Automation Solution for Water Treatment

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COMPANY PROFILE

As a subsidiary company of Chint Group Corporation, Zhejiang Chitic Control Engineering Co., LTD is a leading provider of automation and control technologies and applications in China that helps the industry customers to improve operating safety, reliability and efficiency.

Chitic adheres to the philosophy of safety, energy-saving and green, and devotes to the research and development in process automation, equipment automation, condition monitoring, distributed energy and urban energy measurement, etc.

Chitic has series of products, including CTS700 Advanced DCS, TDCS9200 DCS PCS1800 DCS, GTex-BX control system for high speed rapier loom, GTex-SR drive system of switched reluctance motor, CS2000 on-line vibration monitoring and analyzing system for wind turbine, DS9100 monitoring system for large-scale pumps group, DS9200 monitoring system for reciprocating machine , PVS6000 series PV power plant monitoring system, ChiticM series remote metering system for water, gas and heating, VPR serie intelligent instruments, computing cloud center for new energy, etc. Chitic control system won 2006 the National Science and Technology Progress Awards of China, CTS700 advanced DCS won the award of 2010 Innovative Product of China.

Chitic has provided products and technical service for nearly ten thousand customers in the industries of petrochemical, coal chemical, fine chemical, environmental protection, water treatment, electric power, textile, machinery, wind power, solar energy, biopharmaceutical, and public utility such as water supply, heat supply, gas supply.

Chitic's headquarter is located at the beautiful city of Hangzhou, merely two hours drive from Shanghai. Chitic has its own science & technology park, Chitic Park, which covers about six thousand square meters, with the total investment of nearly 100 million US dollars.

CERTIFICATES

2.Sewage Treatment Control Solution

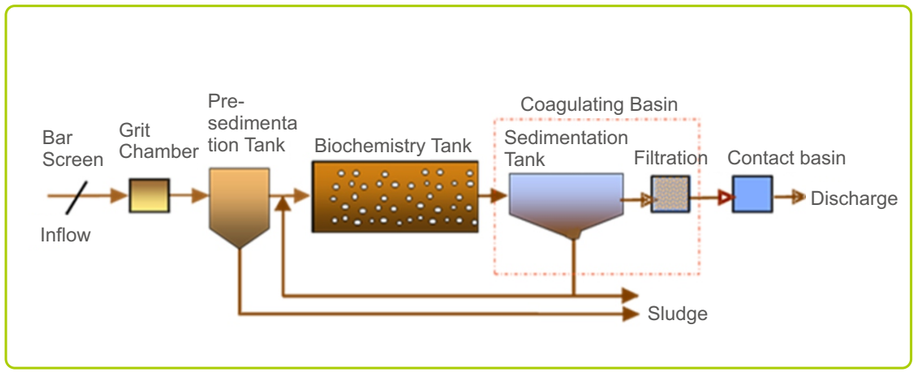
2.1 Sewage Treatment Technique

Sewage Treatment

Municipal sewage and industrial sewage can be safely disposed by multiple separation and transformation methods, and basic methods include physical method, chemical method, physical-chemical method and biochemistry method.

Basic Methods	Basic Principle	Technology
Physical method	Physical or mechanical separation process	Filtration, sedimention, centrifugal separation, flotation
Chemical method	Adding chemicals in the sewage water to casue chemical reactions process	Neutralization, oxidization, restoration, decop -osition, coagulation, chemical precipitation
Physical-chemical method	Physical chemical separation process	Gas stripping, air stripping, adsorption, extraction, IEX,electrolysis, electrodalysis, reverse osmosis
Biochemical method	Microbiology and organic matter cause oxidation and decomposition reaction in sludge	Activated sludge,catalytic oxidaton, BAF, rotating biological contactor, lagoon, anaerobic nitrification

Sewage treatment is the process of removing contaminants from wastewater, primarily from municipal sewage. It includes physical, chemical, and biological processes to remove these contaminants or transform to innocuous substance, so it can meet the national discharged standard of sewage.
Sewage treatment generally involves three stages, called primary, secondary (biochemical) and sludge treatment, tertiary and reuse of regenerated water treatment.



Typical Process of Municipal Sewage Treatment

2.2 Mechanical Treatment (Primary Class)

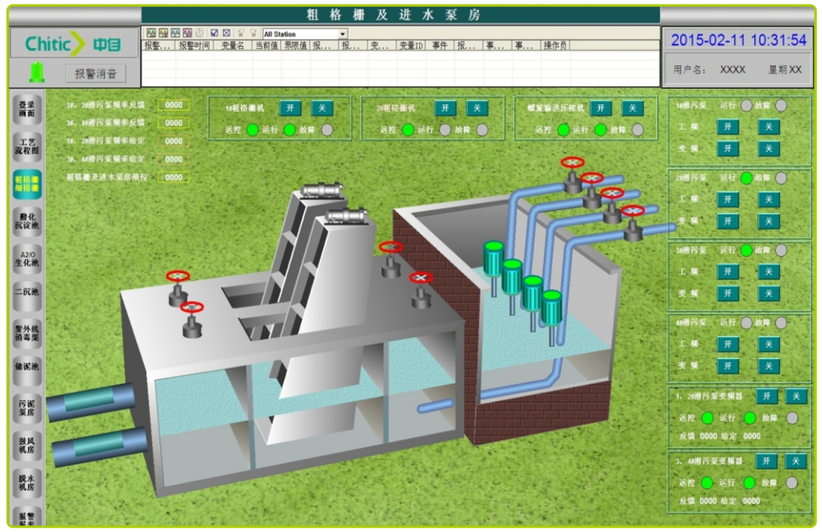
Mechanical Treatment (Primary Class) mainly includes coarse screen, lifting pumping house, fine screen, sedimentation tank, Pre-sedimentation tank and other equipments, the purpose of this process is to remove heavy solids and floating materials. The principle is using physical method to separate the solid from liquid, and remove the contaminant from sewage.

2.2.1 Coarse Screen

Key equipment: Screen cleaner, screw conveyer, ultrasonic level meter.
Control points: utlize the difference of liquid level or according to technology requirements to set a time to control the screen cleaner and screw conveyer automaticlly startup and shutdown.
Sequence: conveyer and bar screen start simultaneously, and bar screen will be prior to be shut down.

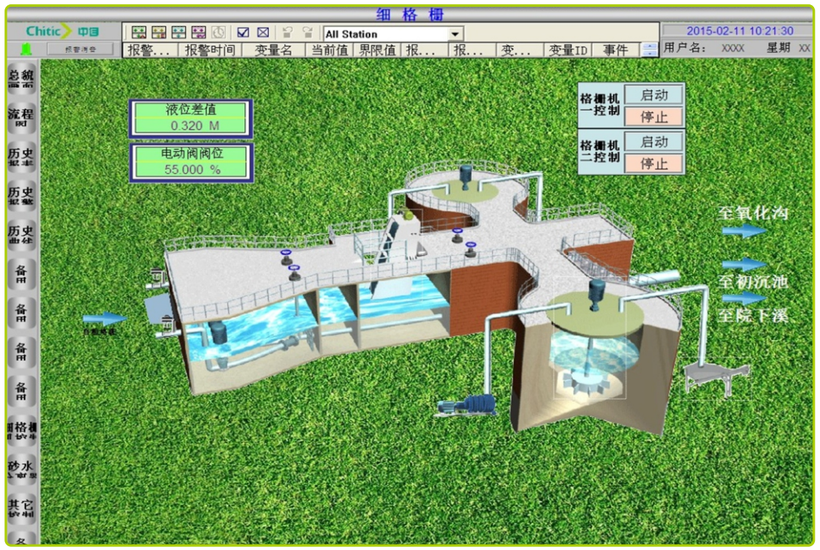
2.2.2 Inlet Pumping House

Key equipment: Submersible pump, electric gate valve, ultrasonic level meter.
Control points: depending on the depth of the incoming, the stations make use of variable-speed drives to automatic control the quantity of operated pumps and pump frequency, and it can control the pumps operate in turns which will ensure all the pumps have same operation time.
Principle: the pump make use of constant water level to control the on-off time, when the water level is below the minimal water level then the pump will automatically stop running, while when it reaches to the constant water level the pump will automatically start.



