Elcor ECO Heat Control system

(Elcor EHC)

Technical description

Rev. 1

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Revision	Description	Date
1	Initial version	22.06.2020

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The Elcor Control System

Functional Description

The control system is a part of the winterization solutions of Elcor AS. It is built up by a scalable PLC-based platform to control the output levels for each circuit. The outputs are equipped with its own Solid-State Relay, to make sure that there is no “wear and tear” which would have been the case by use of contactors.

The control system will always start, stop and control the output level for each zone in sequence to be able to have full control over the inrush currents of the heaters. This gives the controlled outputs a soft start and gives the vessels power management system the time to react if necessary when starting such a large power consumer.

Switchboards

The switchboards are equipped with industry-standard components only to make sure that spare parts are available all around the world if necessary.

Cooling of the switchboards is done by forced ventilation (fans).

All outputs are equipped with its own RCCB (residual current circuit breaker), 30mA – and its own solid-state relay for controlling the output.

The outputs for the heating below deck outputs will mainly be equipped with C32A/30mA RCCBs.

Alarms

All alarms in the control system is presented with its own tag that correspond with the project tags to make sure that any fault-finding is fast and easy. There is alarms for any fault such as circuit breaker trip, earth fault, sensor failure, PLC failure etc.

Run modes

Automatic mode

When in auto-mode, the control system uses weather data and temperature readings from the different zones to control the output level and power consumption for each zone. The control system will regulate the output level to make sure that the surface temperature doesn’t drop below 3*C. If equipped with integration to the vessels Power Management System, the power available signal will control the maximum power output for the whole system. The control system will prioritize the different zones by a user-controlled priority list.

If the ambient temperature drops below X* Celcius for 24 hours, the control system will set its run-mode in “Standby self-testing” until the ambient temperature is below X*C again.

The X* Celsius is a user defined value – usually 4*c or 5*c.

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Manual mode

When the control system is in manual mode, the user can manually define the output level for each zone, and the control system will keep that output level.

Standby self-testing

When in standby self-testing mode, the control system will test each output – one-by-one for insulation value and power consumption. If any deviations from the reference table set during commissioning, the control system will give the user an alarm.

This function is very useful for the users to make sure that there is no “suprises” from any damages to a heating cable etc when starting the system after a “summer period”. The self-testing runs continuisly during the period.

Harbor mode

The harbor mode can be manually controlled, or remotely controlled from the vessels Power Management System. The harbor mode is designed to keep the vessels escape routes free of ice according to the alternative escape route when at quay side.

The remote activation from the PMS system is controlled via hardwired discrete input(s).

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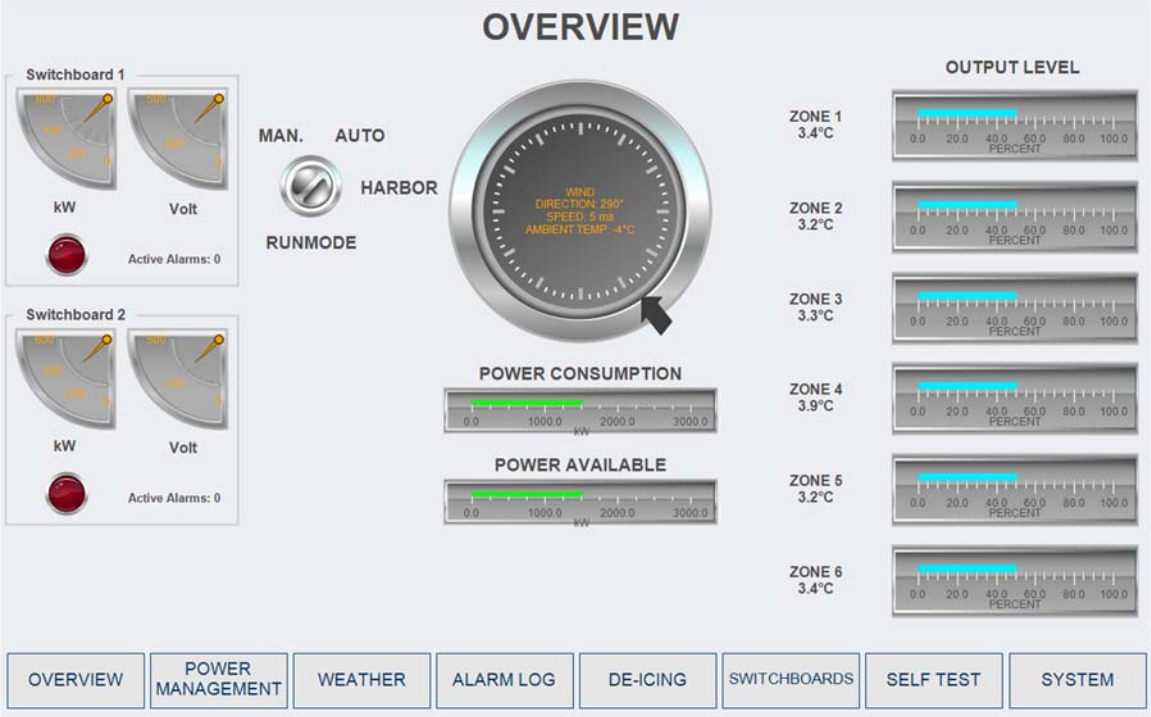
Graphical interface

