTERVALS: 12.6 Automatic Cell Cleaning Device

The Operator Maintenance should be scheduled at least once a week. If needed, prepare the Quick Check List to keep track on maintenance.

For more information, see section 23.1 Operator Maintenance Quick Checklist.

12.1 General Test

- a) Visually inspect instrument for obvious leakages or damage.
- b) Visually check condition of cables and connections.
- c) Check the desiccator:
 - Press **"SYS"** button, select Measuring Cell, confirm.
 - Internal data is displayed. Identify Dew Point Temperature [°C] and relative humidity [%rH] data.

The relative humidity [%rH] should be below 10%rH. Dew Point Temperature should be below 0°C. If not, desiccator exchange is recommended. For more information, see section 21.2.4 Functional Button **"SYS"**.

12.2 Cleaning Process



Stop any water flow.

- a) For instruments equipped with Automatic Cell Cleaning Device (TMD-90A), shut off the instrument air.
- b) Unscrew and remove the Cell Cap. Visually check the wiper piston and the O - Rings for wear or damage.
- c) The wiper seal should be clean.
- d) It is recommended to clean the Measuring Cell on a regular schedule manually using the Cell Cleaning Brush with upwards and downwards motion through the entire length of the cell several times. See 23.1 Operator Maintenance Quick Checklist.
- e) For deposits use a mild detergent on the Cell Cleaning Brush.
- f) Put back the Cell Cap, and the Autoclean incl. wiper piston. Make sure that the Cell Cap is screwed in completely.
- g) Purge with clean water for several minutes to get a clean Measuring Cell.
- h) Verify that the display is showing 0 to 5 NTU.
- i) For instruments equipped with Automatic Cell Cleaning Device (TMD-90A), restore the air supply.
- j) Turn on the sample water flow.



12.3 Intensive Cleaning

- a) If there is no improvement, repeat cleaning with the Cell Cleaning Brush and use Sample Tube Cleaner and check in contemporary the display, if the "0" point is achieved. The process could take about 5 minutes. Shouldn't the result improves again, use Citric Acid and let act on over the night.

- Cut the upper part of the handle of the Cell Cleaning Brush.
- Insert the wire stem of the Cell Cleaning Brush into a screwdriver and fix it.
- Slowly rotate the Cell Cleaning Brush for a few minutes in the Sample Glass Tube.
- Flush with clean water and re-test

For more information, see 24. Appendix IV.

12.4 System Test

- a) Perform a **"System Test"** for checking the alarms contacts. See section 21.2.1 Functional Button "TEST".
- b) The "System Test" is only useful, if the turbidity content is under 120 NTU before starting the test.

12.5 Data Logger Checking

- a) Check the data logger:
1. Is the data logger recording the data?
 2. Check the clock for time deviation.

For more information, see section 13. Programming Mode.

12.6 Automatic Cell Cleaning Device (TMD-90 A only)

- a) Stop water flow and air supply, respectively.
- b) Check the wiper seal and the O-Rings. Clean if necessary. The wiper piston can be pulled out easily. It is magnetically coupled.
- c) To reinsert just put the wiper back. The magnetic coupling will arrest it (see Figure 17).

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The Automatic Cell Cleaning Device may require additional manual cleaning.

Check Sample Glass Tube condition and correct working of cleaning systems at regular maintenance schedule.



→ **Remarks:**

The automatic cleaner will not work without sufficient supply of pressurized instrumentation air.

If the wiper is not correctly installed, the wiper piston may proceed to its lower position, thus blocking the measurement region of the Measuring Cell Glass Tube. This can cause false alarms and error conditions.

A worn out or damaged wiper seal may fail to properly clean the Sample Glass Tube. A damaged or missing wiper seal may lead to permanent damage due to scratching the Sample Glass Tube surface.



With excessive air pressure while the automatic cleaning system is taken out of the Measuring Cell, if the cleaning system operates, the wiper may be thrown out. Handle with care to avoid loss of wiper, and avoid risk of injury.



It is recommended to wear safety goggles and safety gloves while handling chemicals.



12.7 Maintenance Recommendations

Maintenance recommendations for 200 NTU TMD-90 Series

IMPORTANT

**NEVER DISASSEMBLE THE UNITS AS THIS MAY VOID
CALIBRATION AND CERTIFICATION!**

CLEANING HAS ONLY TO BE DONE TROUGH THE REMOVED CELL CAP BY USING THE CELL
CLEANING BRUSH!

In some cases of unexpected high NTU readings with clean water the Measuring Cell has a problem with internal coating of the Sample Glass Tube. Just cleaning with brush and clean water does not always help in this case. Additional cleaning is required.

Please carry out the following instructions to make sure that the Sample Glass Tube is really clean. Then the unit will show 0 to 5 NTU with clean water.

In certain cases, depending on environmental conditions on site, Iron Oxide may be deposited inside the Sample Glass Tube (brownish surface deposit on the Sample Glass Tube). To remove Iron Oxide, it is recommended to use Citric Acid. Drain the instrument, fill Citric Acid into the Sample Glass Tube, add water and let it soak overnight. Flush with clean water. If situation improves, repeat until success. Other deposits may be removed with a mild acidic cleaner.

Additional use of tooth paste may also assist in cleaning as a last resort. Do not use abrasive cleaners containing hard particles. Hard abrasive particles may scratch the glass surface, permanently damaging the instrument.

Clean the Sample Glass Tube by using the Cell Cleaning Brush and a mild cleaning agent.

The Measuring Cell is expected to read 0 – 5 NTU, after successfully cleaned.

Another possible cause of unexpected high NTU reading: Check Measuring Cell humidity readings and desiccator status. Press **"SYS"** button, select Measuring Cell, confirm. Internal data is displayed. Dew Point Temperature [°C] should be below zero Degree Celsius, relative Humidity [%rH] should be below 10%rH. If above values are exceeded, renew desiccator and allow new desiccator to absorb the humidity inside the Measuring Cell.



13. Programming Mode

There are 3 groups of push buttons to control the functions of the display. Navigation buttons are in group 1. Functional buttons are group 2. Group 3 is for data logger operation.

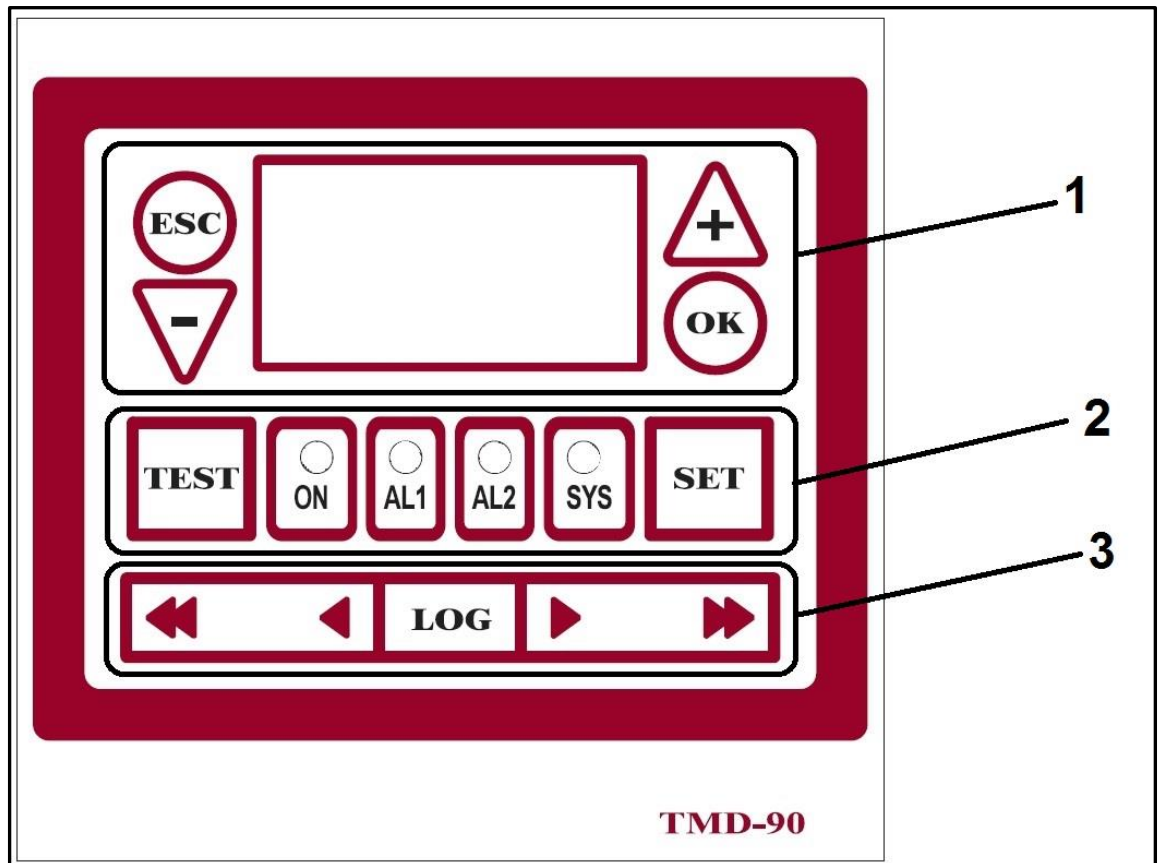


Figure 20 Display Functions

1. Navigation Buttons

With the Navigation Buttons some setting can be adjusted, confirmed or actions can be canceled before confirmed. The display shows status Information. (See section 21.1 *Navigation Buttons for more details.*)

2. Functional Buttons

The Functional Buttons provide a direct access to certain settings. Alarm set points 1 or 2, alarm delays 1 or 2, the Offset, and the Output can be modified. By selecting "set default" all the settings can be reset to the factory default values as well.

Also instrument specific information like type, serial number, the date of the programming, and temperature can be displayed. Additionally, it is also possible to read information about the Measuring Cell, and internal data on temperature, humidity, dew point etc.



With the **“TEST”** button system test can be performed. Additionally, the Desiccator Status can be checked. (See section 21.2 *Functional Buttons for more details.*)

Also cleaning interval at TMD-90A can be managed from minimum 1 minute and maximum 8 hours. By “0” Autoclean will be off.

3. Data Logger Operation Buttons

The **“Log”** buttons are used to operate the integrated data logger. These buttons show a live display, in which the current data from both alarm circuits the alarm status, 2 inputs, the turbidity, the sample temperature and the device status is recording to. That data can be shown as a graphical or a text-based record at any particular time. All the information will be recorded every 15 seconds. All recorded data is available for more than 18 months.

With the “arrow slider” the data can be navigated through time.

The internal clock is factory set for GMT, **Greenwich Mean Time**. The internal clock is adjusted to be within +/- 2 minutes of GMT in production. A few minutes of derivation per year of operation should be expected only. The time can be set via display at any time to local time e.g. (see section 21.3 *Data Logger Operation Buttons for more details.*)

→ See Section 21. *Appendix for more details about the buttons.*

13.1 Buttons

Buttons	Description
	Pressing this button once, it is possible to return to the previous menu. Pressing this button twice, it is possible to return to the “Normal Operation” display.
	Navigates to the next or previous option.
	Navigates to the next or previous option.
	By pressing this button, it is possible to select and confirm entry.
	Pressing this button, directly leads into the “SYSTEM TESTS” menu.
	Pressing this button, directly leads into the “SYSTEM-OPTIONS” menu.
	Pressing “AL1/2” buttons, leads into the “SETTING,def.” menu.
	Pressing this button, leads directly into the “SYSTEM info” menu.
	Pressing this button once, leads into the “SETTING,def.” menu. Pressing the button twice leads into “DEFAULT” menu.
	Pressing this button once, leads into the “DATA LOG live” menu, if the memory card is activated. Pressing this button twice, the recorded data display mode will be invoked and graphical recorded data appears. Pressing this button if a non-activated memory card is inserted, leads to the menu to activate the memory card.
	It is possible to press and slide the “Arrow” sliders (right/ left), to navigate to the data or time of recorded data, in the graphical recorded data menu.



