

User Manual



Fill level display module

EASYLEVEL

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Technical changes reserved!

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Important Information

Before commissioning the device, please read this manual thoroughly and observe the information contained therein. No claims for liability can be made vis-à-vis the manufacturer in the event of non-observance or non-compliance.

Intervention in the device with the exception of that intervention described in the manual shall render the warranty void and result in exemption from liability.

The device is intended solely for the purpose described below. In particular, it is not intended for the direct or indirect protection of personnel. We wish to draw your attention at this point to the fact that the device is not authorised for use in professional maritime applications.

holthausen elektronik GmbH provides no guarantee of suitability for a specific purpose.

Should any questions be outstanding, please contact us via telephone or in writing so that we can provide further assistance.

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1. Generally basical safety-indications

Don't use this device as the only invigilator, if a malfunctioning of the decice could lead to damages on goods or Persons.

To obtain the desired result be sure, that the device with its technical data fits to the bulk of the object you want to supervise.

The electrical hook up is to be done by instructed persons. A mistake by the connection can entail to faulty functions, outfall or ruination of the electronics.

Powerful noise sources for instance inverters, in direct closeness of the electronics or cabling, can result in faulty behaving of the apparatus.

Potential differences and balance currents in the mass guidance can result in faulty behaving too.

2. Packing and the transport

Note:

- Keep the electronic in a dry place.
- In case of a downfall or heckling or squeezing, could the casing or the operation elements or the board get defects.

With adequate warning-labels and through a qualified packaging and storage, you can protect the electronics at carriage against influences from outside.

3. General description

This manual describes the EASYLEVEL display module for displaying the fill level of 7 tanks. It is based on the principle that a fill level sensor is installed in each tank that informs the display module of the respective tank content via an electrical output. The content of Tank 1 is always displayed on the upper display, while the content of Tank 2 is displayed on the lower display. Pressing one of the keys T3 to T7 briefly displays the corresponding tank content on the lower display in %. Pressing the V key switches the display of the current tank content between litres and gallons.

The maximum tank content is limited to 65,535 litres or gallons. There is no volume limitation when specifying the tank level in percent. The resolution of the display amounts to 0.5% or 1/200 of the total tank content when displayed in litres.

Furthermore, warning LEDs and a relay contact (break contact) are provided for the event that the fill level drops below, or surpasses, a specific fuel level. When new, the limit values are 95% and 15% and refer to Tank 1 and 2, but can be changed in Programming mode.

A phototransistor is located beneath the front film. This ensures that the brightness of the display adapts in two stages to the ambient brightness.

4. Mechanical function

4.1 Case design

The standard installation case of company Bopla (NGS 9608) is made of black plastic and is delivered with 2 spring clamps. A transparent cover film from 3M is adhered to the front panel of the case. This is provided with imprints (see front view sketch). The warning LEDs, the red, five-digit, 7-segment display with a height of 9mm and the operating keys are located behind this film.

The rear side of the case houses the screw-connectors with clamp terminals for flexible lines, a 9-pole Sub-D jack and 4 DIP switches.

case dimensions:	case exterior:	90mm x 90mm
	cutting:	92 ^{+0,8} mm x 92 ^{+0,8} mm
	cover film dimensions:	86mm x 86mm
	front panel:	96mm x 96mm
	installation depth:	78mm + 30mm for connectors and connection lines

4.2 Environmental conditions

The module is designed for an operating temperature range of 0°C to 55°C and less than 80% relative humidity. It fulfils Protection Type Class IP20, i.e. it may only be used in dry interior locations. However, the front of the module is protected against splash water when installed.

5. Interfaces

The interfaces comprise three connectors on the rear of the module. The fill level sensors are connected to a 14-pole Weidmüller S2L/B2L connector system, while the voltage supply and relay contacts are connected to the same type of connector system with 10 contacts. A serial Sub-D9 jack is located on the rear of the module for programming. In normal mode, the tank content is output via this port. The module is connected to a PC via a serial RS 232 extension cable (1 * Sub-D9 plug, 1 * Sub-D9 jack, not crossed). The operator can switch between normal operating mode and programming mode via the 4 DIP switches.

5.1 Voltage supply

The display module operates flawlessly with a rated battery voltage of 12V or 24V (permissible input voltage DC 10V to 32V) and is designed to prevent incorrect poling. The current consumption of the module is max. 350mA.

5.2 Sensors

Caution: Prior to connecting a sensor, please note the sensor-specific manufacturer information, particularly as regards application and installation!

The fill level sensors for all tanks must provide an output current of 4 to 20mA, with 4mA corresponding to an empty tank and 20mA corresponding to a completely full tank.