2.2.3 Fine Screens/ Aerated Grit Chamber

Key equipment: Screen cleaner, screw conveyer, rotational flow grit device, grit-water separator, ultrasonic level meter
Control points: utlize the difference of liquid level or according to technology requirements to set a time to control the fine screen bar and screw conveyer automaticlly startup and shutdown, and fine screen bar and screw conveyer are linked.
Sequence: conveyer and fine screen bar start at the same time, while bar screen will be prior to be shut down.
Rotational flow grit system operation cycle: Operation cycle of rotational grift system: Start mixer 3 hours (adjustable) or operate continuously, then turn on blower, open gas valve for 1-3 mins (adjustable) and then close it, open gas lift valve for 15-30 mins (adjustable), operate blower for 10-30 mins (adjustable), and then close them. It is one cycle. Run blower and grit-water separator simultaneously, firstly turn off the blower, then stop grit-water separator after 5-10 mins. When one device defaults, the following devices will turn off subsequently.
Flush valve is auxiliary, it can be washed by hand or center control once in a while. Grit chamber devices run in turns automatically in a set time.



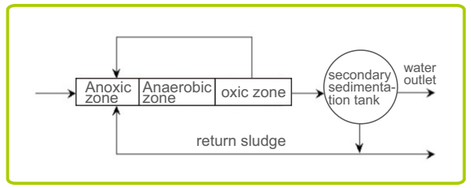
2.3 Biochemical Sewage Treatment (Secondary Class)

Bio-chemical treatment belongs to secondary treatment, the principle is: through biological action especially microbial action to dissolve organic matters and compound living organisms, to turn the organic pollutant into harmless gas (Co2), liquid matter (water) and organic solid (micro population or biological sludge); the superfluous biological sludge will separate the solids from liquid in the sedimentation tank, and be removed from the purified sewage.

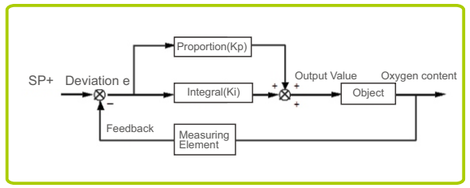
Bio-chemical treatment methods: activated sludge method, A/O, A/A/O, SBR, CASS, aerated lagoon method, oxidation ditch method, etc.

2.3.1 Anaerobic-Anoxic-Oxic

A²O is short for Anaerobic-Anoxic-Oxic, it's the abbreviation of Anaerobic-Anoxic-Oxic biological denitrification and phosphorus technology. This technology treatment efficiency can reach to: BOD5 and SS removal is 90%-95%, total nitrogen removal is above 70%, phosphorus removal is about 90%.



A²O Technology Diagram

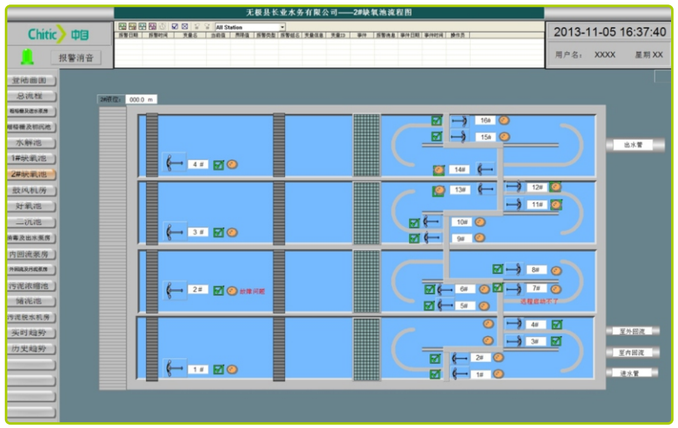


Closed-loop PID

A²O Dissolved Oxygen Control Strategy

Requirements: The dissolved oxygen content must be controlled under 0.2mg/L, for anoxic zone should be under 0.5mg/L, and for oxic zone is 2-3mg/L.

Control points: Adopt closed-loop control method to adjust DO content, automatically control DO content via feedback to maintain a set point in aeration basin. DO, as the input feedback signal regulator, compares with set point within regulator which will carry out PID calculation of deviation and show signal to adjust the operating numbers of blower, operating time, rotational speed or opening of aeration valve to control DO in aeration basin.



2.3.2 Sequencing Batch Reactor Activated Sludge Process

Domesticate certain activated sludge in reactor in advance, when sewage enter the reactor and mixed contact with activated sludge and produce oxygen, microorganism utilize organics in sewage to metabolize, degrade organism and proliferate microorganism cells , separate microorganism cells matter from water, then wastewater is treated.

The treatment process mainly include early removal and absorption, microorganism metabolism , formation and flocculation sedimentation function completion.

SBR Control Strategy

Generally operation cycle is 6 hours, that is, inflow for 1.5 hours (aeration starts after inflowing 0.75 hours). When aerating 3.75 hours, total time of precipitation and drainage is 1.5 hours. If the actual decanting time is less than 0.5 hours, then the remaining time is standby time. Because SBR process operates chronologically, move in circles, the strict time sequence control method is adopted to control SBR tank. The whole process includes five stages, which are inflow, aeration, precipitation, decanting, and idling.

2.3.3 Cyclic Activated Sludge System

CASS biological method, the abbreviation of cyclic activated sludge system, integrates reaction, precipitation, drainage and function. From the time, the degradation of pollutant is a plug-flow process, where microorganism remains on change in the cycle of oxic, anoxic and anaerobic to remove pollutant and to denitrify and remove phosphorous.

Control Strategy

The method that CASS removes organics from sewage at the stage of oxygenic aeration is nearly same as ordinary active sludge. However the difference is CASS has 4 stages, including aeration, precipitation, drainage and idling, that periodically in turn in the same CASS reaction tank. Therefore, it is unnecessary to set secondary tank and return sludge system in CASS tank and reaction stage supplies for inflow continuously.

Four Stages of CASS Operation Cycle

(1) Aeration Stage

Aeration system supplies oxygen for reaction tank, meet the need of oxygen for oxic microorganism.

(2) Sedimentation Stage

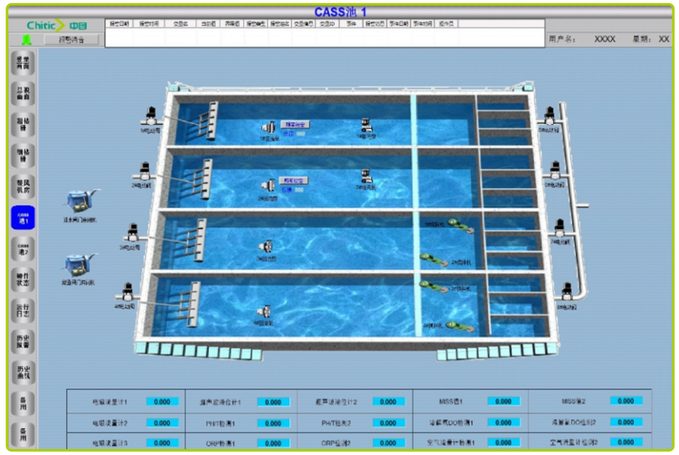
After finishing aeration, it enters into sedimentation stage. At this stage, microorganism continue to utilize DO remain in the water to degrade.

(3) Drainage Stage

After finishing sedimentation, the water decanter placed at the end of reacttion tank start to work under the control of programme, layed discharge supernate from the top down. At the same time, the DO content is very low in the sludge layer of reaction tank, but denitrification is still existed. Microorganism will further remove ammonia-nitrogen, it's beneficial to the next biochemical reaction to low ammonia-nitrogen content in the water.

(4) Idle Stage

Idle stage just lasts for a short time, that is mainly to make sure water decanter can raise to initial position at this stage, to keep off sludge leak out and to recover the activity of activate sludge .



2.3.4 Oxidation Ditch Technology

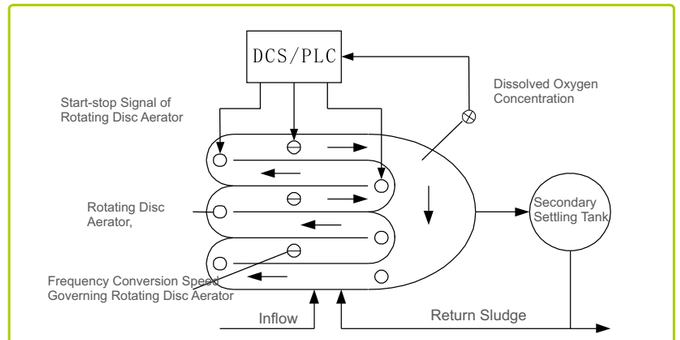
Oxidation ditch, named for closed loop ditch, is a modification of cyclic activated sludge system. Because sewage and activesludge circulate constantly in aeration ditch, hydraulic power stays long time in oxidation ditch and organic load is low. Essentially, it belongs to delayed aeration system.

