Technical Information

V-SCADA2000 Series

Technical Specification Manual

VEESTA WORLD

Author: Veesta World Co., Engineering Department

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Chapter 1 - Introduction

1.1 General Information

This is technical information of V-SCADA2000 Series, the SCADA System Software from Veesta World Company. This document helps you to find about how V-SCADA2000 Series works and designed for your purpose.

V-SCADA2000 Series consist of many supervisory control and data acquisition system and advances system applications adopted for from very small system as like of production line automation and substation automation that can be used in small scale application up to very large system as regional dispatch center and area operating control center, as like of Power grid SCADA control center, Oil & Gas monitoring system Electric grid distribution control and other utilities like water and wastewater enhanced control function.

Veesta World Co. from Iran associated with you! In planning, designing, manufacturing, supply, installation, commissioning and acceptance test for the SCADA System and applications in your projects. Veesta World Company will render full support and services to its customer to enable them to deliver first class services to the Automation Market.

1.2 Veesta World Co

Veesta World Co is a leading company in automation field in Iran and specialized in design and installation of IT Network of wide area and local area, Automation control units, control rooms, DCS design, PLC and SCADA application installation and system integration. The main advantage of Veesta World's products is complying international standards and do customs basic design.

Veesta World Co is a dynamic company located in the Tehran, IRAN, whose main commitment is the customer's satisfaction. Business vision and its future evolution together with the proper combination of

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new and existing technologies are the main aspects considered in the solutions proposed by Veesta World Co. Owing to this, key issues like Scalability, the Return of Investment or the Total Cost of Ownership are carefully considered. Consequently, the solutions offered by Veesta World Co are able to cope with the requirements of a sustainable growth. Veesta World Co is a service-oriented company and the customer perspective is its action guide. An added value of the offer is the evaluation and Management of the risk. This issue is getting a major relevance in the changing environment in which new technologies have to be applied, particularly when profitability is a major concern.

The objective of Veesta World Co is focused on the creation of value for the customer through the proper business strategy alignment and the right combination of technologies. These principles, developed under the Total Quality Management practice, allow Veesta World Co to offer, in a seamless approach, consultancy, engineering and training services.

The founders of Veesta World Co are professionals with a large experience in the Telecommunication and Networking and Industrial fields.

Veesta World Co is formed by a balanced team of professionals that gather knowledge in a wide range of technologies and specific know-how on how to apply these technologies in mission-critical control networks.

1.3 Application prospects of V-SCADA2000 Series

SCADA is the abbreviation of Supervisory Control and Data Acquisition System, which also can be called as Automation Monitoring and Control System. It is an intelligent control system produced with demand for advanced industrial automation. The use of SCADA can improve the production efficiency, reduce administrative cost, increase the profit margin and improve service quality, which enormous social and economic benefits will be brought to enterprises and their competitiveness will be greatly enhanced. Across the world, SCADA is the first choice for various industries such as electrical power, petroleum, chemical engineering, steel, metallurgy, machinery, mining, construction, coal, transportation, communication, refrigeration, food production, water treatment, environmental protection, intelligent building, manufacturing and processing industry and so on.

At present, SCADA system has been applied in wide use and vigorously promoted in power industry, petroleum and natural gas area and railway automation monitoring system.

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Veesta World Co. has absorbed the latest domestic and foreign research results and drawn on the 10-year practical experience on automation monitoring system. We have developed many monitoring systems of high cost-effectiveness. The successful development and introduction V-SCADA2000 SCADA system push us on the leading position both in product technology and after-sales services. Our products can hold the competitiveness even in comparison with the other similar products.

In power industry, V-SCADA2000 product can be subdivided into:

- Regional power dispatching automation system;
- Power network automation system at county level
- Monitoring system for power plants and substation at all level;
- Control system for integrated control station.
- The market covered by value-added products of Veesta.
- Operational and control system for substation;
- Power Distribution automation system;
- Regional optimization system;
- Real-time quotation system for power and power plant market.

In the Oil& Gas industry, V-SCADA2000 products mainly cover the following areas:

- Automation monitoring system for oil and gas pipeline;
- Monitoring system of city gas distribution network;
- Automation monitoring system for oil reservoir;
- Oil field/platform automation monitoring system

Moreover, we will add more application modules for V-SCADA2000 Software series system to make it a supported platform applicable to industries such power market transaction system, regional optimization system, monitoring system of power quality and other power industries that have great market potential.

According to market's new demand and by virtue of the new platform, Veesta World Co. will gradually and systematically exploit the value-added service of automation products which have great potential for making a profit, including supported platform for power market transaction system, supported platform for regional optimization system, supported platform for billing system of electric energy, supported platform for monitoring system of power quality. Veesta World Co. will make great efforts to expand the market of Oil & Gas industry. A whole set of solution which takes the SCADA system as a core and is integrated with substation automation, pressurization station automation, video surveillance and communication will be provided for the pipeline platform, oil field platform and offshore drilling platform in Oil& Gas industry.

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Figure 1-1: Veesta World Co Logo and sign

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Chapter 2 - System Overview

2.1 Overview

Veesta World Company has accumulated 12-year experience in SCADA system development and took advantage of the features of famous SCADA systems over the world, and develops for the present need for engineering and the potential market demand, thus has successfully developed a latest V-SCADA2000 SCADA system.

The main feature of V-SCADA2000 system is that with the same system source program and based on different application, scales of investment, machine styles and plenty usage, it can provide the solutions containing corresponding operator interface and maintenance mode. That is to say V-SCADA2000 system is a multipurpose cross-hardware and cross-operating system SCADA platform. “One platform, several systems” is the design concept of V-SCADA2000. “One platform” is a real-time data and graphics processing platform which can perform various real-time functions. “Several systems” is to adopt the component, plug in and scripting technology to develop various application systems that can be suitable for different industries, which these systems cover SCADA, GIS, MIS application and so on.

In term of computer hardware, V-SCADA2000 System supports various computer systems constructed by CPUs such as INTEL X86, SUN SPARC, HP RISC, COMPAQ RISC, and IBM; as to the operating system, V-SCADA2000 System supports various systems such as Ms-Windows NT, Sun Solaris Unix, HP UNIX, Compaq Alpha, IBM AIX and also Linux.

The unique advantage of V-SCADA2000 System enables it to construct a simplest single V-SCADA2000.

System as well as an extremely complicated V-SCADA2000 System which includes dual networks, dual machine, many workstations, advanced application system and Web Browser.

Veesta World Co. can provide users with powerful V-SCADA2000 System as well as the all-inclusive second development services. Moreover, with a reasonable configuration, the system can be exempted from viruses and attacks of hackers during its entire life,

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which the long-term, safe and stable operation can be ensured. Therefore user' return on investment will be maximized.

Veesta World Co. has always been adhered to "customers uppermost" tenet, and is making every effort to provide customers with most excellent solutions, most cost-effective products, most considerate and timely customer service and to maintain a most friendly and mutually beneficial relation with users.

At present, V-SCADA2000 System has been widely developed in numerous industrial automation industries and other industries such as electric power, chemical engineering, steel, petroleum and natural gas.

2.2 V-SCADA2000 Software Series Model Component List

Table 2-1: V-SCADA2000 Software Series Module List

No.	VEESTA Model	Specification
1	VS-2DAS	Data Acquisition Subsystem
2	VS-2SRV	SCADA Server
3	VS-2MMI	Man Machine Interface Subsystem
4	VS-2HIS	History Server Subsystem
5	VS-2CLK	GPS Clock Subsystem
6	VS-2CCS	Computer & Communication Data Subsystem
7	VS-2WEB	Web Server Subsystem

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Chapter 3 - Technical Characteristics

3.1 Open-type layered all-directional system

V-SCADA2000 System employs the network management technology which includes an advanced open and distributed application environment, database middleware and communication middleware, multilayer Client / Server technology. This System follows the Common Information Model (CIM) and Component Interface Specification (CIS) of IEC 61970 CCAPI. Meanwhile, V-SCADA2000 System has separately defined the functions of the support platform and application subsystem, has designed a real time information system platform able to provide services for various applications. The real time information system platform will provide various services for application subsystems, which have achieved the goal that the System is an open type, layered all directional system both in support platform and application systems for various industries.