14. Memory Card

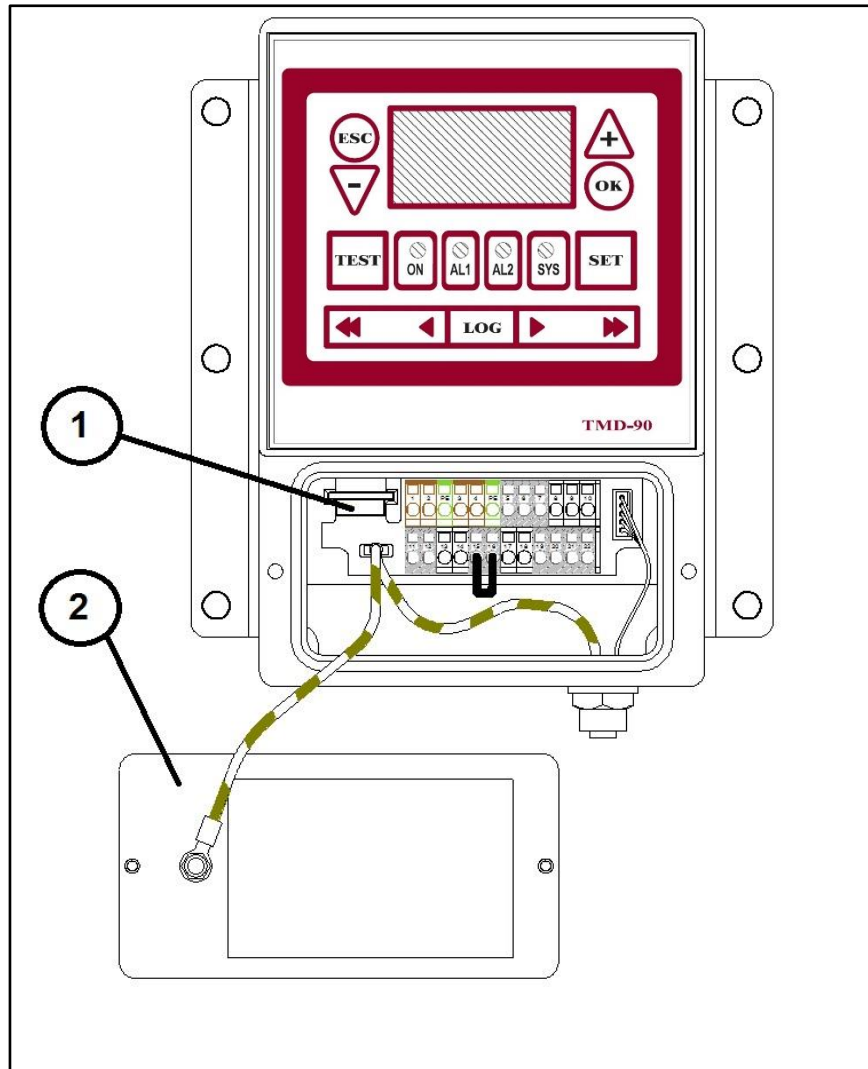


Figure 21 Memory Card Location

1. Memory Card
2. Terminal Cover

The Memory Card is located next to the terminals in the computer housing. It is sufficient for the life of the instrument, and it ensures to the storage time of at least 18 months. When the card is completely used, the oldest entry will be overwritten, so that a replacement is not necessary. Under normal use the card should not be taken out. The memory card is registered with the specific instrument. The card can be read in other TMD-90 units, but writing is only possible in the related system.

If no memory card is mounted, if the memory card is defective, or a card from another system is inserted, the unit will be in alarm condition: **"Status: Datalog"**.



15. Fault finding

→ See Section 2. *Important Notes.*

The TMD-90 Series will indicate several malfunctions in the status line of the display. Pressing the **"OK"** button will display additional information.

Status	OK	
Reading	0..199	EE
System-Alarm-LED	Green/ Blinking	
Alarm Circuit 1,2	No Alarm	Alarm
Reason	Low turbidity. Normal Operation.	Sample reading is out of range: -turbidity content too high (≥ 200 NTU). -dirty Sample Glass Tube. - Air bubbles in sample stream.
Recommendations	-Continue operation -Apply standard maintenance schedule.	Resume normal maintenance schedule. -Wait until turbidity is within range. -Clean Sample Glass Tube.

Status	Com?	Sample?	Data log?
Reading	EE		0..199/ EE
System-Alarm-LED	Red/Steady		
Alarm Circuit 1,2	Alarm		
Reason	No communication between Computer Unit and Measuring Cell.	Meter is not able to measure the sample: -no water in -turbidity too high -no light transmission possible	Data logging is not possible: -No DECKMA memory card inserted. -A read only card has been inserted -A Deckma memory card has been inserted, but has not been activated.
Recommendations	Check connection between Computer Unit and Measuring Cell.	-Check sample -clean Sample Glass Tube according section 11. TMD-90 Series Operating instructions.	-Insert the active memory card. - New memory card: -Activate the memory card.



Status	Int.Err	Desicc.	Humid
Reading		0..199/ EE	
System-Alarm-LED	Red/Steady	Green/ Blinking	
Alarm Circuit 1,2	Alarm	Normal Operation	
Reason	Internal error.	Measuring Cell Humidity critically high (>10%rH)	Sample temperature below dew point. Instantaneous condensation possible.
Recommendations	Restart the system.	Check/ Replace desiccator.	Check/ Replace desiccator.

Status	Flow!	FW!
Reading	0..199/ EE	
System-Alarm-LED	Green/ Blinking	
Alarm Circuit 1,2	Alarm	Normal Operation
Reason	Flow input (Terminals 15&16) open. Check sample flow rate, if external flow switch is mounted.	Check connection external input 19/20.
Recommendations		If terminal 19/20 is shorted, the FW valve at terminal 21/22 will be activated.



15.1 Automatic Cell Cleaning Unit Fault Finding

Fault	Explanation	Solution
Pneumatic Cleaner not operating	Air pressure low.	Restore air pressure.
	Air connections missing or wrong.	Sort out air connections. Air connections are Push-In type. Press release ring to release hose.
	Auto Clean interval set to "OFF".	Activate cleaner via menu.
	Auto Clean interval set to long interval, time not yet expired.	Wait for time to expire, or manually trigger cleaning cycle. Refer to section 21.2.2 <i>Functional Button "ON", "Change of cleaning frequency"</i> .
Wiper moving very slowly	Air flow adjuster too stringent.	Turn Adjuster on Auto Clean Control counter-clockwise with a screw driver.
	Wiper or Cylinder not clean.	Clean wiper.
Wiper moving very fast	Air flow adjuster too wide.	Turn Adjuster on Auto Clean Control clockwise with a screw driver.
Cleaning insufficient	Cleaner not operating.	Check wiper and air supply.
	Debris deposits.	Try additional manual cleaning.
	Deposition of material that cannot be removed mechanically (e.g. Iron Oxide.)	Try chemical removal of deposit. Apply Cleaning Kit. Iron Oxide can be removed with Citric Acid.
	Cleaner frequency not adjusted to situation on site.	Adjust cleaner frequency.
	Wiper seal worn out or damaged.	Replace wiper seal.
	Wiper piston missing.	Re-install wiper piston.



Please do not hesitate to contact DECKMA Hamburg for additional support.



16. Calibration

16.1 TMD-90 Series

The Measuring Cell of the TMD-90 is calibrated in works. It is always possible to adjust the instrument's offset and gain settings. This affects the display, the alarm settings, and the signal output. If lab samples are taken for adjustment, it is recommended to take the samples after the instrument (downstream) without changing the flow conditions.

To provide a simple procedure to check the instrument on site, the TMD-90 Series is constructed in that way, that the zero check also confirms the instrument drift within the specifications.

16.2 Calibration and Repeatability Check

- a) Switch off the power supply and stop any water flow.
- b) Clean the Sample Glass Tube accurately by using a suitable Cell Cleaning Brush as described under Section *page 44*.
- c) Run clean water through the instrument.
- d) Make sure that non-aerated, clean water is in the instrument. The reading should be $< 5\text{NTU}$.
- e) Continue as described under Section 11. *TMD-90 Operating instructions.*

16.3 Function Test

To provide a simple procedure for instrument check on site, the TMD-90 are constructed in that way, that the zero check also confirms the instrument drift within the specifications. The "**Test**" button (see page 60) starts a self-test routine and allows to put both alarms contacts into alarm condition. The instrument will count down from an assumed high reading (120 NTU) downwards until the assumed value is equal to the actual measured NTU value.

i

Note that this test will only switch the alarm contacts to non-alarm condition, if the sample contains less than 120 NTU turbidity content and all other conditions for proper measurement are OK.



17. Spare Parts

When ordering spares, it is important to supply details of the type of monitor instrument serial number, instrument date of commissioning, part number of each spare required, its description and any relevant serial number.

TMD-90	TMD-90	TMD-90 A	TMD-90 EV
ART-Number/ Alarm Set Point Limitation	81100/200 NTU	81102/200NTU	81100/200NTU
DESCRIPTION	ART-NUMBER		
Desiccator	79550	79550	79550
Cell Cleaning Brush	77555	77555	77555
O-Ring Set	77775	77775	77775
O-Ring Adapter (14x 1,5 NBR)	40134	40134	40134
Measuring Cell	81500	81500	81500
Service Exchange Measuring Cell (incl. new Calibration)	2281500	2281500	2281500
T2A Fuse	40107	40107	40107
Wiper Seal		77606	
Service Kit	18570	18570	18570
Memory Card	79186	79186	79186
Air pressure filter/ regulator unit		16270	
Set of push in connectors and hoses		78770	78770
Wiper Piston	77785	77785	



18. Recommended Spares

QTY.	TMD-90 Series	TMD-90	TMD-90 A	TMD-90 EV
	ART-Number/ Alarm Set Point Limitation	81100/200 NTU	81102/200NTU	81100/200NTU
	DESCRIPTION	ART-NUMBER		
2x	Desiccator	77550	77550	77550
1x	Cell Cleaning Brush	77555	77555	77555
1x	O-Ring Set	77775	77775	77775
2x	T2A Fuse	40107	40107	40107
2x	Wiper Seal		77606	77606
1x	Service Kit	18570	18570	18570
1x	Set of push in connector M5x4	40618	40618	40618
1x	Push-In connector with adjuster	40619	40619	40619
1x	Pneumatic Cylinder	78785	78785	



19. Optional Equipment

Equipment	Art-Number
Function Test Kit	18515
Auto Clean Controller Assembly	78790



PRELIMINARILY

All the modifications and deviations from the standard form, which have to be carried out in the supply, should be attached at this paragraph.

by:

Firm's Name

[illegible]



21. Appendix I.

The TMD-90 Series Touch Display consists of several buttons and LEDs. Each button/ LED has its own specific function. It is possible to call, activate/ deactivate, adjust and set certain display status. Further it is possible to perform certain commands directly via display. In the following, it is described particular display status by pressing a combination of buttons.

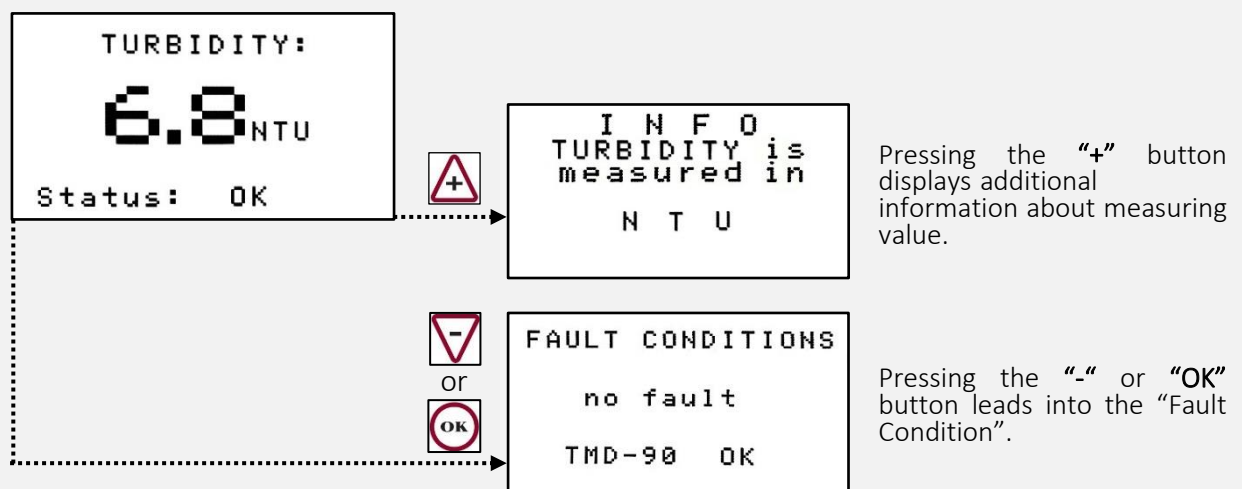
i

If you press the “ESC” button from a particular display status only once, the display will jump back one level. Pressing the “ESC” button twice, will bring you to the initializing display.

