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OPERATING MANUAL

TANK MONITOR TCM 4V

SOFTWARE REV 4x

INDEX

1 GENERAL INFORMATION

Dear customer,

thank you for buying the tank monitor TCM 4V. This digital unit is state of the art in tank monitoring.

On the large, illuminated display you can read:
• the actual filling level of up to 4 tanks without battery voltages or
• the actual filling level of up to 3 tanks and up to 2 battery voltages

You have the possibility of adjusting an alarm threshold:
• for each tank (full or empty alarm)
• for two batteries (min./max.)

The tank levels are shown as a bar and in % or liters.
The TCM 4V is easy to operate and well readable. You have a quick overview of up to 4 tank levels or
1 - 3 tank levels and up to 2 battery voltages.
For level-sensoring we recommend the sensors of our TGT / TGW - series, the ultrasonic sensors UTV and the fresh water flow sensor DFS. These sensors are not part of the purchased parts package.
Sensors of other manufacturers can be connected as well; depending on the type you may need a hardware adaption of the TCM 4V at our company (sensor output 0-10 V, 4-20 mA).

In the SETUP- menu the display will be configured to the connected sensors. Also you have the possibility to adjust the Tank Monitor TCM 4V to your given tank - geometry to show the real tank filling level correctly.

Please note: only when using the flow sensors DFS the shown display of liters is correct, because it measures the flowed liters. If you're using other sensors, the TCM calculates the remaining tank capacity by the tank volume and the actual level. Depending on the accuracy of the sensors it cannot be liter - correct.

1.1 PURPOSE

The Tank Monitor TCM 4V can only be used with suitable tank sensors for low voltage purposes DC 10-30V. It is designed for the use on yachts or camper vans and must be used in an enclosed environment which is protected against rain, moisture, dust and condensation.
Don't use the Tank Monitor TCM 4V in places where there could be danger of explosion by gas or dust.

1.2 CONTENTS

- Tank Monitor TCM 4V
- Plug-in clamp MVSTBR12, Order-no..: 6 2179 2113
- This Instruction Manual

1.3. RECOMMENDED SENSORS (TO BE ORDERED SEPARATELY)

Fresh Water:
• Flow sensor	DFS	Order-no.: 7 0003 0304
• Fresh water tank sensor	TGW 200-800	Order-no.: 6 6011 7xxx

Fuel:
• Fuel tank sensor	TGT 200-800	Order-no.: 6 6011 7xxx

Grey Water / Waste Water:
• Ultrasonic sensor	UTV 20-80	Order-no.: 7 0219 35xx

Recommended accessories for ultrasonic sensors:
• Focus tube	UFT 40 (40cm long)	Order-no.: 7 0219 9400
• Focus tube	UFT 80 (80cm long)	Order-no.: 7 0219 9800
• Distance ring	UTS 25 (25mm high)	Order-no.: 7 0219 9025
• Distance ring	UTS 50 (50mm high)	Order-no.: 7 0219 9050
• Fuse holder incl. fuse 1A for measuring lines	ASH1A	Order-no.: 6 0030 3411

1.4 WARRANTY

philippi elektrische systeme gmbh grants a two year limited and non-transferable warranty for the first buyer of this equipment, commencing on the date of purchase and covers defects in manufacturing, parts and materials.

Production or material defects will be corrected without costs if:

• the equipment is sent to us at the expense of the sender
• an Invoice or proof of purchase (copy) is included
• the equipment was used for its intended purpose
• no unauthorized parts were added, and the equipment was not exposed to extreme conditions

 Not included in the warranty are damages from:

• overvoltage on the inputs or reverse polarity
• ingress of liquids, vapors, condensation, etc.
• lightning
Follow-up costs and normal wear and tear are not covered under warranty.

In case of warranty the defect must be clearly specified. A detailed description of the defect will help to speed up the repair.
Please note that we cannot accept carriage forward deliveries.

1.5 EXCLUSION OF LIABILITY

Both adherence to the operating instructions, and the conditions and methods used during installation, use and maintenance of the BCM, cannot be supervised by philippi electrical systems gmbh. Therefore we do not take any responsibility for loss, damage or costs, which develop due to incorrect installation and/or inappropriate use.

