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GOOGOLTECH

GEM Intelligent Controller
Product Introduction and Application

18 June 2020, V1.2

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1

GEM Intelligent Controller Introduction

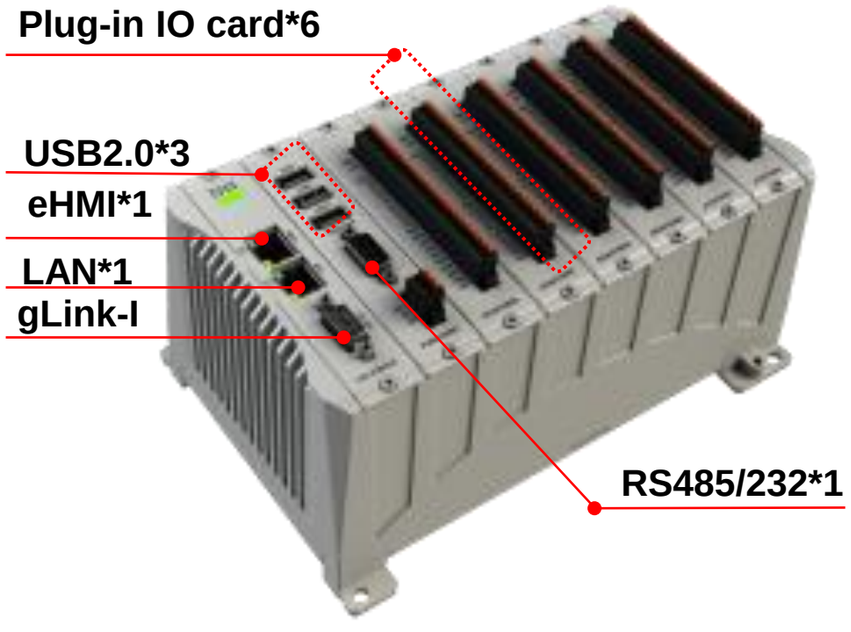
GEM Intelligent Controller

GEM-RT26**

1. High density IO modularized design, **can be combined based on demand;**
2. Multiple cards module IO from slave station nodes are connected to FPGA/CPLD directly to implement data interchange; multiple modules can share power, communication, and control in a slave station to **reduce cost;**
3. Card module is of bare board; multiple modules can share 1 set of shell in a slave station;

Simple structure ;

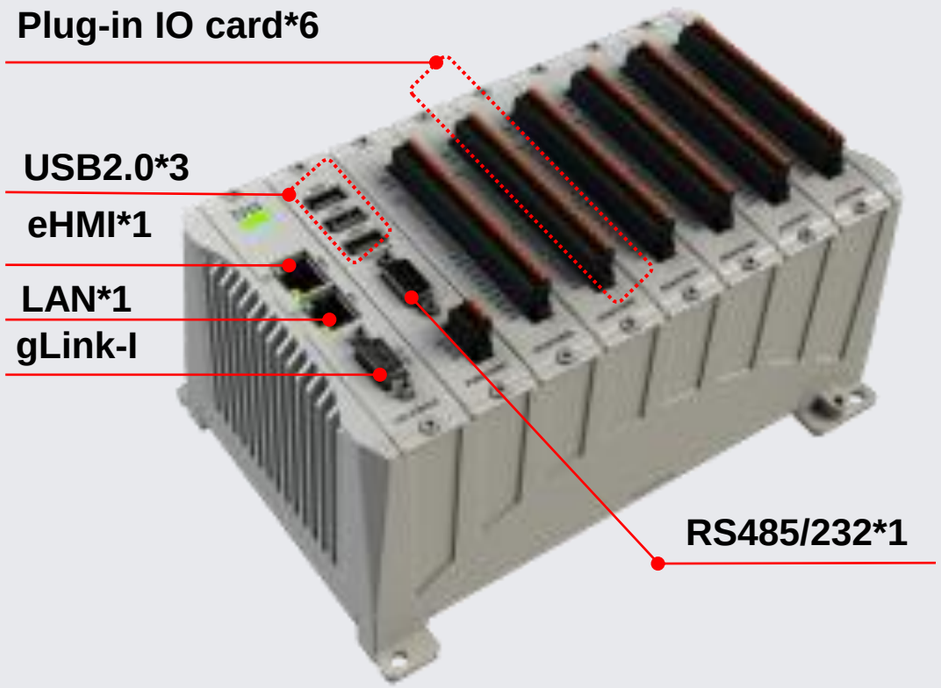
4. All the IOs in the same station point are connected directly to FPGA/CPLD; data can be interchanged among stations by selecting communication modules with different protocols and rate, thus the data bandwidth from all the nodes to CPU is adequate;
5. About 60% is the cost that is proportional to the number of IOs, such as the MOS chip of each channel of DO, optocoupler, connector, LED, etc.; Other 40% is the cost that is basically not related to number of IOs, such as shell of gLink200 module, communication circuit, power supply, CPLD, communication cable, etc. The cost of this portion is apportioned to each IO point; the more the IOs, the lower the cost.
6. **Development difficulty is reduced, development cycle is shortened, product line is improved**



GEM Intelligent Controller

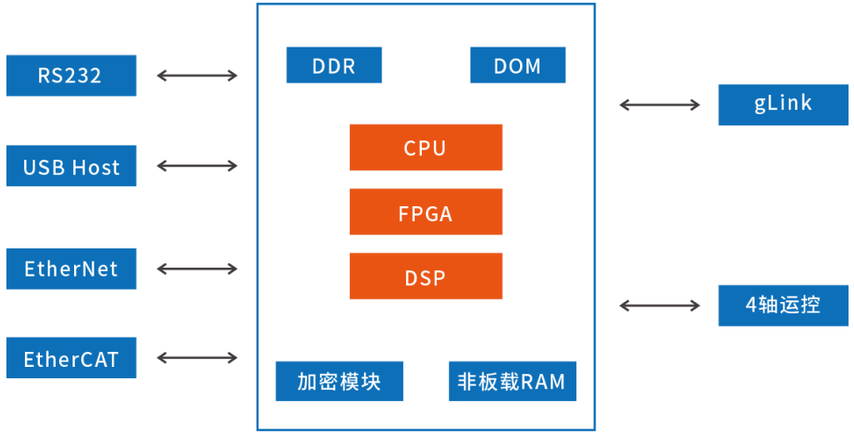
GEM-RT26**

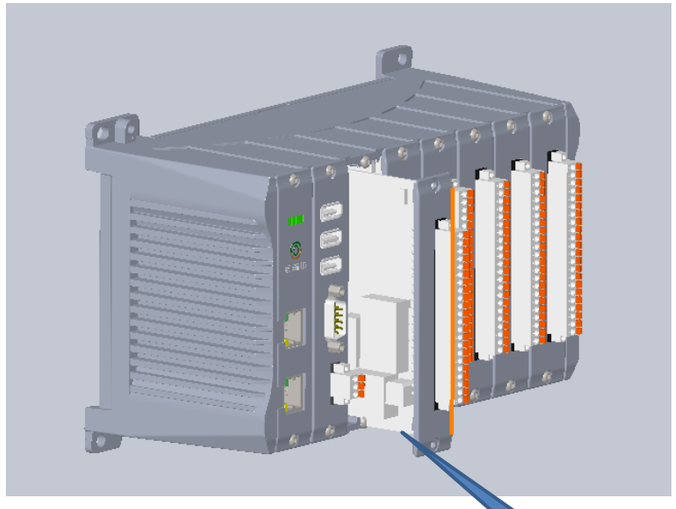
1. Body is precisely casted with aluminum, fanless design, maintenance free;
2. Abundant interface: USB, RS485, LAN, eHMI, gLink, etc.;
3. OtoStudio development platform which satisfies international recognized IEC61131-3 industry control language standard;
4. Windows CE (licensed software) OS, built-in encrypted chip;
5. Built-in watchdog to prevent system from falling into endless loops due to interference of external electromagnetic field
6. Flexible IO module configuration, one console support up to 96 channels IO; industrial grade connectors to facilitate quick integration, maintenance and repair;
7. **gLink-I can extend up to 32 IO (500 Protocol) modules**
8. Hardware adopts precise electronic components that are widely used in aerospace, automobile, and are resistant to interference;