3.2 Employing the OO technology

V-SCADA2000 System employs the most advanced OO technology (object-orientated design) in the current software engineering industry. We follow the ISO-9001:2000 standard and have improve the reliability, maintainability, reusability and expandability of V-SCADA2000 System. Hence the need for a multi-purpose and complicated system can be satisfied.

3.3 CORBA Architecture

The simple hierarchical structure is seamlessly integrated with the system resources, which will provide users with the most cost-effective solutions. CORBA has provided the transplantable, object-orientated and distributed computing application with the application programming interface and model which don't depend on the platform. CORBA doesn't rely on the programming language, computing platform and network protocol, so it is quite suitable for the new development of application and system integration of the existing distributed system. Based on the CORBA architecture, V-SCADA2000 System meets the standard of system and components, which makes the System more open and expandable

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and realizes the plug and play of third-party application or application system.

3.4 Cross-platform feature

V-SCADA2000 System realizes the conception of “one set of code can be run freely”. It can cover operating system between UNIX, Linux, NT and hardware platform between IBM, SUN, HP, ALPHA, X86. In addition, it also can support the mixed platform formed by different combinations, which has provided basic need for different platforms for users. V-SCADA2000 System can help users shift the application from low-end platform to high-end platform, which users’ additional expanses can be exempted.

3.5 Powerful embedded scripting language

V-SCADA2000 System is embedded with a cross-platform QSA scripting language. With the use of various embedded classes, objects, functions, methods and instruction characters, it can program, customize screen effect and setup functions for graphics system, database and various objects under application by user. Accordingly, the QSA scripting language has provided users with a powerful second development tools.

3.6 Providing a powerful second development platform

Based on the GIS platform, V-SCADA2000 graphics system employs the cross-platform component and plug in technology in compliance with CIS standard, which is tailored for users and provides a SCADA development platform for second software developers. Users’ various and changing requirements can be accommodated.

3.7 Distributed architecture

A network architecture which is up to the international standard is employed for V-SCADA2000 System. The functions are systematically distributed to each node in the network, including software self-diagnosis trace facility, network system, real time processing, alerting, sampling record, event recall, real time calculation, data service, safety verification, remote control. Moreover, a user can redeploy the functions in accordance with personal need.

This network architecture we employed for V-SCADA2000 System is based on the architecture development process which had experienced from centralization mode to node distributed mode, from node distributed mode to Client/Server architecture. Its advantage is that: it bears not only the powerful service processing ability that centralized server bears, but only the advantage of node distributed

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mode, which makes each node in the network share the common server resources.

The physical layer of each node in V-SCADA2000 System is interconnected in the manner of star-shaped dual Ethernet and via 10M/100M internet, 10M/100M Hub/Switch. Its transport layer adopts TCP/IP protocol.

V-SCADA2000 System architecture is reasonable, safe, reliable and easy to be upgraded and has a good compatibility.

3.8 Advanced data transmission technology

The whole set of network functions (total subset) support the virtual subnets which are formed in accordance with requirements; the dual Ethernet LAN is used as a backup for the system; the system is interconnected with metropolitan area network and wide area network; it support three-layer exchange and VLAN technology, and simplify the management of network devices and reduce the investment in equipment; the data is not broadcasted and the object is refreshed when necessary, which can effectively improve the transmission efficiency and ensure the normal speed.

3.9 Consistent and reliable data processing system

Under the SCADA system application with the network approach, V-SCADA2000 System can automatically ran in various modes such as Cold Backup, Warm Backup and Hot Backup. No matter what mode is used, the system can automatically maintain the consistency and compatibility for the data in real time database, history database, alerting, and picture and WEB data. So manual intervention is avoided, which has ensured the validity and usability of data.

3.10 Universal interface for data interchange

V-SCADA2000 System can support that the external user interchanges the real time data with the system with the linked and nontransparent mission communication means and TCP/IP. In the V-SCADA2000 System, the preprocessing data that passes through user's application can be imported into the system and all functions in the system can be introduced; all data can be exported from the system into the gateway machine or for other purposes.

Various databases such as Oracle, Sybase, SQL Server, DB2, MySQL can be used for the V-SCADA2000 System to manage the history data. The system provides ODBC, JDBC and OPC access interface and can interchange data with popular commercial relational databases such as Oracle, Sybase, DB2, and Informix.

V-SCADA2000 System supports disk array and allows the storage and access of data in the database cluster system. It also supports the data access from or to Excel.

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3.11 Advanced Man-Machine Interface

3.11.1 Flexible Database Management Interface

V-SCADA2000 System provides Tree view, List view and Profile viewing modes and can change the record of each node in the database. It has standardized the format of files to be interchanged with V-SCADA2000 database, which has greatly improved the entry speed and efficiency. The online update of database is supported. Database test point information will be updated without any interference and influence on the normal operation of system.

3.11.2 Intuitive and Concise User Interface

V-SCADA2000 System provides the flexible configuration software which is designed to be easily used with the intuitive user interface in accordance with the goal of man-computer interaction. Its cross-platform feature can ensure the consistent use in different hardware platforms and operating systems. User can quickly master the system with the use of powerful online help support system.

3.11.3 Multifunction Page Editor

V-SCADA2000 System provides an editor integrated with diagram & text and report of “WYSIWYG”. With the time definition methods containing a group of completed features and the unified graphics structure definition, V-SCADA2000 System can draw wiring diagram, bar chart, curve diagram, tendency chart and write real time report and history report in any workstation or server. It can also make the diagram mixed with random characters and graph.

3.11.4 Advanced Defined Graphic and Display Tool

The graphics system of V-SCADA2000 System is based on GIS platform which supports hierarchical structure. The graphics system has an external Vector Symbol Base and an internal Vector Symbol Base. Any defined data, graphics or combination of graphic can be named and saved to the symbol base. Users can easily copy, deploy and use the symbols.

In additional, V-SCADA2000 System supports entry mode for Persian character and character library as well as various display modes of common graphics. It is easy to make dynamic images. The graphic display can shut off the dynamic image or display designated picture layer. A pop-up picture or no pop-up picture can be set.

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3.11.5 Individualized User Graphical Interface

Users can customize personal graphical interface as well as the menu, tool bar, status bar, right-click menu. The “drag” technique used in Microsoft office is supported too. Users can form own graphical interface.

3.12 Safe & Powerful information distribution (Web distribution)

The conception of Group Communication is introduced in V-SCADA2000 System; online definition is supported and various communication data streams can be organized. We always take the network security into consideration so that the web browser of V-SCADA2000 System is really a safe browser which employs the popular multi-layer/server structure and integrates the traditional browse of power network measurement and SCADA data into DMS browser of application function. Users can use the Windows IE or Netscape and other browser and open the Web homepage to view the picture and statement which are in line with the SCADA system and inquire and print the statement, history curve and events after connecting to the internet via LAN or WAN. V-SCADA2000 System will set different access authorities according to user type; users can set the access authority of IE.

3.13 System functions can be separated by different areas

V-SCADA2000 System enables users to separate the functions in accordance with different areas. Those functions such as graphic display, inquiry on alerting, limit on remote control and adjustment and audio alert can be customized in the workstation for different objects, which the usability of power dispatching system has been maximized. Users’ different requirements and functions can be met as the system security is ensured.

