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Technical requirements for data transmission of pollutant automatic monitoring and surveillance systems

污染物自动监测监控系统数据传输技术要求

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Technical requirements for data transmission of pollutant automatic monitoring and surveillance systems

1 Scope

This standard specifies the system architecture of the pollutant automatic monitoring and control system, the protocol hierarchy between field computers and the host computer, the communication protocol between field computers and the host computer, the communication method between automatic monitoring field instruments and data loggers, the technical requirements for data acquisition, processing, uploading.

This standard applies to data transmission between automatic monitoring equipment and monitoring equipment, as well as data acquisition and processing by automatic monitoring equipment.

2 Normative references

This standard references the following documents or clauses therein. For dated references, only the dated version applies to this standard. For undated references, the latest version (including all amendments) applies to this standard. If other documents are abolished, modified, or revised by new documents, the new documents apply to this standard.

GB 3096 Environmental quality standard for noise

GB/T 19582 (all parts) Modbus industrial automation network specification

GB/T 28181 Technical requirements for information transmission, switch and control in video surveillance networking system for public security

HJ 75 Specifications for continuous emissions monitoring of SO_2, NO_X, and particulate matter in the flue gas emitted from stationary sources

HJ 76 Specifications and test procedures for continuous emission monitoring system for SO_2, NO_X and particulate matter in flue gas emitted from stationary sources

HJ 353 Technical specification for installation of wastewater on-line monitoring system (COD_{Cr}, NH_3-N et al.)

HJ 356 Technical specification for data validity of wastewater on-line monitoring system (COD_{Cr}, NH_3-N et al.)

HJ 524 Codes for air pollutants

HJ 525 Codes for water pollutants

HJ 1402 Technical specification for automatic monitoring of construction noise

3 Terms and definitions

The following terms and definitions apply to this standard.

3.1

Automatic monitoring equipment

Instruments and equipment installed at the monitoring site for direct or indirect environmental monitoring or pollution source monitoring, referred to as field equipment, which include various types of instrumentation and equipment, such as data acquisition and transmission equipment, electricity surveillance equipment, pollutant emission process (operating condition) monitoring equipment, video capture equipment.

3.2

Electricity surveillance

The monitoring of the operating technical parameters (current, voltage, power, electricity consumption) of electrical equipment that reflect the operating status of production facilities and pollution control facilities, using electricity surveillance equipment and power data.

3.3

Emission process (operating status) surveillance of pollutants

The monitoring of the operating parameters (including process parameters such as flow rate, temperature, oxygen content, pressure) and other parameters such as current and voltage of production facilities and pollution control facilities, that affect pollutant emissions, using pollutant emission process (operating status) monitoring equipment and pollutant emission process (operating status) data.

3.4

Video surveillance

The monitoring of pollution sources during their production, treatment, discharge, monitoring phases is carried out using video acquisition equipment or computer systems built with audio and video, communications, computer network

Data mark

The operation of automatically marking the operating conditions of production facilities, pollution control facilities, field equipment using character classification.

4 System structure

The pollutant automatic monitoring and control system can be divided into three layers, from the bottom layer upwards: field equipment, transmission network, host computer. The host computer communicates with the field equipment via the transmission network (including initiation, data exchange, response).

There are two configuration options for the pollutant automatic monitoring and control system:

a) System configuration 1: One set of field equipment integrates automatic monitoring instruments, storage, communication functions. It can directly receive and issue commands to and from the host computer via the transmission network. A schematic diagram of this system configuration is shown in Figure 1.

b) System configuration 2: One or more sets of automatic monitoring instruments are located on-site. These instruments have digital (analog) output interfaces connected to independent data acquisition devices. The host computer communicates with the data acquisition devices via a transmission network (including initiation, data exchange, response). A schematic diagram of this system configuration is shown in Figure 2.

5 Protocol layers between field and host computers

The communication interface between the field and host computers must meet the requirements of the selected transmission network.