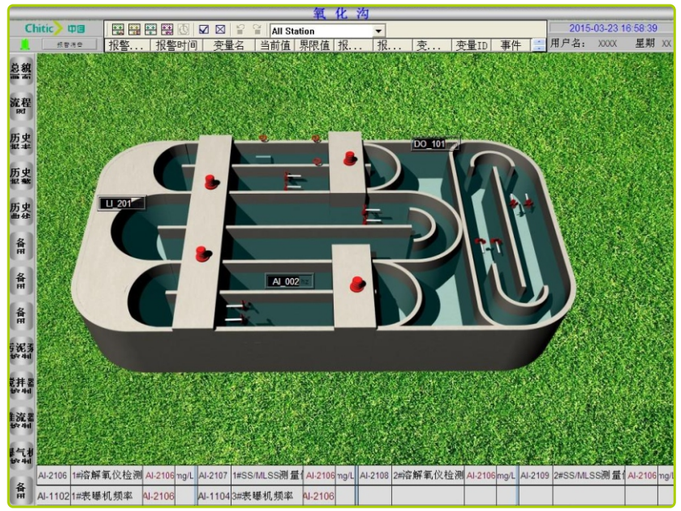
Oxidation ditch is composed of ditch, aeration equipment, water inlet and oulet device, diversing flow system and mixed devices. The shape of ditch is a loop, but it can aslo be rectangle, L shape, round or other shapes, and the end of ditch is always be retangular and trapezoidal.

Main Control Stratage

Key equipment: Surface aerator or rotating disc aerator, underwater propulsor, dissolved oxygen analyzer, sludge concentration meter.

Control points: Preprocessing detection signal of dissolved oxygen analyzer, including reliable signal.





Control Chart of DO (Dissolved Oxygen) in Oxidation Ditch

2.3.5 Biological Aerated Filters

Biological Aerated Filter (BAF) fully takes example by the technology of biological contact oxidation process and the basic design of rapid filter in water supply to integrate suppling oxygen, rapid filter and regular backwash by using special filtering medium. And it adopts different operation modes to remove organics, ss and nitrogen and phosphorus.

BAF structure is basically same as ordinary rapid filters, but it adds aeration system, and there are differences in padding between BAF and ordinary biological filter, while the used filter materials are similar. The partical size is slightly large and porosity is high, thus specific surface area is igher and specific gravity is smaller.

BAF Automation Control

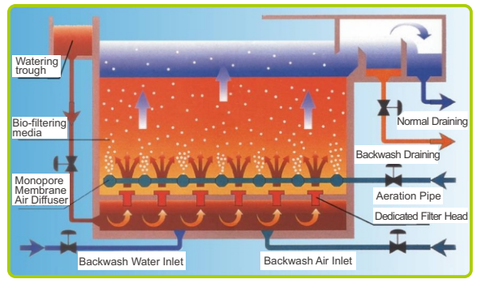
Each BAF equipped with 6 pieces manual butterfly valves and 6 pieces self-operated butterfly valves, including water inlet valve, outlet valve, aeration inlet valve, backwash air inlet valve, backwash water inlet valve, backwash drain valve, and 6 pieces aerator pipe exhaust electromagnetic valves, 6 pieces backwash exhaust electromagnetic valves, backwash inlet main valve and precipitation valve.

BAF does not only operate automatically, but can also manual control. In the situation of fully-automatic operation, each self-operated butterfly valve are fully-open. Each valve opens based on time sequence and links with backwash water pump and blower units. Also each BAF carries out backwash in time sequence

BAF control requirements:

Normal Operation Process

(1) Close backwash gas inlet valve, stop backwash blower;
(2) Close backwash water inlet valve, stop backwash water pump;
(3) Close backwash drain valve;
(4) Open water inlet valve;
(5) Open aeration inlet valve;
(6) Close aerator pipe exhaust electromagnetic valve, backwash exhaust electromagnetic valve;
(7) BAF begins to operate.



Backwash Process

BAF will carry out backwash based on time, outlet turbidity and liquid level of inlet channel. Compulsive backwash cycle is determined by operation and generally it is 24 hours. If BAF inlet and outlet liquid level reach to set point (adjustable) or outlet turbidity is greater than 15NTU (adjustable), it will operate backwash through automatic process control.

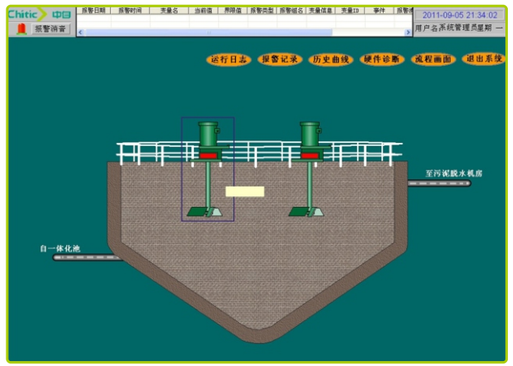
After Backwash

Open water inlet valve, aeration air inlet valve and aeration blower in sequence and turn to next cycle.

2.4 Sludge Treatment System

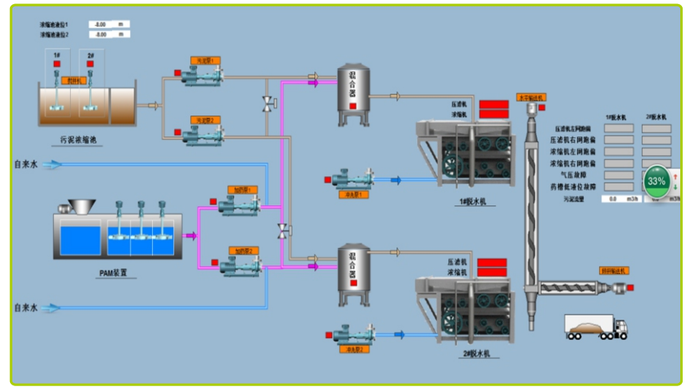
2.4.1 Sludge Storage Tank

Key equipment: blender, ultrasonic level meter
Control points: The mixer within sludge storage tank operates continuously. ultrasonic level meter is used to control switch of sludger in dewatering house and protection of low liquid level. The sludger is controlled in turns to ensure continuous operation. Once the liquid level dropped to warning position, all the pumps will be stopped.



2.4.2 Dewatering Station

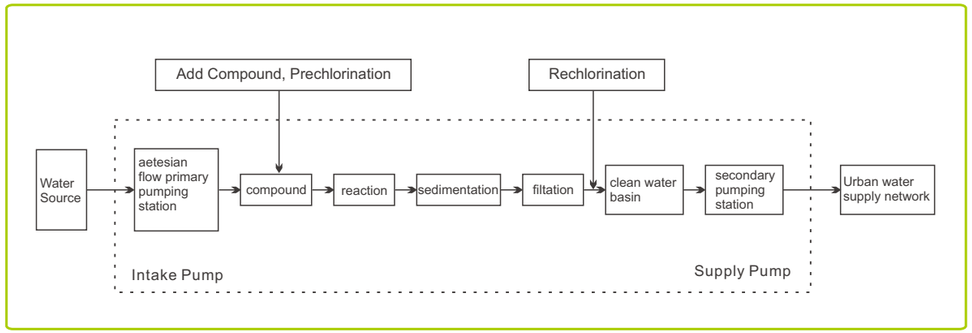
Key equipment: Dehydrator and all accessory devices
Control points: The whole dewatering system operates manually and automatically. When it operates manually, the operator starts the system through the button on the on-site control cabinet, while in the mode of self-operating, autonomous system gives out the full set of orders to start or pause. PLC in on-site control cabinet will run the equipment automatically in sequence. Also the operation status can be monitored by PC.



3.Waterworks Control Solution

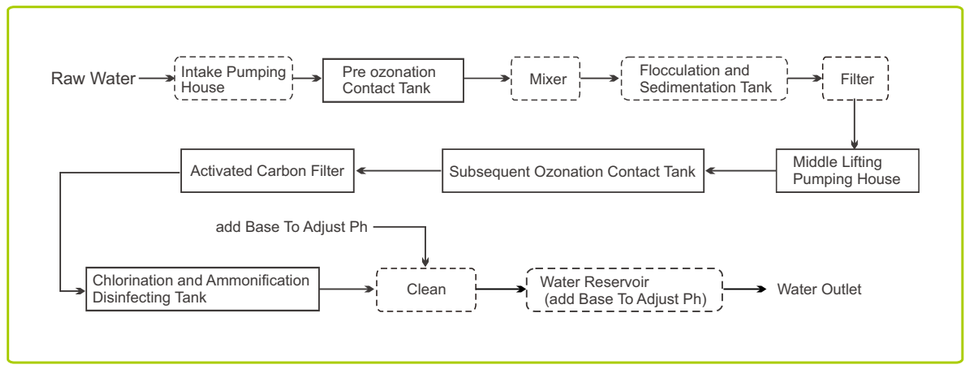
3.1 Overview

Waterworks adopt conventional process, including blend, reaction, precipitation, filtration, and sterilization.