Controller Hardware Architecture

- Adopts CPU + DSP + FPGA 3-core structure to ensure real-time, high speed, and high precision control of the system
- CPU is responsible for task scheduling, EtherNet, RS232,USB,HMI and other communication tasks
- DSP is responsible for motion control algorithm
- FPGA is responsible for I/O control gLink hardware realization

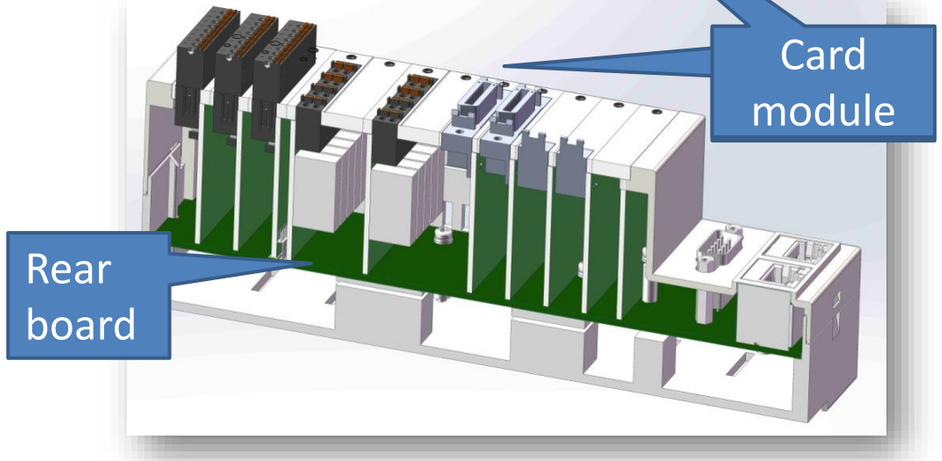




gLink-I 500 Protocol Bus

gLink bus is the rear board bus developed by Googol Technology, it targets high speed communication bus for PLC IO extension application

- Bidirectional transmission rate up to 6.25Mbps
- Can connects 32 IO modules and extends up to 2048 points
- Automatic identifies IO module address, no need for hardware DIP switch setting
- Distance between extension module stations is less than 100m; maximum communication distance is less than 1km
- Daisy chain topology; wiring is convenient and simple, all the modules can be managed intensively
- Passes CRC (Cyclic Redundancy Check) and ARQ (Automatic Repeat Request System) to ensure accuracy of data transmission; supports breakpoint debugging and positioning



GEM Intelligent Controller Configuration

Function unit	Description	Technical index
PC performance	CPU	800MHz or above
	RAM	512MB
	DOM	4 GB
	OS	Win CE 6.0
Power supply specification	21-28V DC, 300mA (excludes general output load current); IO24V/0V DC	
Miscellaneous	Storing temperature	-40℃～+70℃
	Operating temperature	-25℃～+55℃
	Protection class	IP30
	Operating environment	Indoor, free from direct sunlight, dust, corrosive gas, flammable gas, oil, water vapor dripping or salt, etc.
	Relative humidity	Less than 90%RH, non-condensing
	Dimension (L*W*H):MM	221.4*147.2*113.5

	Illustration
GEM-RT2602	4 digital IO module card slots, 2 analog IO card slots, no extension IO
GEM-RT2603	6 digital IO module card slots, no extension IO
GEM-RT2604	5 digital IO module card slots, 1 analog IO slot, no extension IO
GEM-RT2605	4 digital IO module card slots, 2 analog IO module card slots, gLink-I extension IO
GEM-RT2606	6 digital IO module card slots, gLink-I extension IO
GEM-RT2607	5 digital IO module card slots, 1 analog IO card slot, gLink-I extension IO

Accessories Model Selection

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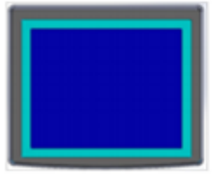
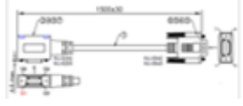
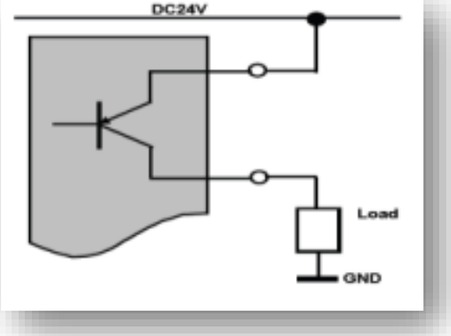
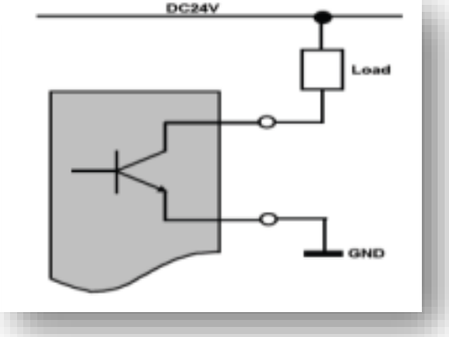
名称 Name	订货号 Model	说明 Description	产品图 Photo
Digital IO module (card type)	CEDX-0808-DTD01	8 in 8 out, transistor drain output	
	CDX-0808-DRA01	8 in 8 out, relay FORM A output	
Analog IO module (card type)	CEDX-0404-A1201	4 in 4 out, 12-bit precision, voltage input range: ±10V; current input range: 0mA~20mA, 4mA~20mA, ±20mA	
Digital extension IO module (transistor output)	HCB5-1616-DTD01	16 in 16 out, input active low drain output	
	HCB5-1616-DTS01	16 in 16 out, input active high/low selectable, source output	
	HCB5-3200-DXX01	32 in no out, input active high/low selectable	
Digital extension IO module (relay output)	HCB5-1610-DRA01	16 in 10 out, input active high/low selectable, first 2 channles transistor source output, last 8 channels normally open relay	
Analog extension IO module	HCB5-0604-A1201	6 in 4 out, I/O resolution 12 bits; I/O support voltage mode, current mode; I/O voltage range: 0-5V, 0-10V, ±10V; I/O current range: 0-20mA, 4-20mA	
	HCB5-0606-A1201	6 in 6 out, I/O resolution 12 bits; I/O support voltage mode, current mode; I/O voltage range: 0-5V, 0-10V, ±5V, ±10V; I/O current range: 0-20mA, 4-20mA	

Panel HMI	GTC-TP-03A (standard)	7-inch metal shell touch screen, resolution 800*480	
	GTC-TP-04A	10-inch metal shell touch screen, resolution 800*600	
	GTC-TP-02A	12-inch metal shell touch screen, resolution 800*600	
	GTC-TP-01A	15-inch metal shell touch screen, resolution 1024*768	
Ethernet HMI cable	CABLE-eHMI/RJ45-RJ45-*m (standard)	Connection cable between controller and panel, CAT5e Ethernet cable, selectable length 3m/5m/10m	
	CABLE-eHMI/RJ45-DB9F-*m	Connection cable between controller and panel, CAT5e Ethernet cable, selectable length 3m/5m/10m	
gLink module communication cable	gLink-I/DB9M-DB9F-*m	gLink module communication cable for extension IO module, selectable length 0.3m/1.5m	