The data transmission protocol specified in this standard corresponds to the application layer of the protocol model defined by the International Standards Organization/Open System Interconnection (ISO/OSI) reference model. It provides interactive communication between field and host computers based on different transmission networks.

A schematic diagram of the data transmission protocol structure is shown in Figure 3.

The basic transport layer in this standard is built on the Transmission Control Protocol/Internet Protocol (TCP/IP) and is applicable to the following communication media:

a) General Packet Radio Service (GPRS);

b) Asymmetrical Digital Subscriber Loop (ADSL);

c) Code Division Multiple Access (CDMA);

d) Wideband Code Division Multiple Access (WCDMA);

e) Time Division - Synchronous CDMA (TD-SCDMA);

f) Wideband CDMA Technology (CDMA2000);

g) Power Line Communication (PLC);

h) Time Division Long Term Evolution (TD-LTE);

i) Frequency Division Duplex Long Term Evolution (FDD-LTE);

j) Worldwide Interoperability for Microwave Access (WiMAX);

k) Narrow Band Internet of Things (NB-IoT);

l) Satellite Communication Technology (including FDMA, TDMA, CDMA, SDMA, etc.).

The transmission network referred to in this standard is composed of one or more of the above communication media.

The application layer of this standard relies on the underlying transport layer, which uses the TCP/IP protocol (the TCP/IP protocol has four layers: network interface layer, network layer, transport layer, application layer). The TCP/IP protocol is built on the selected transmission network; the network interface layer of the TCP/IP protocol implements the interface with the transmission network. The application layer of this standard replaces the application layer of the TCP/IP protocol.

6 Communication protocol between field computer and host computer

6.1 Response mode

A complete command consists of a requester initiating and a responder responding. The specific steps are as follows:

a) The requester sends a request command to the responder;

b) After receiving the request, the responder sends a request response to the requester (handshake completes);

c) After receiving the request response, the requester waits for the responder to

respond with the execution result. If the requester does not receive the request response, the request response is considered to have timed out.

d) The responder performs the requested operation;

e) The responder sends the execution result to the requester;

f) The requester receives the execution result and the command is completed. If the requester does not receive the execution result, the execution is considered to have timed out.

6.2 Timeout retransmission mechanism

6.2.1 Request-response timeout

The rules for determining request-response timeouts are as follows:

a) If a request command is issued and no response is received within the specified time, it is considered a timeout;

b) If no response is received after a specified number of retries after a timeout, communication is considered unavailable and terminated;

c) The timeout period can be customized based on the specific communication method and task nature;

d) The number of timeout retries can be customized based on the specific communication method and task nature.

6.2.2 Execution timeout

If the requester does not receive return data or command execution results within the specified time after receiving a request response (or a subpacket), it is considered a timeout, command execution fails, the request operation is terminated.

See Table 1 for the default timeout and retransmission count definitions (which can be expanded).

information. The host computer will then issue the data logger's network access code;

g) Upload the automatic monitoring device's unique identifier, activate the automatic monitoring device, obtain the formal transmission key.

6.9 Communication bandwidth requirements between field computers and host computers

Depending on the type and structure of the transmitted data and the communication medium at the field end, the field end can select its own network bandwidth and reserve appropriate network bandwidth redundancy to enhance transmission stability.

7 Communication methods between automatic monitoring field instruments and data loggers

7.1 Electrical interface standards for automatic monitoring field instruments and data loggers

Digital signal transmission shall be used between automatic monitoring field instruments and data loggers. A two-wire RS-485 interface is preferred. The electrical standards for the RS-485 interface refer to the RS-485 industrial bus standard. Other electrical interfaces such as RJ-45 may also be used.

The RS-485 interfaces of automatic monitoring field instruments and data loggers shall be clearly marked with "RS485+" or "RS485-", to indicate the wiring method.

7.2 Serial communication standards between automatic monitoring field instruments and data loggers

7.2.1 Serial communication bus structure

The communication bus structure between automatic monitoring field instruments and data loggers is one master and multiple slaves, as shown in Figure 13.

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