Secondary treatment combines conventional water treatment and activated carbon adsorption. Besides conventional water treatment of dosing, coagulation, clear, and filtration, it also adopts activated carbon adsorption, to purify with chloration in depth to remove astringent, smell, taste and all organics, and finally deliver water in accordance with national standard for drinking water supply.

Secondary Treatment Chart



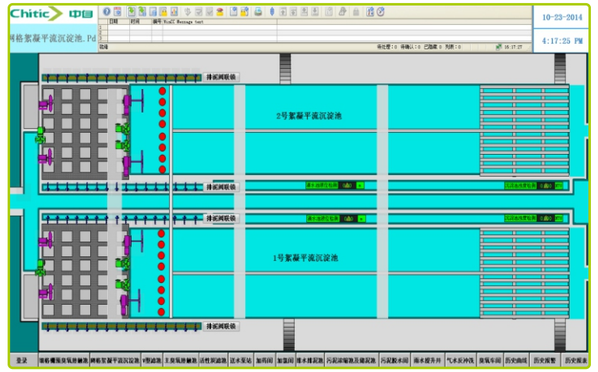
Water Pumping House

3.2 Coagulating Reaction Treatment

After lifting via intake pumping house, raw water begin to be treated by coagulation process, as below.

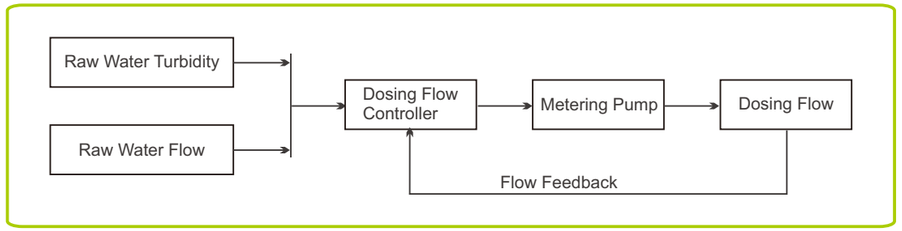
Raw Water + Water Treatment Agent →Mix→React →Aluminium Potassium Sulfate Dodecahydrate

The whole coagulation process is that agent mixes with water evenly until large-grain flocculation is formed. Poly aluminium Chloride, aluminium sulfate and ferric chloride are common water treatment agents. The mixture purpose is to disperse agents into water evenly under hydraulic, mechanical vigorous stirring. The water treated by coagulating reaction flows to sedimentation tank through pipe and then the secondary stage of purification is following.



3.2.1 Automation Control in Flocculants Dosage

Flocculants are kept in storage tank. The raw water flow is used as feed forward control input ,and the value measured by the SCD as feedback input in the control loop to control the dosage pump speed.



3.2.2 Automation Control in Filtration of Flocculation Tank

Two Types of Automation Control

Period Control: Fast open sludge valves are turned on in sequence according to preset period; the opening and closing time are adjustable.
Raw Water Turbidity Control: Control sludge discharge time according to raw water turbidity;
Period control and raw water turbidity control can be carried out at the same time or alternatively.

3.3 Sedimentation Treatment

The process that flocculation formed at coagulation stage seprate from water by gravity is called sedimentation, happened in sedimentation tank. After water flows into sedimentaion zone, covring all the space and then slowly flow out. Grain are sinked at the bottom of tank, the sludge accumulate and concentrate constanly and be discharged periodically.
Particles are deposited at the bottom of sedimentation tank, sludge constantly accumulates and concentrates and deposits at regular intervals.

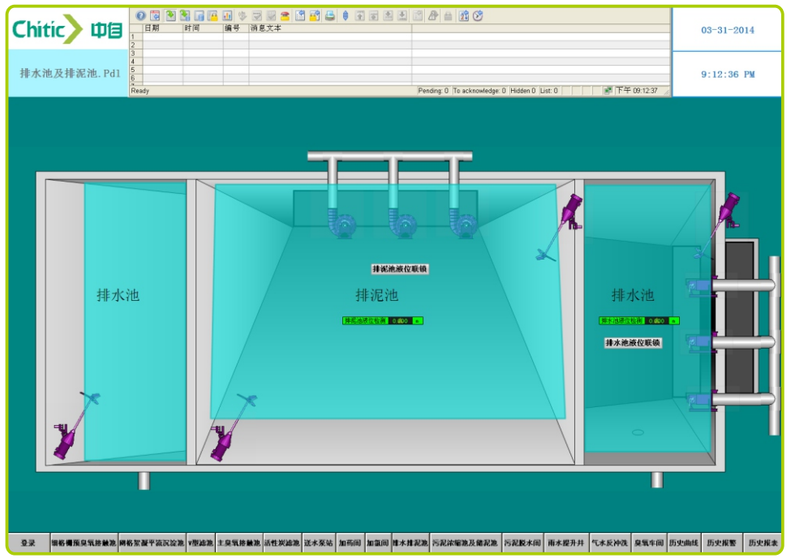
3.3.1 Automation Control in Sedimentation Treatment

Discharge Sludge Process

Operate submersible pump, close motor-driven vacuum breaker valve, open motor-driven vacuum valve and start to vacuum. When the vacuum is detected by vacuum degree reflector, the motor-driven vacuum valve needed to be closed and submersible pump should be stopped. At the moment, the mud scraper starts to automatically discharge sludge. Sludge discharging will be finished once motor-driven vacuum breaker valve is opened after stopping mud scraper. If the vacuum is detected by vacuum degree reflector, but black pipe detector shows that blank pipe still exists, that means the pipe blocked and cannot discharge sludge. At the moment, alarm will be displayed and then operator will backwash the blocked pipes based on results.

Three Types of Automation Control: Key, Linkage, Full-automation

Key: Control each equipment to test
Linkage: Divide into linked normal strike and linked reverse strike; Operators can execute through one-button to complete linked normal strike and linked reverse strike to discharge sludge.
Full automation: Mud scraper discharges sludge automatically in three stages.



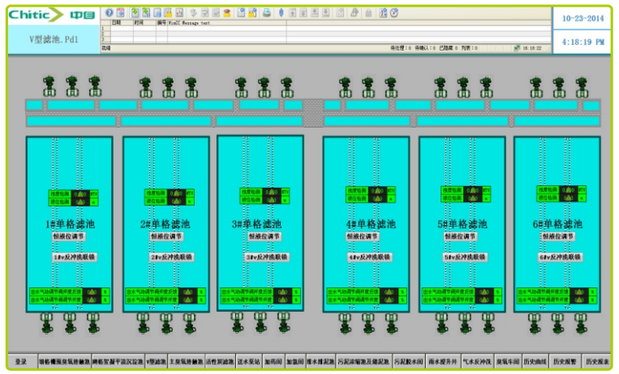
3.4 Filtration Treatment

Filtration is a process of water purification. It utilizes quartz sand and other interstitial granularity filter layer to adhere suspended particulates and further to remove slight suspended particulates, organics, germs, virus, etc.

3.4.1 V Type Filters Automation Control

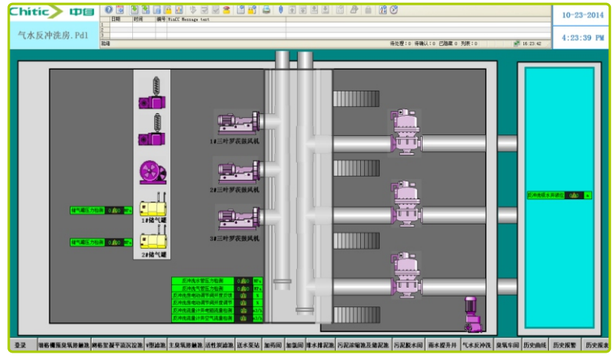
Filtration Control (Constant Water Level Adjustment)

Ultrasonic level meter and head loss sensor are installed at corresponding positions in filter chamber.In the process of filtration, the water level and head loss are tested by them, and send theses value to automatic control system. The open degree of outlet valve is controled by automatic control system to balance the outlet and inlet, so it can complete constant water level and constant filter speed automaticlly.
The opening of water outlet valve is adjusted by automatic control system to balance inlet and outlet, thus it can automatic filter by constant water level and constant filter speed.



3.4.2 Backwash Automation Control

When filtration reaches to filter cycle or water head set point, filter will back wash and control system will backwash in sequence. Once received requirements from one filter, the system will carry out the full process of backwash. If there is only one filter, it is not allowed that 2 filters back wash at the same time (if there is 2 more filters, it will be rechecked by hydraulic power). When one filter carries out backwash, the signal of other filters' backwash will be kept in control system and then the backwash will be operated in sequence.