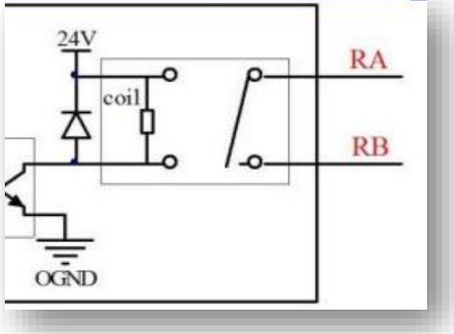
■ PMOS



■ NMOS



■ Relay output 2A



Dimension Drawing

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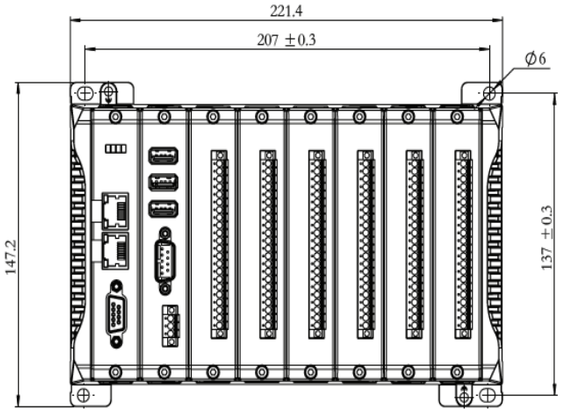
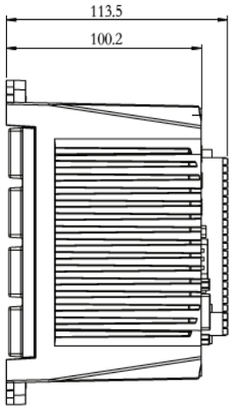
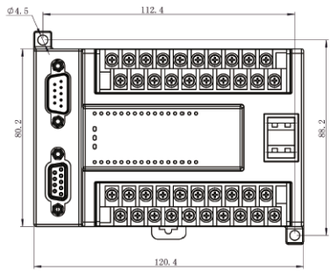
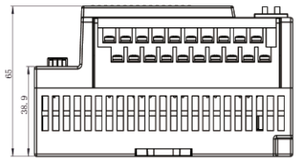
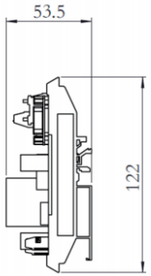
■ Unit: mm

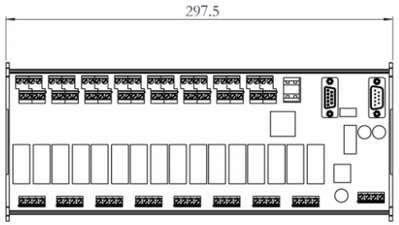






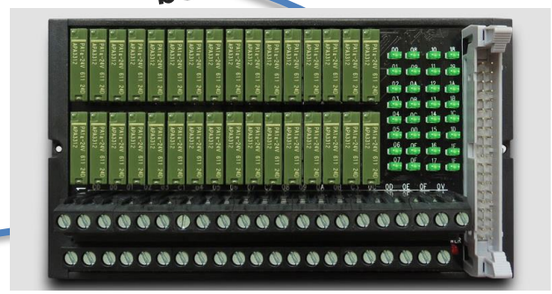




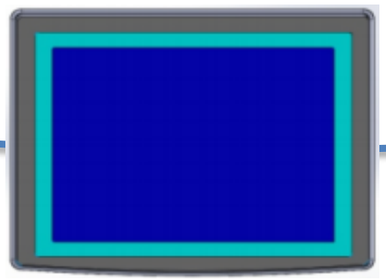


■ Extension IO module

■ HCS3-3216-DRA01 relay board

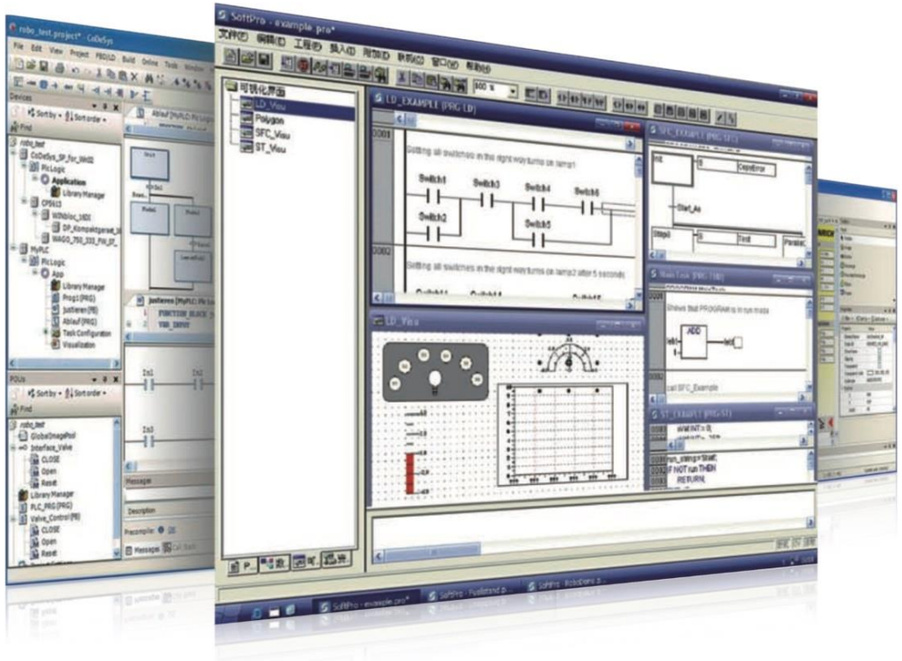


■ GEM intelligent controller



■ Resistive touch screen

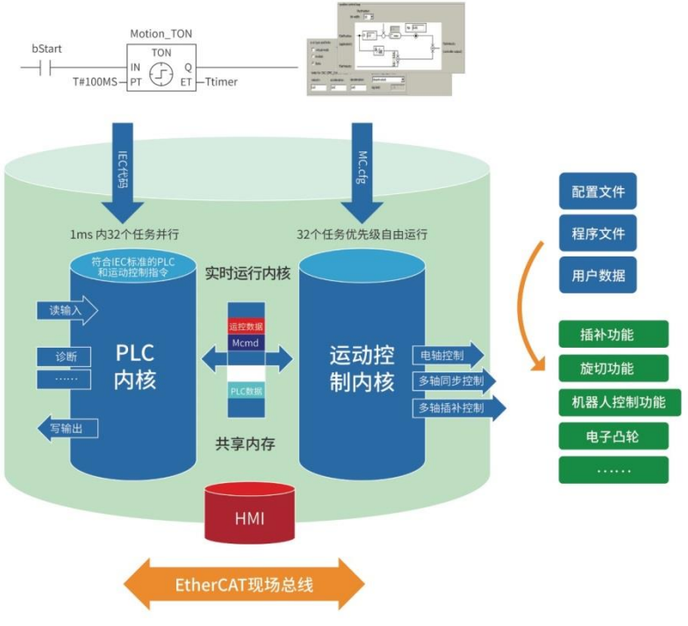
OtoStudio Software Platform



- Meets IEC61131-3 international standard; supports multiple language hybrid programming
- Meets PLCOpen standard Googol dedicated motion control function library and reduce programming time significantly
- Realizes on site data collection, management control, human machine interface integration
- Built-in WEB server, OPC server
- Integrates visual programming interface; can implement human machine interaction programming
- Supports real-time clock and watchdog timer
- Supports password protections, sample tracking, and log management
- Powerful offline simulation debugging tool

Multi-thread Hard Real-time Motion Control Kernel

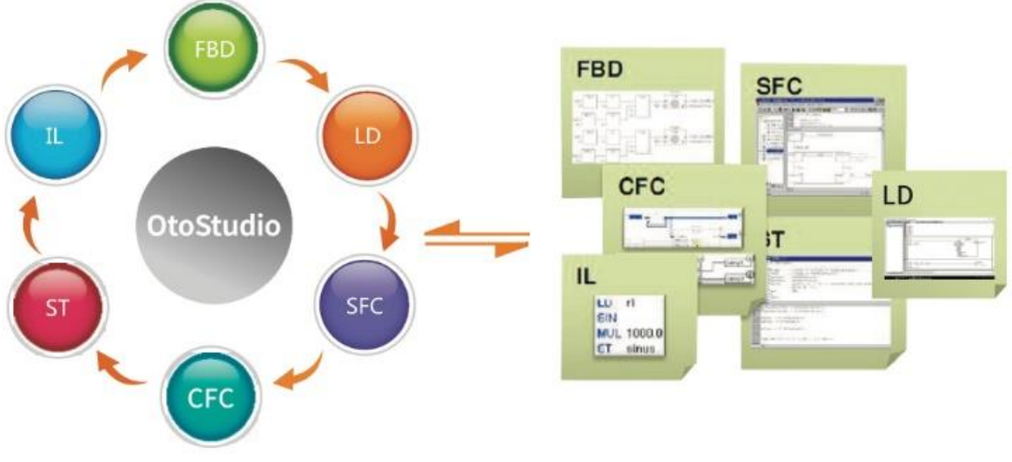
- Development platform of GEM series controller is the development tool based on IEC61131-3 international standard and PLCOpen standard.
- Ensures real-time, high speed, and high precision control of the control system via real-time kernel of DSP.
- gLink combines perfectly with bottom layer hardware so that fieldbus performance can be maximized in PLC and motion control aspects.



