TMP-REG with TMP-SET (optional)
Temperature Analyzer and Regulator System

User manual version 2.4

The TMP-REG system is used for monitoring and regulating water temperature of sea or fresh water in fish tanks, respirometers, aquaria etc.

LIST OF PARTS

1) Controller instrument
2) Data Cable
3) Pt100 temperature probe
4) Power cord
5) Converter piece
6) User manual
7) TMP-SET (OPTIONAL)
   - Submersible Eheim pump
   - Adapter cable for pump
   - Soft PVC tubing
   - Stainless steel cooling coil

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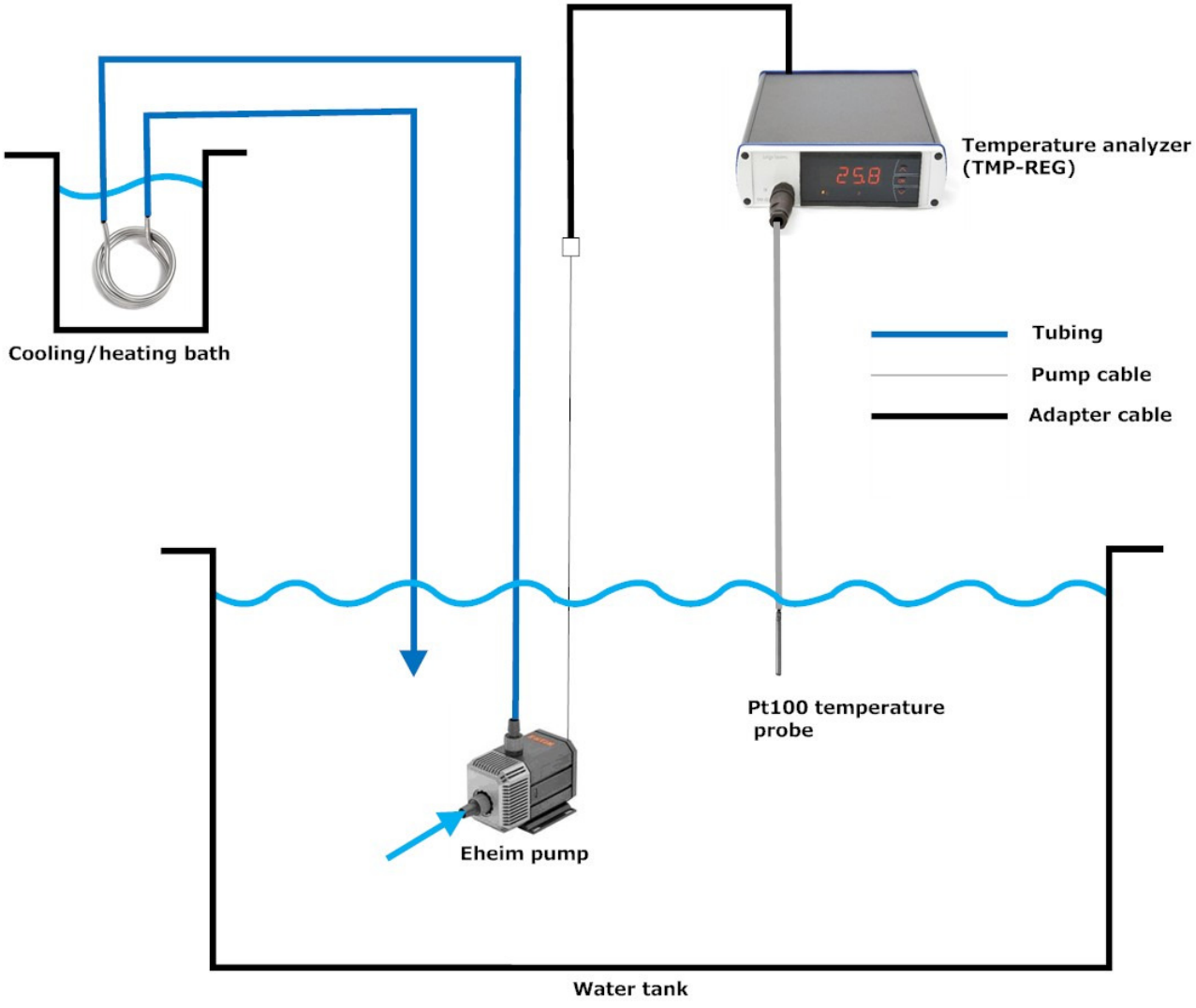
SETUP

Connect the Pt100 temperature probe to the input labelled IN on the front side of the TMP-REG instrument. Now connect the power cord to the input labelled POWER on the backside of the TMP-REG instrument. The TMP-REG will now turn on, and start reading temperature values. There are two relays on the backside of the instrument which can be used to control the activity of the submersible Eheim pump to regulate temperature in the water.



