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ENVIRONMENTAL PROTECTION INDUSTRY STANDRAD
OF THE PEOPLE'S REPUBLIC OF CHINA

HJ/T 212-2005

Standard for Data Communication of Pollution Emission Auto Monitoring System

污染源在线自动监控(监测)系统

数据传输标准

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Forward

This Standard was prepared for the purposes of implementing *Environmental Protection Law of the People's Republic of China*, guiding the construction of pollution emission auto monitoring system, regulating data communication, and guaranteeing the connection among various environmental monitoring instruments, transmission network, and application software system of environmental protection department.

This Standard specifies the transmission protocol of data communication, control, alarm and other information BETWEEN the monitoring center (host computer) of pollution emission auto monitoring system AND auto monitoring equipment (on-site computer).

This Standard was proposed by Department of Science & Technology and Standards of the State Environmental Protection Administration.

Chief drafting organizations of this Standard: Environmental Emergency and Accident Investigation Center of the State Environmental Protection Administration, Information Center of the State Environmental Protection Administration, China Environmental Monitoring Center, and Xi'an Jointsky Software Holding Co., Ltd.

This Standard was approved by the State Environmental Protection Administration on December 30, 2005.

This Standard was implemented since February 1, 2006.

This Standard shall be interpreted by the State Environmental Protection Administration.

Standard for Data Communication of Pollution Emission Auto Monitoring System

1 Applicable Scope

This Standard is applicable to data exchange and transmission BETWEEN auto monitoring equipment AND monitoring center of the pollution emission auto monitoring system. This Standard specifies the data formats and code definitions of data transmission process and the system against the parameter command, interactive command, data command, and control command; this Standard does not limit the system to expand other information contents; when the contents are expanded, they shall not conflict with the control command used or reserved in this Standard.

This Standard shall be revised in proper time as per the development of communication technology.

2 Normative References

The following normative documents contain provisions which, through reference in this Standard, constitute provisions of this Standard, and are as valid as this Standard.

GB/T 16706-1996 Codes for Environmental Pollution Source

YD/T 1093-2000 900/1800MHz TDMA Digital Cellular Mobile Communication Network Technical Specification for General Packet Radio Service (GPRS) Tunneling Protocol

YD/T 1323-2004 Technical Requirements for Access Network - Asymmetric Digital Subscriber Line (ADSL)

YD/T 1334-2004 Technical Requirements of Intelligent Peripheral (IP) Equipment for Wireless Intelligent Network (WIN) Phase 2 in 800MHz CDMA Digital Cellular Mobile Telecommunication Network

EIA RS-232C Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange

3 Terms

3.1 Pollution emission auto monitoring system

It consists of auto monitoring instrument and monitoring center that implement on-line auto monitoring against the main pollutants' emission from the pollution source; it is called system for short in this Standard.

3.2 Monitoring center

It is the system installed in environmental protection departments at all levels, has the permission to connect auto monitoring equipment through transmission line, and conducts the data receiving and processing against the inquiry, control and other commands specified in this Standard, including computer information terminal equipment, computer software etc.; it is called host computer for short in this Standard.

3.3 Auto monitoring equipment

It indicates single or multiple equipment and facilities installed on discharge outlet of pollution source, used for monitoring the discharge situation of pollution source, and finishing data communication and transmission with host computer; including pollutant monitoring instrument, flow amount (velocity) meter, pollution control facility recorder, data acquisition and transmission instrument, etc., it is the integral part of the pollution control facilities. It is called on-site computer for short in this Standard.

3.4 Data acquisition and transmission instrument

It indicates single-chip computer, industrial personal computer, embedded computer, embedded programmable automation controller (PAC), programmable controller etc., which acquire data from various types of monitoring instruments, finish data storage, and realize the data communication and transmission with host computer.

4 System Structure

Pollution emission auto monitoring system can be divided into three levels, such as on-site computer, transmission network and host computer from the bottom upwards. Host computer realizes data exchange and issues or responds commands through the transmission network and on-site computer.