Programming Language

6 Programming languages based on programming environment of internationalization IEC61131-3 standard

- Instruction List (IL)
- Function Block Diagram (FBD)
- Ladder Diagram (LD)
- Structured Text (ST)
- Sequential Function Chart (SFC)
- Continuous Function Compiler (CFC)



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Remote Maintenance & Access

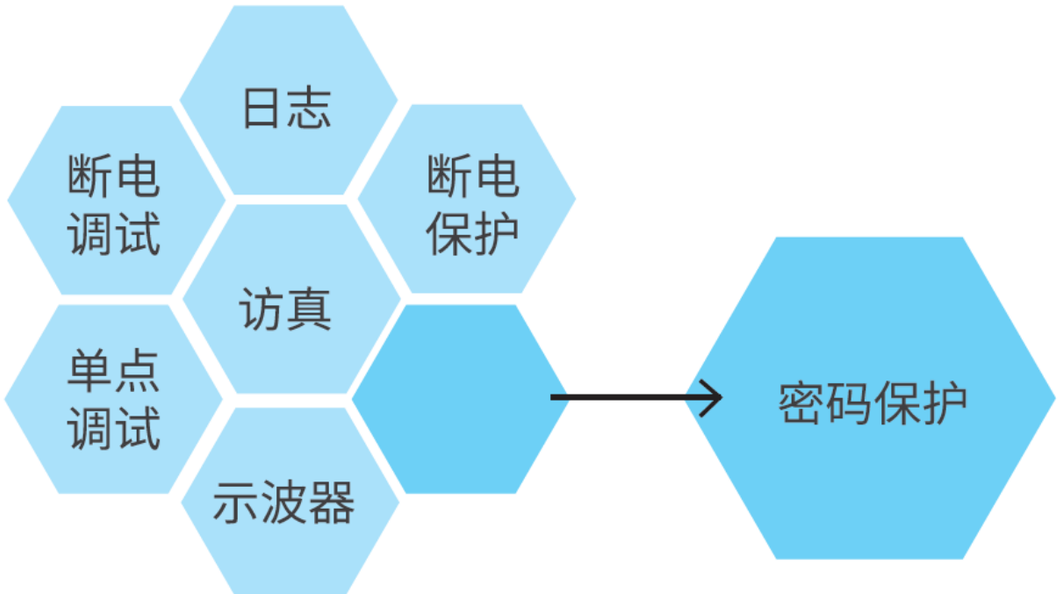
- Abnormal alarm real-time display
- Remote equipment checking log
- Can configure SMS, email functions
- OPC (OLE for process control)
- Client (iClient) for quick setup of industrial private cloud platform

Flexible & Ample HMI Configuration Interface

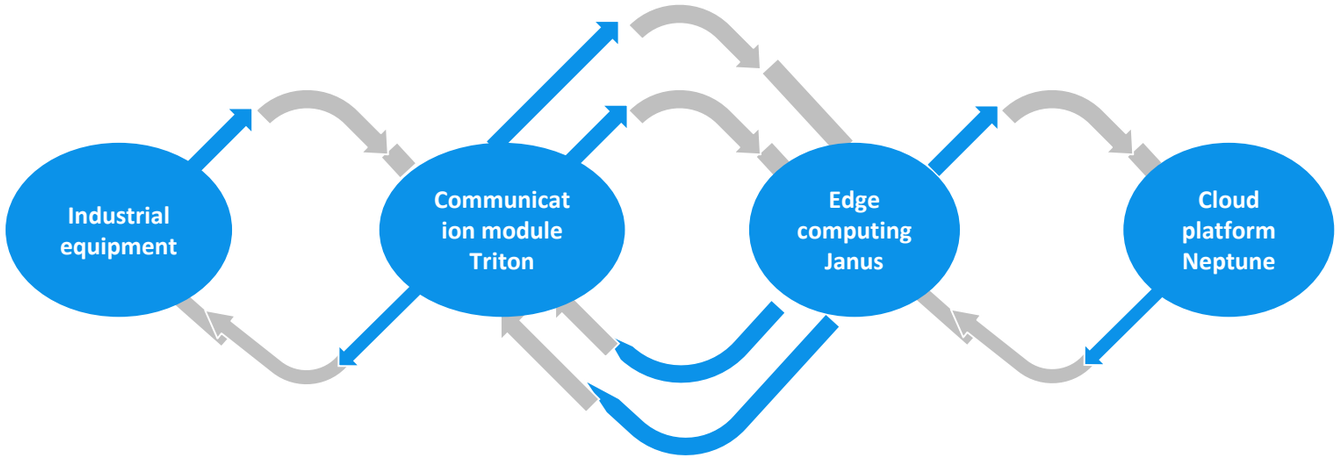
It integrates functions of human machine interface so that users can monitor the program, handle alarm program, software oscilloscope, etc. via this function.

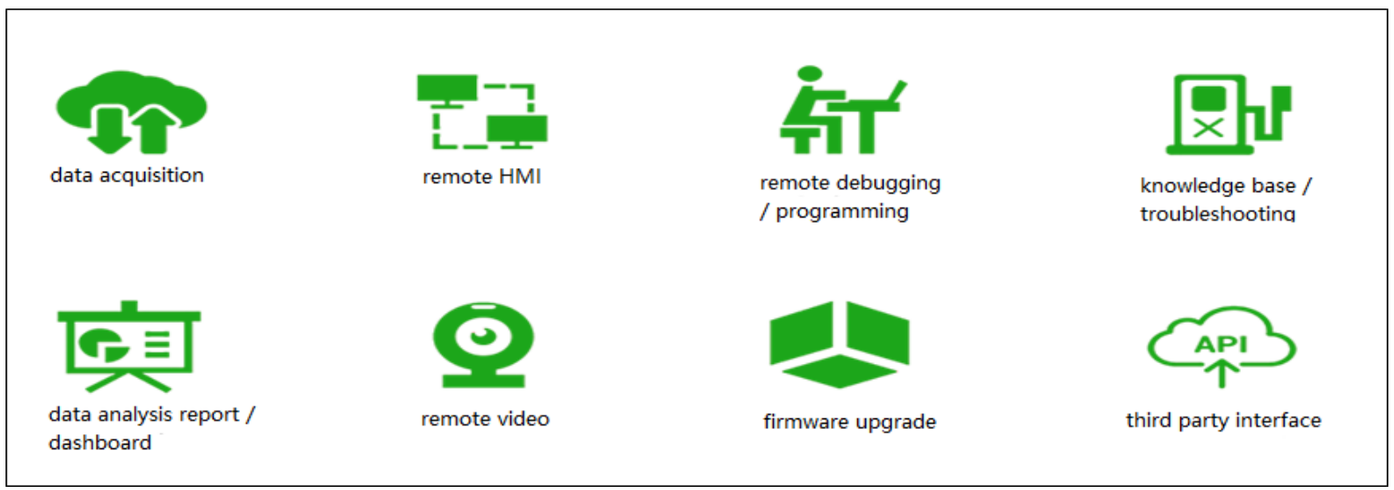
Auxiliary Function

Supports real-time clock, watchdog timer, password protection, sample tracking, log management, offline simulation debugging and other functions



