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## ENGINE ROOM MONITORING ALARM SYSTEM DESIGN AND IMPLEMENTATION

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### **Abstract:-**

*For the current problems of Marine engine room monitoring alarm system, In this paper, design system adopts centralized control method, All monitoring data summary to the centralized control room of the ship computer to unified handling, Implements of main engine, auxiliary engine, oil temperature, pressure, liquid level switch signals and hull, seawater temperature parameters, such as data acquisition, real-time monitoring, transfinite alarm information real-time display and printing, etc. For subsequent ship engine room monitoring alarm system and provide a reliable basis for the design and implementation of security, what has certain theory significance and the practical significance of the high.*

**Keywords:** - GPRS; engine room; Monitoring alarm; the bus; the detailed design

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## 1 INTRODUCTION

With the rapid development of electronic send out sound and light alarm signal output Information technology, modern ship and alarm message printed out. In the engine automation is improving constantly, Ship room monitoring alarm system alarm signals engine room monitoring alarm system is are usually set to "open"(the alarm of the automatic control and integrated monitoring Disconnection),There are exceptions to take device of the ship, Monitoring includes Settings "close"(the alarm of close).It can also in the machinery space host and periodically the status parameters related to operation/Operating state of various kinds of running equipment for display and print.

Auxiliary machines. Ship engine room Modern ship engine all adopt monitoring monitoring alarm system can be centralized alarm system. In the engine room automation, monitoring in a workplace, ensure that all sorts of equipment operation parameters and equipment to work effectively. Turbine operation parameters of the state and fault automation is an important content of the ship alarm display in the engine room monitoring engine room monitoring alarm system, it can be alarm system on the computer monitor, so don't accurate and reliable monitoring of running need to the cabin crew on duty to inspect all the parameters for various equipment cabin, equipment, just within the central control room realized the main auxiliary engine temperature, can learn about the engine room of all the pressure, speed, velocity of each oil tank, oil equipment running status and its parameters, so mist concentration, liquid level signal and as to reduce the work intensity of the crew on switch signal, seawater temperature of hull duty, improve the working conditions of the parameters for data acquisition, real-time crew on duty. Engine room monitoring alarm monitoring of the whole cabin devices of all system enables the crew on duty to discover and troubleshoot equipment failure in time, to ensre the safety and reliable operation of equipment. For AUTO - 0 in the engine room, engine room monitoring alarm system can extend alarm signal to the cab, restaurant, chief engineer and the extension of alarm board. Relevant crew can quickly ran to the central control room, confirm the detailed situation after the alarm, and act in a timely manner as needed to ensure the safe and reliable operation of the ship's <sup>[1]</sup>.

## 2 The Design of the Engine Room Monitoring Alarm System

### 2.1 The Function of the Engine Room Monitoring Alarm

A set of perfect engine room monitoring alarm system, its function includes the following aspects:

- 1) For monitoring parameters to realize data acquisition, display and alarm indication Extension alarm panel function
- 2) Engine room monitoring alarm system fault alarm
- 3) Engine room monitoring alarm alarm lock 4) Engine room monitoring alarm data printing function
- 5) An extension of the engine room monitoring alarm system alarm
- 6) Engine room monitoring alarm delay alarm
- 7) Engine room monitoring alarm watch alarm
- 8) Engine room monitoring and alarm of the police
- 9) Self-inspection of engine room monitoring alarm alarm function, and self-diagnosis
- 10) He automatic devotion of standby power

### 2.2 The Composition of Engine Room Monitoring Alarm System

In this paper, the design of ship engine room monitoring alarm system schematic diagram is shown in Figure 1:

- 1) The information processing equipment Information processing equipment installed in the engine room control on the stage, is composed of 2 computer, is mainly responsible for processing the signal transmitted data acquisition equipment, processing digital quantity input signal and information processing equipment analog input signal, each emergency alarm output through information processing equipment[2] .
- 2) Signal acquisition device Signal acquisition unit inside the equipment installation of various types of signal input/output module, its main function is responsible for all the signals collected together, and will be collected in the form of communication of information to the information processing equipment, signal input and output module or will handle good information output to other system. Between signal acquisition device with dual redundant communication links, to ensure the security of communication.
- 3) The signal transmission equipment Signal transmission equipment mainly include all kinds of sensors, liquid level switches, liquid level sensor, temperature sensor, speed sensor and main box of each system.
- 4) The extension alarm Extension alarm is mainly installed on the control platform, various senior crew lounge, restaurant, recreation room position such as extension of alarm panels. When appear alarm, extension alarm board will display alarm content accordingly, and will notice in the abnormal position of the crew members.
- 5) Engineer security alarm Engineer security ALARM (ALARM DEAD MAN ALARM, also known as the DEAD) is made in the cabin of the engineer of the bench and engine room entrance security call button, and the distribution of engine room in various parts of the reset button. When the engineer search engine room area, safety engineer call button, said someone in the engine room. After 27 minutes, there will be a Forecasting warning, says the engineer's safety by engineer reset button.

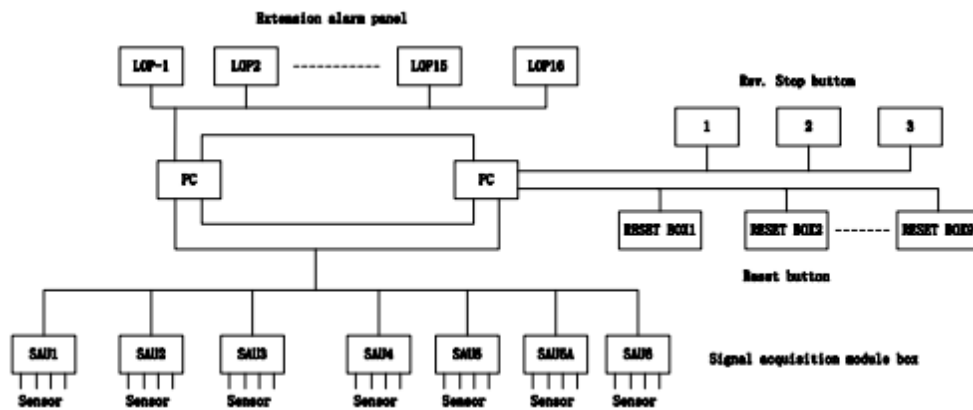


Figure 1 The principle diagram of the engine room monitoring alarm system

### 3 Engine Room Monitoring and Alarm of RS - 485 Bus Technology

Pay attention to in the application of RS - 485 bus problem analysis<sup>[3]</sup>. 1) The relationship between the load capacity and communication cable length In the design of the RS - 485 bus number, length and load to consider signal attenuation, noise tolerance and the effects of pure impedance load. The RS - 485 standard bus receiver noise margin at least should be greater than 200mv. In practice, in order to improve the anti-interference ability of the bus, Generally speaking, the noise tolerance of the system is better than the RS-485 standard [4].

The number of drives V driver output voltage and load. When the load number less than 5, V driver = 2.5 V. Load number between 5 to 35, V driver = 2.4 V. When the load number more than 35, V driver  $\leq 2.3$  V.

Loss in the process of signal transmission in the bus Vloss associated with the specification and length of communication cable, when communication baud rate of 9.6 KBPS, cable length 1 meter, Vloss is 6 v, such as baud rate increases, Vloss can increase accordingly.