1.6 QUALITY MANAGEMENT

During the process of manufacturing, all devices pass several checks, controls and tests. Production, controls and tests are all performed to strict protocols. Each TCM has its own serial number. Please do not remove this label.

The assembly and testing of all TCM devices is carried out completely in our company at Remseck am Neckar, Germany.

2 SAFETY REFERENCES

• unauthorized changes to the equipment will invalidate the CE sign
• the installation of the TCM may be made only by electrical specialists.
• before connection of the TCM the battery terminals must be clamped.
• Important! Pay attention to the correct polarity of the batteries!

The assembly and operating instruction is a component of the TCM package. It must be kept (for reference). Importantly: - for later maintenance work - and for the use of subsequent owners of the equipment.

3. INSTALLATION

Please install the Tank Monitor TCM4V in a visible place, so that it can be read off at any time. The installation cutout is 88 x 88 mm, the minimum installation depth is 40mm.

The TCM4V supervises up to four tanks at the same time. If you have less than 4 tank sensors, start connecting the first tank sensor at terminal TG 1 (if you're using two, connect them to TG 1 and TG 2 and so on).

You can use both passive (resistance like TGT / TGW) and active (ultrasonic / UTV) sensors at the same time. For connection please have a look at the connection diagrams. See chapter 3.1- 3.3.
The flow sensor DFS can be connected either to terminal TG 1 or / and terminal TG 2!
If you want to use tank sensors with an output of 4-20mA or 0-10V you need a hardware-adaption of the TCM4V at the manufacturer. For details please contact us
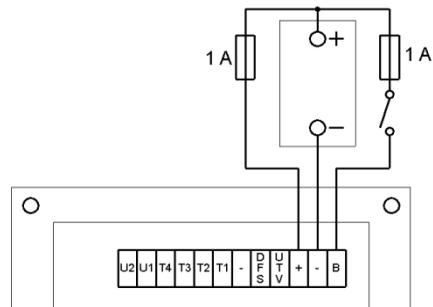
The power supply for the TCM4V is either directly from the battery or from a power distribution panel. A wire of min. 1mm² cross section is recommended, which has to be fused (1A).

The display is lit for 30s when you press a button. You can also connect the terminal "Light" to a switch and a 12/24v DC positive supply, and switch it on and off manually.

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3.1 CONNECTION OF ULTRASONIC SENSORS UTV AND OTHER ACTIVE SENSORS:

ATTENTION:
If the power supply of an ultrasonic sensor (red wire) is connected directly to the on board DC system, not on the terminal UTV+ the tank monitor TCM4V, this wire has to be fused by a 1A fuse!

The negative wires of the tank sensors have to be connected directly to the terminal "GND" in order to avoid wrong measurements.
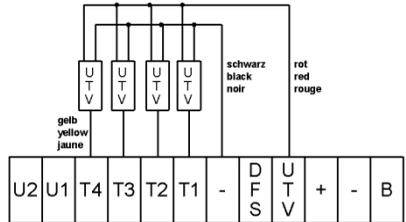
3.2 CONNECT. OF RESISTANCE SENSORS SER. TRG, TGT, TGW

3.3 CONNECTION OF THE FLOW SENSOR DFS
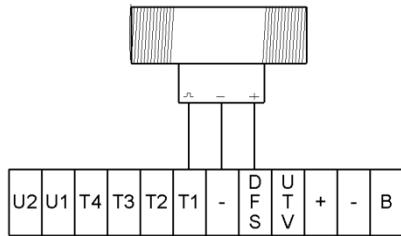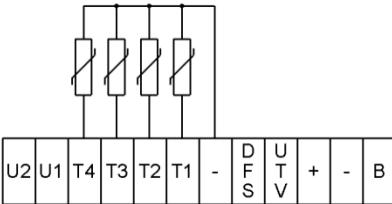
4. OPERATION