Intelligent Operation Platform & Function





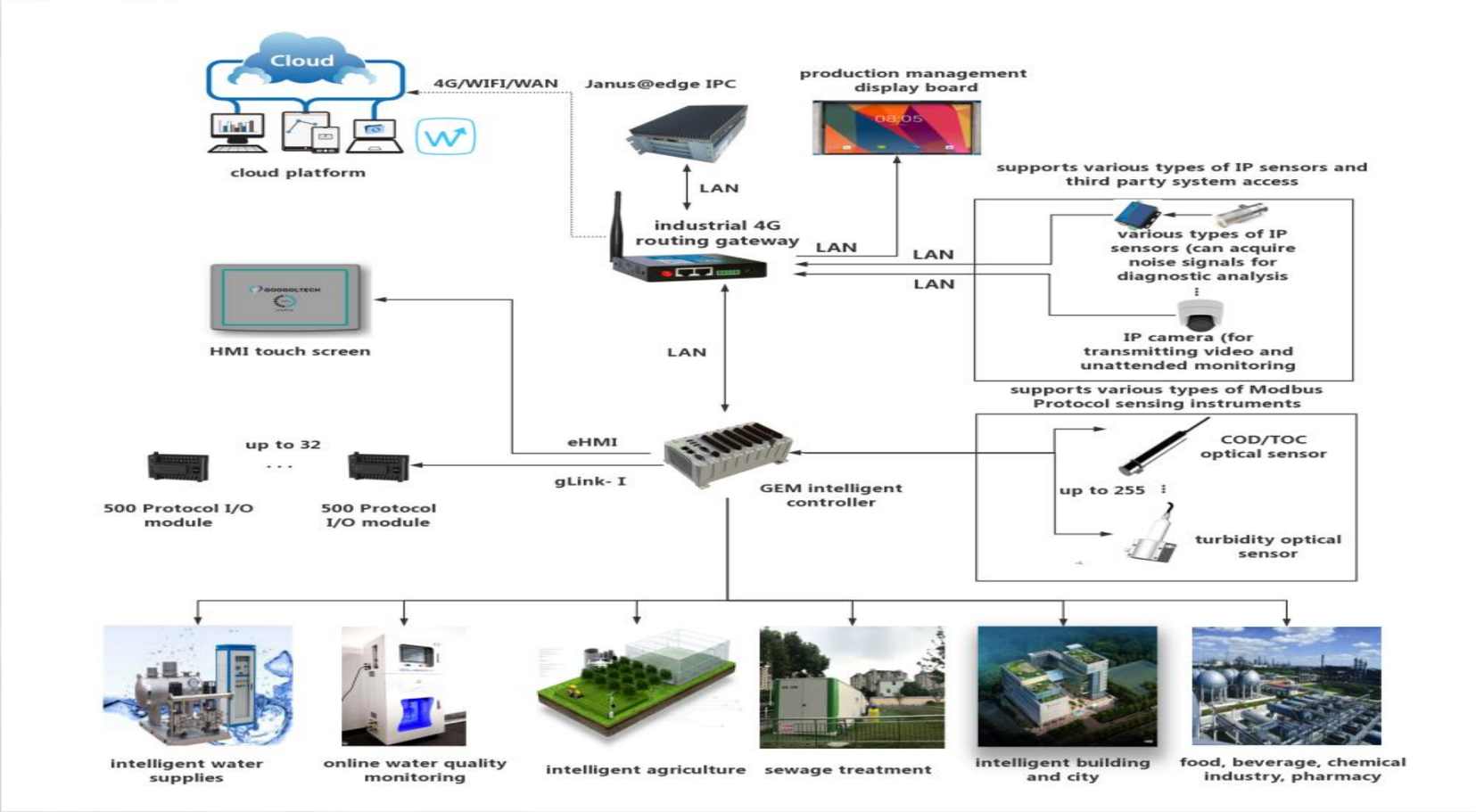
Platform system hardware

- Supports multiple types of data acquisition and monitoring
- Supports various equipment, system interaction and scheduling
- Powerful cloud development tool and interface
- Simple and clear implementation processes
- Cost of users is greatly reduced, user value is relected

2 Application Cases

GEM Intelligent Controller Application

Application fields: intelligent sewage treatment, water quality online monitor, intelligent building, intelligent agriculture, electronic information, IoT, etc.