Auto monitoring equipment is constituted by the following two methods:

- (1) One set of on-site computer combines auto monitoring, storing, communication and transmission functions, which are interactive through transmission network and host computer.

established, the protocol on the entire application layer is irrelevant to the specific transmission network. This Standard reflects the independence of communication media.

6 Communication Protocol

6.1 Respond mode

Complete command consists of the initiation of requesting party and response of responder, and the specific steps are as follows:

- (1) The requesting party sends a query command to the responder.
- (2) The responder responds after receiving the query command, and the connection is considered to be established after the reception of response by the requesting party.
- (3) The responder performs the query operation.
- (4) The responder informs the requesting party that the query operation has been finished; if there is no response, then it shall be treated as overtime operation.
- (5) The command is finished.

6.2 Timeout retransmission mechanism

6.2.1 Timeout for query response

- If one query command is issued and does not receive response within the specified time, then it is considered timeout.
- Retransmit after timeout, if response is not received after the specified retransmit times, then the communication is thought not available, and the communication is over.
- The timeout period can be customized as per the specific communication mode and task nature.
- The retransmission times after timeout can be customized as per the specific communication mode and task nature.

6.2.2 Performance timeout

If the requesting party fails to receive the return data or command performance result within the specified time after receiving the query response (one sub-package), it is considered timeout; if command fails to be performed, then it is ended.

xxx-ZsAvg	Average conversion value within specified time of pollutant	0~9	N14.2	10.11
xxx-ZsMax	Maximum conversion value within specified time of pollutant	0~9	N14.2	10.11
xxx-Flag	Monitoring pollutant real-time data flag	A~Z	C1	As for pollution source (P: power failure; F: emission source outage; C: check; M: maintenance; T: test; L: limit; D: default; S: setting value; N: Normal) As for air test station (0: calibration number; 1: meteorological parameters; 2: abnormal data; 3: normal data)
[Empty row]				
xxx-Cou	Accumulated value within specified time of pollutant	0~9	N14.2	10.11
xxx-RS	Real-time sampling value in equipment operating status	0~9	N1	0: equipment on; 1: equipment off (expandable)
xxx-RT	Running time within specified time of equipment	0~9	N14.2	10.11, and 0=n<=24
xxx-Ala	Sampling value within alarm period of pollutant	0~9	N14.2	10.11
xxx-UpValue	Upper limit of pollutant alarm	0~9	N14.2	10.11
xxx-LowValue	Lower limit of pollutant alarm	0~9	N14.2	10.11
xxx-Data	Historical data on noise monitoring day	0~9	N14.2	10.11
xxx-DayData	Historical data of daytime noise	0~9	N14.2	10.11
xxx-NightData	Historical data of night noise	0~9	N14.2	10.11
AlarmTime	Excessive begin time	0~9	N14	YYYYMMDDHHMMSS
AlarmType	Alarm event type	0~9	N1	1: Excessive; 0: restore to normal
ReportTarget	Address mark of host computer	0~9	N20	Address mark of communication
PolId	Pollutant No.	0~9	C3	See Appendix B
BeginTime	Begin time	0~9	N14	YYYYMMDDHHMMSS
EndTime	End time	0~9	N14	YYYYMMDDHHMMSS
DataTime	Data time information	0~9	N14	YYYYMMDDHHMMSS
ReportTime	Time information for data	0~9	N14	0100

