# Design of the Monitoring Interface of Combustion Control System for Small-size Circulation Fluidized Bed Boiler

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**Abstract.** The combustion control system for small-size circulation fluidized bed boiler is a three-tier distributed control system. The system consists of host computer, master station and slave station. Master station synergizes slave station to complete control tasks, and sends process variables to host computer. Host computer functions as a friendly man-machine interface and shows running status. This paper completed the PC monitoring interface design for the small-size boiler combustion control system. The monitoring interface is based on MCGS touch screen. It mainly includes real-time parameter display, failure alarm, device control, parameter setting and real-time/history curve display.

## Introduction

With the rapidly development of national industry, environmental pollution is becoming more and more serious. Conventional boiler is energy-intensive. It will generate high levels of pollution. Energy-saving and emission reduction is necessary. Today companies are busy with updating conventional boiler to best utilize resources. Circulation fluidized bed boiler is efficient and adaptable to fuels. It can burn various low-quality coals [1]. The structure of circulation fluidized bed boiler is complicated. The automatic control level is lower. Automatic control of circulation fluidized bed has been attached importance to. It has become a key point of control science and engineering [2][3].

In order to ensure the system work regularly, a perfect monitoring system is needed. The rapid development of computer technology gives a great development space to the industrial automation. MCGS configuration software has been used widely in automation and monitoring systems. Variable displaying, parameter setting, status indicating and fault alarming can be completed in an intuitive monitoring interface [4]. It is labor-saving and reliable. In this paper, the system adopts MCGSTPC7602K as the host computer to carry out above-mentioned functions.

## Monitoring Function of the Host Computer

The monitoring system has following functions: real-time display of process variables, fault alarm indication, actuator control, real-time/historical curve display and so on.

There are five user windows under MCGS real-time database. Display and operating variables are related to the real-time database. They function as global variables. Master station sends process variables to the real-time database, waiting for user windows' calling. Operations such as start-stop control of devise and parameter setting are from host computer. They are sent through real-time database to master station. Display of process variables, fault indication, start-stop control of devise and real-time/historical curve all belong to user windows and are configured by users.

## Design of the Host Computer Interface

Monitoring software design of the host computer is completed according to the functions. Constitutional diagram of the host computer interface is shown in Figure 1.

 

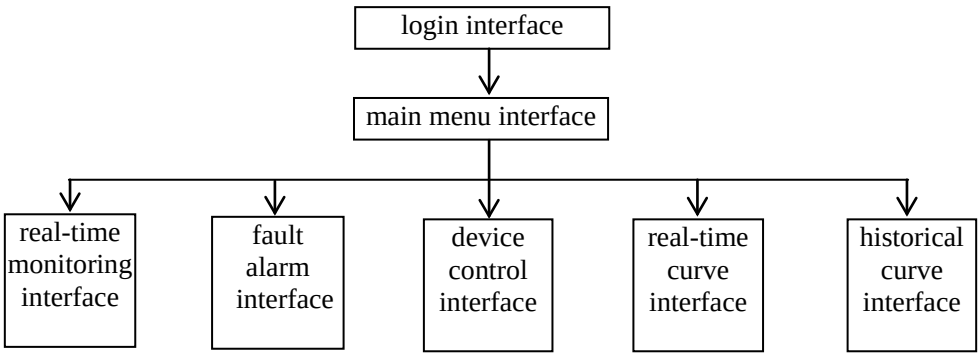


Fig.1. Constitutional diagram of the host computer interface

Besides login interface and main menu interface, there are still five main function interfaces: real-time monitoring, fault alarm, device control, real-time curve and historical curve. Details of the design are as follows.

**Login interface.** We can enter the login interface after starting the touch screen. The interface is triggered by a “click” event. Input correct password and we will have access to the system.

User login password is set through the “user authority management”. Initial user name defaults to: administrator, password: 888. "User login" window will pop up after clicking anywhere on the screen. The function is completed according to event management. Script program of the “click” event is as follows.

```
!LogOn
if !CheckUserGroup=0 then
!CloseSubWnd
!SetWindow
endif
```

System function !CheckUserGroup(strUserGroup) is used to check if currently logged in user is a number of user group “strUserGroup” or not. If return value=0, login windows will be closed and animation window opened.

**Main menu interface.** Main menu interface of the host computer mainly includes “simulative animation”, “real-time monitoring”, “fault indication”, “device control”, “real-time curve”, “historical curve”, “password setting” . We can switch user windows by clicking the button in main menu interface. Every button can be set to have a corresponding interface.