The main display shows the tank levels automatically after switching on. If a voltage higher than 1V is connected to the terminal Batt.1 and/or Batt.2 and the number of tanks is set between 1-3 tanks, a battery symbol with the relating name appears and the measured voltage will be shown.
Battery 1 is shown above, Battery 2 below.
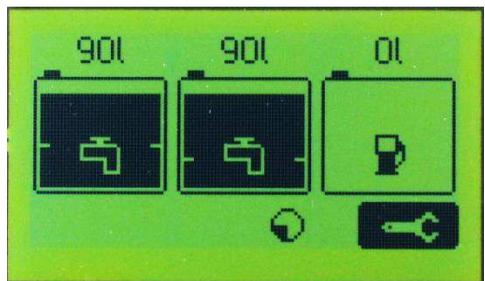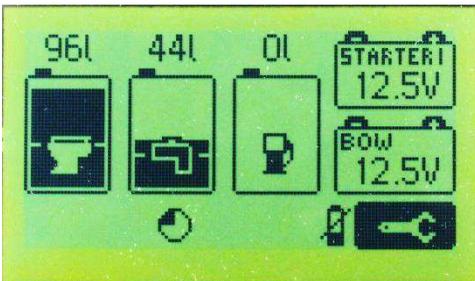
In the SETUP-menu you can set each tank bar individually to the medium (fuel, water...), the volume, the type of sensor used, the compensation value for the tank-geometry and the alarm-threshold. In case of a power supply breakdown all of these settings are saved and are immediately available after switching on.
All tank levels are measured each 5 seconds.
The measured levels are shown in a bar diagram and additionally either in liters, percent or without either being shown. This can be adjusted in the SETUP-menu. If the displayed indication is "----", the measured value of the related tank is out of an expected range or there is no sensor connected.

4.1. TANK ALARM

If an alarm is set you can see the threshold level as small horizontal lines at each side inside the tank graphic at the appropriate level. From this you can see easily if the tank level is in the acceptable range or not.

4.1.1 TANK-FULL ALARM
For alarm thresholds from 51% to 100% the "Full" alarm is used, so that a level over the threshold switches the alarm on.

4.1.2 TANK-EMPTY ALARM
For alarm thresholds from 0% to 50% the "Empty" - alarm is used, so that a level under the threshold switches the alarm on.

The alarm is delayed by 15s. In case of an alarm the relating tank bar flashes.
In addition the display illumination flashes and an acoustical alarm turns on for the period of 1 minute. This alarm can be cleared by pressing any button.
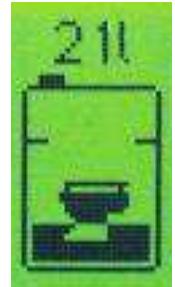
4.2. BATTERY ALARM

4.2.1 UNDER-VOLTAGE ALARM BATTERY 1 / 2 (U1 / U2)

If the battery voltage falls below the threshold for 30s, the relating battery symbol starts to flash. In addition the display illumination flashes and an acoustical alarm turns on for the period of 1 minute. This alarm can be cleared by pressing any button.
Possible thresholds are between 10V and 31V.

4.2.2 OVER VOLTAGE ALARM BATTERY 1 / 2 (U1 / U2)

If the battery voltage rises above the set threshold for 30s, the relating battery symbol starts to flash. In addition the display illumination flashes and an acoustical alarm turns on for the period of 1 minute. This alarm can be cleared by pressing any button.
Possible thresholds are between 11V and 32V.

4.3 POWERSAVE MODE

To reduce the current consumption of the tank measurement system when using ultrasonic sensors or other active sensors (50mA / sensor), you can choose the POWERSAVE MODE.
In the Powersave Mode the measurement of the active sensors is carried out every 30 min. respect. 2 hours. A measuring cycle lasts 5 minutes, thereby the sensors are scanned each 5 s.
   - At a power supply voltage between 11,5 - 13V a measuring cycle takes place every 30 minutes;
   - If the supply voltage is below 11,5V a measuring cycle takes place every 2 hours.
A new measurement cycle is started always by pressing of any button. During the breaks the last measured values are shown.
The Powersave Mode is activated / deactivated automatically if the power supply voltage is:
   - above 13V the Powersave Mode is switched off;
   - under 11,5V the Powersave Mode is switched on. The display illumination is also deacivated.
At 24V- operation double values are applying.
If the Powersave Mode is activated in the SETUP, the following symbol is shown at the bottom right of the display:
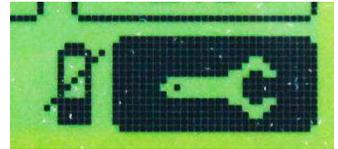
Attention: when using the Powersave Mode, the alarm is de-activated.