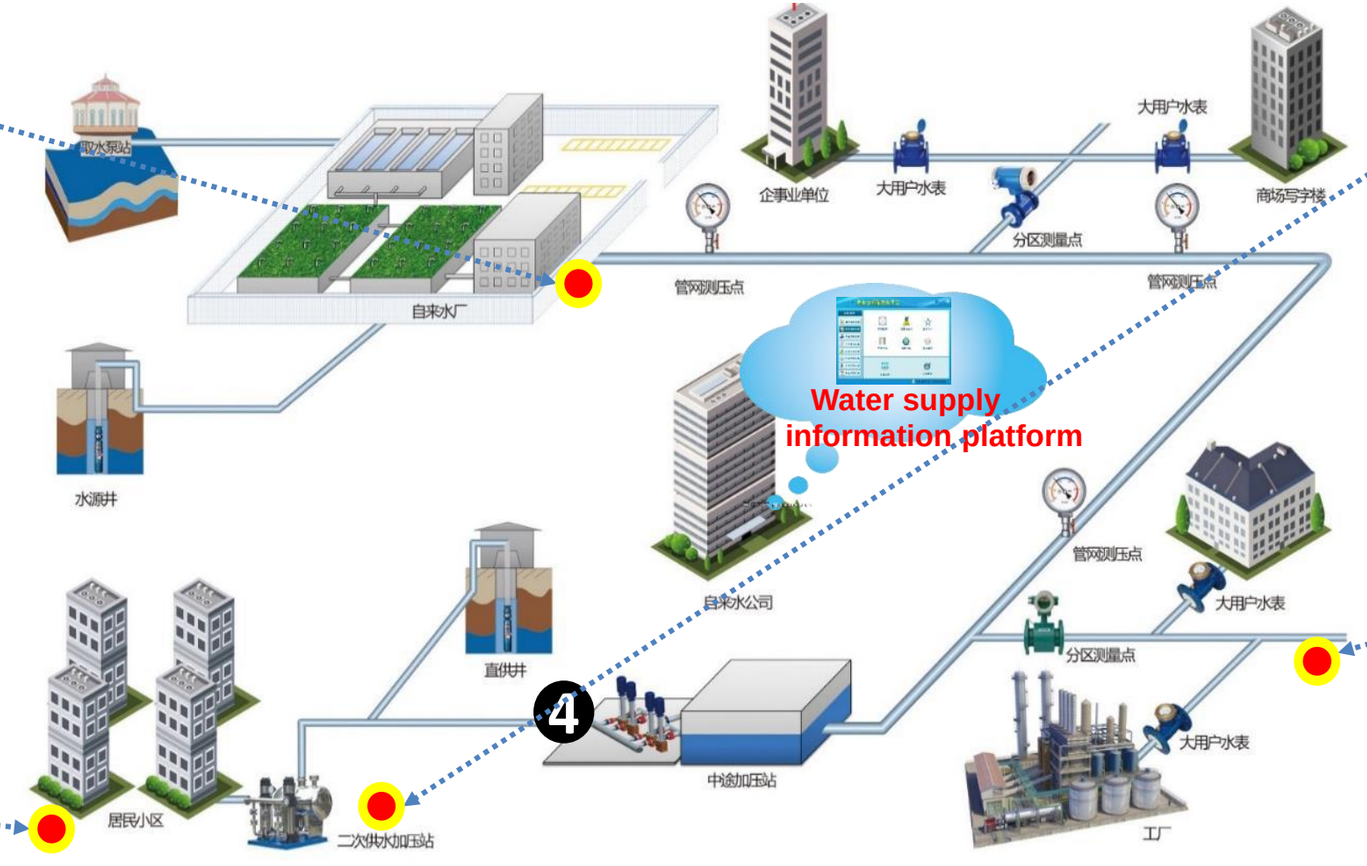
Case 1 -Water Quality Online Monitor

AIoT@Water

Direct Drinking Water Process Monitor

Dedicated for finished water

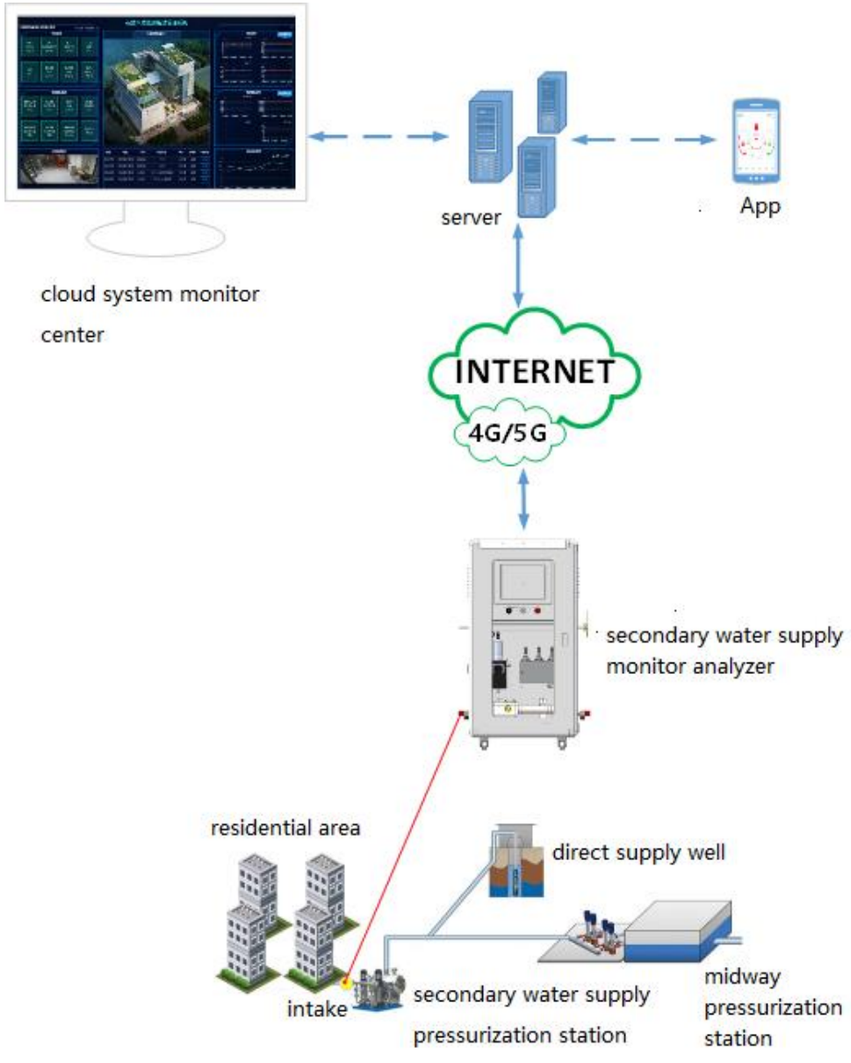
Dedicated for households

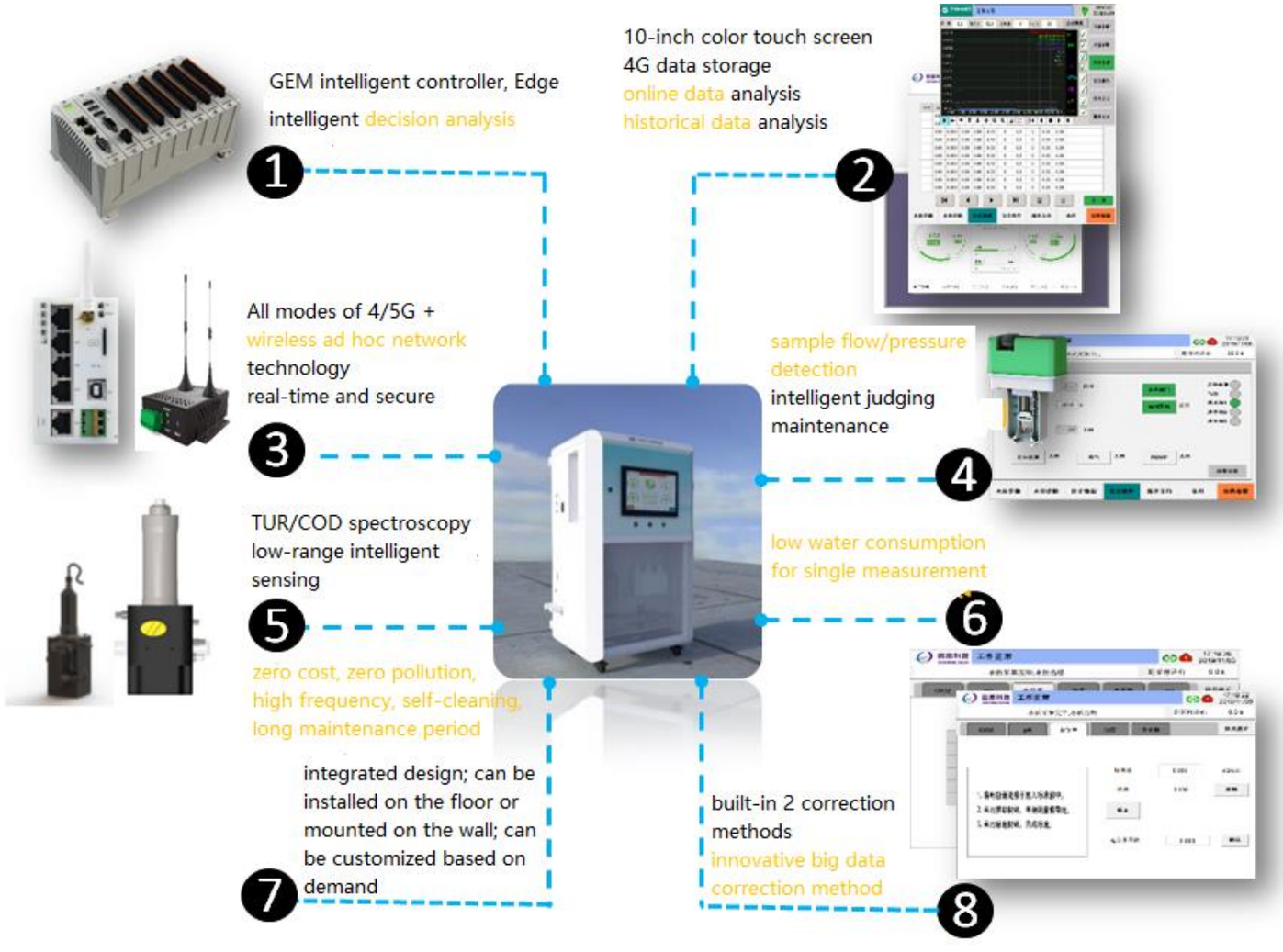


Dedicated for secondary water supply

Dedicated for pipe system and source water

Product Feature





Spectrum-based Sensor Feature

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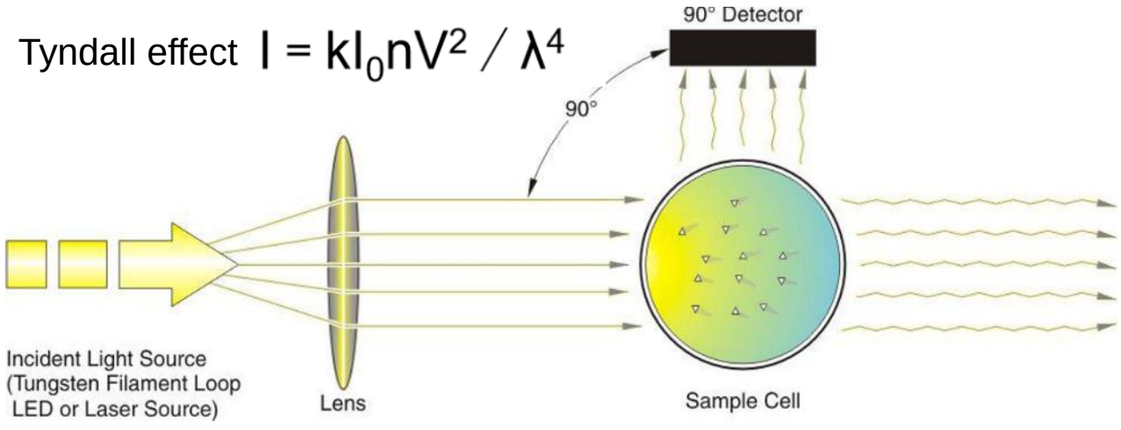
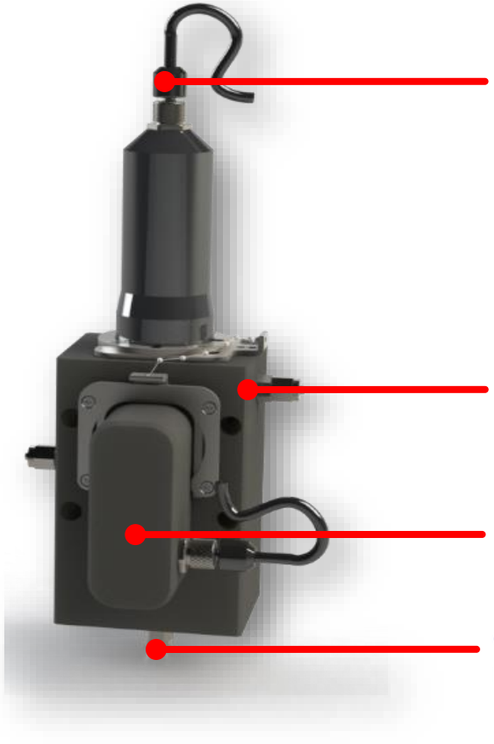
■ TUR: Ultra low range water quality sensor