3.5 Disinfection Treatment System

The main disinfection methods are chlorine disinfection, chlorine dioxide disinfection, sodium hypochlorite disinfection and ozone disinfection, etc.

3.5.1 Chlorination System

Pre-chlorination

The process of pre-chlorination is to add chlorine into source water based on water flow, that is, with changing of flow, the amount of chlorine can be controlled in proportion, the proportionality coefficient changes based on pre-chlorination amount and can be customized by operator on the control panel or PC.

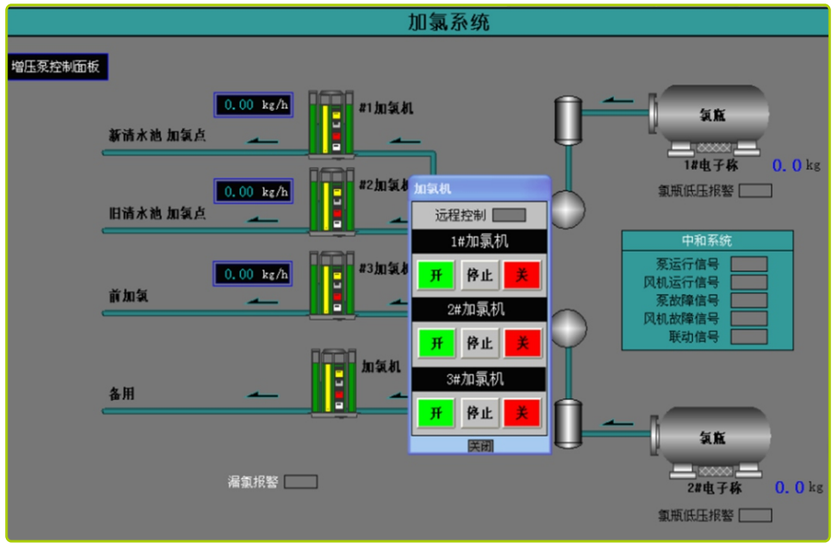
After Chlorination

It is related to qualified rate and stability of residual chlorine of water outlet. In the process of after chlorination, the target is to disinfect and keep certain residual chlorine in pipe. That takes source water flow as feedforward, make mixed free residual chlorine as feedback, and control chlorination amount by feedforward and feedback to ensure residual chlorine at the range of set point.

Supplementary Chlorination

Replenish chlorine to the end of pipe system to ensure residual chlorine amount and avoid regenerate germ, so it can be disinfected. Automatically add chlorine when residual chlorine is below standard.

When received signal of empty bottle, it will automatically switch gas path to change bottle. When chlorine leaks out, exhaust fan and chlorine absorption device will be opened. Chlorinator is standby. Evaporator can be started and stopped on the distant place or on the spot.

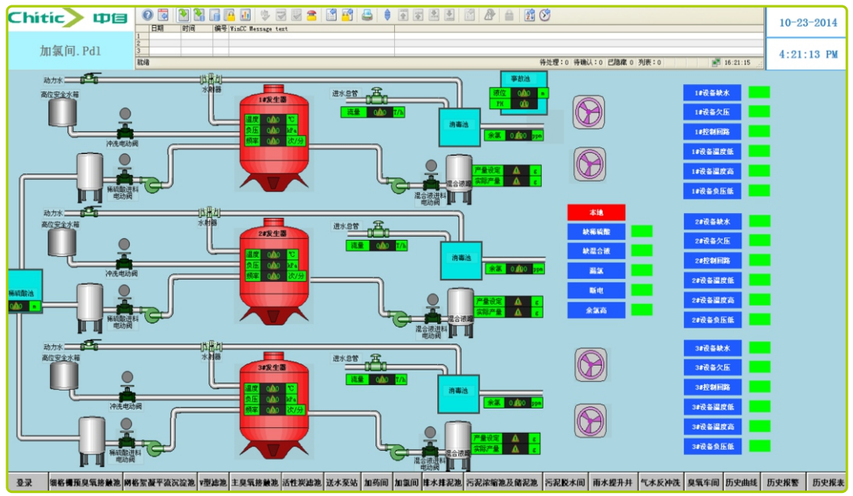


3.5.2 Chlorine Dioxide Disinfection System

The system consists of stock tank, dissolver, chlorine dioxide generator, metering pump, control system and instruments, etc.

Principle:

By absorption and osmosis, chlorine dioxide generated can pass cell body and oxidize enzyme system and bio-macromolecule in cells. That can perfectly kill germ and virus without damage to animals and plants. The bactericidal effect can lasts long time and be insensitive to PH.



3.5.3 Sodium Hypochlorite Disinfection System

Sodium hypochlorite dosing system mainly consists of reservoir, dosing system and control system. The principle is to disinfect by hypochlorous acid (HCIO) generated by hydrolysis.

Automatic sodium hypochlorite system in waterworks is usually composed of pre-chlorination, after chlorination and supplementary chlorination. The control method is similar to chlorination system.

3.5.4 Ozone Disinfection System

The principle includes direct oxidation and indirect oxidation which generates free radical and destroy structure of microorganism by oxidation. During the process of ozone disinfection, bromate, aldehyde, ketone are generated, among them, there is standard for bromate in water quality, while aldehyde, ketone and others are harmful for health, some of them will reduce the stability of organisms in pipe system. Therefore, ozone disinfection is limited to some extent.

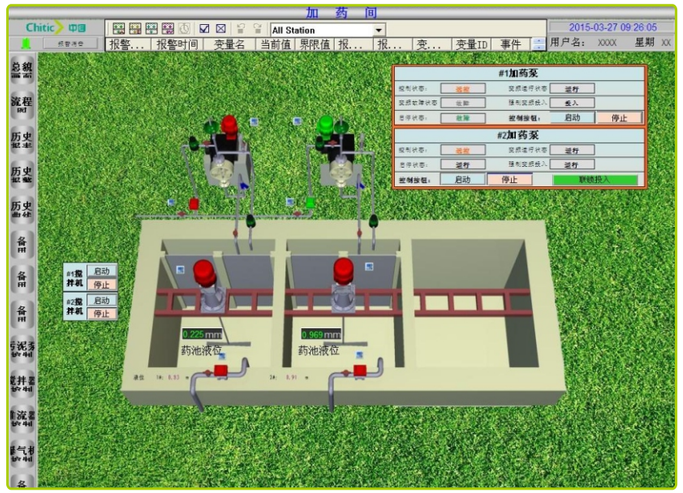
3.6 Dosing System

3.6.1 Dry Powder (Calcium Carbonate/ Activated Carbon) Dosing System

Dry powder (calcium carbonate/ activated carbon) dosing System mainly includes conveying system, storing system, delivery system, solution system, dosing system and control system, etc.

Adding Calcium Carbonate: Automatically control dosage based on water volume and concentration; Combine with tested PH to feedback and control dosage.

Add Activated Carbon: Automatically control dosage based on water volume and concentration; Combine with tested permanganate value to feedback and control dosage.



3.6.2 Poly Aluminum Chloride (PAC) System with Vitriol

(PAC) System mainly include chemical solution system, dosing system, security system and control system, etc.
Control Point: Control adding alum based on raw water volume, the proportion can be adjusted, or control dosage according to set point

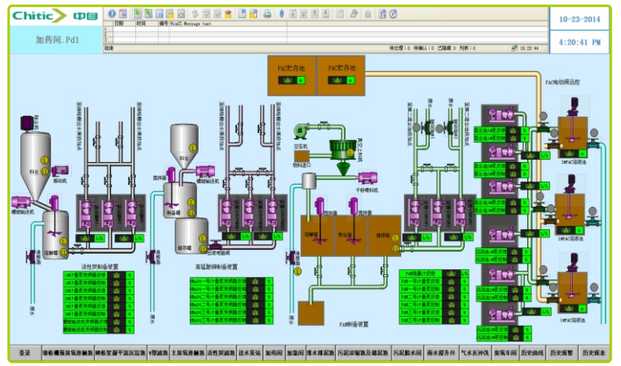
In preliminary stage, vitriol dosage can be feedforward controlled on the basis of multiple parameters, such as inlet flow, raw water turbidity, raw water temperature, raw water PH value, etc. Long-term control is to combine statistical analysis of water turbidity and other parameters in sedimentation tank and control experience to confirm fuzzy control rules which control the dosage, form expert system library. It is a way to improve control level and accuracy.