3.14 Several data sources is supported

V-SCADA2000 System supports the data processing from several data sources. When the data has several data sources, the system can select the data automatically and manually. The required data can be obtained through data processing while the system collects data from sources. Users can intervene in the selection or set conditions including station status / bit error rate / data quality mark / operation ratio / precision / interruption frequency / effective time.

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3.15 Powerful graphics engine integrated with GIS and MIS

The graphic system of V-SCADA2000 System is a vector graphic system designed on the basis of the cross-platform QT. It is integrated with system server through data engine, which can run independently. The component and plug in technology is employed for the system. The applications of relevant industries can be displayed with the use of component technology and the interconnection of each subsystem is realized with the plug in technology. It can automatically form a topological relation between components and perform topology analysis and dynamic coloring, which has the powerful graphical processing ability.

GIS is embedded into graphic engine, which has perfectly integrated with SCADA system and GIS system. In addition, V-SCADA2000 System can be connected to commercial database to integrate the MIS system with SCADA system. All “isolated information resources” have been included to commonly share the resources, which will provide a powerful support platform for the large-scale all in one solution.

3.16 Remote maintenance

V-SCADA2000 System enables workstation to collect data and control the system via remote dial up/network; hence the remote diagnosis and maintenance can be conducted. It is so convenient for users to handle the operation and get immediate service.

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Chapter 4 - System parameters

4.1 System platform's compatibility parameters

V-SCADA2000 supports various hardware platforms and operating systems and the mixed platforms. The following have listed the platforms that V-SCADA2000 supports

Table 4-1: V-SCADA2000 System platform compatibility List

Hardware Platform	Support	Operating System Platform	Support	Note
Intel x86	✓	Windows Family NT/2K/2003	✓	Support various Mixed platform from Operating System and Hardware platform
Intel x86	✓	Unix Sun Solaris 10 for x86	✓	
Intel x86	✓	Linux OS Family, RedHat, Suse, etc	✓	
AMD	✓	Windows Family, Linux Family	✓	
Sun Sparc	✓	Unix Sun Solaris 8, 9, 10	✓	
IBM Power System	✓	IBM Unix Aix 5L	✓	
Alpha	✓	Tru64 Unix, Cosix	✓	
HP Minicomputer	✓	HP-Unix, VMS	✓	

4.2 The parameters of system capacity

Theoretically, there is no limit on the data collection and database in V-SCADA2000. However, users' requirements and the processing ability of system server will decide the detailed parameters; the following parameters are just for your reference.

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Table 4-2: V-SCADA2000 System Capacity

Item	Capacity	Item	Capacity
Analog Input Points	150,000	Calculation Points	60,000
Digital Input Points	500,000	Event recall	150,000
Pulse Counter Points	30,000	Sequence Of Event	No limit
Digital Output Points	60,000	Picture & Screen	No limit
Analog Output Points	30,000	History Curve	No limit
System interface to RTU	256 (**expandable**)	Number of Workstations	Up to 26
Communication baud rate		From 300bps up to 10/100/1000Mbps	
Communication interface		Can be interconnected with data interfaces of various devices	
Channel rate of remote computer		64Kbps - 2Mbps	

- *Above Capacity of points are expected on the single quad core computer system. Therefore we can have more & more capacity if we use from distributed computer structure.*

4.3 The parameter of system availability

4.3.1 The parameter of system operational reliability

1- The annual availability of workstation and server: >99.9%
2- The annual availability of the entire system: >99.9%
3- The annual availability of SCADA function: >99.99%
4- The operating life of SCADA system is: 8 to 10 years
5- MTBF: >20000 hours
6- MTTR: <1 hour

4.4 The precision of time synchronization

1- The time deviation between SCADA time and standard time: ≤1ms/ per day.

4.5 The parameter of data processing

1- AI processing
   - Telemetering processing error: < 0.1%
   - Statement telemetering data acceptance rate: > 99.9%
2- DI processing
   - DI accuracy: 100%
   - System's SOE resolution: < 8ms
3- DO processing
   - DO accuracy: 100%
4- AO processing
   - AO error: <0.1%

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4.6 The parameter of response time

1- The scanning period for Polling PLC/RTU: 1~2s, adjustable
2- The whole scanning period for data: 2s~3600s, adjustable
3- The scanning period for system's data is: 1~5s, adjustable
4- Telemetering the time transmitting from dead area to main station or refresh time of key data under cyclic transmission mode: ≤1s
5- Transmission time of quantity of state: ≤1s
(from the changes detected by PLC/RTU for quantity of state to the display in CRT close time)
6- Time for control command selects, executes or cancel transmission: ≤1 s
7- Time for regulating command selects, executes or cancel transmission: ≤1 s
8- Response time for deploying the picture: ≤ Display resolution above 1280 X 1024 X 256, the response time <2 s
9- Data refreshing cycle measured by picture: minimum is: 1s, adjustable
10- Computer's switching period under hot backup: ≤ 30s, computer's switching period under cold backup: ≤ 2~5min

4.7 The Load Rate of CPU and network

4.7.1 Average Load Rate of CPU

1- System is under normal condition
   - average load rate of MMI CPU: < 25%
   - average load rate of server's CPU: < 30%
2- System is not under normal condition
   - average load rate of MMI CPU: < 30%
   - average load rate of server's CPU: < 35%

4.7.2 Average Load Rate of Network

Average load rate of network (dual network): < 20%

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Chapter 5 - Operation Conditions

5.1 Environmental conditions

5.1.1 Height above sea level

- 600－800m

5.1.2 Maximum relative humidity without dew

- 15%~90%

5.2 Indoor conditions

5.2.1 Indoor temperature and humidity

- maximum temperature: 30℃
- minimum temperature: 5℃
- change rate of temperature: less than 5℃/h
- relative humidity: 45%~65%

5.2.2 Indoor earth resistance

- Not more than 0.5Ω

5.2.3 Power supply voltage and Power supply frequency

- Power supply voltage: 200V~250V
- Power supply frequency: 50Hz

5.2.4 Load borne by floor

- The load can be determined by UPS weight of UPS

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Chapter 6 - Introduction on System Functions

6.1 Architecture of V-SCADA2000 System

A typical architecture diagram of V-SCADA2000 SCADA System is showed below:

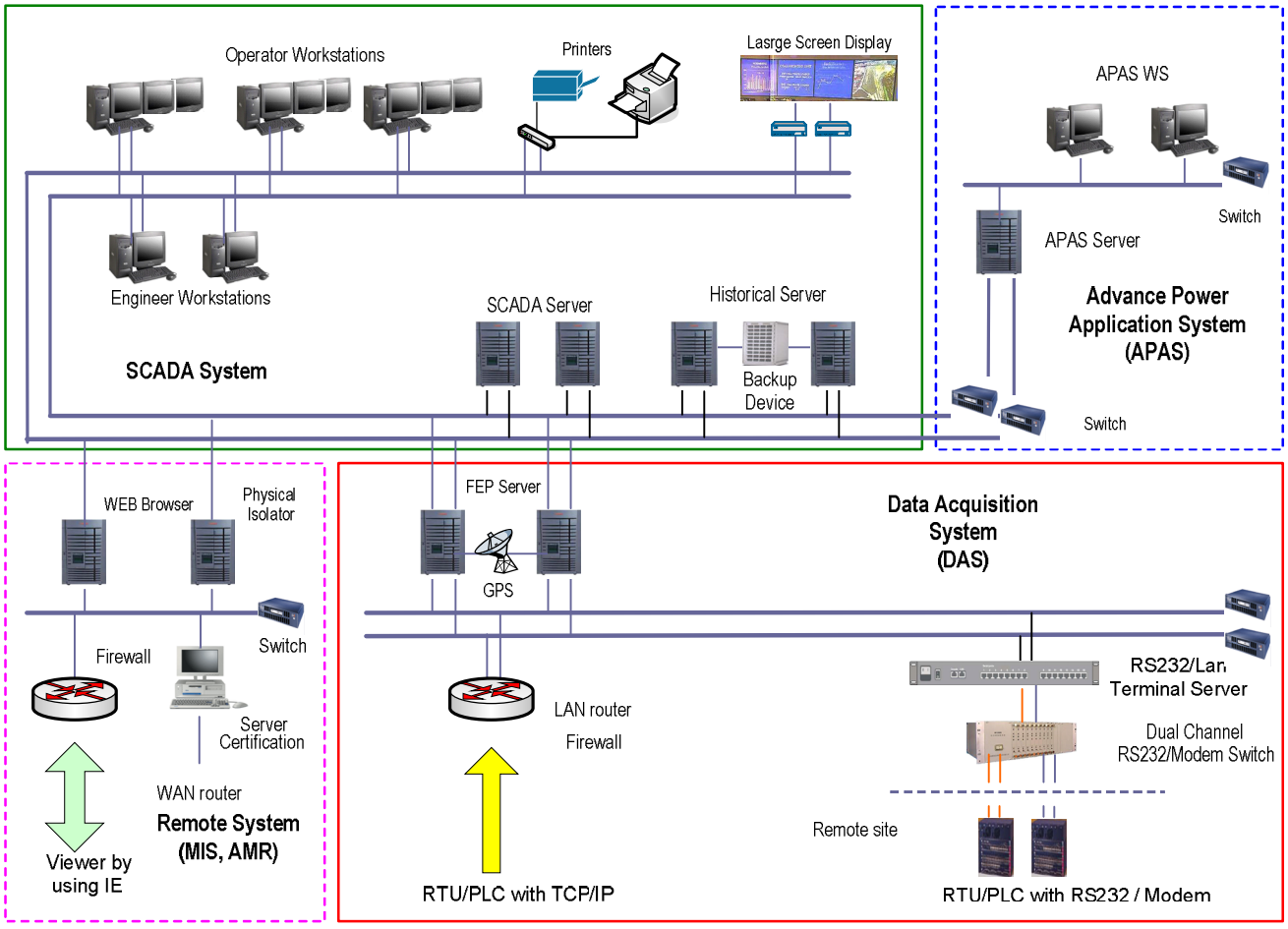

Figure 6-1: V-SCADA2000 Sample Configuration

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6.2 Basic hardware system of V-SCADA2000

Dual Ethernet is included in V-SCADA2000 System and each node is interconnected in a star-shaped form. Considering the subsystem is relatively independent and factors such as network data flow and external isolation, we divide the System into the following on the basis of SCADA main framework:

1- Data Acquisition Subsystem (*Veesta VS-2DAS*)
2- SCADA Subsystem (*Veesta VS-2SRV*)
3- MMI Subsystem (*Veesta VS-2MMI*)
4- History Server Subsystem (*Veesta VS-2HIS*)
5- Clock Subsystem (*Veesta VS-2CLK*)
6- Computer & Communication Data Subsystem (*Veesta VS-2CCS*)
7- Web Subsystem (*Veesta VS-2WEB*)

6.2.1 VS-2DAS = Data Acquisition Subsystem

Data acquisition subsystem consists of RTU/PLC communication front-end processor, channel interfaces (Main/Standby Switch Modem, analog and digital channel plate, fiber network) and other auxiliary equipment. The front-end processor can be constructed by two sets of terminal Servers that back up each other, also can be constructed by two high performance computers. The data from RTU/PLC, FTU, TTU, and DTU will simultaneously go into two front-end processors. Under the standard mode, only one processor will be communicated with nodes in network. The front-end processor can be automatically and manually switch without any loss of data. A fault in the channel won't cause the front-end processor to be switched.

6.2.2 VS-2SRV = SCADA Subsystem

This subsystem generally consists of two sets of identical servers that are in hotly backup mode. The servers are connected by dual Ethernet to jointly finish processing the real-time data and work of SCADA System. They undertake to write historical data and provide buffer area for the management of trending data. The two sets of servers can automatically (If there is a fault) switch or can be manually switched to avoid single point of failure. No data will lose when switching.

6.2.3 VS-2MMI = Man Machine Interface Subsystem

MMI (Man Machine Interface) subsystem consists of MMI workstation, analogue screen (or screen-controlled machine, large-screen rear projection) and input and output equipment.

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An integrated interactive environment consisting of graphic, animation, diagram and voice will be offered to various operators; A dispatcher can operate and control user's analogue screen through MMI workstation;

This system can be provided with a workstation on duty and a system development/maintenance workstation. The workstation on duty can send the information about the running statue to remote operator through telephone dial-up or messenger call when no operator on duty in main station.

The system is generally furnished with a PC statement workstation which can prepare and print various running statements.

6.2.4 VS-2HIS = History Server Subsystem

This subsystem generally consists of two sets of identical servers that are in hotly backup mode and a history server formed in disk array (mini-system needs not deploy disk array). Commercial relational database such as Oracle, MySql can be installed in the history server to perform data storage, statistics and data inquiry. Its configuration has an important bearing on the performance of the whole subsystem. This subsystem can be constructed by two servers with hot backup and combined with SAN or NAS storage technology to make data redundancy backup. V-SCADA2000 can automatically ensure the data consistency of main and backup history server.

6.2.5 VS-2CLK = Clock Subsystem

A clock system GPS can be covered in this subsystem. Clock signal output is used to synchronize time with SCADA subsystem, therefore the accuracy of time in SCADA system can be ensured.

6.2.6 VS-2CCS = Computer & Comm. Subsystem

This subsystem consists of access equipment to data network, including Ethernet switch, communication server, gateway machine, convergence router, physical isolation devices, communications software, various interface etc.

6.2.6.1 Input and Output Equipment

Input and output equipment is the ancillary equipment of computer, including printer and plotter. The printer is used to print graphic, statement and log record.

6.2.6.2 Network equipment

Distributed network architecture is employed for V-SCADA2000; each node in the system is connected by the dual Ethernet. This architecture is formed after fully considering the data flow and real-time performance.

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The traffic rate of master network can be 100MB/s, 1000MB/s. Under normal condition, load-balancing will be employed by dual Ethernet. Once there is a fault in a network, the other one will take over all communication loads. V-SCADA2000 supports VLAN and Bonding technology. VLAN can effectively utilize the existing hardware resources of network. Each VLAN is relatively independent and won't affect each other. Bonding technology is to bond two network cards into one IP address. Once there is single point of failure in the network, the other one can be used.

To meet the need for remote diagnosis and maintenance, the system has dial-up Modem which can be used to perform remote diagnosis and maintenance.

6.2.6.3 Uninterruptable Power Supply Subsystem

UPS power is required in order to ensure the safe running of the system and to prevent data losses due to power failure. So even the power supply is shut off power grill, the system still can be in normal operation and ensure the system and data safety.

6.2.7 VS-2WEB = Web Subsystem Optional Module

The national requirement on Secondary safety protection demand that WEB subsystem and main system are relatively independent, there can be one or two web servers and Unix server is recommended as taking system safety protection into consideration. Special physical isolation devices with forward and reverse direction can be deployed between safety zone I and safety zone III. Forward direction isolation is used for communication from inside to outside. By virtue of the isolation device, V-SCADA2000 automatically sends real-time data, historical data and graphics files to web server without manual operation and maintenance. Reverse isolation is used for communication from outside to inside and for sending planned values etc.

6.3 Functional module of software supported by the System

Main functions of software:

- **Human Computer Interaction:** to define, maintain the data necessary for the normal operation of SCADA application system.
- **System Management:** to define, maintain the parameters necessary for the normal operation of SCADA application system.