21.1 Navigation Buttons



Pressing one of the tagged buttons, let the “Normal Operation” display appears.

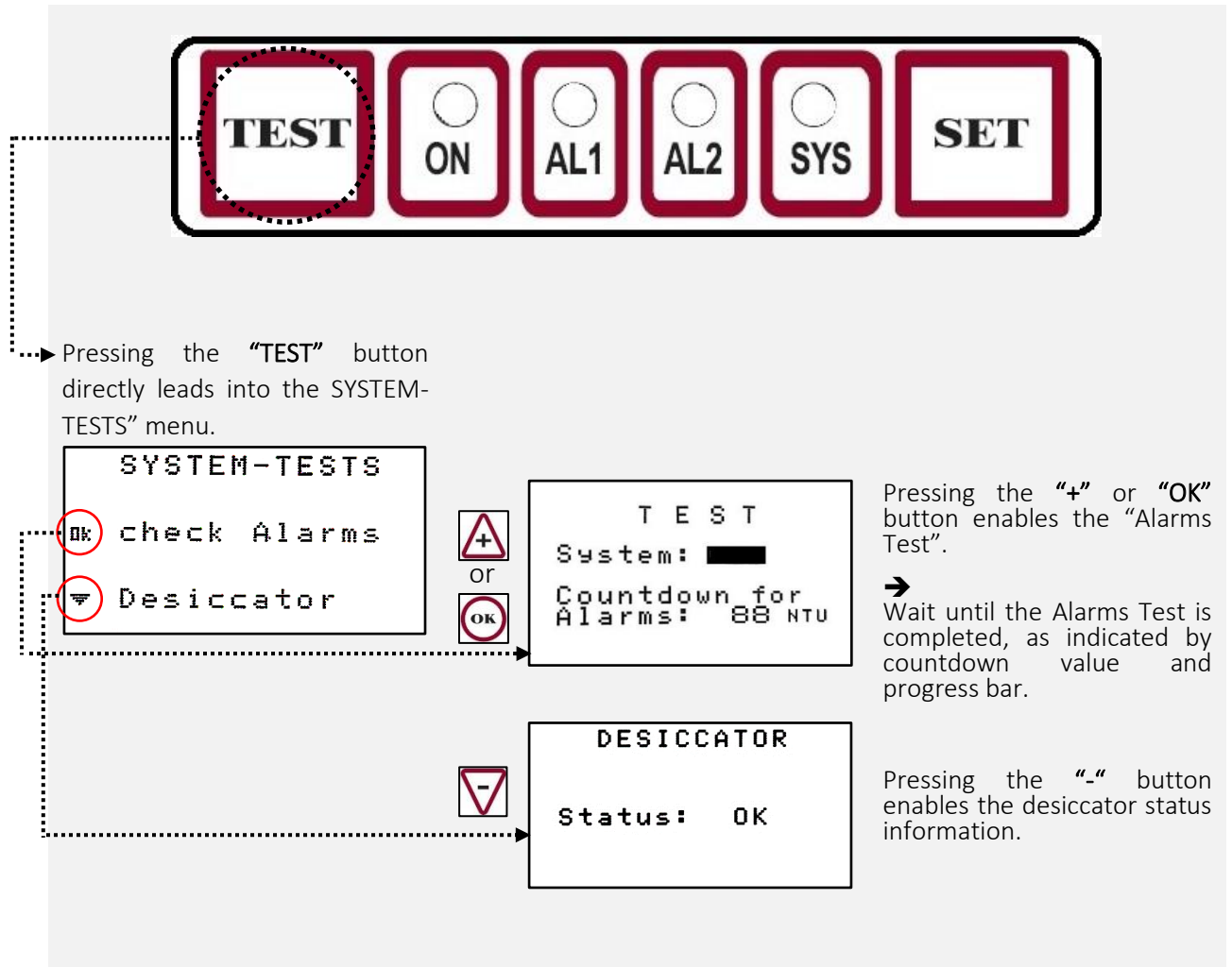


➔ Refer to Fault Finding Table in manual for explanation of status information.



21.2 Functional Buttons

21.2.1 Functional Button "TEST"



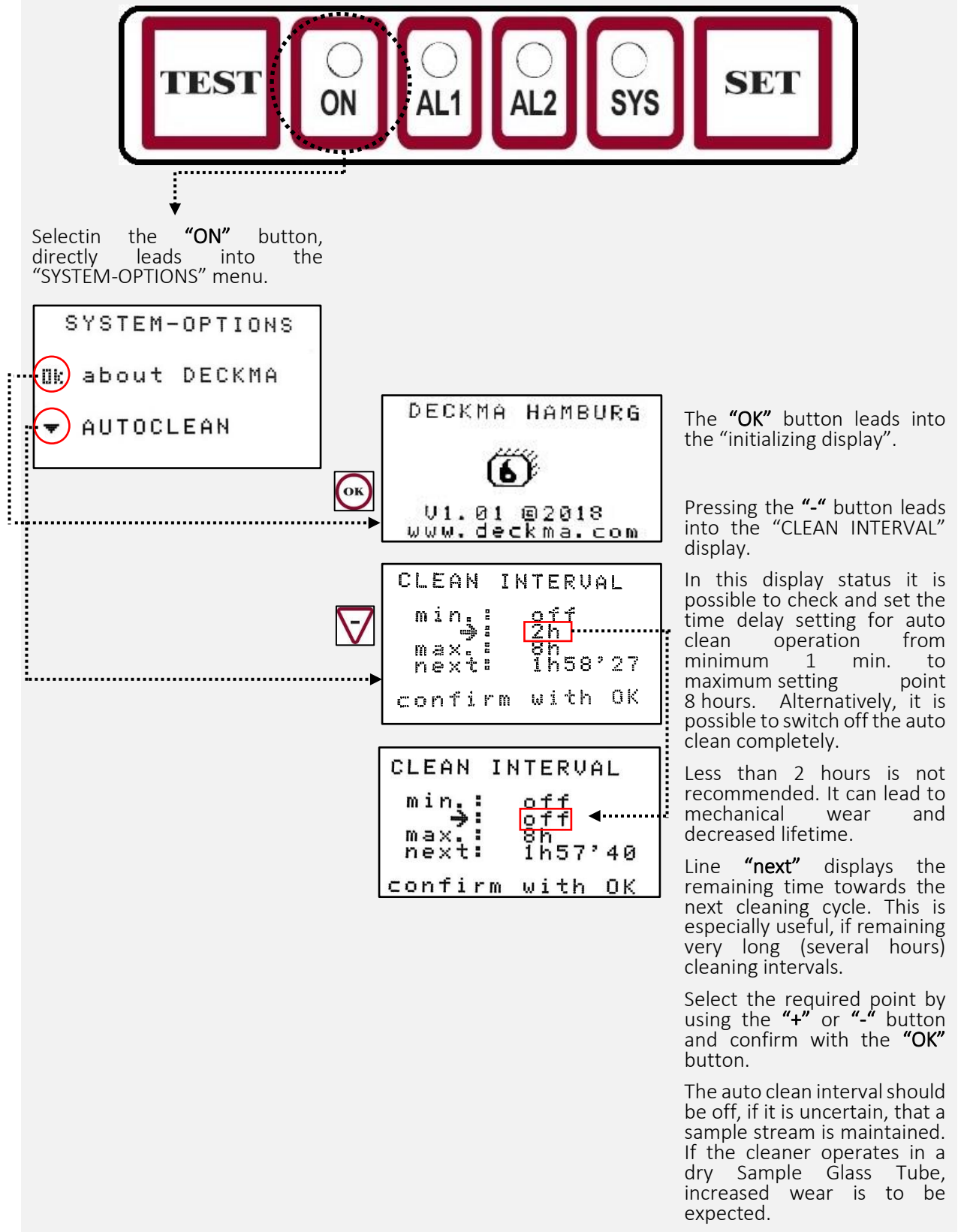


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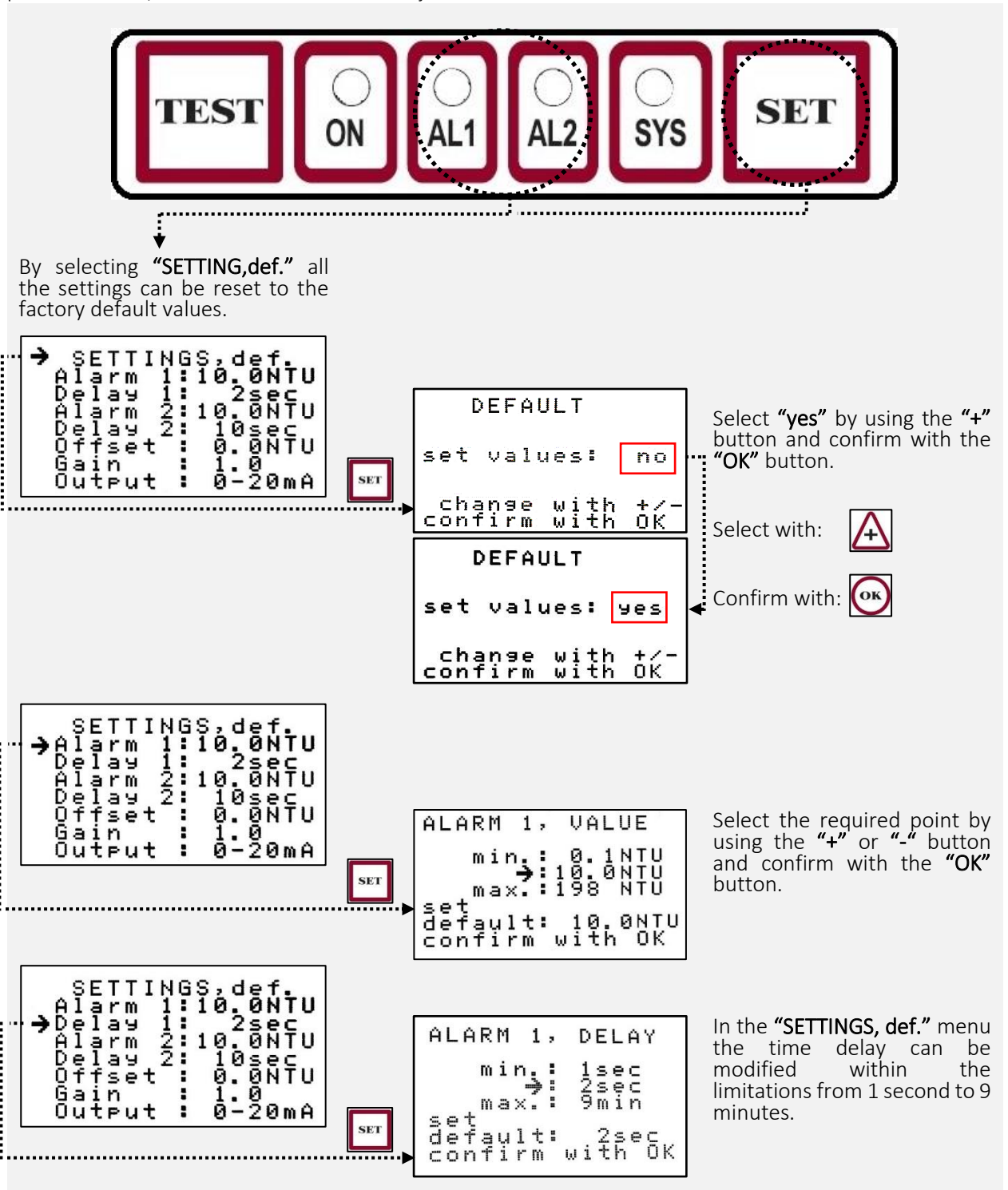
21.2.2 Functional Button "ON"





21.2.3 Functional Buttons AL1/ AL2/ SET

Pressing "AL1", "AL2", or "SET" button leads into the "SETTINGS, def" menu. At the SETTINGS, def." menu the alarms, time delays, the offset, the gain, and the output signal can be modified within the limitation. And the unit could be also reset to factory default values there. Pressing the "SET" button in the "SETTINGS, def." menu leads into the particular values, where the limitation can be adjusted.