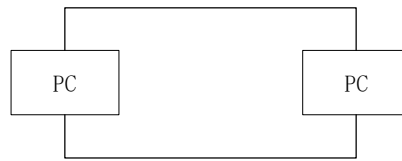
1. Drive with the size of the output voltage V driver bus load is inversely proportional to the number of losses in the process of bus transmission signal Vloss is inversely proportional to the size and length of the bus. Therefore, on the selected drive RS - 485 bus, communication baud rate certain situations, the more load, can signal transmission distance is short. On load quantity is less, can signal transmission distance is more far.
- 2) Signal attenuation of the cable A transmission cable can see it as the distribution of resistance, distributed capacitance and inductance of equivalent circuit, the distributed capacitance of the cable is mainly formed by two parallel wires of twisted-pair cable. Conductor resistance influence on signal is almost negligible. Composed of cable distribution of distributed capacitance and inductance LC low pass filter circuit caused the attenuation of the signal.
- 3) Pure resistance load of cable pure impedance load is mainly composed of terminal resistance, bias resistors and RS - 485 transceiver. The RS - 485 standard in drives with multiple nodes, in the case of a 1500  $\Omega$  connection terminal resistance, at least can output differential voltage of 1.5 V. A receiver input resistance of 12 k  $\Omega$ , RS - 485 drive load capacity is 62.5  $\Omega$ . Now commonly used RS - 485 load capacity can reach 20  $\Omega$ . Without considering the effects of other factors, according to the driving ability and the relationship between the load calculation, a driver can bring the maximum number of nodes will be greater than 32 [5].
- 4) The bias resistors when communication baud rate is quite high, plus the need on bias resistors, for after the line into the idle state, there is no data on the bus (free style) of electricity between 0 levels. In this way, even if the line of small reflection signals or interference. That won't affect articulated data receiver on the bus.

### 4 Engine Room Monitoring and Alarm of Double Machine Redundant Structure

In the design of this system USES dual computer redundancy control in the plan. In the whole system using two industrial control computer, in order to realize the hot standby each other. One of the industrial control computer as host, the other an industrial control computer is from the machine. From the machine is the host of a mirror, it runs prepared, the same as the host of monitoring process and application, maintained the data synchronization between the host and at the same time, test running situation of the host. When they tested the host fails and cannot work normally, the machine can automatically takes charge of the host, including data acquisition, alarm functions, data management and so on all applications, and can ensure the normal operation of continuous monitoring system, to minimize the loss to the data. When the damage to the host after repair, as a new system run operation from the machine. System will never fail all the monitoring data on a computer sent to restore computer, complement fault blank computer data, and ensure the continuity and integrity of data. In addition, from the machine has the function of data backup can save the data very well. Between the host and from the machine connected by Ethernet front-end ports, two machine connection is connected to the switch, switch to connect the Ethernet frontend ports, the conversion interface complete TCP/IP and the RS - 485 bus interconnection, all acquisition module and control module on the RS - 485 bus. Each acquisition module contains a number of sampling channels, complete the sensor output data collection.

Configuration 2 industrial control computer<sup>[6]</sup>. Main technical parameters as: display: 21 inch LCD monitor, CPU: InterP42. SG, bus clock: 400/1 GHZ, memory: DDR - 2 g, hard disk: 250 g, graphics card: 256 m independent graphics

CARDS, network CARDS: double network adapter configuration, a serial port: two, PCI slot, cd-rom, DVD RW, size: 483 mm (D) (w) x 130 mm x 355 mm. In the engine room monitoring alarm double redundancy structure diagram as shown in Figure 2:



**Figure 2 Pairs of redundant structure**

## 5 Engine Room Monitoring Alarm System Debugging

### 5.1 Switch Stations and Debugging

Switch alarm and basic principle is through the on and off of the circuit to determine if there is a fault monitoring. When in the case of closed (off), if the circuit is disconnected (closed), then the monitoring alarm system will be a failure is detected, then feedback to the display unit to report to the police.

- 1) The amount of liquid level switch Check the floating ball is good or bad, will float in high (simulated high level) to find the common point of terminal, the multimeter test breaking point. Will float in a low low level (simulation) to see if the two closed, if closed will outside wiring in the two, and then floating ball, SAU display screen and examine whether the host display alarm when float high, normal when float down low.
- 2) Switch electrical equipment will be used for oil pump power control box electric transmission, control alarm relay action, use multimeter to detect its closure. Cut off the power supply, multimeter is used to inspect whether these two are broken, if you disconnect the external alarm line, took the two wiring has been completed, will be available for inspection by the sending off oil pump control box is the SAU and host display is correct
- 3) The amount of pressure switch Such as the generator self-cleaning filter is generally by the manufacturer will set the alarm value, so the alarm value of high/low for is adjustable. The alarm value is less than 0.07 MP for generally low alarm. High above 0.09 MP for alarm. Using the hand pump of the header 0.40 MP, will play to 0.07 MP under pressure, at this time for the alarm state. More than 0.07 MP and less than 0.09 MP. At this time as the normal state, when the pressure value is higher than 0.09 MP, at this time for the alarm status, and check the SAU and host display instructions are correct.
- 4) The temperature switch Fresh water generator parking value is high temperature 90 °C , the temperature sensor using heater heating, use multimeter monitoring terminal closed off state at the same time, the heater closed slowly to a temperature of 90 °C to check whether the terminal point. If in the 90 °C temperature switch action, normally open point into a closed. Will be outside wiring connect the two points, if the temperature switch at 90 °C in advance or delay action adjustable switch on the adjusting screw, make its action at 90 °C, after set, can simulate generator operation. And then, turn the heater temperature to 90 °C, see if diesel generator company "parking".