All functional module of software supported by the system can be realized by components in order to improve, expand and upgrade the system; the software is composed of the following functional modules:

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6.3.1 Real-Time Database Management Subsystem

An interactive interface is provided for users to maintain all real-time data and equipment parameters in SCADA System. Real-time database / equipment parameter base are stored in SCADA server in the form of relational database tables and synchronously updated memory buffet zone.

CORBA/COM, ODBC, JDBC and OPC technology is employed for this subsystem. The versatile real-time/equipment database definition tool with clear storage path of unified style is provided by all sites in the network. Users can enter characters, numbers and use scroll bar, list box, check box and some technique used in Motif/Windows to add information into, delete, replace and modify the database tables that have leveled logic relations.

The data consistency can be maintained automatically and manually for the corresponding database in the master and backup SCADA server.

According to V-SCADA2000 system architecture formed by real-time/equipment parameter database on the basis of CORBA/COM standard, the remote management and data distribution can be easily conducted for the real-time/equipment parameter database. As long as the network and load permits, a random machine like RTU/PLC communication server can manage the real-time/equipment parameter database and copy an image for this database, which the database security redundancy of N grade can be achieved. This will be more reliable than the dual redundancy and hot backup.

6.3.2 Subsystem of History Database Management

This subsystem enables users to maintain historical data in the interactive interface and make a backup for history database. History database is stored in history data server (disk array and hard disk and memory of history data server) in the form of relational database tables and synchronously updated memory buffet zone.

CORBA/COM, ODBC, JDBC and OPC technology is employed for this subsystem. The versatile real-time/equipment database definition tool with clear storage path of unified style is provided by all sites in the network. Users can enter characters, numbers and use scroll bar, list box, check box and some technique used in Motif/Windows to add information into, delete, replace and modify the database tables that have needs for different cycles.

Relative data can be undated automatically and manually for the history data server. The two mechanism hardware configuration (disk array) and software algorithm (dual redundancy) will be employed to ensure no loss of history data when the master and backup history data server is switching.

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The data consistency can be maintained automatically and manually for the corresponding database in the master and backup history data server.

A floppy and compact disk can be used to record the history data and the data in the floppy and disk can be copied to the database.

According to V-SCADA2000 system architecture formed by real-time/equipment parameter database on the basis of CORBA/COM standard, the remote management and data distribution can be easily conducted for the real-time/equipment parameter database. As long as the network and load permits, a random machine like RTU/PLC communication server can manage the real-time/equipment parameter database and copy an image for this database, which the database security redundancy of N grade can be achieved. This will be more reliable than the dual redundancy and hot backup.

6.3.3 Subsystem of Graphics Management

This subsystem enables users to draw and maintain graphics and pictures in the system. And the SCADA picture files with designated format can be generated in accordance with requirements of SCADA System and specific definitions of real-time/equipment database.

V-SCADA2000 graphics subsystem based on GIS platform offers abundant and practical drawing tools which can draw various required graphics. It supports all characters in Motif/WINDOWS.

The following graphics can be made with the powerful graphics functions of GIS and database correlation functions:

Straight line, broken line, oblique line, rectangle, polygon, circle, ellipse, bar chart, curved line and so on; other languages' characters and letters; dynamic diagram, tidal current diagram, dynamic graphics primitive, meter and figure and so on.

This subsystem provides "symbolic library"; users can save self-made bitmap and vector diagram for further use.

Users can make changes to all the graphics, to copy, cut, delete and reverse the pictures, and to change their sizes and colors.

A clipboard and Undo commands are provided.

Online editing and update for the graphics are supported.

6.3.4 Event management subsystem

Events can be defined as the following:

- **System emergency:** Various warnings, advance notices, reports, accident and events set by users when the system is operative.
- **SCADA System events:** The records of start and stop of each node, records of changes in running status and resources, communication and other operation records;

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All events will be recorded into the events database of relational database. Predefined automatic/manual inquiry, statistical tool and an inquiry interface supporting SQL language are provided. The inquiry and statistical result will be shown on the inquiry interface and can be imported to other tables of database. A wide variety of computing can be carried out in the real-time database or shown in the picture statement.

6.3.5 Statement Generating Management Subsystem

The statement-generating and editing and management subsystem can generate history data and real-time statement of power system; curved line and various graphics also can be embedded into this subsystem. The inlaid graphics editing system of V-SCADA2000 System can realize the following functions:

- **Statement Editing:** users can use the statement-generating tool to create various forms and define their formats. Daily, monthly, quarterly and annual statistics can be made.
- **Statement Display:** is integrated into human-computer interface to facilitate reading of statement, online change of parameters and formula. The statement can be exported as a excel file.

6.3.6 Internal Network Comm. Management Subsystem

Based on CORBA/COM, the network communication management components that inhabit in all nodes have the following functions:

1- Other nodes' running status can be known in a random node. Network management and flow control can be realized.

2- These components accept service request aiming at SCADA system, users need not know the details about network connection. They can just enter their commands and send the detailed parameters.

3- As for the designated network service types, network communication management components support all the network protocols supported by UNIX/Linux and Windows2000/2003/XP, including TCP/IP, Netbios, Netbeui. Users may add other protocols to realize the connection with networks of other types when necessary.

4- To remotely access to the server, remote workstation can be connected with SCADA system via RAS dial-up. Like other workstations in V-SCADA2000, this remote workstation also can monitor the system's running status.

5- This subsystem can communicate with SCADA system through remote router. The application layer of data communication may adopt DL-476-92 and other standards.

6- Its CORBA/COM interface can be used to expand high-level application software.

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6.3.7 Security Management Subsystem

V-SCADA2000 employs the typical INTRANET and router, “firewall” and physical isolation, which can effectively prevent the viruses and attacks of hackers when connected with external computer. The worst case is that the WEB server stops operating due to the D.O.S (DENY OF SERVICE) attacks and the external computer can’t get the information from SCADA System. However, the SCADA System still can run normally.

The system administrator will allocate each user a user name and password. Permission and authority will be given according to user types such as administrator, serviceman, supervisor and operator. The file records user authority is called GUD, which can be stored in SCADA server with encryption or stored in each computer node. A user must enter user name and password before operating the system. The system will check whether this user has the right to enter the system. If everything is OK, the user can operate the system. The operating record may be recorded into the events database which cannot be modified. User’s passport is valid within a predefined period. If this period has elapsed, the password will become invalid so as to prevent illegal use.

6.3.8 System Monitoring and Maintenance Subsystem

The management of all nodes’ process is of great importance if we want to make balanced use of system resources and maximum its performance and ensure its normal operation. A RAPM (Resource And Process Monitor) will be displayed after the boot of V-SCADA2000 of each machine. A highest running priority can be set in a RAPM which can use the resources in RAPMs of other nodes and component services collecting process information to get the resources and process information in designated machine and display them in the local Resource and Process Monitor subsystem. The RAPM in each node will check the running status of application modules and connecting status with other equipment in order to ensure the normal operation of each remote subsystem. The RAPM will set off alarm and cut the faulty node if there is a malfunction in hardware and software. If condition permits, RAPM can automatically or be manually set to start or stop related processes and conduct diagnosis and maintenance for each subsystem of SCADA System. At the same time, the monitoring record will be saved as logs for further analysis and maintenance of running status of system.

6.3.9 Print Management Subsystem

Print management subsystem inhabits the each computer node in the form of CORBA/COM, to print graphics, statement and events and define the printer, parameters. Laser printer, ink-jet printer, dot-matrix printer and other printers are supported.