**Real-time monitoring interface.** During normal operation, data of the real-time monitoring interface come from sensors at work site. Thermocouple detects the temperature of furnace and returning charge. Pressure sensor completes monitoring of steam pressure and furnace negative pressure. Real-time variables display interface of the host computer is shown in Figure 2.

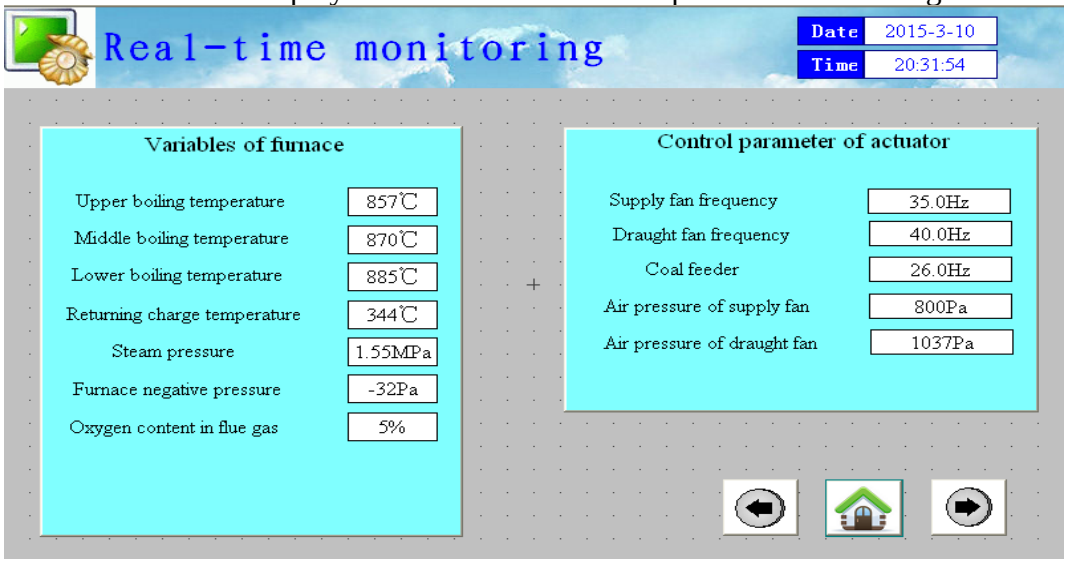


Fig.2. Real-time variables display interface of the host computer

The number of variables displayed in the picture above does not represent the number of filed sensors. For example, furnace temperature is acquired by nine thermocouples. They are distributed in three different places. Steam pressure is detected from three pressure sensors. They are located in steam header's foreside, middle and posterior respectively. Data in the real-time monitoring interface are the synthesis processing results of process variables. Through the method of averaging, the number of variables displayed is reduced to form an intuitive interface.

**Fault alarm interface.** The interface monitors running status of slave stations and actuators. It also has the function of limit alarm.

Process variables' limit alarm is related to group object. When the boiler is in normal operation, upper limit of furnace temperature is set as 970℃, and lower limit of that is 830℃. Upper limit of steam pressure is 1.9MPa, and corresponding lower limit is 1.3MPa. An alarm popup will deliver a message when temperature or pressure is out of limit. Once any error happening in slave stations, supply fan, draught fan or coal feeder, corresponding fault indicating lamp will be lighten. And a sound-light alarm is accompanied.

**Devise control interface.** Devise control interface of the host computer is shown in Figure 3. The interface is used to control actuator's start and stop. Under normal conditions, the boil system is in automatic operation. Manual switch is not required. Start-stop control of supply fan, draught fan and coal feeder can be completed by master station and intuitive man-machine interface of the host computer. During regular maintenance of the boiler, we can switch to manual control. Setting regulating frequencies of supply fan, draught fan and coal feeder is also completed in the interface.


Fig.3. Devise control interface of the host computer

**Real-time/historical curve display interface.** In a safety production process, quantitative analysis of a large number of process variables is not enough. It is necessary to draw curves according to vast quantities of data information. Real-time/historical curve display interface of the host computer has been completed.

## Conclusion

This paper expounds the monitoring function of host computer of combustion control system for small-size circulation fluidized bed boiler. It designs the host computer's monitoring interface. The Interface has the function of variable displaying and operating. It contributes to a reliable system.

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