CONFIGURATION / OPERATING THE FUNCTION KEYS

The TMP-REG is a menu-driven instrument. The front panel has three buttons for operation, *e.g.* two arrow buttons (**Λ** and **V**) and one **OK** button. Use these three buttons to scroll through the menu and accept instrument settings. For each menu there is a scrolling help text which is automatically shown in the display, this starts after five seconds if no key has been activated. Use the menu to calibrate the temperature probe, and set relay action and level of control.

Λ	will increase the numerical value or choose the next parameter.
V	will decrease the numerical value or choose the previous parameter.
OK	will accept the chosen value and end the menu.

To summarize, the **Λ** and **V** buttons are used to toggle betweens options. The **OK** button is used to accept settings and go to the next option. Press and hold the **OK** button for 0.5 seconds, to get the last option available. Once the entire configuration has been entered, the display will show "----".

The following two pages show the complete menu routing diagram and scrolling help texts.

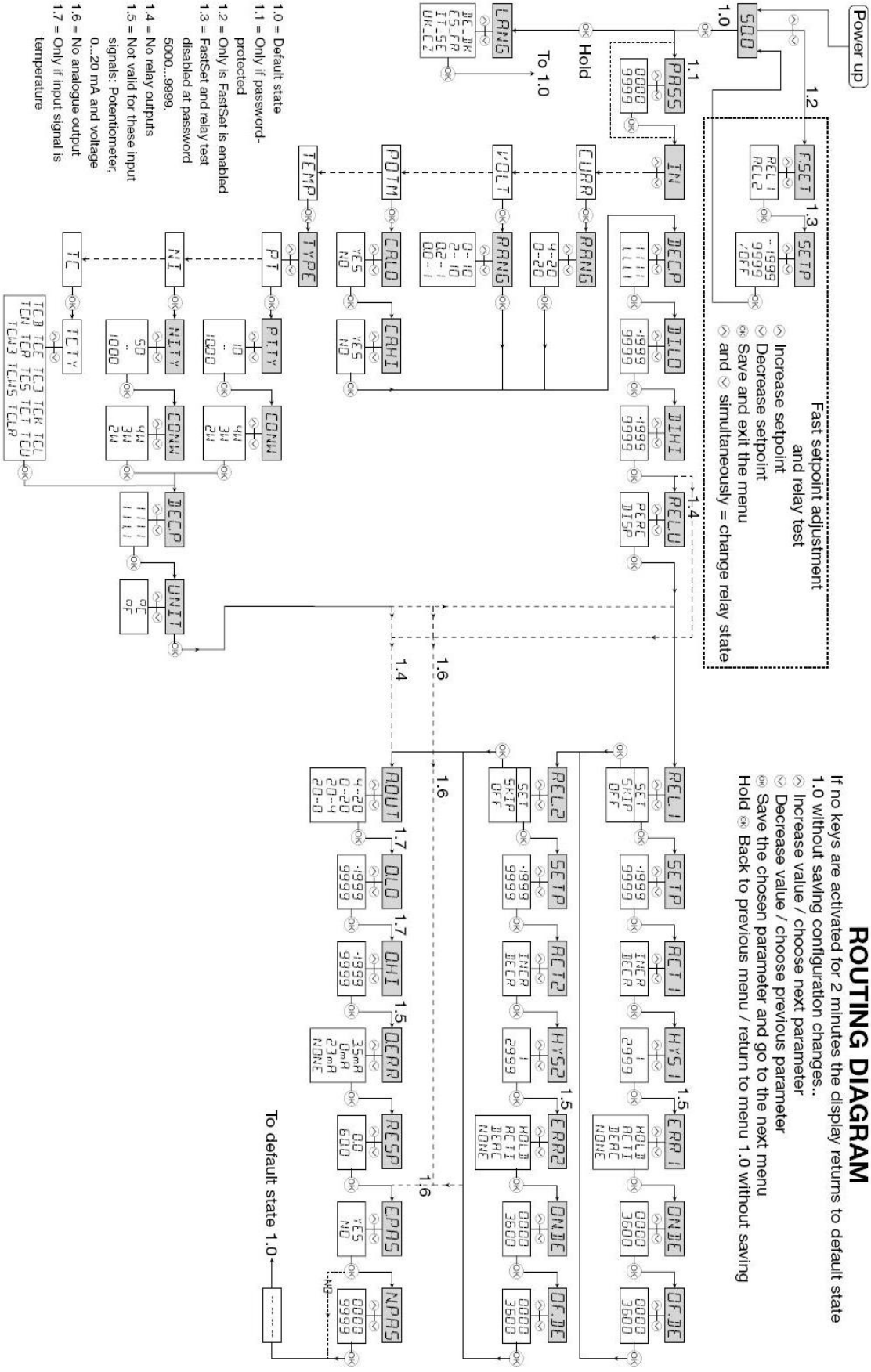
NB! Please note that the TMP-REG is password protected. The Password is 1234. The RE1 is set to act on a decreasing signal, the RE2 is set to act on an increasing signal. Use the fast set point adjustment to adjust the set point.