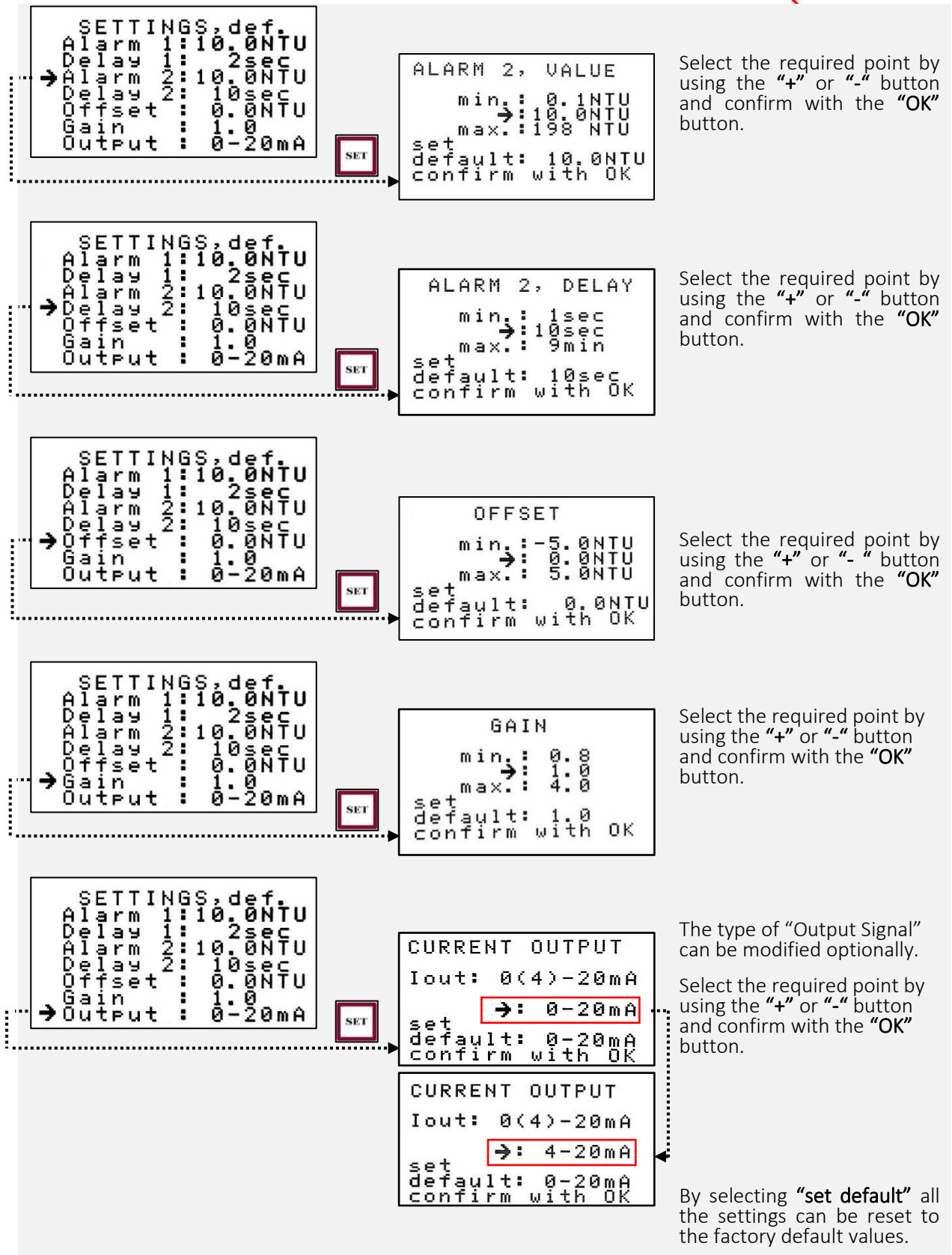




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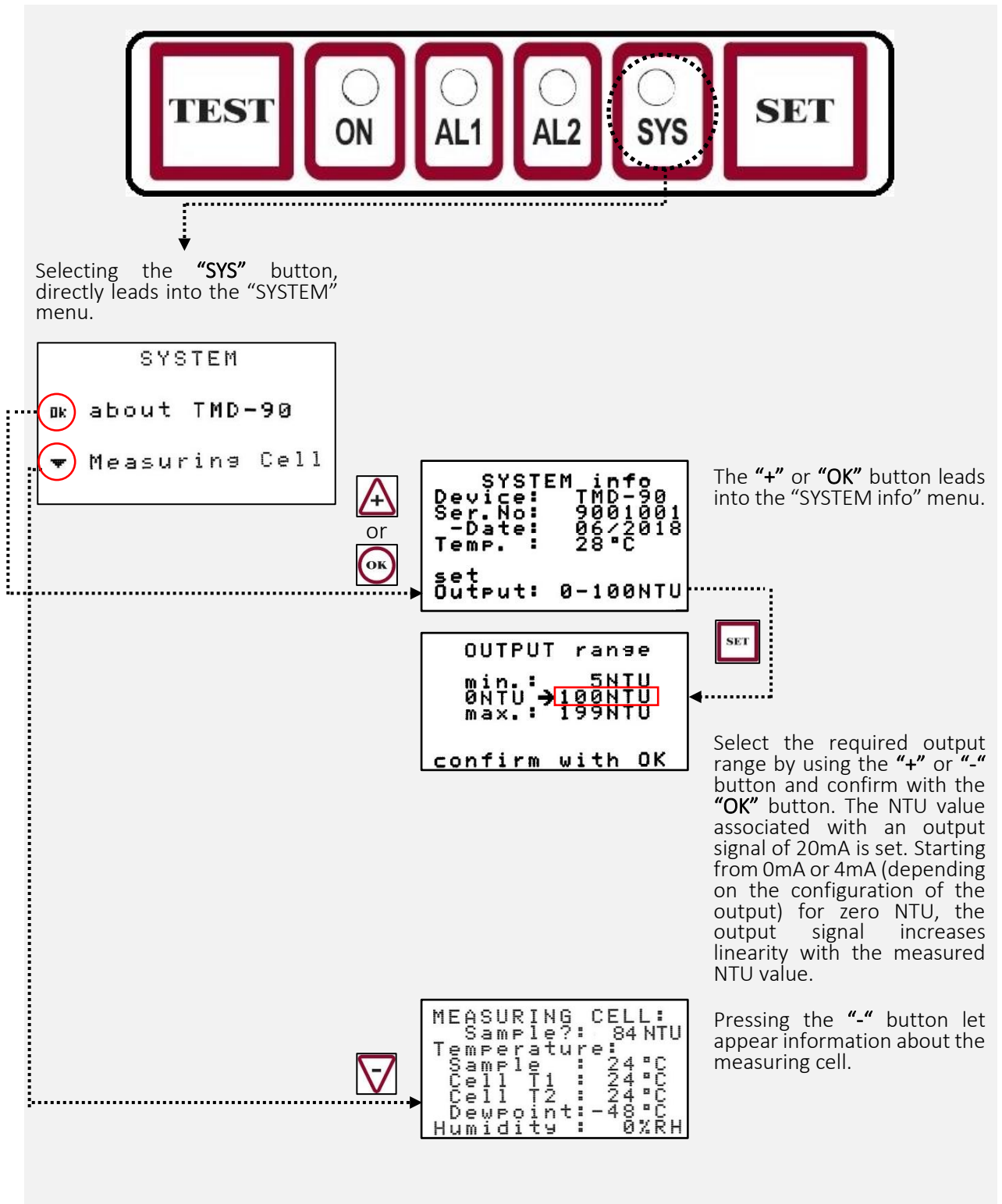
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21.2.4 Functional Button "SYS"





21.3 Data Logger Operation Buttons



The “LOG” button leads into the data logger function.

The “LOG” button leads into the data logger function.

Initially the data logger displays the live data.

TURBIDITY:
6.8 NTU
Status: OK

LOG

DATA LOG **live**
TIME: Sep 17, 2018
10:45:35
IN1: off IN2: off
AL1: on AL2: on
TURB.: 95 NTU
Temp.: 23°C
Status: OK

By pressing the “LOG” button again, the recorded data display mode is invoked and the graphical recorded data appears. By pressing the “LOG” button again, you will change into the non-graphical recorded data.

TIME: Sep 17, 2018
10:45:30 → [10 min] ...
IN1: %
IN2: %
AL1: %
AL2: %
100 %
NTU 0

LOG

DATA LOG **card**
GMT: May 2, 2016
13:49:15
Sep. off
Al2. on
Res. off
Oil 2 PPM
Status: sample

LOG



The “Arrow” sliders can be used to navigate to date or time recorded data.

For leaving the non-graphical recorded data, press the “ESC” button once. The live data appears.

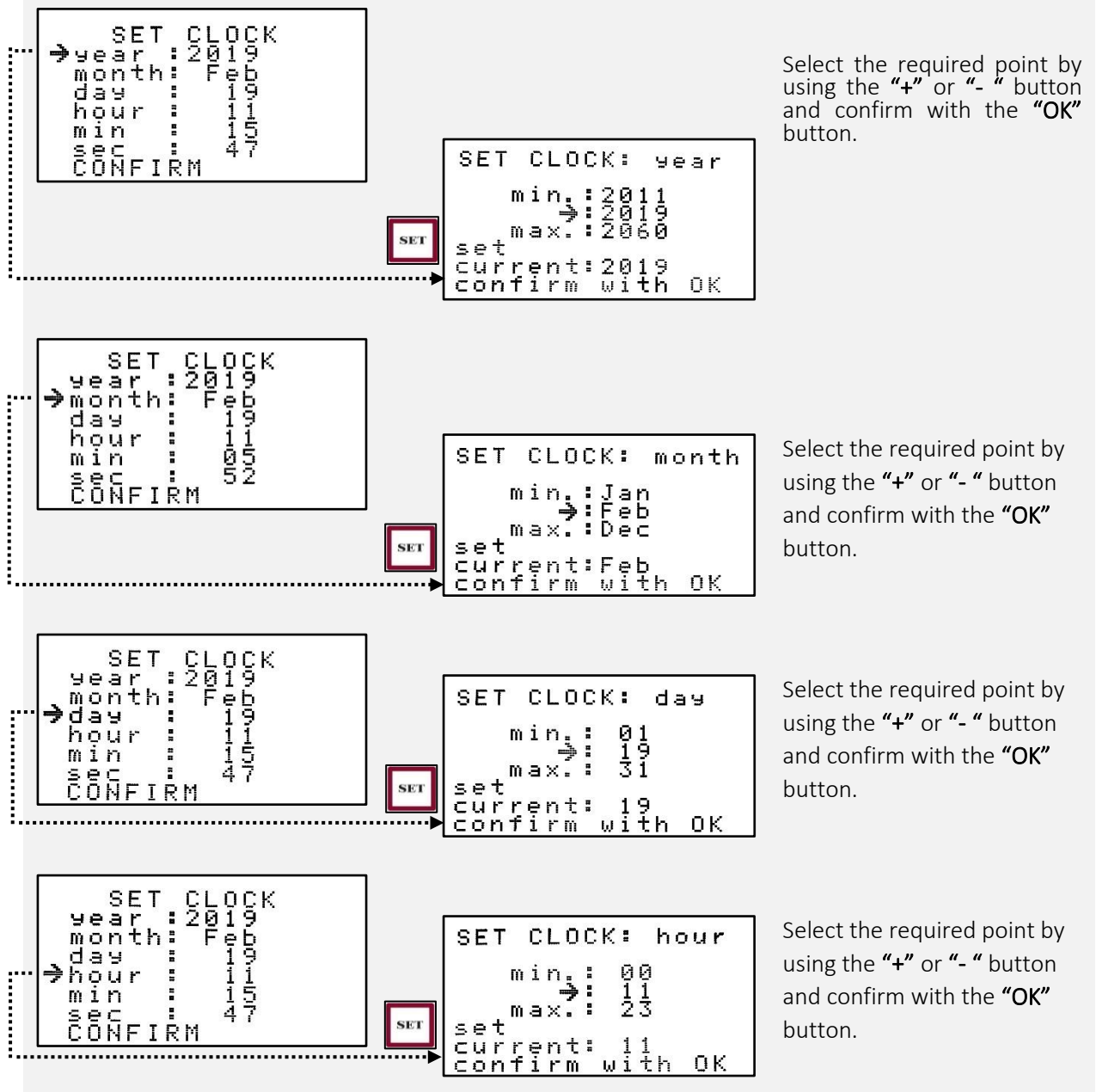




21.4 Setting the TIME / DATE



Press the "LOG" button and "SET" button subsequently to go to the time setting display.