In this context, the sensors must be able to provide an output voltage of at least 5V (load = 200Ohm). The electrical outputs of the sensors must be potential-free to rule out interference via the ground network of the boat. The sensors are not supplied with voltage by the display module.

5.3 Fuel warning outputs

The tank fill level display outputs a warning if the value drops below, or surpasses, the limit value for Tank 1 and Tank 2. In the event that the value drops below a specified minimum fuel level, a red LED lights up. This is labelled "min" and is located to the left of the fuel tank fill level display. At the same time, the relay contact leading to the connector is opened. In the event that the value rises above a specified maximum fuel level, the red LED labelled "max" to the left of the fuel tank fill level display lights up and the corresponding relay contact is opened.

5.4 Sensor error warning

A warning is output if the sensor current drops below a value of 2.5mA, or if no sensor is connected. In this case, the 7-segment display of the corresponding tank flashes. Thus, a sensor error is immediately recognizable for Tank 1 and Tank 2 (the associated „min“ LED also flashes and the corresponding relay contact is opened). In the case of Tanks 3 to 7, the flashing sensor warning is displayed when the corresponding key to display the tank content is pressed.

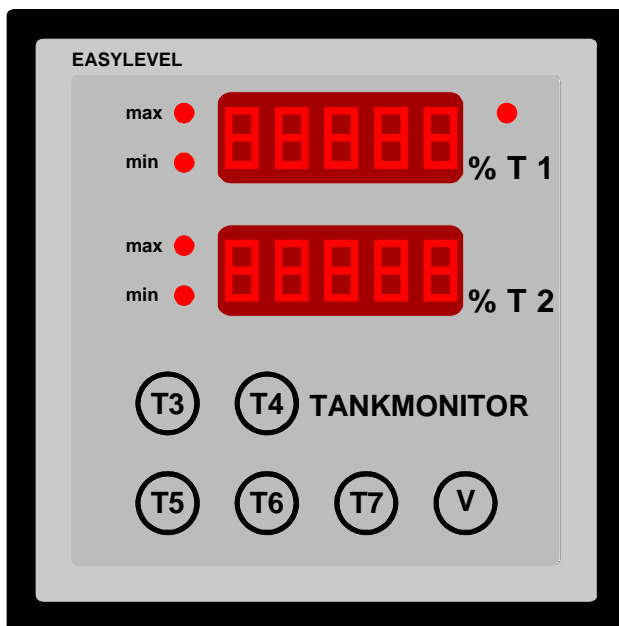
5.5 Serial RS232 output

The contents of all tanks are output at intervals of 10 seconds via the Sub-D9 connector on the rear of the module. Only the TxD, RxD and GND lines are used on the serial connector. The voltages correspond to the RS232 standard.

5.6 Programming input

In order to program the fill level display module, the Sub-D9 jack is connected to a PC via a serial cable. This is the only possibility of changing the default values.

6. Operation



Front view sketch

6.1 Operation in normal mode

The following values are displayed in the basic configuration (without any keys being pressed):

T 1 (in %)

T 2 (in %)

Pressing one of the keys T3 to T7 displays the corresponding tank content in % for as long as that key is pressed, instead of the value for tank content 2.

Pressing the V key displays the fuel tank content in litres or gallons (for as long as the key is pressed).

6.2 Receiving data at the PC

The Windows[®] (from version 95 onwards) communications program Hyperterminal is launched. (Hyperterminal is installed as standard in a complete Windows[®] installation. If this is not the case, it must be installed separately). To launch Hyperterminal, proceed as follows:

START ⇒ ALL PROGRAMS ⇒ ACCESSORIES ⇒ COMMUNICATIONS ⇒ HYPERTERMINAL

Select the following settings: (in menu item FILE ⇒ PROPERTIES):

connected Com port, configured for 9600 Bits per second

8 data bits, no parity, 1 stop bit, Flow control: Hardware

Now establish the connection.

A data set with the following format is now received every 10 seconds:

T1:xxxxxL T2:xxxxxL T3:xxxxxL T4:xxxxxL T5:xxxxxL T6:xxxxxL T7:xxxxxL

Where „xxxxx“ stands for the tank content in litres. In the event of a sensor error (sensor current < 2.5 mA), „error“ is displayed for the corresponding tank.

6.3 Programming the tank display

The following section describes how to set the maximum tank content, the tank content at which a warning is triggered and the calibrated tank values. The calibrated tank values serve to allow the correct display even if a non-linear tank shape is utilised.