FAST SET POINT ADJUSTMENT

It is possible to quickly change set point values without having to scroll through the whole instrument menu.

With the instrument turned on, press the **Λ** button once. Now choose relay 1 (or 2), and press the **OK** button. Then change the set point value using the arrow buttons. Finish by pressing the **OK** button.

Test relay functions, by pressing both arrow buttons simultaneously. The LED diode will toggle its state. When done, press the **OK** button several times until the display reads "----".



ROUTING DIAGRAM

If no keys are activated for 2 minutes the display returns to default state 1.0 without saving configuration changes..

Increase value / choose next parameter

Decrease value / choose previous parameter

Save the chosen parameter and go to the next menu

Hold Back to previous menu / return to menu 1.0 without saving

SCROLLING HELP TEXT

Display in default state xxxx, hardware error:
SE.BR --> SENSOR WIRE BREAKAGE
SE.SH --> SENSOR SHORT CIRCUIT
IN.HI --> INPUT OVERRANGE
IN.LO --> INPUT UNDERRANGE
9.9.9.9 --> DISPLAY OVERRANGE
-1.9.9.9 --> DISPLAY UNDERRANGE
HW.ER --> HARDWARE ERROR
EE.ER --> EEPROM ERROR - CHECK CONFIGURATION
RA.ER --> RAM MEMORY ERROR
CJ.ER --> CJC SENSOR ERROR

Fastset (Enabled):
F.SET
REL1 --> FAST SET MENU - SELECT RELAY
REL2 -->

SETP
xxxx --> RELAY SETPOINT - PRESS OK TO SAVE

Fastset (Disabled):
SETP
xxxx --> RELAY SETPOINT - READ ONLY

Configuration menus:
LANG
DE --> DE - WAEHLE DEUTSCHEN HILFETEXT
DK --> DK - VAELG DANSK HJAELPETEKST
ES --> ES - SELECCIONAR TEXTO DE AYUDA EN ESPANOL
FR --> FR - SELECTION TEXTE D'AIDE EN FRANCAIS
IT --> IT - SELEZIONARE TESTI DI AIUTO ITALIANI
SE --> SE - VALJ SVENSK HJALPTEXT
UK --> UK - SELECT ENGLISH HELPTEXT
CZ --> CZ - VYBER CESKOU NAPOVEDU

PASS
xxxx --> SET CORRECT PASSWORD

IN
C.LIN* --> TEXT ENTERED BY USER IN PRESET
CURR --> CURRENT INPUT
VOLT --> VOLTAGE INPUT
POTM --> POTENTIOMETER INPUT
TEMP --> TEMPERATURE SENSOR INPUT

RANG **When current selected:**
0-20 --> INPUT RANGE IN mA
4-20 --> INPUT RANGE IN mA

RANG **When voltage selected:**
0-10 --> INPUT RANGE IN VOLT
2-10 --> INPUT RANGE IN VOLT
0.0-1 --> INPUT RANGE IN VOLT
0.2-1 --> INPUT RANGE IN VOLT

CA.LO
YES --> CALIBRATE POTENTIOMETER LOW
NO --> CALIBRATE POTENTIOMETER LOW

CA.HI
YES --> CALIBRATE POTENTIOMETER HIGH
NO --> CALIBRATE POTENTIOMETER HIGH

DEC.P
1111 --> DECIMAL POINT POSITION
111.1 --> DECIMAL POINT POSITION
11.11 --> DECIMAL POINT POSITION
1.111 --> DECIMAL POINT POSITION