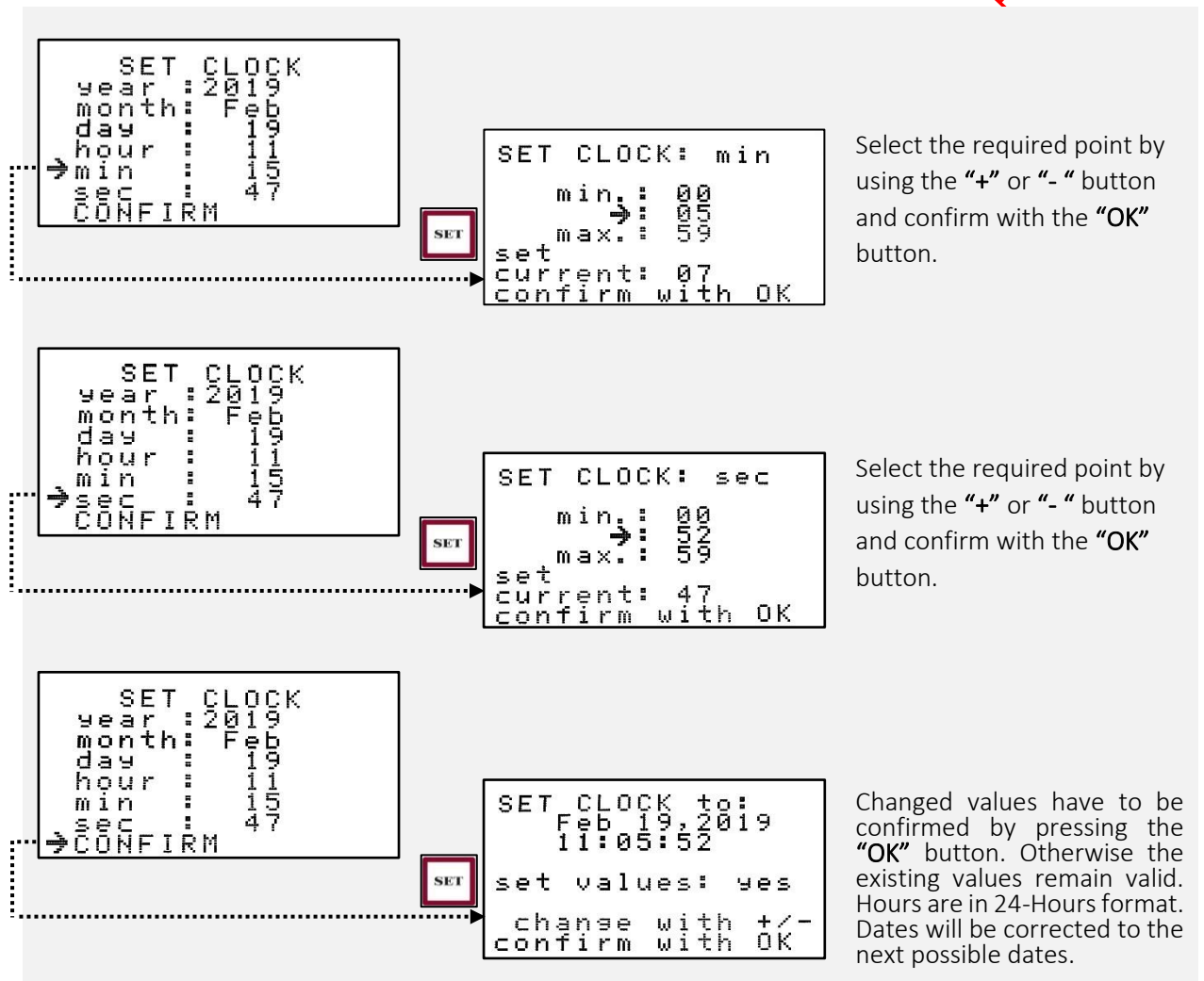




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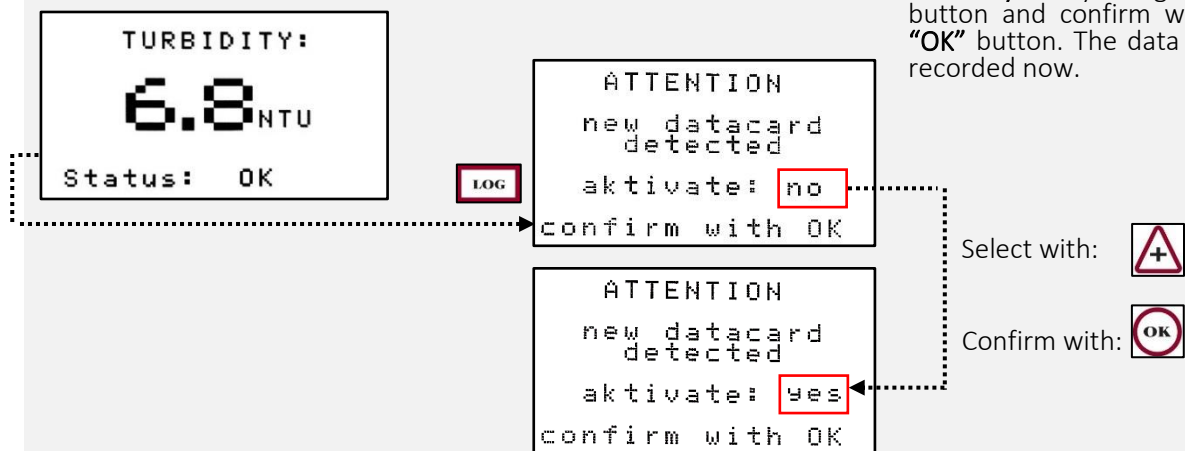


21.5 Activating the Memory Card



If you have inserted a new DECKMA memory card, you have to activate the memory card as follows.

After pressing the "LOG" button twice, the display will appear with the information, if you want to activate the new DECKMA memory card.





21.6 Software additional information

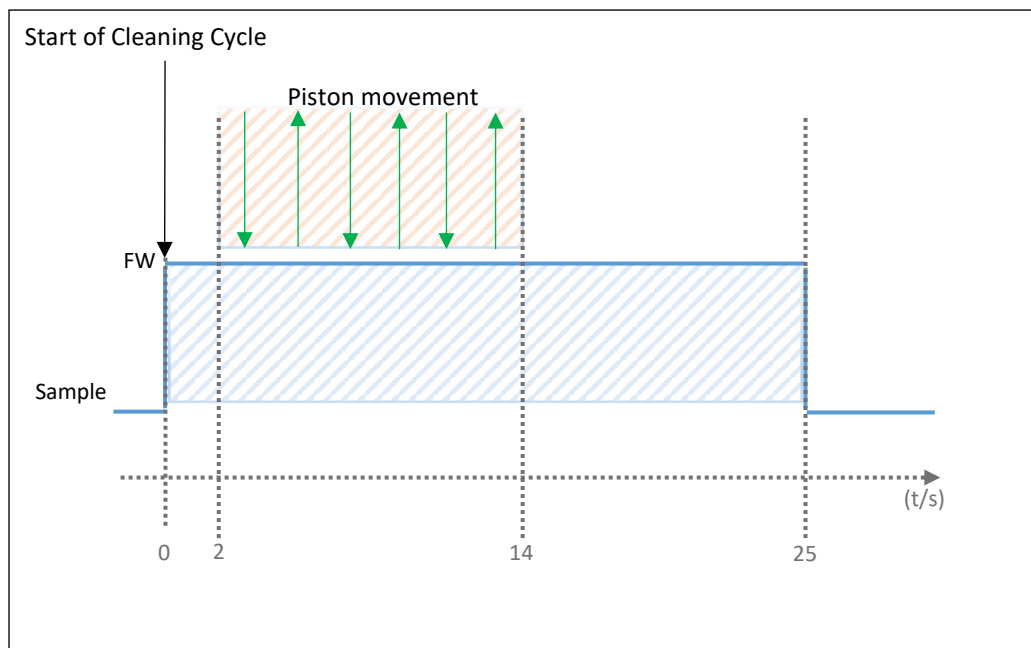
This TMD-90 EV A Ti AC Unit is applicated with a special software to control the Autoclean System in connection with fresh water flush. All settings can be done on **“SYSTEM OPTIONS”** menu.

Condition 1: Setting the FW-Flush

FW Flush can be selected with the FW flush entry. It can be set to **“off”**, **“on”**, and **“Autoclean”** which enables that FW flush is started by the Autoclean timer in case of cleaning the glass-tube automatically.

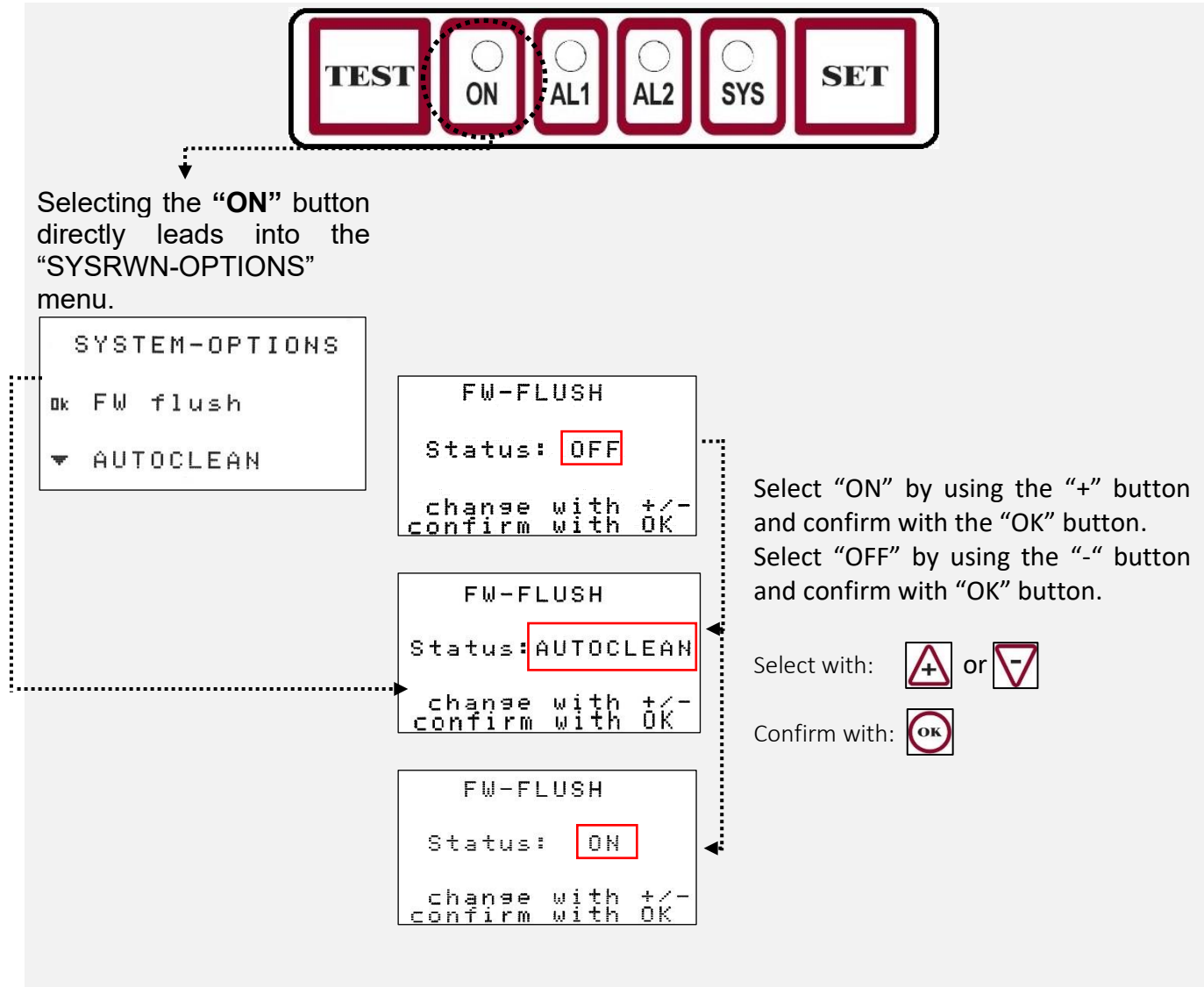
Timing:

If FW flush is set to **“on”** the FW-Valve switches to FW-input instantaneously and switch back to **“Sample-Input”** after 2 minutes autonomous, either if FW flush is set to **“Autoclean”** the FW-Valve switches to FW condition 2 seconds before a cleaning cycle is started by the Autoclean - Timer (**“AUTOCLEAN”**). After cleaning with cleaning piston, the system allows flush with freshwater another 10 seconds more before switch back to **“Sample”** input. In any case, setting the FW Valve to FW-input set system in **“alarm”**- condition.





FW FLUSH - AUTOCLEAN



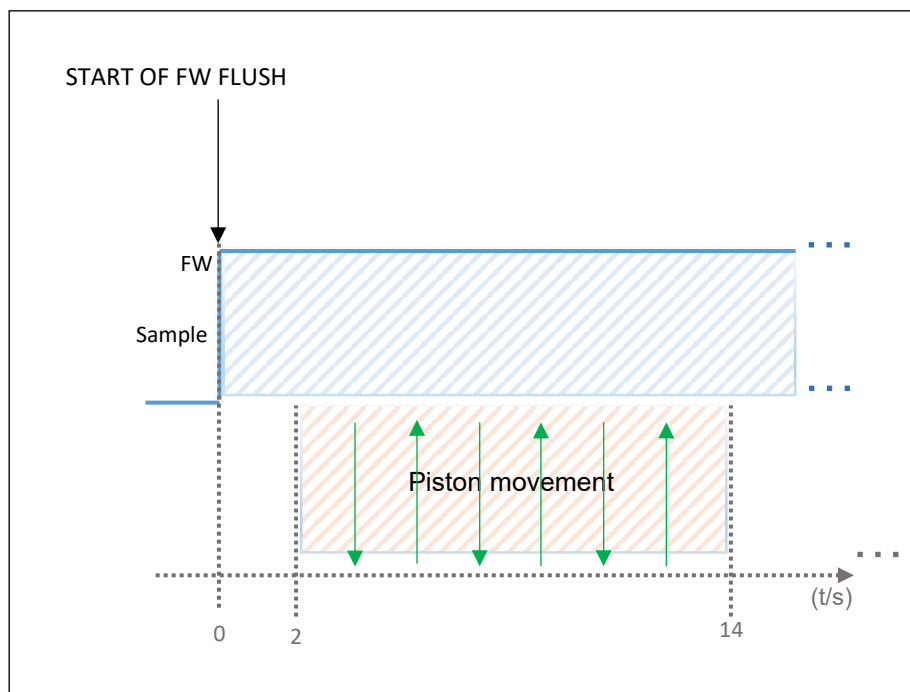


Condition 2: Setting the Autoclean-System

The Autoclean interval can be set to several cleaning intervals. It is possible to set the time delay setting for Autoclean operation from minimum 1 min. to maximum 8 hours. Moreover, it is also possible to set the Autoclean system to “**FWdriven**”. That starts a cleaning cycle, whenever the unit is set to FW condition.

Timing:

About 2 seconds after switching FW-Valve to FW-input by software (see FW Flush “**ON**”) or externally (short terminals 19/20) a cleaning cycle is started automatically.



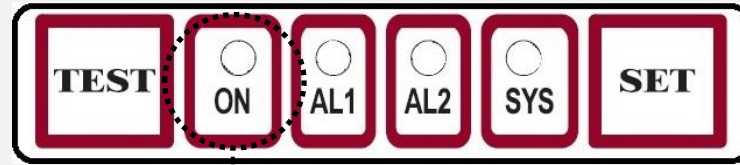


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FW FLUSH ON



Selecting the "ON" button directly leads into the "SYSTEM-OPTIONS" menu.

```
SYSTEM-OPTIONS
Ok FW flush
▼ AUTOCLEAN
```

```
CLEAN INTERVAL
min.: off
max.: 8h
next: 3h57'41"
def.: 2h
confirm with OK
```

```
CLEAN INTERVAL
min.: off
max.: 8h
next: FWdriven
def.: 0h00'51
confirm with OK
```

```
CLEAN INTERVAL
min.: off
max.: 8h
next: 4h
def.: 3h57'41"
confirm with OK
```

Pressing the "-" button leads into the "CLEAN INTERVAL" display.

In this display status it is possible to check and set the time delay setting for Autoclean operation from minimum **1 min.** to maximum **8 hours**. Alternatively, it is possible to switch **off** the Autoclean completely or set the Autoclean in connection with FW to **FWdriven** (see above Autoclean Instruction).

Less than 2 hours can lead to mechanical wear and decreased lifetime.

Line "next" displays the remaining time towards the next cleaning cycle. This is especially useful, if remaining very long (several hours) cleaning intervals.

By pushing the "SET" button, the time will be reset default times "def." 2 hours will be adopted.

Select the required point by using the "+" or "-" button and confirm with "OK" button.

The Autoclean interval should be "off" or "FWdriven", if it is uncertain, that a sample stream is maintained. If the cleaner operates in a dry Sample Glass Tube, increased wear is to be expected.



22. Appendix II.

22.1 ALARMS

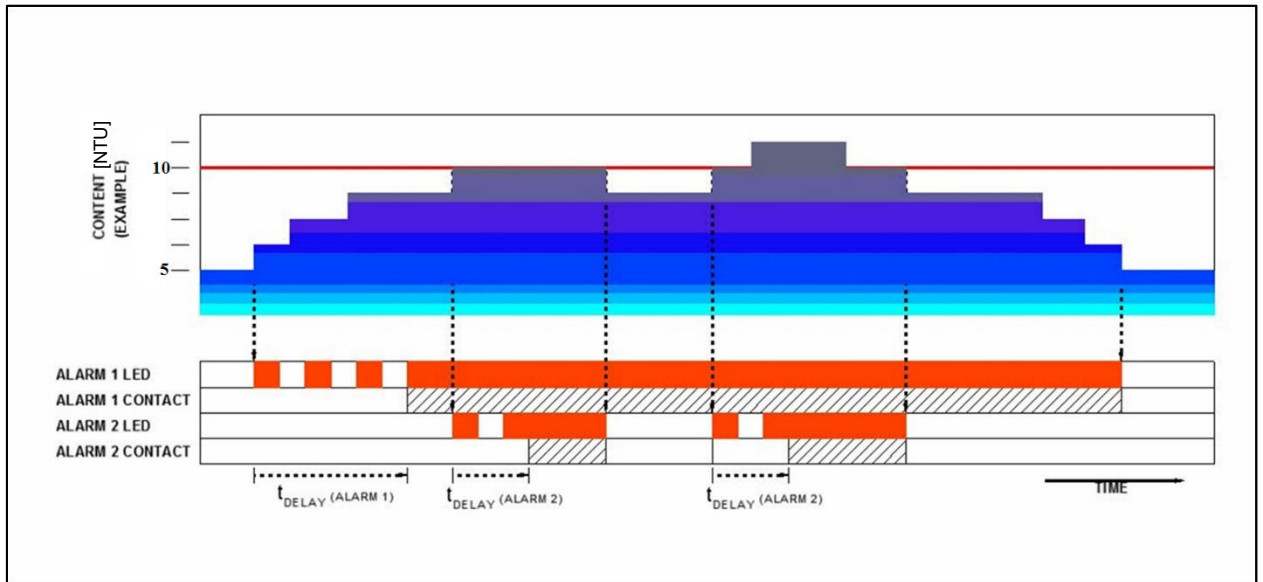


Figure 22 Alarms Example

The figure above reflects how the two independent alarms are working. In this example alarm 1 is set to 5 NTU and alarm 2 is set to 10 NTU. Each alarm is set to an individual delay setting.

Once the content is higher than 5 NTU, alarm 1 LED will blink red until the alarm 1 delay is exceeded. Then the alarm 1 contact will be in operation and alarm 1 LED will be continuously red as long as the measurement is higher than 5 NTU. Once the measurement is below 5 NTU, the alarm 1 contact will be out of operation and alarm 1 LED will be off.

Once the content is higher than 10 NTU, alarm 2 LED will blink red as long as alarm 2 delay is exceeded. Then alarm 2 contact will be in operation and alarm 2 LED will be continuously red, as long as the measurement is higher than 10 NTU. Once the measurement is below 10 NTU, alarm 2 contact will be out of operation and alarm 2 LED will be off.



23. Appendix III.

23.1 Operator Maintenance Quick Checklist

Quick Checklist	Done	Intervention needed	Partly	Value
1. Check at first the outward appearance for leakages.				
2. Check out the cables for wear.				
3. The desiccator humidity [%rH]:.				
4. Switch the stream.				
5. Flush the Measuring Cell with clean water.				
6. Display shows 0 to 5 NTU. If not, follow up with the steps 8- 15.				
7. Stop any water flow. (Shut off the instrument air/ TMD-90A.)				
8. Check the O-Rings for wear.				
9. Check the wiper piston.				
10. Clean the Measuring Cell Glass Tube.				
11. Screw back Cell Cap or Autoclean tight in.				
12. Flush the Measuring Cell with clean water.				
13. Display shows 0 to 5 NTU. If not, use the Servicing and Cleaning Appendix.				
14. Check air pipe connection of air supply.				
15. Turn on the sample water flow.				
16. Perform a "System Test" for checking alarms.				
17. Check data logger/ clock.				
Checked by:	Date:		Signature:	



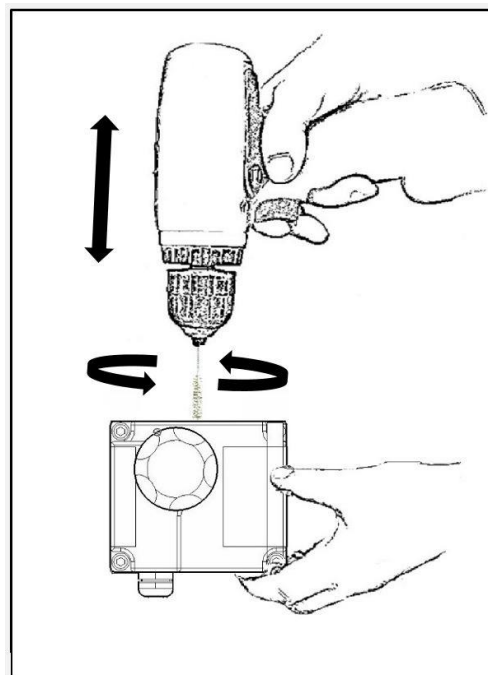
24. Appendix IV

24.1 Servicing and Cleaning Manual

To accomplish the cleaning process, please use the Servicing and Cleaning Manual.