command				1002~1010
Parameter command				
Extract on-site computer time	1011		Query command	Used for time synchronization system for host and on-site computer
Upload on-site computer time		1011	Upload command	
Set on-site computer time	1012		Query command	Used for time synchronization system for host and on-site computer
Extract pollutant alarm threshold	1021		Query command	Used for pollutant exceed-limit alarm
Upload pollutant alarm threshold		1021	Upload command	
Set pollutant alarm threshold	1022		Query command	
Extract address of host computer	1031		Query command	Extract address of host computer
Upload address of host computer		1031	Upload command	Upload address of host computer
Set address of host computer	1032		Query command	Indicate address of host computer
Extract data reporting time	1041		Query command	Extract data reporting time
Upload data reporting time		1041	Upload command	Upload data reporting time
Set data reporting time	1012		Query command	Indicate data reporting time
Extract real-time data interval	1061		Query command	Extract real-time data interval
Upload real-time data interval		1061	Upload command	Upload real-time data interval
Set real-time data interval	1062		Query command	Indicate real-time data interval
Set access password	1072		Query command	
Interactive command				
Query respond		9011		Used for responding query from on-site computer to host computer. E.g. whether execute the query
Operation execution result		9012		Used for execution result of query from on-site computer to host computer
Notify response	9013	9013		Respond notice command

Appendix A

(Normative)

Cyclic Redundancy Check (CRC) Algorithm

Cyclic Redundancy Check (CRC) indicates an error checking method of data transmission; CRC code has two bytes, and contains one 16-bit binary value. It is added to the data package after calculation of transmission equipment. The receiving equipment recalculates CRC received message, and compares with value in CRC receiving field, if the above two values are different, then there is an error.

The specific algorithm is as follows:

CRC firstly transfers a 16-bit register with all digits are “1”, and then transfers a process to handle the consecutive 8-bit bytes in a message and the value in the current register. Only 8 Bit data in each character is valid for CRC, while the start and stop bits, as well as parity bits are invalid.

The build steps for CRC to check bytes are as follows:

- ① Install a 16-bit register, all digits are 1.
- ② Conduct “Exclusive-Or” calculation against one byte in checked string, and high byte in 16-bit register. The calculation results shall be put into such 16-bit register.
- ③ Move 1-bit towards right of such 16-bit register.
- ④ If the digit is 1 that is removed towards right (fag), then polynomial of 1010 0000 0000 0001 is generated, and conduct “Exclusive-Or” calculation with such register; if the digit is 0 that is removed towards right, then return to ③.
- ⑤ Repeat ③ and ④, until 8 digits are removed.
- ⑥ Extract the next byte of the checked string.
- ⑦ Repeat ③~⑤, until all bytes of checked string are conducted “Exclusive-Or” calculation with 16-bit register, and are moved 8 times.
- ⑧ The contents of 16-bit register is 2-byte CRC error check code.

Check code shall be stored as per the order of high byte firstly, and low byte follows.

11	Chlorine	Waste gas	mg/m ³	N4.3
12	Carbon disulfide	Waste gas	mg/m ³	N4.3
13	Thiol	Waste gas	mg/m ³	N4.3
14	Sulfuric acid mist	Waste gas	mg/m ³	N4.3
15	Chromic acid mist	Waste gas	mg/m ³	N2.4
16	Benzene Homologues	Waste gas	mg/m ³	N4.2
17	Toluene	Waste gas	mg/m ³	N4.2
18	Xylene	Waste gas	mg/m ³	N4.2
19	Formaldehyde	Waste gas	mg/m ³	N3.3
20	Benzo (a) pyrene	Waste gas	mg/m ³	N3.6
21	Aniline	Waste gas	mg/m ³	N4.3
22	Nitrobenzene	Waste gas	mg/m ³	N3.4
23	Chlorobenzene	Waste gas	mg/m ³	N4.3
24	Phosgene	Waste gas	mg/m ³	N3.3
25	Hydrocarbons (containing NMHC)	Waste gas	mg/m ³	N5.2
26	Acetaldehyde	Waste gas	mg/m ³	N3.4
27	Phenols	Waste gas	mg/m ³	N3.3
28	Methanol	Waste gas	mg/m ³	N5.2
29	Vinyl chloride	Waste gas	mg/m ³	N4.3
30	carbon dioxide	Waste gas	mg/m ³	N4.3
31	Mercury and its compounds	Waste gas	mg/m ³	N4.4
32	Lead and its compounds	Waste gas	mg/m ³	N2.4
33	Cadmium and its compounds	Waste gas	mg/m ³	N3.4
34	Tin and its compounds	Waste gas	mg/m ³	N4.3
35	Nickel and its compounds	Waste gas	mg/m ³	N3.3
36	Beryllium and its compounds	Waste gas	mg/m ³	N4.4
37	Ringelman blackness	Waste gas		N1
99	Other air pollutants	Waste gas		
B01	Sewage	Sewage		
001	pH value	Sewage		N2.1
002	Chroma	Sewage	Chroma unit	N5.1
003	Suspension	Sewage	mg/L	N5.1
010	Biochemical Oxygen Demand (BOD ₅)	Sewage	mg/L	N5.1
011	Chemical Oxygen Demand (COD _{cr})	Sewage	mg/L	N6.1
015	Total Organic Carbon	Sewage	mg/L	N3.2
020	Total mercury	Sewage	mg/L	N2.3
021	Alkyl mercury	Sewage	mg/L	N2.1
022	Total cadmium	Sewage	mg/L	N2.2
023	Total chromium	Sewage	mg/L	N3.2