DI.LO
xxxx --> DISPLAY READOUT LOW

DI.HI -->
xxxx --> DISPLAY READOUT HIGH

REL.U
PERC --> SET RELAY IN PERCENTAGE
DISP --> SET RELAY IN DISPLAY UNITS

TYPE
PT --> SELECT PT SENSOR TYPE
NI --> SELECT NI SENSOR TYPE
TC --> SELECT TC SENSOR TYPE

PT.TY
10 --> SELECT PT SENSOR TYPE
20 --> SELECT PT SENSOR TYPE
50 --> SELECT PT SENSOR TYPE
100 --> SELECT PT SENSOR TYPE
200 --> SELECT PT SENSOR TYPE
250 --> SELECT PT SENSOR TYPE
300 --> SELECT PT SENSOR TYPE
400 --> SELECT PT SENSOR TYPE
500 --> SELECT PT SENSOR TYPE
1000 --> SELECT PT SENSOR TYPE

NI.TY
50 --> SELECT NI SENSOR TYPE
100 --> SELECT NI SENSOR TYPE
120 --> SELECT NI SENSOR TYPE
1000 --> SELECT NI SENSOR TYPE

CONN **When Pt and Ni sensor selected**
2W --> SELECT 2-WIRE SENSOR CONNECTION
3W --> SELECT 3-WIRE SENSOR CONNECTION
4W --> SELECT 4-WIRE SENSOR CONNECTION

TC.TY
TC. B --> SELECT TC SENSOR TYPE
TC. E --> SELECT TC SENSOR TYPE
TC. J --> SELECT TC SENSOR TYPE
TC. K --> SELECT TC SENSOR TYPE
TC. L --> SELECT TC SENSOR TYPE
TC. N --> SELECT TC SENSOR TYPE
TC. R --> SELECT TC SENSOR TYPE
TC. S --> SELECT TC SENSOR TYPE
TC. T --> SELECT TC SENSOR TYPE
TC. U --> SELECT TC SENSOR TYPE
TC.W3 --> SELECT TC SENSOR TYPE
TC.W5 --> SELECT TC SENSOR TYPE
TC.LR --> SELECT TC SENSOR TYPE

DEC.P **When temperature selected**
1111 --> DECIMAL POINT POSITION
111.1 --> DECIMAL POINT POSITION

UNIT
°C --> DISPLAY AND RELAY SETUP IN CELSIUS
°F --> DISPLAY AND RELAY SETUP IN FAHRENHEIT

REL1
SET --> ENTER RELAY 1 SETUP
SKIP --> SKIP RELAY 1 SETUP
OFF --> RELAY 1 DISABLED

SETP
xxxx --> RELAY SETPOINT

ACT1
INCR --> ACTIVATE AT INCREASING SIGNAL
DECR --> ACTIVATE AT DECREASING SIGNALL

HYS1
xxxx --> RELAY HYSTERESIS

ERR1
HOLD --> HOLD RELAY AT ERROR
ACTI --> ACTIVATE RELAY AT ERROR
DEAC --> DEACTIVATE RELAY AT ERROR
NONE --> UNDEFINED STATUS AT ERROR

ON.DE
xxxx --> RELAY ON-DELAY IN SECONDS

OF.DE
xxxx --> RELAY OFF-DELAY IN SECONDS

REL2
SET --> ENTER RELAY 2 SETUP
SKIP --> SKIP RELAY 2 SETUP
OFF --> RELAY 2 DISABLED

SETP
xxxx --> RELAY SETPOINT

ACT2
INCR --> ACTIVATE AT INCREASING SIGNAL
DECR --> ACTIVATE AT DECREASING SIGNAL

HYS2
xxxx --> RELAY HYSTERESIS

ERR2
HOLD --> HOLD RELAY AT ERROR
ACTI --> ACTIVATE RELAY AT ERROR
DEAC --> DEACTIVATE RELAY AT ERROR
NONE --> UNDEFINED STATUS AT ERROR

ON.DE
xxxx --> RELAY ON-DELAY IN SECONDS

OF.DE
xxxx --> RELAY OFF-DELAY IN SECONDS

A.OUT
0-20 --> OUTPUT RANGE IN mA
4-20 --> OUTPUT RANGE IN mA
20-0 --> OUTPUT RANGE IN mA
20-4 --> OUTPUT RANGE IN mA

O.LO
xxxx --> DISPLAY VALUE FOR OUTPUT LOW

O.HI
xxxx --> DISPLAY VALUE FOR OUTPUT HIGH

O.ERR
23 mA --> NAMUR NE43 UPSCALE AT ERROR
3,5 mA --> NAMUR NE43 DOWNSCALE AT ERROR
0mA --> DOWNSCALE AT ERROR
NONE --> UNDEFINED OUTPUT AT ERROR