5. HANDLING

5.1 DISPLAY ILLUMINATION

By pressing the push buttons the display illumination is lit during 30s. The display illumination can be activated also by connecting the terminal connection "Light" to a voltage of 12/24V.

5.2 SETUP

By pressing the right hand side button the Setup menu will be activated. In this menu you can change all values and settings.

The highlighted line is active for changes to be made.

Following actions are activated by pressing:

Arrow up:	choice of the input line
Arrow to right:	choice of the sub menu
Minus:	decreasing of the value
Plus:	increasing of the value
Return:	save the values and return to the main display

The SETUP menu can be locked by pressing the right hand side button ("tool") for 10s. The "tool" disappears. By pressing the same button again for 10s the SETUP menu will be unlocked.

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5.2.1 ADJUSTMENTS MAIN MENU
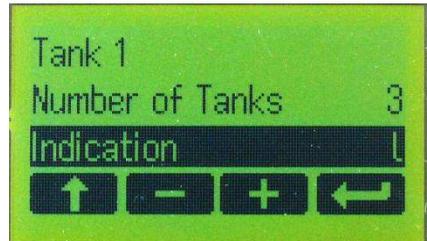
INDICATION	Set Indication of the tank volume in liters (l)
	Set indication of the tank volume in percent (%)
	Set no numerical indication of the tank volume
NUMBER OF TANKS	Set number of the tanks shown (1 - 4 tanks), display of the voltage only if max. 3 tanks are set.
TANK X	See chapter 5.2.2 individual settings for each tank: tank volume in liters, tank type, sensor type, compensation value and alarm level.
POWERSAVE MODE	ON / OFF
CONTINOUS LIGHTING	ON / OFF
CONTRAST	Display contrast attitude: adjustable values: 20 (dimmer) to 40 (brighter)
LANGUAGE	Language in the Setup menu. Following languages are available: German / English / French
NAME U1 (U2)	Name of the related battery (Starter, Service...)
ALARM U1/U2 min.	Adjustment of the under-voltage alarm for battery 1 / 2
ALARM U1/U2 max.	Adjustment of the over-voltage alarm for battery 1 / 2
INFO	Software version, factory setting and test.
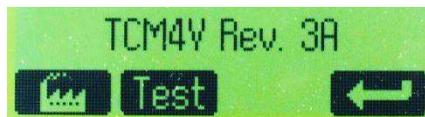
If you want to reset to the factory setting, please press the "factory" button for 10 s, until an acoustic signal sounds. The "Test" - button is only for our internal service purposes.

5.2.2 ADJUSTMENTS MAIN MENU:

You can select the desired tank menu by pressing the button (arrow to the right):

In the tank menu you can set the tank volume, the tank type (e.g. water, fuel, ...), the type of sensor, the alarm level and the compensation value (adjustment of the tank-geometry).

If you set the type of sensor to a custom resistance sensor (User R) you have the opportunity to set the ohm-values for 0%, 25%, 50%, 75% and 100% or alternatively the given values of the tank sensor can be taken by the tank monitor by pressing a button.

The same procedure can be done with sensors with a voltage output (User U).

If you have chosen the sensor type UTV 40/80, you can adjust the tank depth and an optional use of a distance ring UTS.
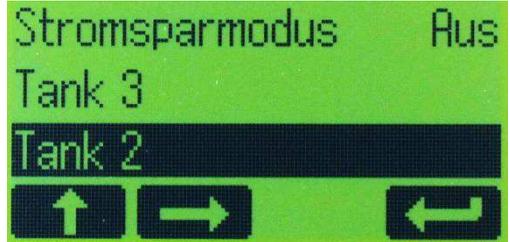
5.2.2.1 VOLUME

Adjustment of the tank volume by pressing the +/- - buttons. The volume is shown in liters.