Overview

Gives the user a quick and easy to read overview of the system such as:

- Weather data such as wind direction, speed, ambient temperature etc
- Runmode – auto, harbor or manual
- Switchboard conditions
- Output levels zone by zone
- Power consumption vs power available
- Active alarms etc



Typical overview

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Power management view

The Power Management View gives the user total control over the power consumption of the control system:

- View and/or override the “power available”-signal from the vessels Power Management System (PMS).
- Prioritize the different heated zones/areas – which zones to be prioritized if the power available is less than what is needed to keep the zones free of ice
- View the trend of the power available signal

Typical Power Management view

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Options; Integration to 3rd party systems

The control system is easily integrated to 3rd party systems as standard.

Weather station

NMEA or other bus signals from the vessels dedicated weather station or the DP system can be used to anticipate the extra needed heating in different zones before the surface is cooled down by rapid changes in the wind or changes in the vessel heading. It will also have a great impact on the heating regulation in zones affected by wind, and zones which are not affected by wind at the current weather conditions.

Power management system

Because this is a great power consumer on the vessel, the control systems total power consumption can be controlled by the vessels power management system.

The interface can be hardwired analog signal (4-20mA) or bus (Modbus etc).

Alarm system / IAS

Hardwired signals

As standard, the control systems are equipped with the following standard hardwired potential free outputs for alarms:

- Common alarm active
- New not acknowledged common alarm
- Earth fault alarm active
- New not acknowledged common alarm

Serial interface / Ethernet

The control system can be integrated with serial or ethernet interface to the vessels alarm system with all detailed alarms available in the control system.

Web interface

The control system can out of the box be accessed from computers on the same Ethernet network. The web interface gives an identical view and control as in the HMI panel for the control system.

The web interface can be integrated in the vessels IAS system with for example an iFrame-view in the SCADA system.

Customization

The eco heat control system can be customized to control other equipment such as heating of louvres, sea chest, windows etc (not included in quote).

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Potential savings

Elcor has performed calculations to compare estimated energy consumption with and without the control system – based on 450kW installed power. The weather data used is from Makkaur Fyr.

This is to compare the energy use when controlled (on/off) by the crew and Elcor ECO Heat Control system.

Manual on/off by crew:

Month	Avg temperature	Avg wind speed	Estimated avg output	Estimated consumption (kWh)
jan.17	-2,3°	10,7 m/s	100 %	334800
des.16	-0,5°	7,8 m/s	100 %	334800
nov.16	0,0°	6,2 m/s	100 %	324000
okt.16	5,3°	5,6 m/s	100 %	334800
sep.16	8,9°	3,8 m/s	0 %	0
aug.16	11,0°	4,1 m/s	0 %	0
jul.16	12,7°	3,6 m/s	0 %	0
jun.16	8,1°	5,1 m/s	50 %	167400
mai.16	7,2°	4,2 m/s	50 %	162000
apr.16	1,8°	4,9 m/s	100 %	334800
mar.16	-1,0°	8,8 m/s	100 %	324000
feb.16	-2,1°	6,8 m/s	100 %	302400
jan.16	-5,4°	5,9 m/s	100 %	334800
				2953800

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Automatic control by Elcor ECO Heat Control system

Month	Avg temperature	Avg wind speed	Estimated avg output	Estimated consumption (kWh)
jan.17	-2,3°	10,7 m/s	20 %	66960
des.16	-0,5°	7,8 m/s	12 %	40176
nov.16	0,0°	6,2 m/s	8 %	25920
okt.16	5,3°	5,6 m/s	5 %	16740
sep.16	8,9°	3,8 m/s	1 %	3240
aug.16	11,0°	4,1 m/s	0 %	0
jul.16	12,7°	3,6 m/s	0 %	0
jun.16	8,1°	5,1 m/s	1 %	3348
mai.16	7,2°	4,2 m/s	2 %	6480
apr.16	1,8°	4,9 m/s	6 %	20088
mar.16	-1,0°	8,8 m/s	15 %	48600
feb.16	-2,1°	6,8 m/s	20 %	60480
jan.16	-5,4°	5,9 m/s	25 %	83700
				375732

This shows that when the escape routes are controlled by the Elcor Control System, it can use **2 578 068 kWh less** (estimated) in this period than if manually operated – giving a reduction of energy consumption of approx. 87% in these environmental conditions. By manually operated, we mean turning the outputs on and off when there is need for heating.

The reason is that the Elcor ECO Heat Control system only adds the necessary amount of heating to the deck. When manually operated, it is either 100% or 0% output.

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