- ✓ Compact and portable, easy to install
- ✓ Possesses self-cleaning system, maintenance workload is thus reduced

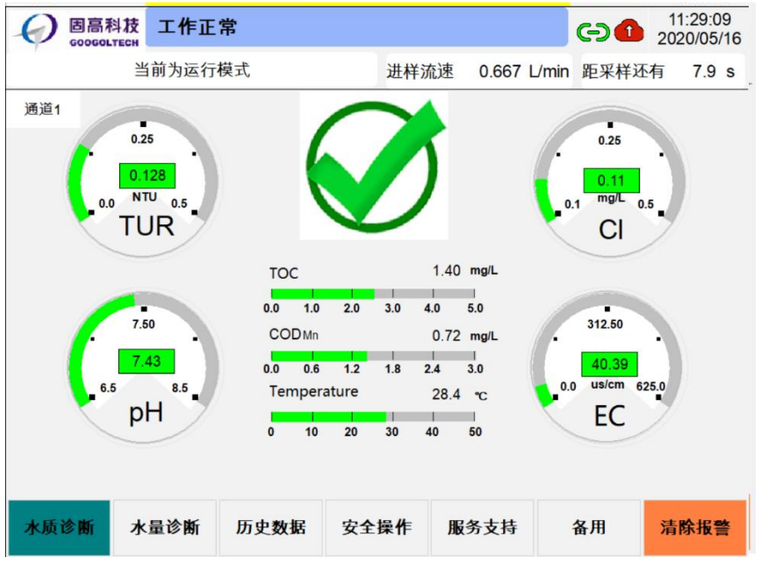
Tyndall effect $I = kI_0nV^2 / \lambda^4$





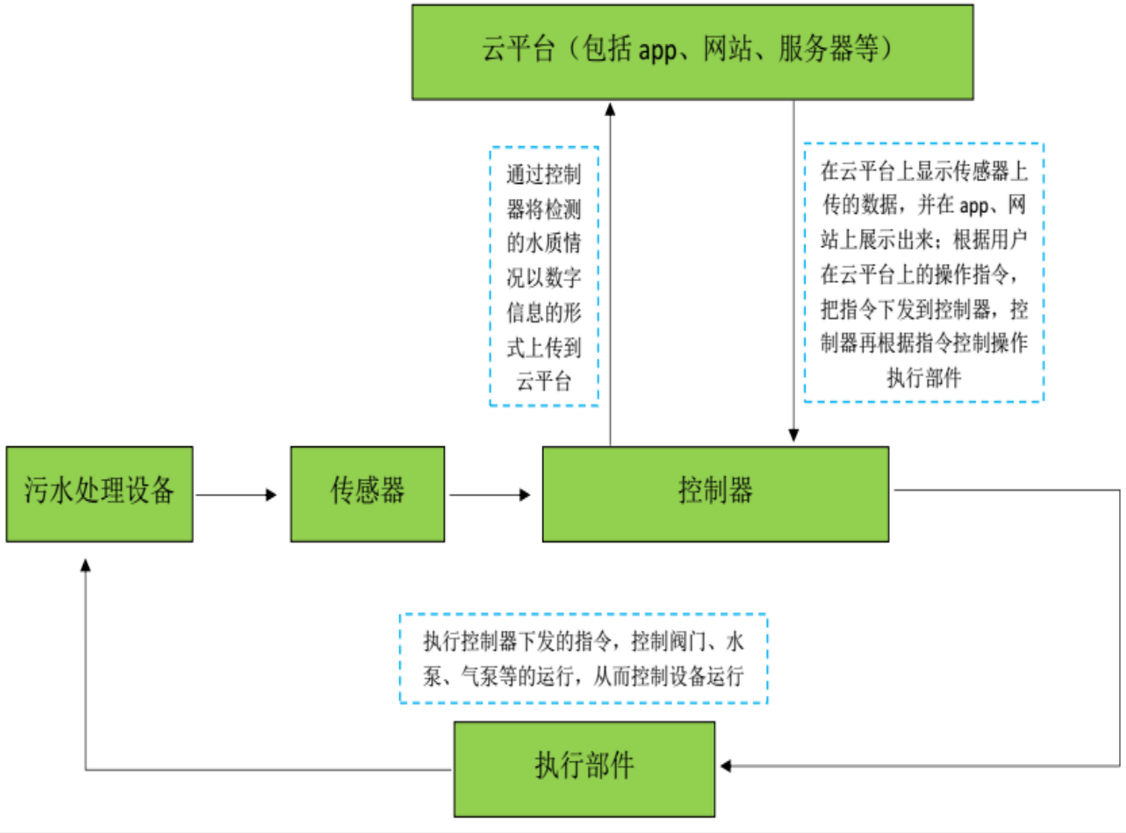
	WQS-T-SC	Hach 1720E /FilterTrak 660 sc	Hach Ultraturb
Measurement Principle	90° scattering EPA180.1 standard / ISO7027 standard	90° scattering EPA180.1 standard	90° scattering ISO7027 standard
Measurement precision	★★★★	★★★★	★★★★★
Volume weight	★★★★★	★★★	★★★★
Maintenance workload	★★★★★	★★★	★★★★★
Calibration workload	★★★★	★★★★	★★★★
Price-performance ratio	★★★★★	★★★	★★