RESP
xxx,x --> ANALOGUE OUTPUT RESPONSE TIME IN SECONDS

E.PAS
NO --> ENABLE PASSWORD PROTECTION
YES --> ENABLE PASSWORD PROTECTION

N.PAS
xxxx --> SELECT NEW PASSWORD

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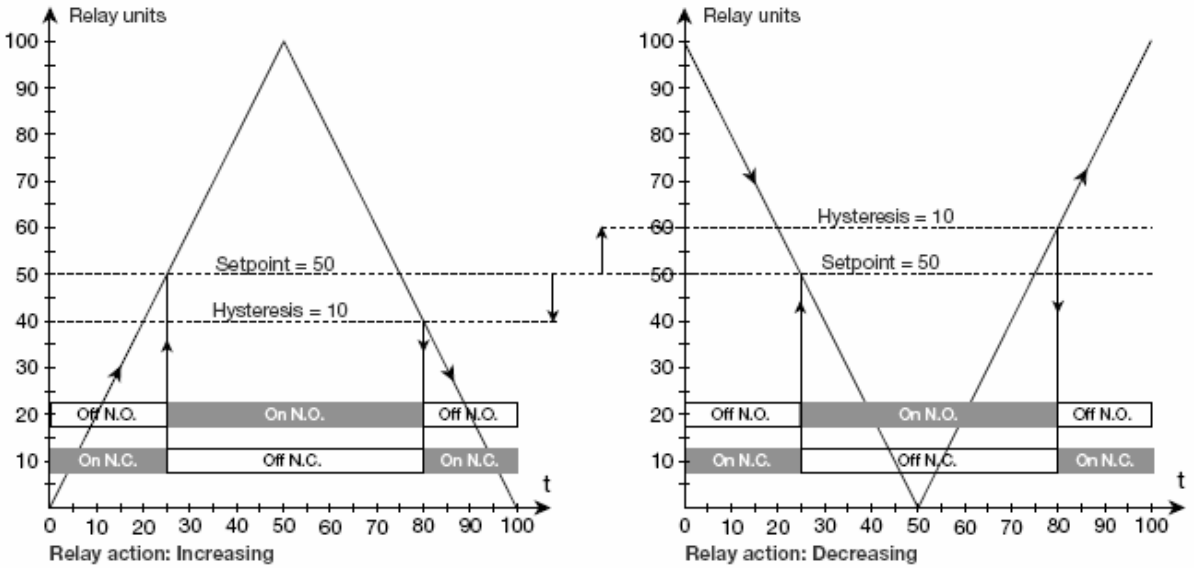
USING THE RELAYS

The TMP-REG instrument has two independent relays to control the activity of submersible pumps. For each relay choose a set point and a hysteresis value. Now decide if the relay should be activated when the signal drops below a set point (DECR), or if it should be activated when it rises above (INCR), *e.g.* for cooling control the relay should act on a increasing (INCR) signal, since temperature will increase above the set point due to heating effects in the chamber, e.g. sun shining.

Graphic depiction of the relay function setpoint:



Example – how to keep temperature low despite warming effects

Set up the TMP-REG system in the following way, to keep temperature at say 15 °C in aquaria due to warming effects from sun shining and heating from pumps.

1. Connect the submersible Eheim pump to relay 1 on the back side of the TMP-REG instrument (relay 2 is not used in this example).

2. Connect the coil to the output of the submersible Eheim pump via the tubing. Use so much tube, that the coil can be placed in the cooling bath.

3. Place the coil into the cooling bath. Make sure that the temperature of the cooling bath is cooler than the wanted Setpoint (15 °C), e.g. water with ice cubes.

4. Connect to the coil the remaining tubing and place the tubing into the aquaria. Now, when the relay turns on, the submersible pump will suck water from the aquaria and pump it through the coil. While water is pumped through the coil, the water will be cooled down. So the water that is pumped back into the aquaria is cooled.

Instrument settings

5. Press the **OK** button several times until the display reads REL1. Wait for one second, and the display now reads SET, or toggle using arrow buttons until it reads SET, and then press OK.

6. Now use the **Λ** or **V** buttons to increase or decrease the set point value. Set it to 15 (°C), and then press OK.
7. Set the action of the relay to INCR, and then press OK.
8. Now enter the hysteresis value. Use arrow buttons to set the value to 0,5 (°C), and then press OK.
9. Press OK several times, until the display reads "----" to finish.