Appendix C

(Informative)

Example of Communication Process for Each Commands

The following command examples are the ones that do not need data response and package splitting (of which Example 6 specially describes the package splitting and response). For the uploading data, QN, PNO, and PNUM are optional.

Examples of data instruction: the following example of QN is connected at May 16, 2004 01::01:01:001, namely, 20040516010101001; ST is 32 indicating pollution source on surface water; the unique mark of equipment is 88888880000001, which indicates the backward seven digits of the manufacturer's organization code is 8888888, while equipment serial number is 0000001, and the validation password is 123456.

1. Set Access Password of On-Site Computer:

Type	Item		Example/Instruction
Use command	Host computer	Set access password of on-site computer	QN=20040516010101001; ST=32; CN=1072; PW=123456; MN=88888 880000001; Flag=3; CP=&& PW=654321&&
	On-site computer	Query response	ST=91; CN=9011; PW=123456; MN=88888880000001; Flag=0; CP=&& QN=20040516010101001; QnRtn=1&&
	On-site computer	Return operation execution result	ST=91; CN=9012; PW=123456; MN=88888880000001; CP=&&QN=20040516010101001; ExeRtn=1&&
Use field	QN		Query No.
	QnRtn		Query return result
	PW		Host computer needs the access password of on-site computer of equipment
	ExeRtn		Query execution result
Execution process	After host computer issues the command to set the access password of on-site computer, it waits for response from on-site computer; after receiving response, the host computer shall determine whether to wait for execution result as per the QnRtn value in the response code, on-site computer executes the query to set clock, return execution and end command, then the query is finished. After the command is executed correctly, new password shall be used afterwards for communication, otherwise the old password shall be used.		

2. Extract System Time of On-Site Computer:

Type	Item		Example/Instruction
Use command	Host computer	Extract time of on-site computer	QN=20040516010101001; ST=32; CN=1011; PW=123456; MN=88888 880000001; Flag=3; CP=&&&&
	On-site computer	Query response	ST=91; CN=9011; PW=123456; MN=88888880000001; Flag=0; CP=&&QN=20040516010101001;

			CP=&&QN=20040516010101001; ExeRtn=1&&
Use field	QN		Query No.
	QnRtn		Query return result
	ReportTime		Data Reporting time, the forward two digits are marked hour, the backward two digits marked minute
	ExeRtn		Query execution result
Execution process	After host computer issues the command to set data reporting time, it waits for the response from the on-site computer, after the host computer receives the response it shall determine whether to execute the result as per the response code, on-site computer executes setting query, returns query, and ends command, then this query is finished.		