3.6.3 Flocculants PAM Preparation System

Poly acrylamide shorts for PAM. The system is a device to use chemical solution that dissolves dry powder and water. Powdery drug in hopper will be delivered to mixer by constant feed, be completely mixed with water then flowed to solution tank. The intermixture will stir to uniform solution, will be flow to liquid storage tank and will be dosed finally.
Control Points: Dissolve and mix automatically by adding water based on setting density. That mainly controls inlet flow and stirring. As it takes certain time for PAM to cure, there would be several time left when continuous allocation.
Based on raw water flow and setting proportion parameters, automatically control frequency of dosing pump can ensure water quality reach to standard.

3.6.4 Potassium Permanganate Preparation and Dosing System

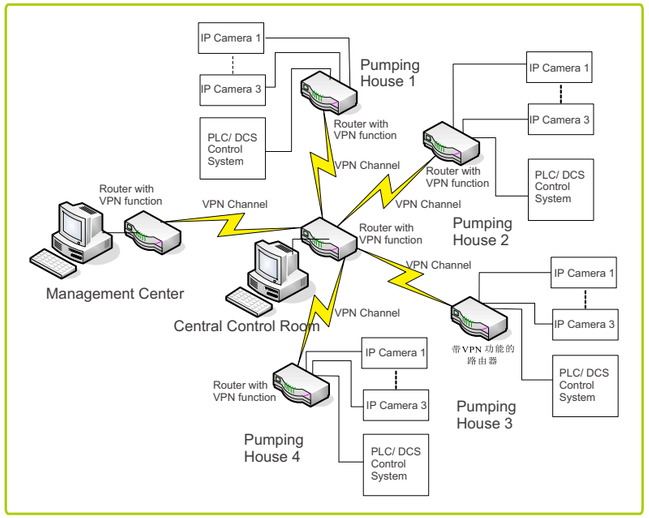
The system mainly consists of conveying system, water preparation system, dissolution and storage system, dosing system and control system. Conveying system includes screw conveyor, VLG, bunker and hopper, level meter, and others. Water preparation system mainly includes preparation tank, mixer, level meter and valve. Dosing system includes metering pump, absorber, back-pressure check valve and safety valve, etc.
Control Points: Dissolve and mix automatically by adding water based on setting density. That mainly controls inlet flow and stirring. Based on raw water flow and setting proportion parameters, automatically control frequency of dosing pump can ensure water quality reach to standard.



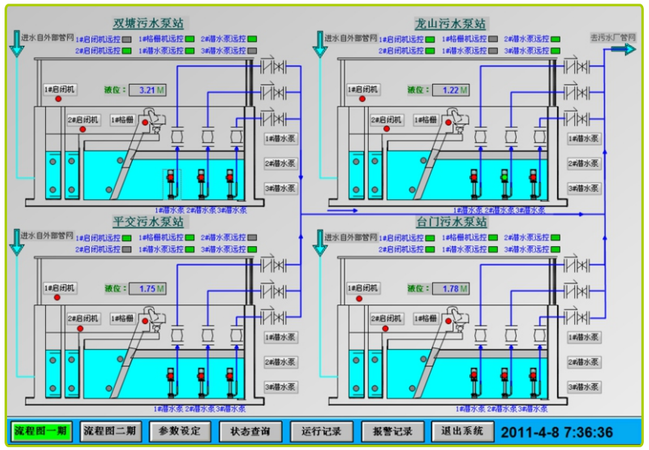
Process of Dosing Room

4.Pumping House Control Solution

Control solutions are divided into remote PLC/DCS monitor and webcam system. They share external network system but internal control is independent. Each pumping house establishes VPN connection using one router with VPN and router in central control room. That forms a network through connecting PLC/DCS, camera system and router in pumping house. In the network, central control room, as a VPN server, can connect with multiple remote Client to establish VPN connection, where remote pumping house and router in management center conduct as VPN Client to establish connection with remote VPN server. Only VPN established through several routers can perform communication.



System Network Chart



Process picture

5.Operation Monitoring Management System

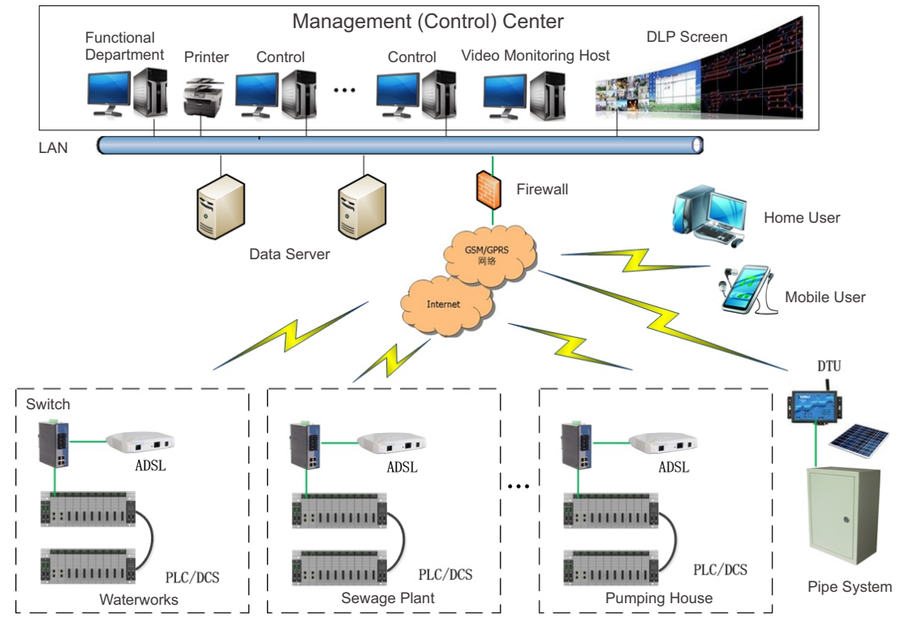
5.1 Overview

Due to long distance between each waterworks and pumping house, wide range of distribution and dispersed location, it is imperative to adopt advanced computer information technology, software engineering, communication technology and automation control in order to get real-time operation information of waterworks, pumping house and pipe system and to further improve modern management level. Build operation data of waterworks, pumping house and pipe system to real-time collect, analysis and management platform. Also video monitor system has been brought into management platform to complete modern monitoring of operation status of waterworks, pumping house and pipe system.

The system consists of software integration and network transmission platform. Real-time database server of control center carries out communication and collection with each pumping house and waterworks through on-site installation of software with special data exchange method and effectively integrates data. It aims at turning real-time, historical and comprehensive data into schedule information, providing decision basis for management after analysis. And professional operators control each system according to relevant information to achieve integration of monitoring, management and control.

5.2 System Configuration

The whole system is divided into three layers, including control (management) center, network, and plant (station, pipe system) monitoring center.



5.2.1 Plant (Station, Pipe System) Monitoring Center

Plant (station, pipe system) monitoring Center: Set DCS/PLC as core unit to control equipment and process parameters of each pumping house, waterworks and pipe system. They focus on different network environment, software and hardware environment.

Water Treatment Plant

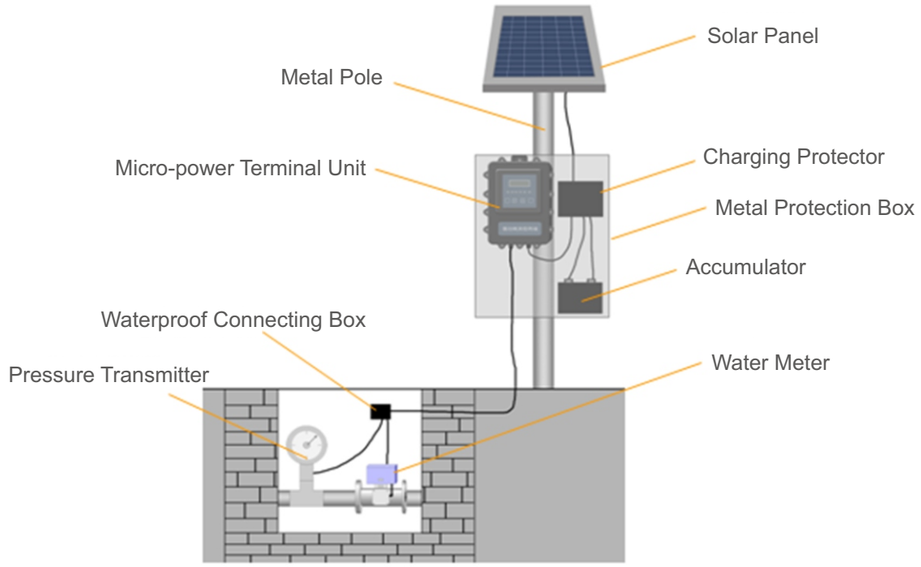
Collect data that gathered from monitoring computer in waterworks or IO data of each waterworks and uploaded to servers from current configuration software by OPC. Configuration software get real-time data and send directly to industrial database of control center to store data.