When new, the EASYLEVEL display module is set to the following factory values:

Tank content: 10000 litres	Tank shape:	linear
Min. warning: 15%	Max. warning:	95%

In order to program the EASYLEVEL display module, it is connected to a free COM port of the PC via a serial RS232 extension cable.

DIP switch 1 located on the rear of the module must be switched to the „ON“ position for programming.

The following data sets can be sent from the PC for every tank:

- Tank volume (in percent) at 5%; 10%; 15%; 20%; 30%; 40%; 50%; 60%; 70%; 80%; 90%; 95% fill level.

- Total tank content in litres or gallons.

Additionally for Tank 1 and Tank 2, the limit fill levels (in %) for triggering a warning.

6.4 Programming procedure

The Windows[®] (from version 95 onwards) communications program Hyperterminal is launched. (see section 4.2 for installation instructions). Establish the connection.

Entering the tank volume

The following sequence is entered in the terminal window on the PC:

(xxxxx is the tank content in litres, and must be entered with 5 digits)

V1xxxxx[ENTER] changes the tank volume for Tank 1

:

V7xxxxx[ENTER] changes the tank volume for Tank 7

After pressing the [ENTER] key, the following is displayed on the EASYLEVEL display:

T1, left digit: tank number T1, right 3 digits: tank volume

T2, right 2 digits: tank volume

Entering the maximum value warning / minimum value warning

(xx is the maximum value in % of the fill level, or the minimum value in % of the fill level)

+1000xx[ENTER] changes maximum value warning for Tank 1

+2000xx[ENTER] changes maximum value warning for Tank 2

-1000xx[ENTER] changes minimum value warning for Tank 1

-2000xx[ENTER] changes minimum value warning for Tank 2

After pressing the [ENTER] key, the following is displayed on the EASYLEVEL display:

T1, left digit: tank number T1, right 3 digits: 000

T2, right 2 digits: warning value in %

Entering tank correction values

xx is the fill level in percent and may have the following values:

05; 10; 15; 20; 30; 40; 50; 60; 70; 80; 90; 95

yy is the associated tank volume in percent (correction value)

T10xxyy[ENTER] changes tank volume for Tank 1

:

T70xxyy[ENTER] changes tank volume for Tank 7

After pressing the [ENTER] key, the following is displayed on the EASYLEVEL display:

T1, left digit: tank number

T1 right 3 digits: fill level with prefixed zero

T2 right 2 digits: tank volume correction value

In the event that problems occur during programming (the expected value is not displayed after pressing the Enter key), you can reset the tank display by briefly disconnecting the voltage supply connector.

Example for entering values without tank correction

This example assumes that you wish to connect 4 tanks, each with a volume of 2280 litres, to the inputs for Tank 1 to Tank 4 and that the tanks are more or less cuboid (the tank volume is directly proportional to the fill level), allowing you to dispense with a correction. For Tank 1, you wish the minimum warning to be output at a fill level of 22% and the maximum warning to be output at a fill level of 91%. For Tank 2, you wish for a warning to be output for the preconfigured values (value drops below 15% of the fill level or exceeds 95% of the fill level).

To this end, enter the following lines in the Hyperterminal window:

```
V102280[ENTER]    2280 litres volume Tank 1    (you only need enter these 4 lines
V202280[ENTER]    2280 litres volume Tank 2    if you wish the tank content to be
V302280[ENTER]    2280 litres volume Tank 3    displayed in litres)
V402280[ENTER]    2280 litres volume Tank 4

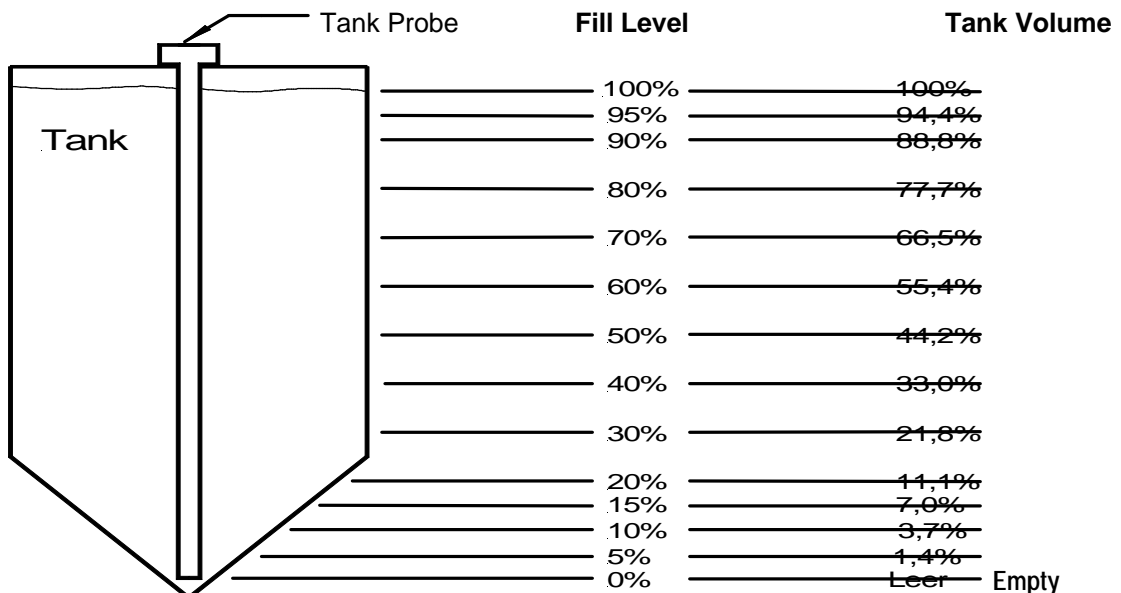
+100091[ENTER]    91% maximum value warning Tank 1
-100022[ENTER]    22% minimum value warning Tank 1
```