16. Extract Data Reporting Time:

Type	Item		Example/Instruction
Use command	Host computer	Extract data reporting time	QN=20040516010101001; ST=32; CN=1041; PW=123456; MN=88888880000001; Flag=3; CP=&&&&
	On-site computer	Query response	ST=91; CN=9011; PW=123456; MN=88888880000001; Flag=0; CP=&&QN=20040516010101001; QnRtn=1&&
	On-site computer	Upload data reporting time	ST=32; CN=1041; PW=123456; MN=88888880000001; CP=&&QN=20040516010101001; ReportTime=0101&&
	On-site computer	Return operation execution result	ST=91; CN=9012; PW=123456; MN=88888880000001; CP=&&QN=20040516010101001; ExeRtn=1&&
Use field	QN		Query No.
	QnRtn		Query return result
	ReportTime		Data Reporting time, the forward two digits are marked hour, the backward two digits marked minute
	ExeRtn		Query execution result
Execution process	After host computer issues the command to extract data reporting time, it waits for the response from the on-site computer, after the host computer receives the response it shall determine whether to receive the host computer address as per the response code, on-site computer executes setting query, returns query, and ends command, then this query is finished.		

17. Zero calibration and Full-Span Calibration of Lower-terminal Monitoring Equipment:

19. Extract Real-Time Sampling Data Reporting Interval:

Type	Item		Example/Instruction
Use command	Host computer	Extract real-time sampling data reporting interval	QN=20040516010101001; ST=32; CN=1061; PW=123456; MN=888888800000001; Flag=3; CP=1111
	On-site computer	Query response	ST=91; CN=9011; PW=123456; MN=888888800000001; Flag=0; CP=11QN=20040516010101001; QnRtn=11
	On-site computer	Upload real-time sampling data reporting interval	ST=32; CN=1061; PW=123456; MN=888888800000001; CP=11QN=20040516010101001; RtdInterval =3011
	On-site computer	Return operation execution result	ST=91; CN=9012; PW=123456; MN=888888800000001; CP=11QN=20040516010101001; ExeRtn=11
Use field	QN		Query No.
	QnRtn		Query return result
	RtdInterval		Real-time sampling data reporting interval
	ExeRtn		Query execution result
Execution process	After host computer issues the command to extract real-time sampling data reporting interval, it waits for the response from the on-site computer, after the host computer receives the response it shall determine whether to receive the real-time sampling data reporting interval as per the response code, on-site computer executes query, returns query, and ends command, then this query is finished.		

20. Initialization Timeout Period and Retransmitting Times:

Type	Item		Example/Instruction
Use command	Host computer	Set on-site computer timeout period and retransmitting times	QN=20040516010101001; ST=32; CN=1000; PW=123456; MN=888888800000001; Flag=3; CP=11OverTime=5; ReCount =311
	On-site computer	Query response	ST=91; CN=9011; PW=123456; MN=888888800000001; Flag=0; CP=11QN=20040516010101001; QnRtn=11
	On-site computer	Return operation execution result	ST=91; CN=9012; PW=123456; MN=888888800000001; CP=11QN=20040516010101001; ExeRtn=11
Use field	QN		Query No.
	QnRtn		Query return result
	OverTime		Timeout period
	ExeRtn		Query execution result
Execution process	After host computer issues the command to set the on-site computer timeout period and transmitting times, it waits for the response from the on-site computer, after the host computer receives the response it shall determine whether to wait for the execution result as per the QnRtn response code, on-site computer executes setting clock query, returns query, and ends command, then this query is finished.		

command		sampling time	
	On-site computer	Query response	
	On-site computer	Return operation execution result	
Use field	QN		Query No.
	QnRtn		Query return result
	CTime		Equipment sampling time
Execution process	After host computer issues the command to set sampling time, it waits for the slave computer to receive response, after the host computer receives the response it shall determine whether to wait for the execution result of the slave computer as per the response code, slave computer executes query, and ends command, then this query is finished. Each command sets an equipment sampling time period. Note: CTime=04 indicates that sampling begins at 04:00 O'clock.		

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