Relay 1 will be activated every time temperature rises above 15 °C, pumping water through the coil.
This will cause the temperature of the water to decrease, and as it reaches 14,5 °C the relay de-activates. After some time temperature will rise above 15 °C again due to heating effects, and relay 1 is activated once more.

In this way, temperature in the aquarium is automatically kept at 14,5-15 °C at all times.

PASSWORD PROTECTION

Using a password will stop access to some of the menu and parameters. There are two levels of password protection. Passwords between 0000-4999 will allow access to the fast set point adjustment and relay test. (Using this password stops access to all other parts of the menu). Passwords between 5000-9999 stop access to all parts of the menu, fast set point and relay test. (Current set point is still shown). By using the master password 2008, all configuration menus are available.

If you want to enable password protection, press the OK button several times, until the display reads E.PAS. Use an arrow button to choose YES, and then press OK. Now set the password using the arrow buttons, and press OK when done. If you want to disable password protection, go to the menu option E.PAS. again and set it to NO. Finish by pressing the **OK** button.

DEFAULT SETTINGS

The TMP-REG instrument is delivered with the following default settings:

IN:		TEMP
TYPE		PT
PT.TY		100
CONN		4W
DEC.P:		111.1
UNIT		°C
REL1		
	SETP	25.0
	ACT	DECR
	HYS	0.5
	ERR	HOLD
	ON.DE	0
	OF.DE	0
REL2		
	SETP	25.0
	ACT	INCR
	HYS	0.5
	ERR	HOLD
	ON.DE	0
	OF.DE	0
ANALOG OUTPUT:		4-20 (converted into a 0-5V instrument output)
0.LO		0
0.HI		100
0.ERR		3.5mA
RESP		1.0
E.PASS		YES
N.PASS		1234

USING THE CONTROLLER FOR DATA ACQUISITION

The instrument produces a 0-5 Volts analog output signal for data acquisition purposes. Connect the data cable to the socket marked *Out* on the backside of the TMP-REG instrument. Connector pin 1 is positive (+), connector pin 4 is 0 (zero).
The low instrument value (0.LO) corresponds to a 0 V output, and the high value (0.HI) corresponds to a 5 V output. This means, that the gain becomes HI value/5 V. With the default values the gain is then 20 °C/V, *e.g.* if the output voltage is 4 V, the calculated temperature value is 80 °C.
If the 0-5 Volt analog signal is noisy try to shorten the range of interest of the temperature output. E.g. the temperature signal will always be within the range of 15-25°C. Then set 0.LO to 15 and 0.HI to 25. Now the 0-5 Volt output voltage will be 0 V at 15°C and 5 V at 25°C. The gain will be 2°C/V.

CHANGE TEMPERATURE UNITS

It is possible to measure and control temperature in other units than °C. Press **OK** several times until UNIT appears. Now use the **Λ** or **V** buttons to toggle between °C or °F. When done, press **OK** several times until "----" appears.

TMP-REG SPECIFICATIONS

Supply voltage (universal):	21.6-253 VAC, 50-60 Hz or 19.2-300 VDC
Internal consumption:	3.2 W
Max. consumption:	3.5 W
Isolation voltage (test / operation):	2.3 kVAC / 250 VAC
Signal- / noise ratio:	Min. 60 dB (0-100 kHz)
Response time, programmable:	0.4-60 s
Calibration temperature:	20-28°C
Accuracy:	≤±0.1% of reading
Temperature Coefficient:	≤±0.01% of reading/ °C
EMC immunity influence:	≤±0.5% of reading
Potentiometer input, min:	10 Ω
Potentiometer input, max:	100 kΩ
Relay function:	Setpoint
Hysteresis, in % / display counts:	0.1-25% / 1-2999
On and Off delay:	0-3600 s
Sensor error detection:	Make / Break / Hold
Max. voltage:	250 VRMS
Max. current:	2 A / AC
Max. AC power:	500 VA
Max. current at 24 VDC:	1 A

IMPORTANT: DO NOT connect relays to >500W equipment (max 2 A, 250 V).

Marine approval
Det Norske Veritas, Ships & Offshore
Standard for Certification No. 2.4

Observed authority requirements:
Standard: EMC 2004/108/EC

Emission and immunity	EN 61326
LVD 73/23/EEC	EN 61010-1
UL, Standard for Safety UL 508	