When entering this data, it is imperative that the above mentioned values are displayed on the tank display after pressing the [ENTER] key. If this is not the case, briefly disconnected the display module from the voltage supply connector and re-enter the last value.

Once programming is complete, all DIP switches on the rear of the EASYLEVEL display module must be switched to the "Off" position. The display module then returns to normal operating mode and uses the new values you have just entered.

Example for entering all values for Tank 2 with tank correction

Calculate the corresponding tank volumes for **all** fill levels as a percentage of the overall tank volume. In this context, the lowest point of the tank probe is assumed to correspond to a fill level of 0%. (In the case of fuel tanks, this should be the height at which the outlet is located.) The maximum permissible fill level is used as the 100% fill level. (The fuel probe must provide a current of 20mA at a fill level of 100%.)



Let us assume that Tank 2 is the tank just calculated and has a volume (at 100% fill level) of 3750 litres and that you wish to output the minimum warning at a fill level of 25% and the maximum warning at a fill level of 95%.

To this end, enter the following lines in the Hyperterminal window:

V203750[ENTER]	3750 litres tank volume
+200095[ENTER]	95% maximum value warning, (entry can be dispensed with as it is identical to the preconfigured value)
-200025[ENTER]	25% minimum value warning
T200501[ENTER]	Correction value for 5% fill level is 1% volume
T201004[ENTER]	Correction value for 10% fill level is 4% volume
T201507[ENTER]	Correction value for 15% fill level is 7% volume
T202011[ENTER]	Correction value for 20% fill level is 11% volume
T203022[ENTER]	Correction value for 30% fill level is 22% volume
T204033[ENTER]	Correction value for 40% fill level is 33% volume
T205044[ENTER]	Correction value for 50% fill level is 44% volume
T206055[ENTER]	Correction value for 60% fill level is 55% volume
T207067[ENTER]	Correction value for 70% fill level is 67% volume
T208078[ENTER]	Correction value for 80% fill level is 78% volume
T209089[ENTER]	Correction value for 90% fill level is 89% volume
T209594[ENTER]	Correction value for 95% fill level is 94% volume

When entering this data, it is imperative that the above mentioned values are displayed on the tank display after pressing the Enter key. If this is not the case, briefly disconnected the display module from the voltage supply connector and re-enter the last value.

Once programming is complete, the switch on the rear of the EASYLEVEL display module must be switched to the "Off" position. The display module then returns to normal operating mode and uses the new values you have just entered.

7. Installation instructions

These instructions only apply to the EASYLEVEL fill level display module. Please refer to the corresponding manufacturer's information for installing the flow rate sensors and temperature sensors and establishing the electrical connections. **Installation and electrical connections** may only be performed by **qualified specialists**.

7.1 Installation

A cut-out pursuant to DIN 43700 of $92\text{mm}^{+0.8} \times 92\text{mm}^{+0.8}$ is made at a suitable position in the interior with an installation depth of 10.8cm (installation depth 87mm + 300mm for connector and connecting lines) and the display module inserted and locked in place. If the installation site prevents the satisfactory securing of the case by means of the spring clamps, alternative securing fixtures are available.

7.2 Electrical connection

The following electrical connections must be realised **professionally and without tensile loading**, to guarantee a long service life. For the supplied connector, flexible lines with a cross-section of 0.34mm^2 to 1mm^2 must be stripped over a length of 6mm to 8mm. To secure the line, a small screwdriver is used to depress the tongue in the rectangular hole of the connector, the bared wire is inserted into the round hole and the screwdriver removed. Once all lines have been connected, the connections are checked again to ensure that they are correctly poled. The connectors are then attached to the EASYLEVEL display module and secured in place with the small screws. Please ensure that the long connection lines do not coil in this context, as this could result in malfunctions arising from coupled interference.