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- **Perfect Print Management:** A unified management of print job can be obtained for the system. The print jobs can be equally allocated in accordance with requirements. The default setting of a print is supported. In a same workstation, default setting for time setting print and call print can be different.
- **Graphic Print:** to print all graphic files and bitmap. The graphics can be printed according to paper types and pages.
- **Statement Print:** All statement generated by the system can be printed. A specific time for automatic printing can be set. The statement about telemetering and electricity measurement can be printed too.
- **Event Print:** can be set to automatically print the record of accident and out-of-limit event, which also can print the logs. The events can be printed according to categories such as different workstations, areas, period of time. Moreover, line-by-line and page-by-page print can be selected.

6.4 V-SCADA2000 SCADA applied function module

The application software is the realization of function of V-SCADA2000 System. It is based on the functional module of software supported by the system.

6.4.1 Data Acquisition & Protocol Processing of FEP

According to different protocol types, front-end processor will load the corresponding protocol components from the protocol component base and finish the shift from the original data related to protocol to the data not related to protocol. The data acquired includes AI (analog quantity), DI (digital quantity), PI and other data of power grill.

- Front-end processor's data acquisition system supports multi-channel serial, full-duplex and multi-protocol channel. Each channel can set it own communication rate, which can be set between 300~115200Bps to communicate with RTU/PLC, analog screen and other intelligent devices and systems. It can directly communicate with digital channel (serial port, fiber optics) through RTU/PLC. It also can be accessed to Modem for communication. It supports Ethernet with 2M/10M/100M/1000M. The system provides communication isolation, lightning protection to reduce interference and to prevent lightning.
- 300bps ~ 115200bps
- Diverse transmission rates: 300bps ~ 115200bps.
- Diverse transmission channel: microwave, carrier wave, optical fiber, cable, LAN, CDMA, VPN, Wireless LAN.

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- Single channel and multi channel are supported. No original data will lose when switching between front-end processors and channels.
- Synchronous / asynchronous communication is supported.
- The front-end processor can be placed in local area network (LAN) and be directly connected to server in the backstage.
- Protocol library, at present, V-SCADA2000 can resolve a wide range of communication protocols, including MODBUS, DNP, PROFIBUS,AB PLC,ABB PLC, SIEMENS PLC, IEC60870-5-101, and IEC60870-5-104. As for different transmission protocols, the system will resolve them with component technology solutions. The system has adopted unified real-time data description, when adding a new protocol, the corresponding component resolving this protocol can be develop and plugged to machine, hence user's additional need can be suited.
- The method for data acquisition includes acquisition method of marked changing threshold level and cyclically updated scanning method.
- The data capacity received and transmitted by the system can be expanded in accordance with requirements.
- To receive the information from standard GPS clock and transform it to the SCADA system time unrelated to the format of GPS time.
- The system will carry out a real-time processing for the remotely collected communication data, and will monitor the connection and running status of each master and backup channel of RTU/PLC. It supports the automatic switch between master and backup channel and counts the bit error rate, operation ratio and idle time of the channels. If there is a malfunction in the channel, the SCADA System event will be generated in conjunction with an audible alarm. Users can print that information and online shutdown and switch-on of designated channel can be realized.
- The communication subsystem can switch between master and backup channel without any interference and loss of original data.
- To upwardly and downwardly transmit and receive AI, DI, PI and other information.
- It supports the data communication with analog screen and refreshes the real-time data.
- It supports calculation, to transmit the data after arithmetic operation of data from different interfaces.
- The front-end processor can be cross linked with SCADA real-time server, meaning "one plus two", to fully achieve system redundancy and improve system's reliability and availability.
- Completed adjusting and testing means Varied upstream and downstream data can be monitored, adjusted and tested on the basis of SCADA data format and protocol transformat, and the bit error rate, operation ratio and out-of-step rate of

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communication channel can be counted. Manual digital simulation and orders can be given by users to conduct a simulation test.

6.4.2 Subsystem for AI processing and Limit value

The AI in the system is those analogue quantities with continuous change.

6.4.2.1 Unique Data Point Identification Technology

This technology is employed to allocate a sole identifier for each data point including the actual collected points and SCADA system event data point. Users won't sense the existence of these identifiers when they are not in need.

6.4.2.2 Conversion of Engineering Value

The system has linear and nonlinear conversion methods. Users just need to set a suitable conversion parameter. When the data is conversed into engineering value, the system will check data's rationality according to the rationality range set by user and will remove those illogical data. The system will filter the data and deal with the dead zone to eliminate the interference and frequent alarms.

6.4.2.3 Quality mark

A quality mark will be given to all measurements of telemeter and calculation to reflect data's reliability and status. The quality mark covers normal data, invalid data, dead data, bad data and manual parameters. Different data's quality mark will be reflected by different colors.

6.4.2.4 Return-to-Zero

Whether the system will set the AI input data as zero depends on the given value range and the status of related switching value;

6.4.2.5 Test on Rationality

The system will check the rationality of each object to be tested in accordance with the pre-set correction range and won't update the unreasonable real-time database;

6.4.2.6 Out-of-Limit processing

The upper limit, lower limit, above upper limit and below lower limit can be set for measuring points. The system will judge whether the measuring points have stepped over these limits and set an alarm dead zone to avoid frequent alarms as the measuring points fluctuate near the limits. The out-of-limit points will be recorded into log for future inquiry or generating various statements.

6.4.2.7 Manual intervention to measuring points is allowed

The system allows users to set the values for the measuring points on the man-machine interface, or users to conduct calculation to

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process measuring points or conditionally set their engineering values.

6.4.2.8 Statistics

The system will automatically count AI's maximum value, minimum value and the time when the maximum value and minimum value appear, will calculate mean value, accumulated value, out-of-limit time, percent of pass, peak difference. According to customized time period, it will count the maximum value, minimum value and the time when the maximum value and minimum value appear. All these values will be recorded into history database.

6.4.2.9 Historical Storage

AI values will be stored into database in accordance with storage cycle (will be saved accordance with the set seconds, minutes). Under the condition of dual server redundancy and hot backup, the history database in one server will agree with the other. The scale of history database depends on the number of data points needed to be stored in history database and the max storage capacity provided by the system. The data can be stored for at lease 5 years depend on number of AI points. The stored history data is easily transferred to storage medium such as floppy and compact disk. The stored history data can be stored in MIS and SCADA system in the form of ODBC and OPC. So the log can be seen in SCADA system and can be used for analysis and other purposes.

6.4.3 Subsystem for Monitoring DI Status

DI is those digital quantities have changes between figure 1 and 0.

6.4.3.1 Quantity of State

Users can online or offline alter the properties of DI switching values in batches. The properties includes criterion for classifying a accident, alarm status, alarm type, conditions for setting off alarm, a picture for alarm, displacement printout, displacement records saving, displacement count, calculation of value and point under remote control locking condition.

6.4.3.2 Status Types

It supports processing of single contact DI, double contact DI, DI of singlet state and other DI with different natures.

6.4.3.3 Statistics

Automatically count the number of normal separation and gathering of DI and number of separation and gathering of accident. When the limit value set by user is met, warning will be given.

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6.4.3.4 Manual Setting

As for those DI points without actual hard contact signal, the separate and combined status can be manually set and they can be differentiated by different colors and mouse sharps showed in man-machine interface. The system will automatically record each manual setting for future inquiry.

6.4.4 Subsystem for Logical Operation and Judgment

This subsystem can make some general calculations and statistics for SCADA System in its real-time processing. It also provides some expressions and formulas for users' different and customized requirements.

Some basic calculation includes: addition, subtraction, multiplication, division, mathematical power, extraction of root, round-off; logical calculus and/or non-logical calculus, trigonometric function, getting a maximum, minimum and absolute value; Beep sound, formatting character strings and other function operations. The quantity used for calculation can be real-time and historical, as well as an AI and DI. Users can define the attribute of the quantity and the real-time database that the quantity inhabits. The subsystem can finish complicated judgment and control. The calculation period is adjustable. For some specific calculations shown below, users may customize relevant Formulas:

Weekly, monthly and annual maximum, minimum, average value and the time when these values appear, users can customize what they want to calculate.