SERVICING AND CLEANING MANUAL

TMD-90 SERIES



Cleaning Procedure of Measuring Cell

- Cleaning Manually
- Cleaning Mechanically Assisted
- Cleaning of Iron Oxide and Calcification



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Revision

Document-Name	Revision No.	Notation	Date
Servicing and Cleaning Manual TMD-90 Series	R00_20190222		22.02.2019

Usage of the Service Manual



This Service Manual will guide you how to clean a Measuring Cell onboard. The instruction manual is split into sections. Every section handles a specific type of cleaning. The first part gives you general information about the outward appearance before cleaning and servicing the Measuring Cell.

The included information should be used only by a technician or a system operator for keeping the units correctly set up and cater for a clean Measuring Cell.

Following this Service Manual ensures clean maintenance and allows a right handling of the instrument.

This instruction manual contains also information about the service support and our contact details. Additionally, the symbols below will support you during the cleaning process.

Symbols



This symbol is used to show the right handling.



This symbol is used to show what to avoid.



This symbol is used for giving advices about servicing.



This symbol is used for giving general advices.



This symbol is used to draw attention to hazardous substances.



1. Measuring Cell Cleaning

1.1 Cleaning Manually

Step 1.

Stop any water flow.

Step 2.

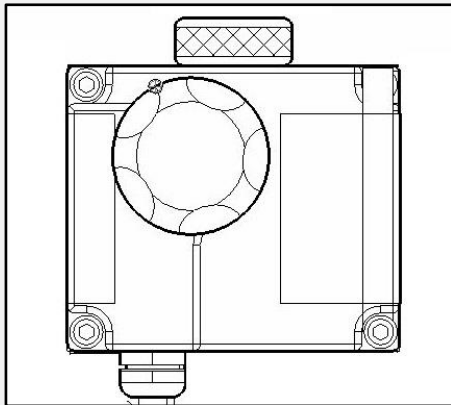
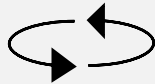


Figure 1

Unscrew Cell Cap, or Autoclean.

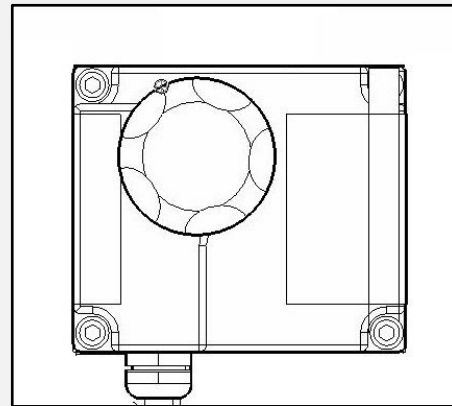


Figure 2

Remove Cell Cap, or Autoclean.

Step 3.

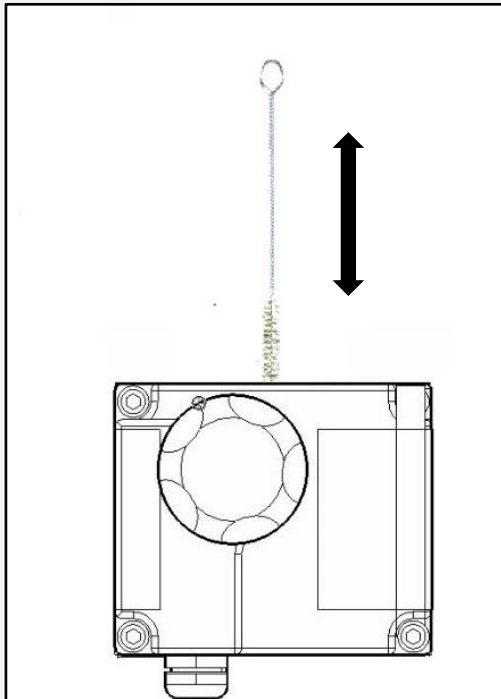


Figure 3

1. For cleaning the Sample Glass Tube, use the Cell Cleaning Brush with upwards and downwards motion through the Measuring Cell several times. Use some water to wet the Cell Cleaning Brush.
2. Remove the Cell Cleaning Brush and replace the Cell Cap.
3. Switch clean water valve to fresh water and allow clean water to flow through the instrument for few minutes.
4. Avoid air bubbles in the stream.
5. Verify, that the display shows 0 to 5 NTU.
6. Cleaning has been sufficient if display shows 0 to 5 NTU.



Step 4.

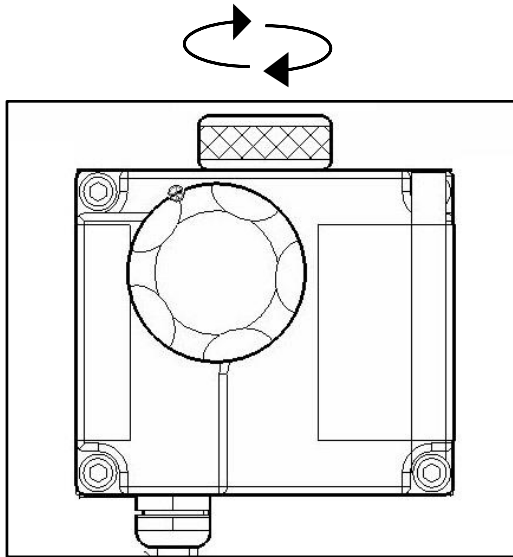


Figure 4

1. Screw in the Cell Cap/ Autoclean.
2. Check, that the Measuring Cell Cap is screwed down completely.



1.2 Cleaning with Sample Tube Cleaner

Step 1.

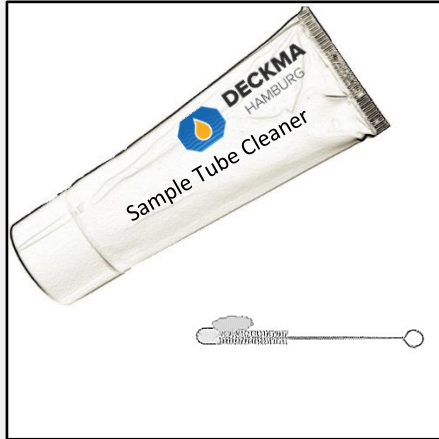


Figure 5

For intensive cleaning use the Sample Tube Cleaner from the Service Kit (Order No.: 18570). Apply clean Sample Tube Cleaner to the Cell Cleaning Brush and add water.

Step 2.

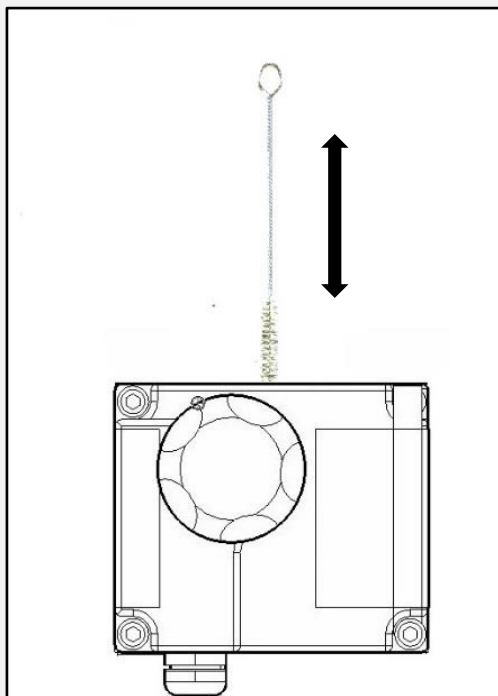


Figure 6

Clean the Sample Glass Tube with the Cell Cleaning Brush by applying the Sample Tube Cleaner.

1. For cleaning the Sample Glass Tube, use the Cell Cleaning Brush with upwards and downwards motion through the Measuring Cell several times. Wet the Cell Cleaning Brush.
2. Remove the Cell Cleaning Brush and replace the Cell Cap.
3. Switch clean water valve to fresh water and allow clean water to flow through the instrument for few minutes.
4. Observe, that the display shows 0 to 5 NTU.

➔ Check, that the Measuring Cell Cap is screwed down completely.



1.3 Cleaning Mechanically Assisted

Step 1.

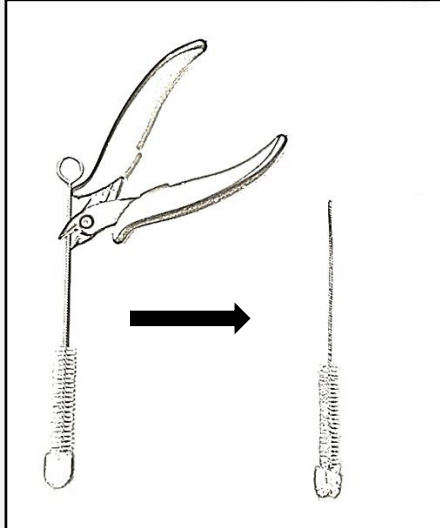


Figure 7

If the manual cleansing was not successful, an additional cleaning is recommended.

1. Cut the upper part of the Cell Cleaning Brush.
2. Insert the wire stem of the Cell Cleaning Brush into a screwdriver and fix it.
3. Slowly rotate the Cell Cleaning Brush for a few minutes in the Sample Glass Tube (See Step 3.)
4. Flush with clean water and re-test.

Step 2.

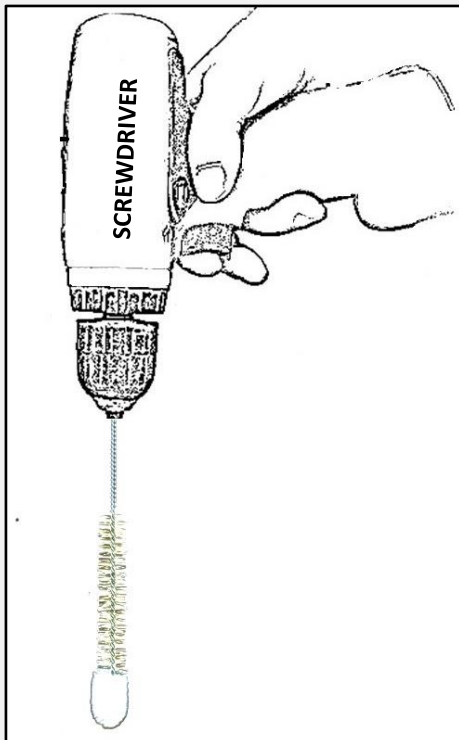


Figure 8



You can also use some Sample Tube Cleaner. It does not damage the surface of the Sample Glass Tube. Please do not use other abrasive cleaners, hard particles contained may damage the Sample Glass Tube within seconds.



Step 3.

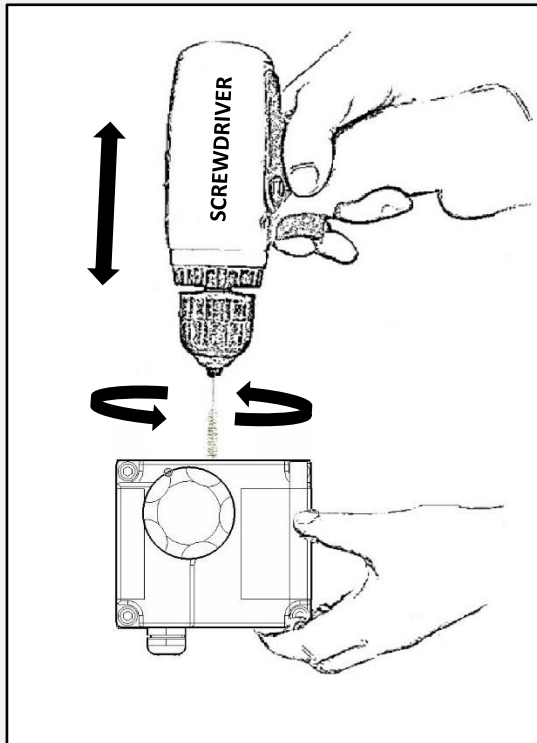


Figure 9

Use a screwdriver for an efficient cleaning. Slowly strike the Cell Cleaning Brush in the Measuring Cell for a few minutes and flush with clean water.