5.2.2.2 TANK TYPE

There are 4 different tank symbols to choose from:

| Water | Fuel | Waste Water | Grey Water |

5.2.3 ADJUSTMENT OF THE TYPE OF SENSOR

Sensor name	Sensor type	Measuring range	Attention
TRG philippi	philippi TRG	6 steps (6-190 Ohm)	
TGX 10-180 (Ohm)	philippi TGT / TGW	10..180 Ohm	
240 - 33 (Ohm)	240 – 33 Ohm	240...33 Ohm	UTR not possible!
User R	1 – 1000 Ohm	free adjustment of resistance range	
UTV/UTA	philippi UTV	0,5..2,5V	
	philippi UTA	4...20mA	Factory hardware modification is required!
DFS ↓ (down)	philippi DFS	Flow sensor	
DFS ↑ (up)	philippi DFS	Flow sensor	for water maker
DFSW	philippi DFS at TG 1 & 2	Flow sensor	for water maker
TDS / User U	0,1 - 5V	free adjustment of voltage range	

PB42	5 bars sensor	4 levels	aux. hardware PB42 !
TRS	philippi TRS / RSW	Level switch OFF / ON	
Gobius4	Gobius	4 levels for Gobius 4 (1-4V) from year 2016	

Incorrect display information can occur due to not compatible parts and settings. In this case the value shown is "---". Please ensure that the selected sensor type matches to the installed sensor.

5.2.3.1 SENSOR TYPE TRG (built until 2006)

This function is for sensors series TRG with a 6 level resistance output 6-190 Ohm.

5.2.3.2 SENSOR TYPE TGX

For this adjustment you need a tank sensor series TGW (fresh water) or TGT (fuel) with a resistance output of 10 - 180 Ohm (10 Ohm = empty / 180 Ohm = full).

5.2.3.3 SENSOR TYPE 240 - 33 (OHM)

For this function you need a tank sensor with a resistance output of 240 - 33 Ohm
(240 Ohm = empty / 33 Ohm = full).

5.2.3.4 SENSOR TYPE User R:

For this function you need a passive resistance sensor with a resistance output range between 1 ohm and 1000 ohm. Then you have to fill in the voltage values for the tank levels 0, 25, 50, 75 and 100%.
Now you have two possibilities to do this:

1. You know the resistance value for each tank level and fill them in.

2. You press the right button with the „Arrow Ohm Arrow" symbol when the matching tank level is reached. While pressing this button the tank monitor takes the given resistance as level for the relating tank level.

⚠️ **Sensors:** this mode can only be used in combination with passive resistance-sensors, not in combination with active / capacitive sensors! (like UTR) !

5.2.3.5 SENSOR TYPE UTV

For this function you need an ultrasonic sensor Philippi UTV with a voltage output of 0,5 - 2,5V
(0,5 V = empty / 2,5 V = full).

⚠️ If you want to connect an ultrasonic sensor Philippi UTA with an output of 4 - 20mA the hardware of the tank monitor has to be modificated in our company first!

5.2.3.6 SENSOR TYPE UTV 40 / 80

You need the following ultrasonic sensors:

- tank depth (plus opt. distance ring UTS) equal or less than 40 cm: UTV40
- tank depth (plus opt. distance ring UTS) greater than 40 cm: UTV80 (max. depth measurable : 80 cm)
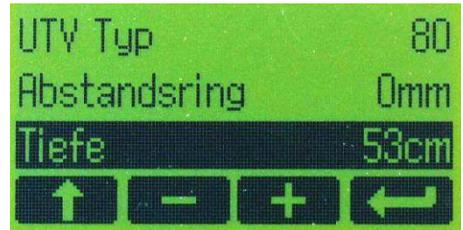
The depth of each tank can be adjusted in cm in the SETUP-menu. (1 inch = 2,5 cm).

After having selected the tank type UTV 40/80 you have to choose the UTV type UTV-type (40 or 80), a distance ring UTS (if installed), 25 or 50mm, and the depth of the tank.

 If the tank depth plus the distance ring is equal or less than 40 cm you need an UTV 40; greater than 40 cm an UTV 80. If the UTV40 is chosen, the adjustable depth incl. distance ring is always less than 40cm.

To account for the dead-band of the ultrasonic sensor UTV (the range which is not measurable between the sensor and the surface of the liquid at the top of the tank) you can use a distance ring UTS 25 or UTS 50 to obtain a completely full reading. If you're using such a distance ring UTS, you have to set this too.

 ATTENTION! If the total of tank depth and height of the distance ring is greater than 40 cm, you have to use an UTV 80! (e.g. the tank depth is 37 cm and distance ring is 5 cm = total depth is 42 cm) You can use only ultrasonic sensors UTV40 or UTV80 for this setting!