The default calculation period is 3s, which can be adjustable, minimum is 1s.

6.4.5 Subsystem for Controlling DO, AO

All predefined objects in the pictures can be remotely control. The subsystem has several verification methods so as to ensure the security, correctness and speed of remote control.

6.4.5.1 Authority Verification

Operators enter the passwords to verify their authorities. The valid period for the authority can be manually set.

6.4.5.2 Specific Control

The operator can select an operational objective and check whether it can be controlled, and a remote dialog box will appear and show the description of the object's attribute for the operator's confirmation.

6.4.5.3 Internal Verification

To verify the DI status of DI in the database and check the legality for operating the DI

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6.4.5.4 Statistics

It provides statistics of remote control, failure to operate and correct ratio. The system administrator has the right to set these statistics.

6.4.5.5 Methods for Remote Control

- **Direct Remote Control:** To directly control the remote switch without verification
- **SBO control (Selection - Verification - Execution):** After sending the command of selecting an object to RTU, the system will receive the verification of RTU and show the information on the screen of MMI machine. The operator can execute or revoke the command according to the verification results. This operation may be automatically cancelled because of remote control timed out and no verification. The timeout period can be freely set.
- **Batch Control:** In an emergency, the batch control can be made in the system in order to reduce the numbers of operation and shorten the operation time. A user can preset several target control switches and control sequences. In an operation, an operation enters the command. On the basis of the parameters set by the user, the system will ask whether the operator executes the batch control. And the operator confirms to execute the batch control. All information about the operation process and user's name will be recorded and filed.
- **Sequence Control:** For those remote control points that have logic locking relations with each other, users can set their logic locking relations. If the locking relation is not matched, the remote control will be denied.

6.4.5.6 Operating Record

Operator's name, operating time and content will be recorded and stored. All data can be retrieved for analysis and print in accordance with types.

6.4.6 Processing of Events, Alarms & Emergencies

When there exists a malfunction or unusual status in any node and module, or a malfunction or unusual status appears when processing the real-time or historical data, the system will automatically set off alarms which cover preset sound alarms, window alarms, picture alarms and graphics/lines/areas alarms. The information about the alarm can be immediately printed out. Users can set a single alarm or the combination of these alarms. All these alarms can be set in dispatching workstation or other workstations and can be conditionally selected for the workstations according to their duties.

According to the pop-up images set by user, the designated image will be showed when setting off alarm. These images can be the wiring diagrams, ordinary statements as well as the specially made pictures by user for research purpose.

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6.4.6.1 Alarm Priority and Number

The alarm priority can be set by the system according to user's requirement. An important alarm will be given to priority to be set off. The number of alarm can be randomly set. The important alarm has no limit.

6.4.6.2 BP / Cell Phone / Fixed Telephone / E-mail Alarm

V-SCADA2000 system can define the class of malfunctions. When an operator is needed but the operator is not present, various communication means will be used to inform the operator, reporting the location of a malfunction appears, the type of malfunctions, and related superiors will be notified.

6.4.6.3 Printing of Alarms

When an alarm sets off, according to configuration and parameters set by a user, the system will show the log to be printed for operator on duty to check and for filing purpose.

6.4.6.4 The Processing of Signals

The system will check various kinds of signals for any unusual state, if there is, the system will set off an alarm, show a picture, print the recorded events, emit sounds and light or a voice alarm;

6.4.6.5 Deviation Alarm

If there is any deviation (normal change or accident) in the quantities, a flicker will flash in the preset picture to alarm the operator. When the alarm is confirmed or disappear, the flicker will be removed.

6.4.6.6 Sorted Alarm Window

Different kinds of alarms will set off in accordance with users' different alarm setting and some information will be displayed in the bulletin window, including time for alarm, geographical information, type of alarm, and content of alarm. If the alarm is confirmed by an operator but is not disappeared, the colors used for an alarm are still used to show the information of alarm. And normal colors will be used when the alarm is confirmed by an operator and is disappeared.

6.4.6.7 Historical Alarms and Inquiry on Statistics

All alarms generated by the system, including time of an alarm appears, information on site, type of alarm and description will be stored in the event repository. Meanwhile, inquiry and complicated statistics can be made in accordance with time, geographical information, and type of alarm and description of alarm.

6.4.7 Dual Standby Switch the Subsystem

Dual standbys are employed for the front-end processor, real-time server, and history database server in key components of the SCADA system. So these components bear the reliable redundancy,

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which the reliability and availability have been enhanced for maintenance and dealing with emergencies.

The system provides automatic and manual switch. When the dual standbys is required to be switched, select the manual mode for the switch, then perform authority verification. Only an operator who obtains the authority can perform switch. After passing the authority verification, the system will perform switch and maintain the data uniformity of the shared database. At the same time, the record in connection with the switch operation will be kept in the database; the record includes information about operation account, time and the node computer used for operation. And the system will check whether these standbys are in the same status, if not, the system will return the unusual one into correct status according to user' setting or by default.

6.4.8 Synchronization of System Clock

The clock in each node and RTU/PLC will be synchronized on the basis of GPS clock. The front-end processor receives the synchronization signal from GPS in accordance with the given format and set the local clock. Moreover, the clock synchronization signal can be received in accordance with user's setting. When the front-end processor and the server are on the same computer, server may synchronize the time.

The system supports various external satellite clocks.

The whole network will use the SCADA time of the unified format.

6.4.9 Communication of Large Screen Display

6.4.9.1 Analog MIMIC Panel

The system provides the interface for connecting an analog MIMIC panel. The communication protocol between the system and the analog panel is provided by a user. The status, analog quantities showed in the indicator light of the analog MIMIC panel corresponds with the real-time status displayed in the monitoring screen.

This analog panel is a functional module of the front-end processor. The transmission of data, the test on the analog screen, data processing and monitoring can be realized. The automatic switch of serial ports can be realized by the multi-function board and switch box in the front-end processor, which the analog panel can be normally driven under dual redundancy and hot backup mode. Various analog panels are supported by the system.

After the framing processing of the real-time data of analog panel in the real-time database in accordance with the protocol, processed data will be sent to the analog panel.

The type of analog panel and test mode can be set via the man-machine interface, so the analog panel can be tested.

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The means to monitor and test the analog panel are provided to facilitate the supervision and control of analog panel and show the real-time data received and sent, which facilitates the adjustment and maintenance of the system.

6.4.9.2 Digital Large Screen Display, DLP/LCD/LED

Rear Projection System and large screen LCD display with several cubes is supported, which has been integrated into MMI for display multi screens MMI graphs on the video walls.

6.4.10 The connection of MIS and WEB

The system employs CORBA/COM technology and provides web browse, the browse in MIS network (i.e. INTRANET) and the hook-up INTERNET workstation is supported, but users just install a file server used for SCADA graphics/statements and make some easy configurations.

- The system is seamlessly connected with WEB browser
- Physical isolation and firewall and other safety devices are supported
- The real-time system graphics/statements and a same user interface can be viewed in the browser
- The date of history data can be set in the browser. The data in a certain time can be viewed in the browser too;
- All touch points in chart/statement and screen menu employ hyperlink;
- The geographical information of all data points will display;
- The size of graphics/statement can be zoomed;
- The switch to main picture of the system can be made with one key;
- The recent record on alarms will be provided while refreshing the data (this function is optional)
- The graphics/statements will be automatically uploaded to WEB server. The changed graphics/statements will be automatically updated by the system or can be manually updated;
- Real-time data and historical data will be sent to MIS in accordance with user's requirements, which the unified interface in provided for MIS to visit the history database.