System Function

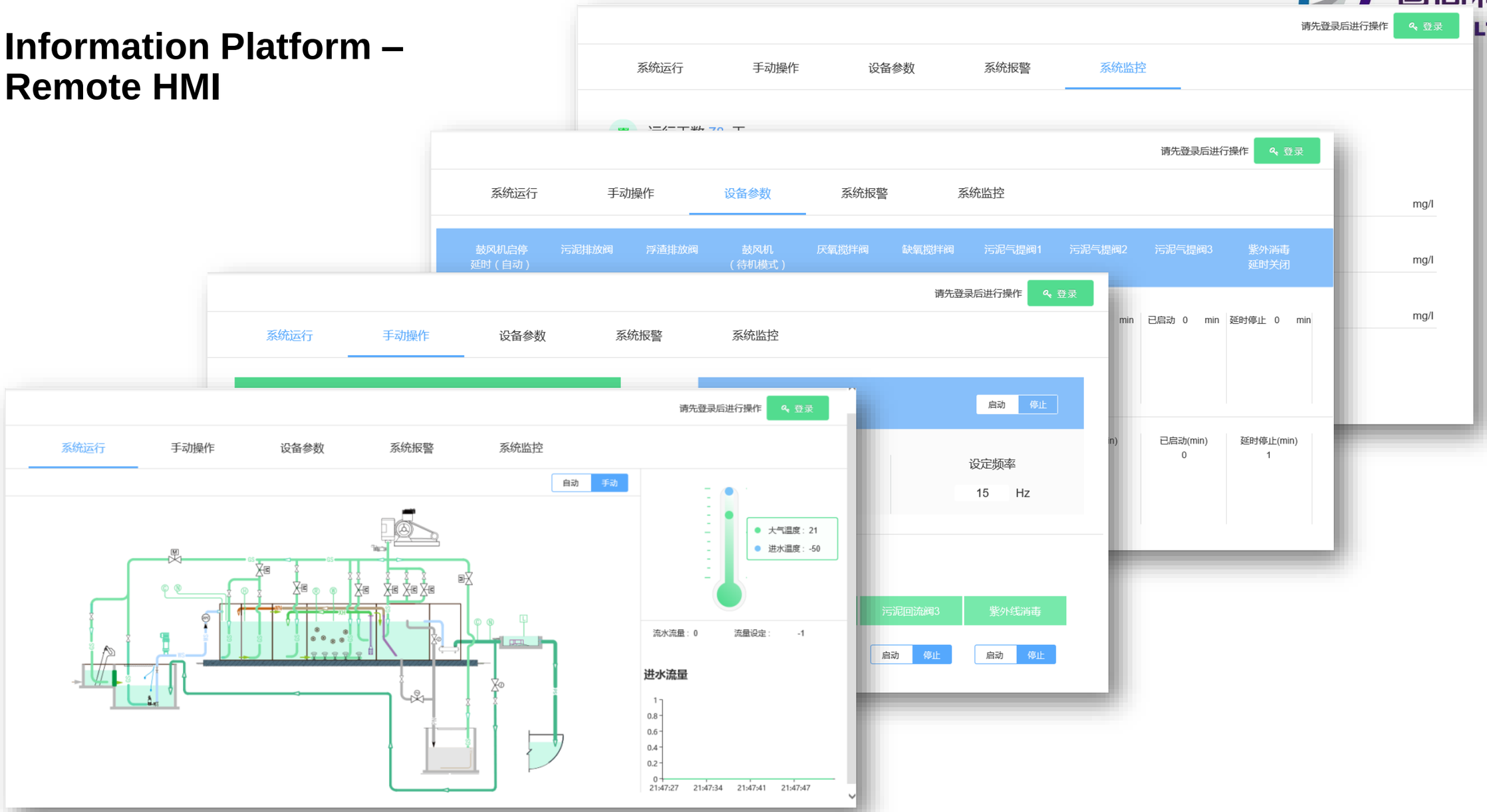


Case 2 - Sewage Treatment

Intelligent Controller Industrial Internet



Information Platform – Remote HMI



Advantage of Integrated Sewage Water Equipment Products

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Expandable

Treatment scale can be expanded via parallel connection based on demand

Energy-saving

Efficient biofilm packing; no need to add chemicals; precise aeration; efficient and energy-saving

Intelligence

Intelligent operation management, local and remote intelligence for equipment

Intelligent closed-loop control

Closed-loop control is realized by increasing the number of water quality sensor, water outlet is stable and up to standard

Industrial design

Compact structure, small occupied area, above ground / underground installation

Case 3 Pump Room Intelligent Control

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Pump Room IoT "Intelligent" Control System Architecture

Pump status
- Pump equipment status detection
- Pump equipment reverse control

Pump room status
- Pipe pressure/ flow in
- Pipe pressure/ flow out
- Reservoir level/water temperature
- Pump room energy consumption

Diagnosis information
- Pump noise
- Pump surface temperature
- Pump leakage detection
- Ambient temperature & humidity
- Pump vibration

Water quality information
- Water quality detection

Auxiliary system
- Illumination
- Access control
- Video surveillance
- Smoke detection

Edge computing system

Data acquisition analysis	Control strategy
Water quality model	Fault model
Energy-saving model	Energy-saving model

Water group big data platform

NEPTUNE

Googol industrial cloud platform

- Remote surveillance
- Remote support
- Data interface
- Operation & maintenance work order
- Model tuning

Mobile APP

- Equipment remote surveillance
- Fault alarm checking
- Work order processing

485 connection | Wired Ethernet | Wireless Ethernet

Pump Room Data Surveillance

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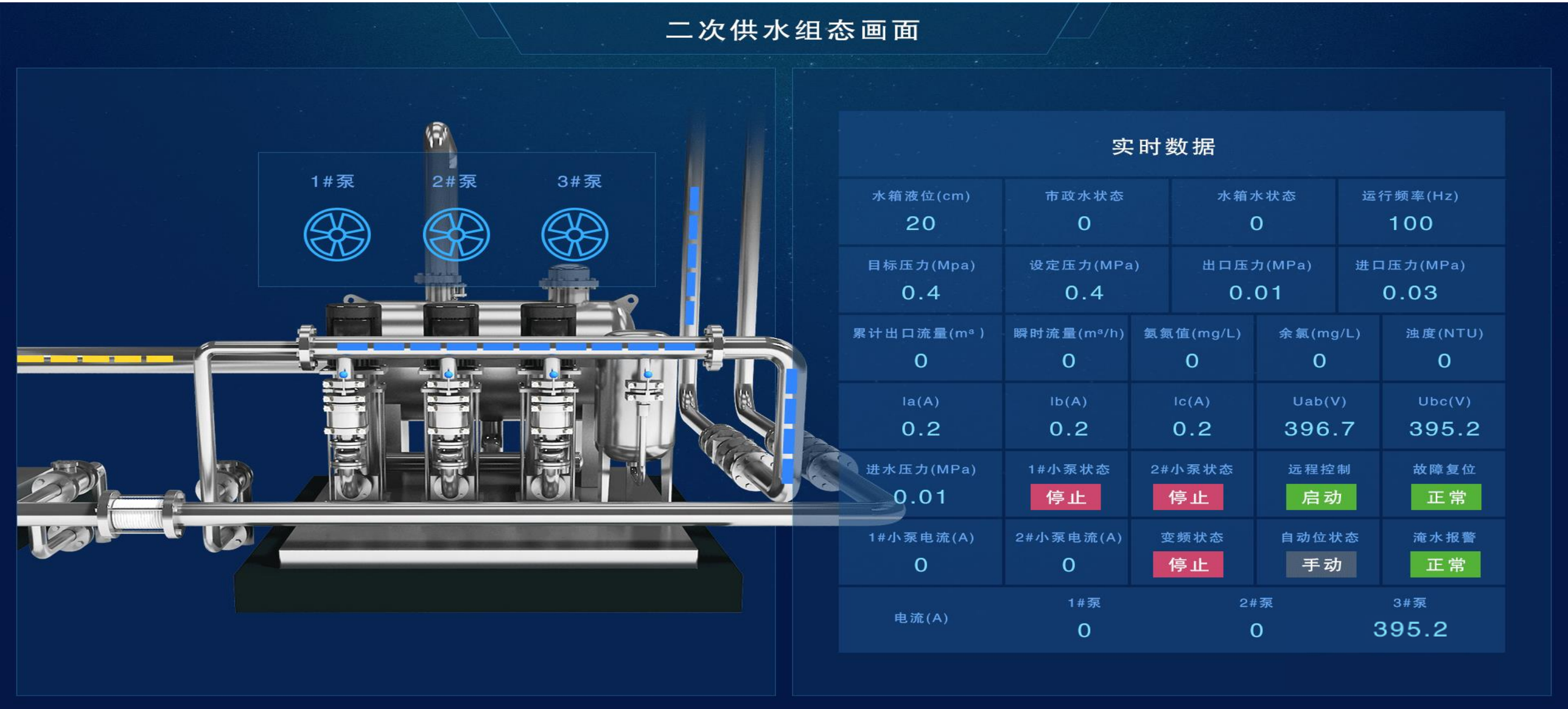

Pump Room Data Surveillance

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Unattended Pump Room Operation & Maintenance Based on Data

➢ Pump room IoT “intelligent” control architecture

Edge Computing system

Data acquisition analysis	Control strategy
Water quality model	Fault model
Energy-saving model	Energy-saving model

NEPTUNE

Googol industrial cloud platform

- Remote surveillance
- Remote support
- Data interface
- Operation & maintenance work order
- Model tuning

Mobile APP

Equipment remote surveillance
Fault alarm checking
Work order processing

485连接 有线以太网 无线以太网

4 Seamless Integration With Water Supply Big Data Platform

固高科技 GOOGOLTECH

- Unattended intelligent operation & maintenance based on data

NEPTUNE

Googol industrial cloud platform

- Remote surveillance
- Remote support
- Data interface
- Operation & maintenance work order
- Model tuning

Edge Computing system

Data acquisition analysis	Control strategy
Water quality model	Fault model
Energy-saving model	Energy-saving model

Result data processed by edge computing is connected to the water supplies big platform to realize strategic control.

485 connection Wired Ethernet Wireless Ethernet

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THANK YOU!