Pumping Station

Configuration software collects and controls data of process, electrical parameters, operation status and alarm display. The software uploads real-time data to industrial database of control center and guarantees data integrity by data-cashing mechanism.

Pipe Network

Pipe data generally includes pressure, temperature and flow of pipeline, which has been uploaded directly to real-time monitoring system and industrial database of control center. Some of pipe monitoring site is remote and cannot connect to electric. It is considered to adopt low-power consumption module and the power supply mode of accumulator and solar energy as below:



5.2.2 Network

The network mostly adopts VPN, that is, Virtual Private Network. VPN is a service that users feel like it connects directly with their own network, but in fact it connects through service providers.

According to different project requirements and geographic position of detected objects, the network mainly includes two types, which are wired network and wireless network. If possible, wired communicate would be better to adopt, while for communication point, which is with long distance and few data, like pipe network, it is recommended to use GPRS/CDMA/3G.

5.2.3 Control (Management) Center

Based on different functions, the system is divided into two parts, which are real-time monitoring system and historical data analysis system.

Real-time Monitoring System

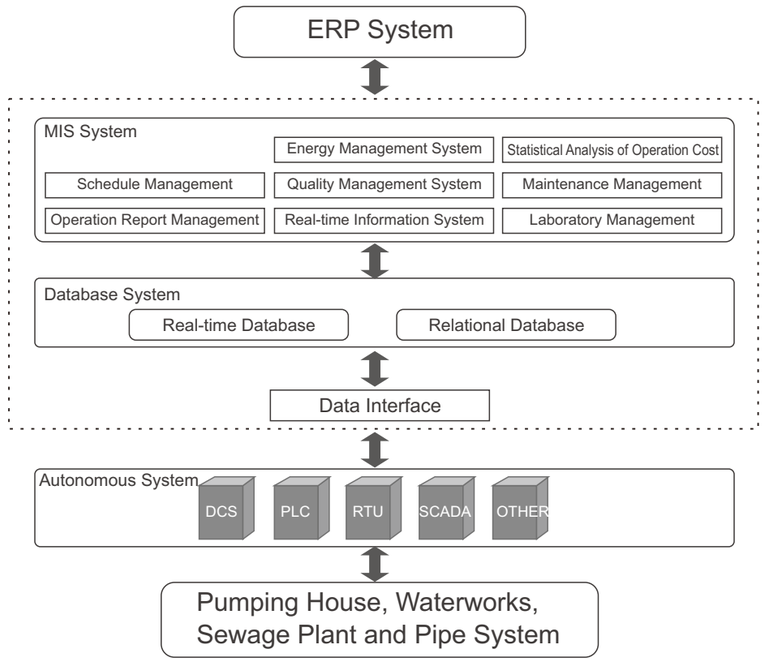
It consists of engineer station and operator station that are used to remote monitor all waterworks, pumping house, sludge disposal plant and pipe system. There are multiple functions, such as real-time animation to show each process and equipment status, visual real-time data curve, data report, real-time alarm display and event query.

Historic Data Analysis Scheduling System

Taking redundant industrial database as center, the system adds two pieces of redundant real-time data server to management network and then store data to database after receiving, compressing, calculating and analyzing the data of control system to provide historical data and real-time data query to other users.

Remote Browsing

Use WEB SERVER to release data via webpage. The user can be authorized to get access to control system by IE browser, whether using internal network or Internet.



6.Chitic Automation Products

Chitic has developed own-label control systems, includeing TDCS9200, PCS1800 AND CTS700, among them, TDCS9200 has been applied in water treatment industry for many years and there are 50 more successful cases, while PCS1800 is customized for small I/O station, pumping house, pipe system monitoring, and water projects and is a DCS with PLC architecture.

6.1 TDCS9200 Distributed Control System

The system integrates sophisticated electronic technology, computer technology, communication technology, automation technology, default diagnosing technology, reliability design and software platform technology. That is reliable, powerful, easy to maintain and cost-effective

High reliability

◆ Module Intelligent Control, decentralized control, distributed process, and coordinate;
◆ Power supply, network, control, I/O arbitrary 1:1 redundant;
◆ Module self-diagnosis, self-recovery, default isolation and hot-plugging;
◆ Complete isolation, full power distribution, universal signal input;
◆ Each signal adopts independent DC/DC power supply module to isolate power and signal.

Flexible and Open

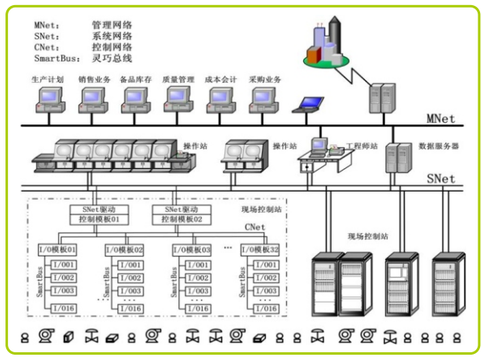
◆ Entirely base on network; Equipped with expansion structure of Client/Server;
◆ Support ActiveX, OPC, ODBC; Open design;
◆ Be accordance with IEC61131-1 standard language, include functional bloack diagram FBD, ladder diagram LD, structured text ST, etc.Conform to IEC61131-3, including FBD, LD and ST.

Easy maintance

◆ Modular structure, standard inter-connected cabinet, be convenient to expand and upgrade system;
◆ Online diagnose default, find out fault point automatically, hot-plugging module and recover online;
◆ Analog input adopts universal input card, multi-functional, fewer types, easy to maintain;
◆ Analog input types and digital input mode can be set by software, convenient to select, easy to modify.

Highly cost effective

◆ I/O minimal unit is point; equipped by point, the maintance cost is low;
◆ Analog input adopts universal input card, fewer spare parts needed;
◆ Provide high cost performance products for customer based on reliable quality, professional service and perfect training.



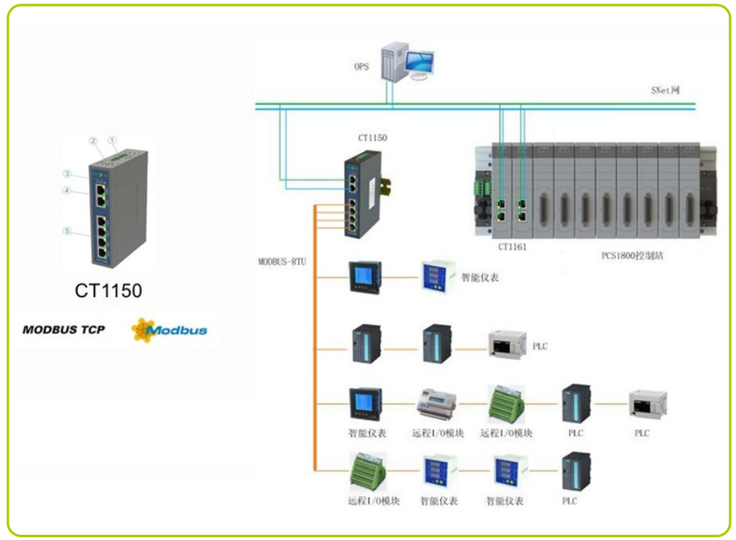
System Network Chart

6.2 PCS1800 Distributed Control System

PCS1800 distributed control system, installed based on cabinet, is a small and medium control system with 8/16 channels, high performance, small size and quick installation. The system adopts simple, easy to use, professional industrial control software, it can help users to handle series of small and middle scale applications cost-effectively. PCS1900 distributed control system is DCS based on PLC structure.

System Characteristic

◆ Power supply, 1:1 redundancy for network and control, online hot-plugging module, LED display
◆ Small size, modular design;
◆ Small scale, low power consumption, no fan free thermal convection design, easy to install
◆ Install with rail mounting cabinet, Mbus with backplane structure, support hot-plugging module, easy to maintain online
◆ Anti-corrosion, be adaptable to extreme environment;
◆ Fully-integrated 8/16 channel modular design, fewer spare parts
◆ Special cable and terminal units, easy to install and fast delivery
◆ Easy to extend, with multiple open interface
◆ Support various third party communication protocol: Modbus TCP, Modbus RTU, OPC, Profibus, etc.