5.2.3.7 SENSOR TYPE DFS ↓

For this function you need a flow sensor philippi DFS. The flow sensor DFS can only be connected at terminal TG1 and / or TG2. You can see the following symbol under the relating tank in the main menu:

 Because the Flow Sensor DFS cannot detect when the tank is refilled, the operator must adjust the level manually after filling. By pressing the relating button you can enter directly into the menu where you can adjust the filled level accordingly.

When water is flowing through the Flow Sensor DFS, this symbol is rotating. The DFS with an arrow down empties the relating tank.

 ATTENTION! Please check the pulse number of the tank sensor (DFS or DFS24). The factory setting is 1000I/l for the DFS24.

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5.2.3.8 SENSOR TYPE DFS ↑

Please see 5.2.2.3.7 - in contrast to the emptying version this one fills the relating tank. This function is used in connection with a water maker in order to measure the produced amount of water.

5.2.3.9 SENSOR TYPE DFSW (only for tank 1)

Please see also the two previous chapters. When choosing this function, you̇'re using two flow sensors DFS for one tank; one flow sensor empties the tank (this one has to be connected at terminal TG1) and the other flow sensor fills up the tank (water maker, flow sensor connected to terminal TG2).
With this function the values of both flow sensors are added and displayed as tank 1 in the main menu. The tank 2 is only virtual and cannot be seen / displayed.
If you choose this function for tank 1 the tank 2 will be automatically adjusted to DFS ↑ (arrow up).

5.2.3.10 SENSOR TYPE TDS / User V:

If you have a tank sensor with an output range between 0,1 and 5V you can use this function (if you have a sensor with a range between 0,1 and 10V please ask for an optional hardware modification).

⚠ If you want to use a tank sensor with a current output of 4-20mA (e.g. TDS200, TDW200, UTA) you need a hardware modification from the factory.

While chosen this function you have to fill in the voltage values for the tank levels 0, 25, 50, 75 and 100%. You have two possibilities to do this:
Method 1 (recommended, tank has to be filled step by step):
the sensor is in the empty tank. You go in the Setup menu to the value for 0%. Then press the right button with the "arrow V arrow" symbol. While pressing the measured value for 0% will be entered. In the next step you fill up the tank to 25%. Then you go in the Setup menu to the value for 25% and press again the arrow V arrow button.
For the values 50%, 75% and 100% you proceed in the same manner. We recommend to take a note of these values for later maintenance work. You have to make sure, that every voltage value (for 0%, 25%, 50%, 75%, 100%) is recorded/registered.
This method has the advantage, that the shown tank level of even an abnormal tank form is displayed correctly.
Method 2 (Installing the TDS200 in a full tank):
The sensor is outside of the tank. You go in the Setup menu to the value for 0%. Then press the right button with the "arrow V arrow" symbol. While pressing the measured value for 0% will be entered. Please note this value. Then install the sensor (take care that it is at the bottom of the tank) , go in the Setup menu to the value for 100% and press the „Arrow V Arrow" button. Please note this value too.
The values for 25%, 50% and 75% have to be calculated now. First please subtract the 0% value from the 100%. Divide this value by four. Add this value to the 0%- value and you have the 25%- value. Go in the Setup menu to the 25% value and enter it by pressing the + / - buttons. In the same manner you calculate the 50% and 75% values and enter them into the TCM manually.
Method 3:
You already know the voltage values for 0, 25, 50, 75 and 100%? Then you can enter these values directly in the Setup menu at the relating value by pressing the + / - buttons.

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5.2.3.11 SENSOR TYPE PB42:

For this function you need a 5 bars sensor together with an electronic printed board PB42. The tank level will be displayed in 4 levels.

5.2.3.12 SENSOR TYPE TRS:

If you have a float level sensor like the philippi TRS (installation on top of the tank) or a philippi RSW (installation at the side of the tank) you have to choose this function. The display of the tank level rests at 0% until the level sensor is switching - then the displays goes to 100%. A pre - resistor isn't required.