7.3 Pin assignment

SL1: (connector system for sensor connections)

Sensor 1:	+ Pin 1	⊥ Pin 8
Sensor 2:	+ Pin 2	⊥ Pin 9
Sensor 3:	+ Pin 3	⊥ Pin 10
Sensor 4:	+ Pin 4	⊥ Pin 11
Sensor 5:	+ Pin 5	⊥ Pin 12
Sensor 6:	+ Pin 6	⊥ Pin 13
Sensor 7:	+ Pin 7	⊥ Pin 14

SL2: (connector system for alarm outputs and voltage supply)

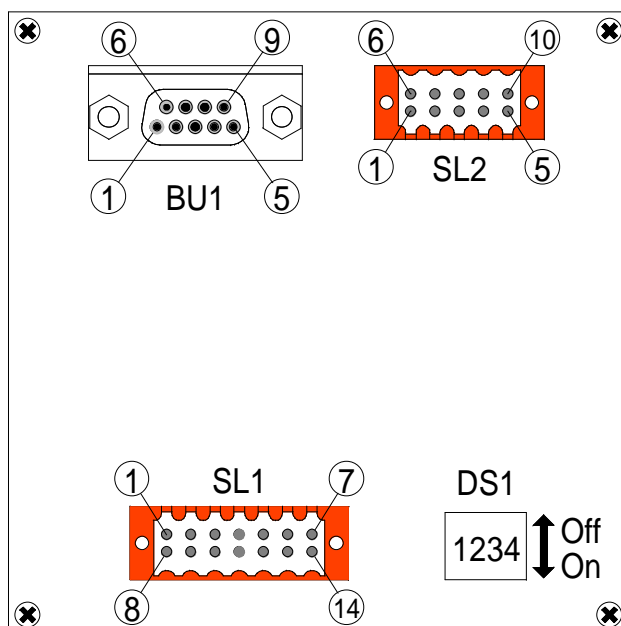
Alarm Tank 1 max:	Pin 1 and 6
Alarm Tank 1 min:	Pin 2 and 7
Alarm Tank 2 max:	Pin 3 and 8
Alarm Tank 2 min:	Pin 4 and 9
Voltage supply:	+ Pin 5 ⊥ Pin 10

BU1: (Sub-D9 jack as serial RS232 interface)

Pin 5:	GND
Pin 2:	Data Out
Pin 3:	Data In

DS1: (countersunk 4-pole DIP switches)

Normal operating mode:	all OFF
Programming mode:	Switch 1 ON
Not used:	Switches 2, 3 and 4



8. Accessories

We can offer you probes for fresh water, faeces and sewage.
You can obtain probes from us for diesel but not for gasoline since these don't have an Ex-permission.

9. Accuracy

The display accuracy depends on the following factors:

- Accuracy of the sensors
- Accuracy of the calibration values entered
- The shape of the tank (the display module always uses a linear to calculate the tank content between two calibration values)
- Boat motion (the display module filters signal proportions of $< 5s$ from the carrier signal with a 2nd order filter)
- Installation site of the sensors
- Errors of the A/D converter of the display module and the electrical voltage converter of the display module: $< \pm 2\%$ from the final measuring range value
- Display resolution in %: 0.5%
- Display in litres: resolution of $1/200$ of the maximum tank content

10. Technical data

input voltage range	10V DC to 32V DC
current consumption	max. 350mA
operating temperature range	0°C to 55°C
protection type	IP20
case dimensions	92 x 92 x 84,5mm (W x H x D), without plug cutting 92 ^{+0,8} mm x 92 ^{+0,8} mm
installation depth	108mm
weight	approx. 375g
capacity of the relay break contacts	at connecting a load with high starting-current (electric bulb) or an inductive load (horn, relay) the maximum values must not be passed switching current max. 2A switching voltage max. 220V DC switching power max. 60W 2A 30V DC / 0,5A 125V AC / 0,5A 110V DC vibration resistance up to 20*g
sensor inputs	4 to 20mA
load	200Ohm
electrical connection	2 * Weidmüller connector systems with tension spring clamps for flexible lines from 0.34 to 1 mm ² for voltage supply, relay contacts and sensors Sub-D9 jack for programming and for outputting the serial data
display range	0% to 100% (resolution 0.5%) or 0 to 65,535 litres (or any other measure, e.g. gallons) (resolution 1/200 of tank content)