### 5.2 Analog Alarm Point Debugging:

Analog alarm point can be divided into: two kinds of pressure and temperature.

- 1) The pressure analog alarm point debugging Generator lub oil low pressure alarm, the alarm value of 0.35 MP. When the oil pressure value is less than 0.35 MP will report to the police. When the hand pump (MP) 0.40 meter zero pressure values in the MP, within the host adjust CONTS values make its pressure values on the screen display for OMP, then put the hand pump pressure to 0.40 MP, adjust CONTS value within the host, made the value on the screen is 0.04 MP, the state should be normal, will slowly decrease pressure value. If the host screen have alarm. If the pressure when the alarm value of 0.35 MP or greater than or less than 0.35, the error can be within the scope of the permit. If the error is too large to readjust, the pressure value is 0 MP and 0.4 MP CONTS value, until the error is within the scope of the permit.
- 2) Temperature analog alarm debugging When temperature changes, the resistance of the temperature transmitter also with change, under the premise that the voltage must lead to current changes, the system get the corresponding temperature value according to the current signal receiving, automatic and setting temperature value comparisons, when greater than or less than the set value, the system will alarm [7]. Using PT - 100 temperature for debugging diesel generator company lub oil high temperature alarm point, procedure is as follows:

The temperature sensor on the external cable core release, and then open the thermometer to output state. According to the sensor type, select the thermometer three line or two line input mode. The thermometer outside the wire clamp and wire connection is good, if there is a temperature display the host display. If not, any change the red and black clip until normal temperature display. This is to adjust temperature of the same type of temperature sensor method is basically the same? Will the temperature of the thermometer zero. Coarse and fine tune are available, and two kinds of knob to adjust. Adjust the monitor screen of a host CONTS value makes its temperature value is zero. Thermometer temperature to 100 °C , after being stable temperature, adjust the host screen CONTS value displayed as 100 °C, the status of alarm status. The temperature fell to below 75 °C, until the alarm to disappear, according to normal after, then slowly rose to 75 °C temperature. The host on the display alarm value and 75 °C difference is within the scope of the permit, if within the

scope of the permit the emergency alarm is in tune. If the error is too large to readjust CONTS value of 0 °C and 100 °C when error within the scope of the permit.

## 6 Concludes

Based on the function of the ship's engine room monitoring alarm system and technical requirements, the system has the following features:

- 1) Typical modular structure Many independent modules of the engine room monitoring alarm system, the standardization of these modules are a unified interface specification module, monitoring and alarm system is no longer a separate relationship with equipment, using the system at different ship, need not to carry on the redesign of the whole system, only need to reset the related module can easily complete build system, flexible system.
- 2) Multiple redundant mechanism In order to ensure the safety and reliability of data transmission system, to avoid due to cable fault cause paralysis of the entire engine room monitoring alarm system, in the system of communication and computer communications between the module box are made redundant design.
- 3) Easy extension alarm Design scheme based on fieldbus makes extension alarm is simple.
- 4) The system module of generality Field data acquisition module can realize not only the current signal is collected by transmitter, also can realize the conventional voltage signal acquisition, greatly increase the versatility of the system module, it is highly advantageous to monitoring alarm system maintenance spare parts, repair after damage to monitor and control system has very important significance.

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