5.2.3.13 SENSORTYP GOBIUS4

The voltage output oft he Gobius control unit has to be connected to a TCM input. The display of the fluid level is shown in 4 levels according to the Gobius LED-display. The internal adjustments of the Gobius system cannot be adjusted from the TCM. They have to be done by using the Gobius LED-display.

5.2.4 COMPENSATION / ADJUSTMENT TO THE GEOMETRY OF THE TANK

K = 50

With non-rectangular tanks, the level height is not proportional to the content of liquid in the tank. By means of the "Compensation" value, this can be allowed for in the display. The Compensation value changes the tank characteristic in such a way that the indicated level is approximated to the geometry of the tank.

K = 45

The value to be entered is the half-height percentage by volume of a full tank. The examples on the left show what Compensation value (K) would be entered as an approximation for tanks of several common geometric shapes.

K = 40

If your tank geometry deviates greatly from those shown on the left, then the Compensation value can be determined by the formula below.
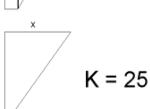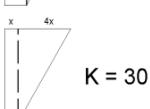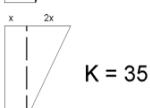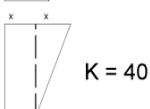
The Compensation value is found by dividing the liquid capacity at half the tank height, by the capacity of the tank when full, multiplied by 100.

K = 35

$$\text{Compensation value } K = \frac{\text{Capacity of half level height}}{\text{Level of fuel in the tank entirely}} \times 100$$

Example:

K = 30

The tank has a total volume of 150 L with a maximum filling height (tank height) of 50 cm.

K = 25

In order to determine the Compensation value, the tank is filled to the half-tank height (= 25 cm), and it is found to require 65L to fill to this level.

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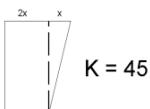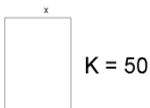
Using the formula, the Compensation value is found to be:

K = 65 l/150 l x 100 = 43

The number 43 is then entered as the Compensation value in Setup.

5.2.5 ALARM LEVEL

You can adjust the alarm threshold for each tank separately.
Alarm level:

0 %	Alarm off
1..50 %	Empty-alarm: if the level falls below the selected threshold the alarm will be activated. The activation is delayed by 15s.
51... 99 %	Full-alarm: if the level rises above the selected threshold the alarm will be activated. The activation is delayed by 15s.

⚠ ATTENTION - when using the Powersave mode, the alarm is switched off!

6. TROUBLESHOOTING

- If the tank monitor shows wrong values or (---), please first check the sensor and that the electrical connections are good. Check also the wiring between the sensor and the tank monitor, as this is the main source of problems
- If the reading from an ultrasonic sensor UTV is incorrect, check the power supply voltage at the sensor. This must be at least 10V (see technical data of the tank sensor)
- If you can't see the SETUP ("Tool") button, the Setup may be locked. To unlock, you will have to press the right-hand side button for 10 seconds. The "tool" button will appear and you can then enter the Setup menu.
- If the monitor shows only "garbage", the monitor can be reset to the factory settings: press button 1 and button 2 simultaneously for 10 seconds. The buzzer will then beep three times and the display will show "Loaded Factory Data" .All values must then be reset.
- If the monitor is constantly restarting, the factory settings can also be reloaded if the button 1 and the button 2 are pressed simultaneously during the restart. All values must then be reset.

7. MAINTENANCE

The Tank Monitor TCM 4V does not request special maintenance. The front panel can be cleaned with a damp cloth without using aggressive detergents.

8. TECHNICAL DATA

Power supply   DC 10-30 Volt

Power consumption   8mA when using resistance sensors,
                                              60mA if the display is lit (12V)
                                              12mA when using a flow sensor DFS
                                              when using ultrasonic sensors UTV:
                                              50mA per sensor (without Powersave mode)

Dimensions: 105 x 105 x 40 mm

Installation cutout: 88 x 88 mm

9. DECLARATION OF CONFORMITY

This device fulfills the requirements of the European regulation:

C €   2004/108/EG "ElectroMagnetic Compatibility"
                    Immunity EN 61000-6-1
                    Emission EN 61000-6-3

The conformity to this regulation is certified by the CE - sign.

10. DISPOSAL NOTE

Please take care of your local directives on waste electrical and electronic equipment.
Please use collection points for waste electrical and electronic equipment.