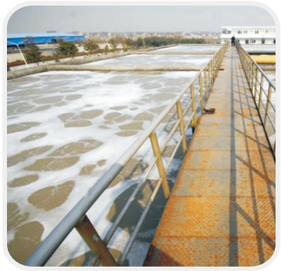


System Network Chart

7.Projects

Item No.	Clients	Projects
1	Hunan Yongzhou Xiahe Wastewater Treatment Plant	150,000 ton/day integrated sewage treatment autonomous system
2	Shengzhou Junji Advanced Wastewater Treatment Co., Ltd.	150,000 ton/day Sewage treatment upgrading and reconstruction automatic control system
3	Luohe Shanan Wastewater Treatment Plant	130,000Ton/Day wastewater reclaimed water reuse automatic control project
4	Shisi Urban Sewage Treatment Plant	100,000 ton/day wastewater treatment instrument and autonomous system
5	Heilongjiang Qitaihe Wastewater Treatment Plant	100,000 ton/day wastewater treatment and reclaimed water autonomous system
6	Jiangsu Taixing Wastewater Treatment Plant	100,000 ton/day wastewater treatment autonomous system
7	Chendu Qingbaijiang Wastewater Treatment Plant	100,000 ton/day wastewater treatment instrument autonomous system
8	Taizhou Huangyan Beikong Wastewater Purification Co., Ltd.	80,000 ton/day Jiangkou Wastewater Treatment Plant autonomous system
9	Henan Zhoukou Shanan Sewage Plant	80,000 ton/day sewage treatment autonomous system
10	Haining Ziguang Water Co., Ltd.	80,000 ton/day sewage treatment autonomous system
11	Sewage Treatment Co., Ltd. in Liuyang Biomedical Park	80,000 ton/day wastewater treatment instrument, electric and autonomous system
12	Wuji Changxing Water Co., Ltd.	80,000 ton/day integrated sewage treatment plant autonomous system
13	Leqing (Panshi) Sewage Treatment Plant	80,000 ton/day sewage treatment expansion, upgrading and reconstruction project
14	Huzhou Fenghuang Sewage Treatment Plant	75,000 ton/day upgrading and reconstruction of autonomous instrument
15	Kunshan Huaqiao Sewage Treatment Plant	62,500 ton/day sewage treatment autonomous project
16	Xiaoxian Sewage Treatment Plant	60,000 ton/day sewage treatment instrument and autonomous system
17	Cangnan Hebin Sewage Treatment Co., Ltd	60,000 ton/day sewage treatment instrument and autonomous system
18	Wuyi Sewage Treatment Plant	50,000 ton/day sewage treatment instrument and autonomous system
19	Liyang Secondary Sewage Treatment Plant	50,000 ton/day sewage treatment instrument, video and autonomous system
20	Jinan Hi-tech Wastewater Treatment Plant	50,000 ton/day sewage treatment instrument and autonomous system
21	Fuzhou Fucun Sewage Treatment Plant	50,000 ton/day sewage treatment instrument and autonomous system
22	Weigang Fangzi Sewage Treatment Plant	50,000 ton/day integrated sewage treatment system
23	Kunshan Wusong Sewage Treatment Plant	50,000 ton/day wastewater treatment autonomous system
24	Kunshan Zhangpu Sewage Treatment Plant	50,000 ton/day wastewater treatment autonomous system
25	Quanzhou East Sewage Treatment Plant	45,000 ton/day Sewage integrated treatment autonomous system
26	Hebei Hengshuijing Sewage Treatment Plant	40,000 ton/day wastewater treatment autonomous system
27	Guangxi Yizhou Sewage Treatment Plant	40,000 ton/day wastewater treatment autonomous system
28	Anhui Chizhou Sewage Treatment Plant	40,000 ton/day wastewater treatment autonomous system
29	Fujian Dehua Sewage Treatment Plant	440,000 ton/day integrated wastewater treatment autonomous system
30	Hebei Gucheng Sewage Treatment Plant	30,000 ton/day wastewater treatment autonomous system
31	Nanping Nanzhuang Sewage Treatment Plant	30,000 ton/day integrated wastewater treatment and pump house autonomous system
32	North Hubei Sewage Treatment Plant	30,000 ton/day upgrading and reconstruction of autonomous instrument
33	Lianyungang Xuwei Sewage Treatment Plant	30,000 ton/day sewage treatment instrument and autonomous system
34	Jiangsu South Tongzhou Sewage Treatment Plant	25,000 ton/day integrated sewage treatment project
35	Hebei South Shenze Sewage Treatment Plant	25,000 ton/day engineering autonomous system and instrument
36	Guangxi Xingye Sewage Treatment Plant	20,000 ton/day sewage treatment autonomous system
37	Hunan Huayuan Sewage Treatment Plant	20,000 ton/day sewage treatment TV monitoring and automatic contorl system
38	Taicang Jiangcheng Urban Sewage Treatment Co., Ltd	20,000 ton/day sewage instrument and autonomous system
39	Zhejiang Chun'an Nanshan Sewage Plant	20,000 ton/day integrated sewage treatment
40	Xiamen Water Group Co., Ltd.	10,000 ton/day Aotou autonomous system of Sewage Treatment
41	Nan'an Electroplating Control Center	4,300 ton/day electroplating sewage treatment and integrated reclaimed water reuse system
42	Jinjiang Huamao Electroplating Control Center	6,000 ton/day electroplating wastewater treatment and electricity reuse, instrument and autonomous projects
43	Zhoushan Liuheng Water Co., Ltd.	Pump house and video monitoring system
44	Zhoushan Huangyan Municipal Administration	Automatic control of rainwater pump house and equipment engineering
45	Changle Urban Sewage Treatment Plant	Control system of sewage pump house upgrading and construction
46	Xiamen Water Group Co., Ltd.	Automation Control Project of Sewage Interception Pump House
47	Taizhou Huangyan Ningxi Pepple's Government	Equipment engineering project of North Ningxi sewage pump house
48	Taicang Water Treatment Co., Ltd.	200,000Ton/Day South Suburbs Water Plant autonomous system, chlorination equipment
49	Fuzhou Chengmen Waterworks	10,000 ton/day integrated waterworks automatic control
50	Shifang Third Waterwork	80,000 ton/day waterwork instrument, autonomous system
51	Baoying Yuehai Water Co., Ltd,	13,000 ton/day waterwork instrument, video and autonomous system
52	Lianyungang Lianhua Water Co., Ltd.	60,000 ton/day electric power, instrument and autonomous system in waterworks
53	Wuping Tianquan Water Co., Ltd.	60,000 ton/day automation system of Wuping Secondary Waterwork
54	Liyang Water Co., Ltd.	50,000 ton/day waterwork autonomous system
55	Zaozhuang Jiangyuan Water Supply Secondary Waterworks	50,000 ton/day waterwork instrument and autonomous system
56	Shanghai Yatong Environmental Protection Co., Ltd.	50,000 ton/day water supply automatic control equipment of pesticide industry base
57	Xinghua Tap Water General Company	Waterworks integrated autonomous system
58	Fuzhou Nangang Water Co., Ltd.	30,000 ton/day automation control system

Item No.	Clients	Projects
59	Zhangzhou Dongshan Secondary Waterwork	25,000 ton/day automatic control of waterworks and dosing equipment
60	China Three Gorges Corporation	Automatic control of right bank of Xiluodu hydropower station drinking water plant, electrical projects
61	Wuping Tianquan Water Co., Ltd.	Automatic reconstruction project of Wuping Primary Waterworks
62	Pinghu Water Co., Ltd.	Sludge dewatering automatic control projects of Guhengqiao Waterworks
63	Set Equipment Manufacturing Co., Ltd. of CHINT Group	Dodoma water supply autonomous system
64	Cixi Water General Company	Automatic control of water supply pump, instrument, and chlorination equipment
65	Hangzhou Water Group Co., Ltd,	Automatic control and security system of Longwu Three Pump House
66	Changde Taohuayuan Waterworks	30,000 ton waterwork instrument and autonomous system
67	Peng'an Water Resources Development Co., Ltd.	Rural drinking water security projects (Jingu water supply project)
68	Xiamen Municipal Construction Co., Ltd.	Automation monitoring system of Guanxun Xishui sluice
69	Shaoxing Tang Sluice Administration	Real-time figure and sound display projects of Shaoxing Binhai Sluice
70	Flood diversion emergency Engineering Control Station of Yongjia Santang Water Pipeline	Integrated automatic system of drainage emergency
71	Pinghu Water Investment Co., Ltd.	Automatic control system and hydrologic monitoring of polder areas
72	Yongjia North Oujiang Flood Control Dyke Construction Headquarters	Integrated Automatic System of North Oujiang flood control dyke
73	Armenia YEREVAN Hydropower Station	Hydropower station monitoring system and protection system
74	Fenghua Anlan Construction & Development Co., Ltd.	Automatic system of Yongjiang flood control engineer
75	Cangnan Water Resouces & Electric Power Investment Co., Ltd.	Automatic system of Cangnan Pacao Dyke Reinforcement



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