6.4.11 Print Management

- Graphics and statements can be outputted to any designated printer in the local and network
- The default setting of a printer can be used to print the graphics and statements, or each graphics and statement can has its own print setting

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- Graphics and statements can be printed in accordance with page, designated area and scale
- The sizes of graphics and statements can be set
- Print designated statement at pre-scheduled time, print on call, print day-book event alert at real-time.

6.4.12 History Database

- Users can set the time that a data point stays in the history database and even the data point just stays for few seconds.
- The history data will be filed
- The statistics about the most common used data will be made as the real-time database is in use
- Peak, valley and normal count and recount
- It can adapt to the buffer when quickly accessing history data
- It uses the modules and the unified data to visit the interface
- The simple drag and haul can be used to alter the values of history database and the record about the alteration will be saved
- It uses the modules to access history data and can adapt the programming interface of a rapid development tool
- It supports that the history data can be imported from files and commercial database

6.4.13 Basic element of Graphics

Abundant vector diagram and symbols are provided and bitmap is supported

- Straight line, broken line, polygon, freehand line, rectangle, ellipse, arc, sector,
- The graphics and symbols (vector diagram) in common use
- Lattice diagram
- Picture formats such as wmf, bmp and jpg
- Dynamic data (AI, calculation quantity, PI) and status symbols (DI), various display forms
- Graphic colors, line shape, line width, graphic rotation, various filling mode and special picture effects
- The common characters are supported; the size of a character can be adjusted and rotate
- The close connection between dynamic data and status symbols with equipment-oriented database
- These elements of graphics can be edited.
- The combination of these elements
- The editing, add and deletion of elements can be made

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6.4.14 Editing of Graphics/Statements

Various simple and complicated graphics/statements can be made with the use of the configuration tools in the system. Meanwhile, the popular Excel can be used to prepare statements.

- The tips on use of the configuration tools, the selection of configuration tools
- The placement, move, copy, paste and deletion of the elements of graphics
- Multiple selections on single point, region selection and its “move”, “copy”, “paste” and “delete”
- Single alteration of attribute of an element and several alterations of elements can be made
- The repeated status switches can be made between alteration and editing, view and navigation, analog test
- Flush upper, flush lower, flush left and flush right; center on page; transverse and vertical adequate distribution
- The correlation between the related data in database and status data in the system
- The common graphics can be added into the symbol library, which can be used as the templates for other purposes

The elements of graphics in the graphics/statements can be modified under the running state and the normal operation of the system won’t be affected. In addition, data conformity of graphics/statements can be maintained within the whole network.

6.4.15 Graphics/statement Display

An interface displays system’s graphics and statements.

- The interface is a standard X-WINDOW interface
- A unified interface type
- Layer-by-layer display, each layer has a appropriate display ratio
- A concise and clear navigation chart
- The embedded divided zones can quicken the display and presentation of graphics
- The memory buffer technology can minimize the flashing of screen
- Cruising and zooming, the images can be synchronously updated in the process of cruising and zooming without vibration.
- Auto cut layer, auto delete complication, auto add complication
- The display of graphics and statements can be automated by customizing script
- The position of graphic elements will be automatically checked, the graphic elements whose positions are overlapped will be indicated, which can eliminate potential incorrect operation
- The status of data will be checked and colors and flickers will appear to indicate the unusual state, an alarm will be set off

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- Different colors and flickers will be used to differentiate the dynamic data and status data
- The real-time data and manual setting parameters can be distinguished
- The list of parameter of the certain device and its photos of on-site running can be quickly displayed on the screen
- Graphs are provided to reflect tendencies of historical changes or to make historical comparisons
- Bar charts and pie charts are provided to reflect real-time changes, historical changes or to make comparisons
- The meter needles and graphics show real-time and historical data
- Implement real-time curve monitoring over data point on system second-level data points.
- A list (form) is provided to show AI, PI, calculation quantity and the tele-signaling status
- A random shortcut key can be customized to make the picture showed with a key
- Adjust picture with touch point element on it
- Parameters are provided to be set and managed
- The menu, toolbar, right-click menu are provided for user's customization

6.4.16 Computer Network & Data Comm. Software

- MIS and other application systems can be interconnected with this software in the form of DDE/ODBC/OPC.
- The safety precautions can be set for this software and other systems. The system can be organically integrated with data network and safety protection devices.
- The software can be linked with MIS through the Web server based on INTRANET, which can effectively prevent information of MIS form entering into SCADA and just allow EMS to send information to MIS. Detailed functions show below:
  - The system has safety isolation to ensure the safety of SCADA; MIS will receive the real-time data and historical data from SCADA;
  - At the request of user in MIS network, the required data will be retrieved and presented to user;
  - At the request of user in MIS network, the real-time graphics including various system wiring diagrams, varied curves and production statements will be automatically generated. And an electronic billboard will be offered to display the real-time data or graphics in connection with public concerns.
  - According to different requirements, different user authority can be set to restrict user's inquiry.

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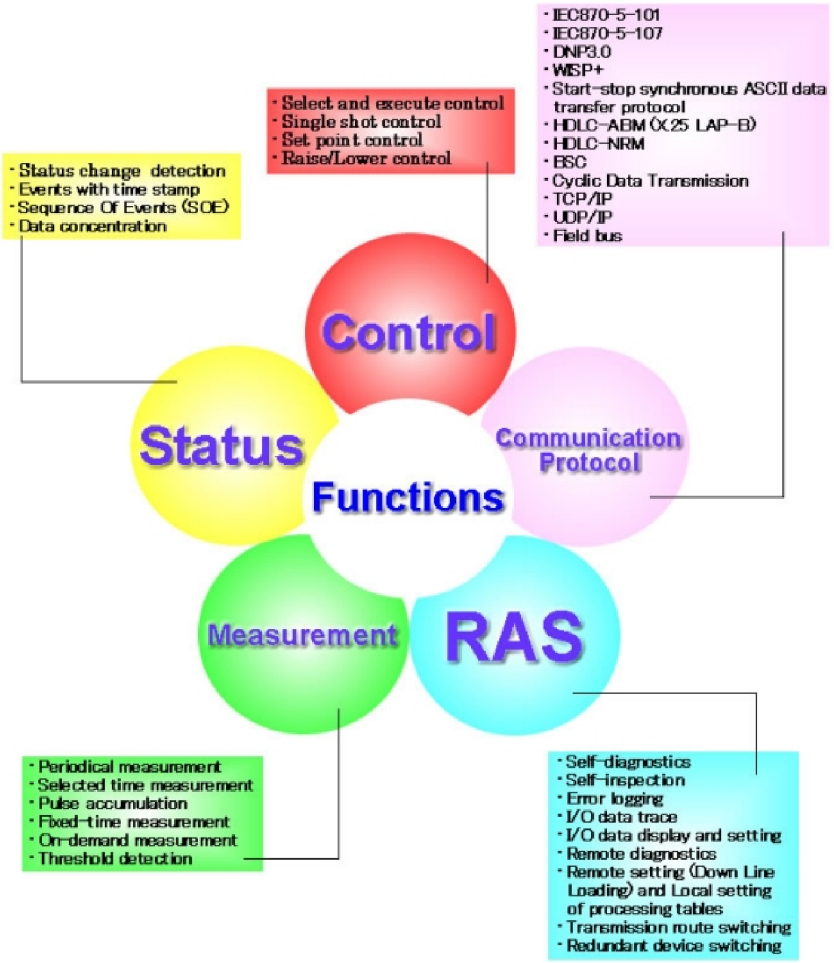

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Veesta World Co
World Wide Web: http://www.veesta-world.com/
E-Mail: info@veesta-world.com