➔ Check, that the Measuring Cell Cap is screwed down completely!



1.4 *Cleaning of Iron Oxide and Calcification*

Step 1.

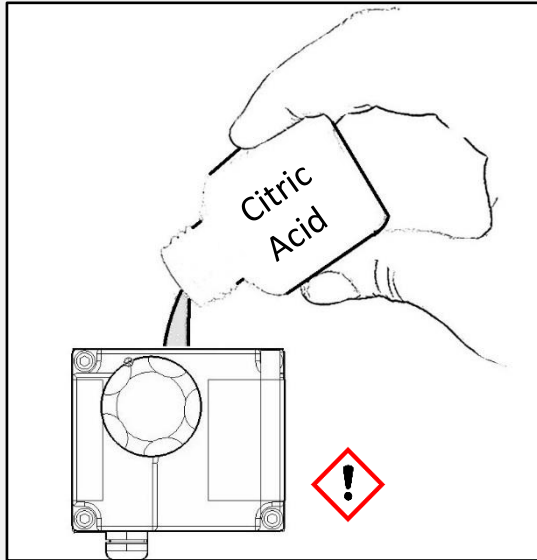


Figure 10

To clean Iron Oxide deposit, calcification, and other stubborn deposit, it is recommended to use the Citric Acid from the Service Kit (Order No.: 18570).

1. Ensure that the valves remain closed.
2. Mix some Citric Acid with 15 ml water.
3. Fill the Sample Glass Tube with the Citric Acid liquid and let it soak over night.
4. Flush with clean water without gas.



1.5 Outward Appearance

Step 1.

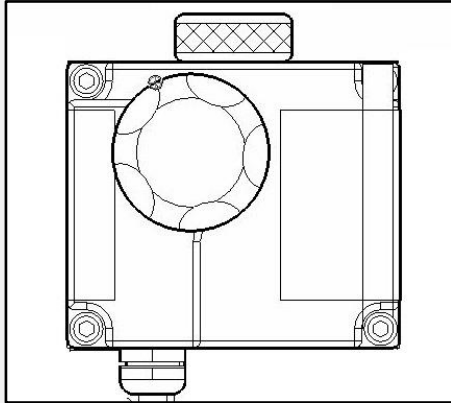


Figure 11

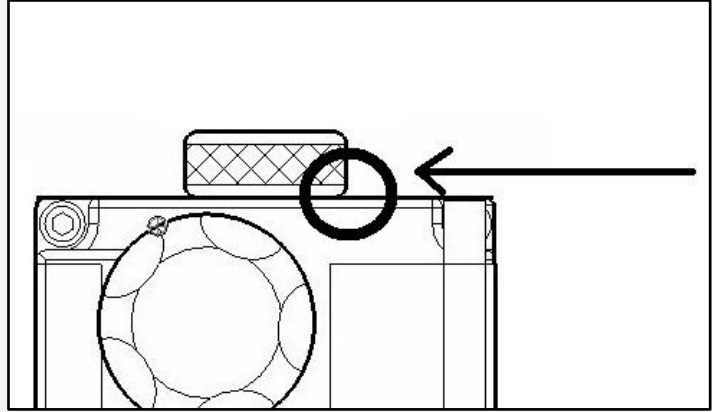


Figure 12

Check, that Cell Cap, or Autoclean is screwed down completely.

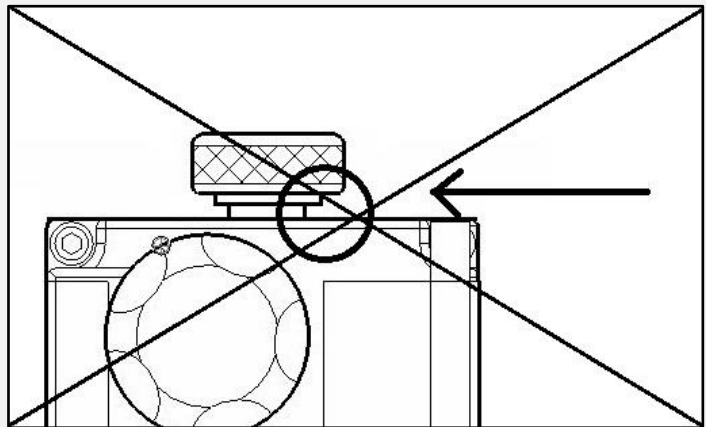


Figure 13

A not completely screwed down Cell Cap may allow formation of air bubbles and may influence with flow rate settings.



1.6 Checking the O-Rings

Step 1.

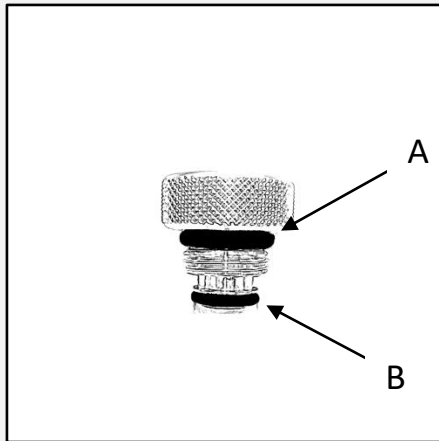


Figure 14

1. Check the condition of the three O-Rings as shown in the figures. If damaged, replace.
2. O-Rings B + C may or may not be present, depending on flow rate adjustment.
3. O-Ring A is always present.

A=11.5X3 mm

B= 8.5X2 mm

C= 4.5X2 mm

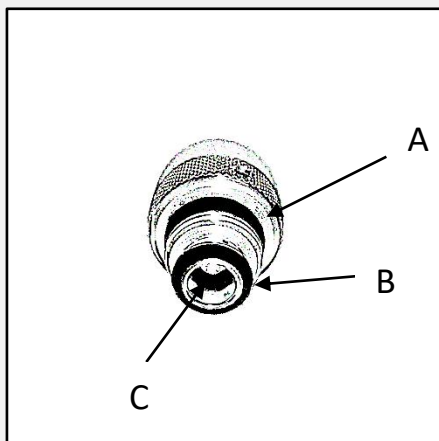


Figure 15

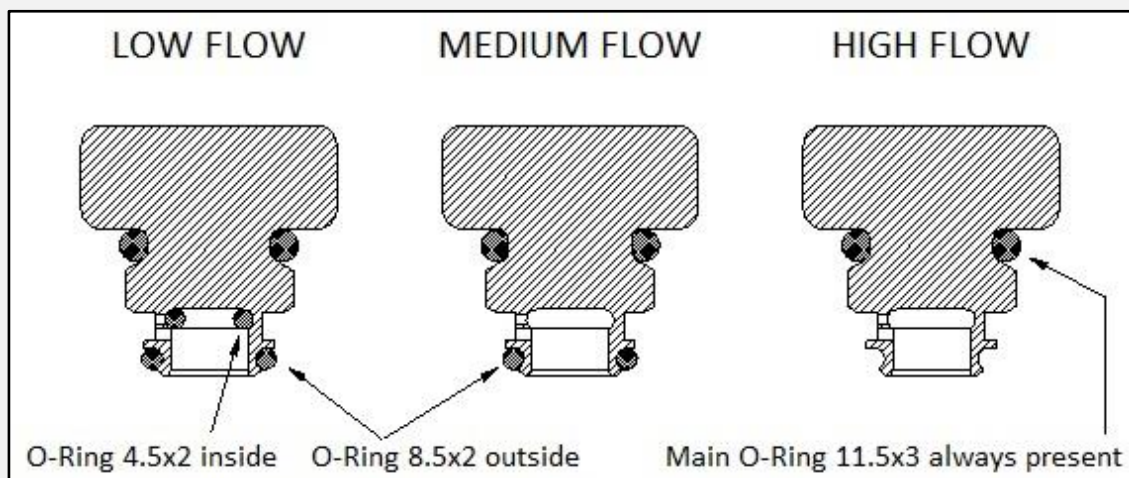


Figure 16

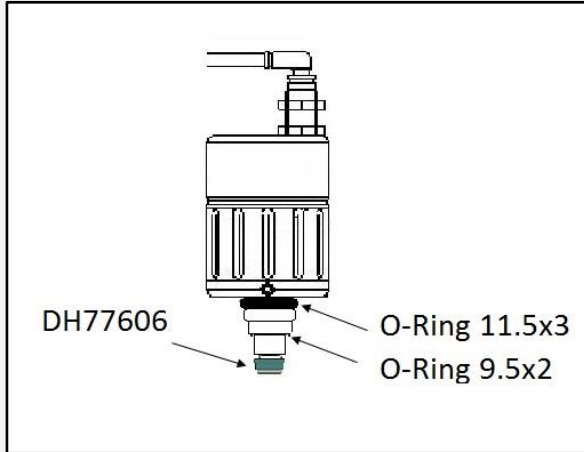


Figure 17

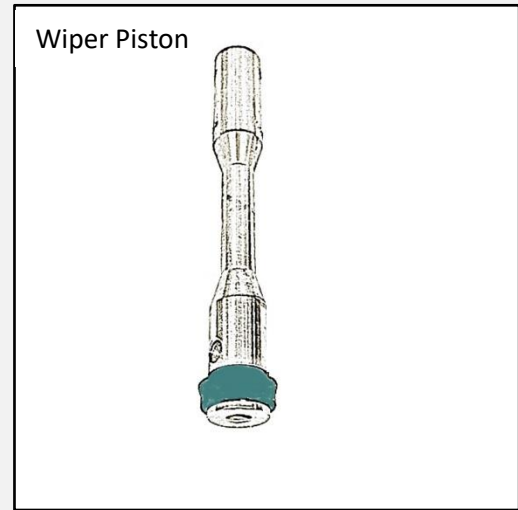


Figure 18

For Units equipped with Automatic Cell Cleaning Device, check the two O-Rings and the piston seal.



1.7 Desiccator Check

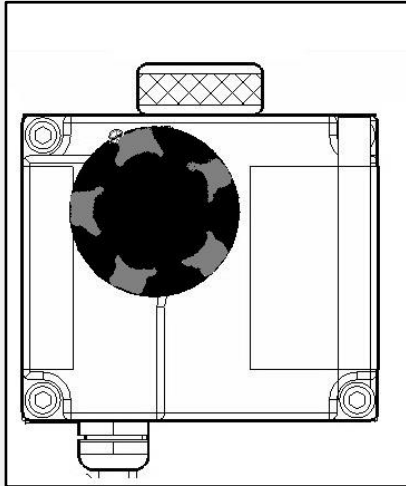


Figure 19

1. Press "SYS" Button, select Measuring Cell, confirm.
2. Internal data will be displayed.
3. The relative humidity [%rH] should be below 10%rH.
4. The dew-point Temperature should be below 0° C.
5. If not, exchange desiccator.
6. The desiccator also has to be exchanged, if humidity is higher 10%rH.

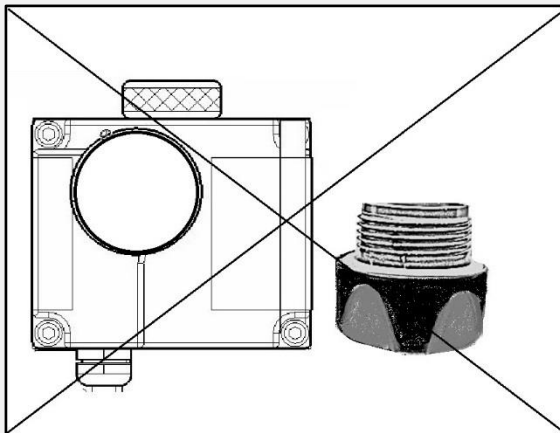


Figure 20



Do not expose the Desiccator to ambient air. Do not leave the Desiccator opening uncovered.



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