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A STEERING FAILURE MONITORING SYSTEM

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ABSTRACT

The total control system, together with the electric, mechanical and hydraulic components, is monitored for correct functioning. Dependent on the direction of rotation of the handwheel and of the resulting follow-up motion of the rudder gear, an electronic check is made to show, whether or not the blade runs into the rudder position required by the defined minimum *rate of displacement*.

Keywords: *rate of displacement*

1. INTRODUCTION

The signaling unit (fig.1) is designed for functional monitoring of ship's steering controls, which are equipped with one or two mechanically independent rudder blades.

2. THE CONTROL

2.1. Single rudder control

The signaling unit monitors the correct functioning of a follow-up/follow-up steering control from the control transmitter to the rudder stock, including the mechanical, electronic and hydraulic components.

During operation, the total control system, together with the electric, mechanical and hydraulic components, is monitored for correct functioning. Dependent on the direction of rotation of the handwheel and of the resulting follow-up motion of the rudder gear, an electronic check is made to show, whether or not the blade runs into the rudder position required by the defined minimum *rate of displacement*.

In order to take into account the dead time (time elapse between the input of the control command and the rotary motion performed of the rudder blade) a certain time must go by prior to the evaluation of the measurement (alarm delay). The adjustment of this period (dead time) is performed one time only within the signaling unit.

In parallel to the rate-of-turn control of the rudder, the angular displacement between the desired and the actual rudder angle is being checked. An additional transmitter (provided in the rudder angle feedback) permits to sense the respective rudder angle, to convert it into a voltage value and to feed it into an electronic monitoring circuit of the signaling unit.

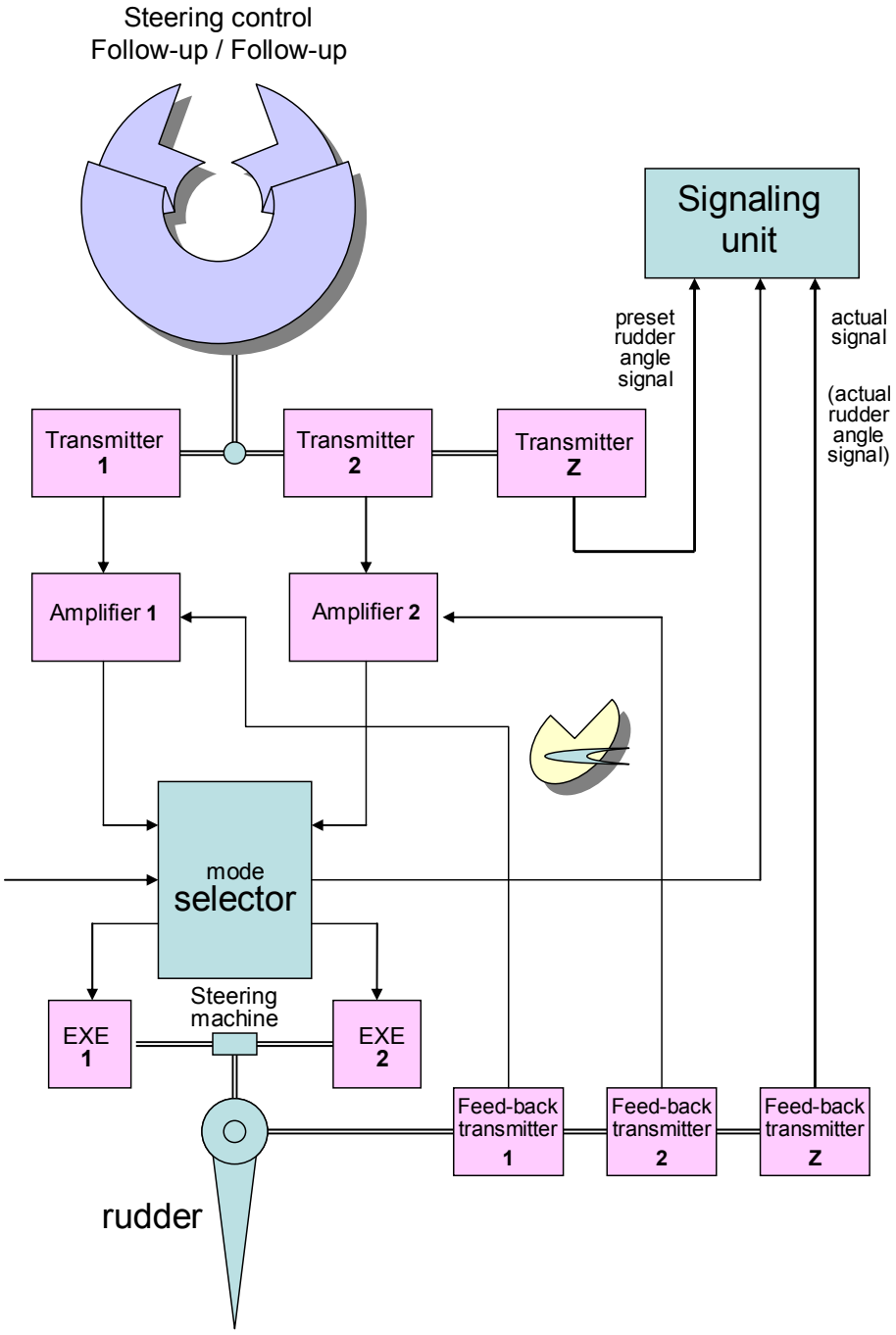

fig.1
The steering failure signaling system

A second signal, the desired rudder angle signal supplied by the additional transmitter in the follow-up steering control is also fed into the electronic monitoring circuit of the signaling unit. It is from these signals (desired and actual values) that the electronics produces a certain electrical value which, when the threshold value adjusted for the ship concerned is exceeded, causes visual and audible alarm to be given.

The operation of the monitoring system is independent of the number of the pumps (possibly resulting in a reduced time for putting the helm) and of the non-linearity in the rudder movement characteristic.

2.2. Signaling in case of disturbances of the Steering Control Equipment

The logic operation of the two signal circuits, desired and actual rudder positions, permits to give visual and audible signaling of the following disturbances witch may occur within the steering control equipment:

- The rudder does not follow-up the rudder order

$$\delta_{act} \neq \delta_{set}$$

- The rudder blade follows-up the rudder order only in part.

$$\delta_{act} \leq \delta_{set}$$

- Without rudder order, the rudder blade runs into an indefinite rudder position

$$\delta_{set} = 0, \delta_{act} \neq 0$$

- The rudder blade runs into a direction opposite to the rudder order given. For example, the desired rudder angle is set to the port and the actual rudder angle is actuated to the starboard

$$\delta_{set} \leq 0, \delta_{act} \geq 0 .$$

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