Product catalogs

Process Data Acquisition - PDA

Detailed analysis of quality management & industrial big data sources

PDA Process Data Acquisition

LTA Long Trend Analysis

HDS open time serial History Data Server

OCX WinCC-PDA FTView-PDA Web-PDA

DBU Database Upgrade

DCC Digital Coil Convert system

CFS Coil Fast Search system

DSO Device diagnostic Synchronous Oversampling system

RSA Roll Spalling Alarm and quick stop system

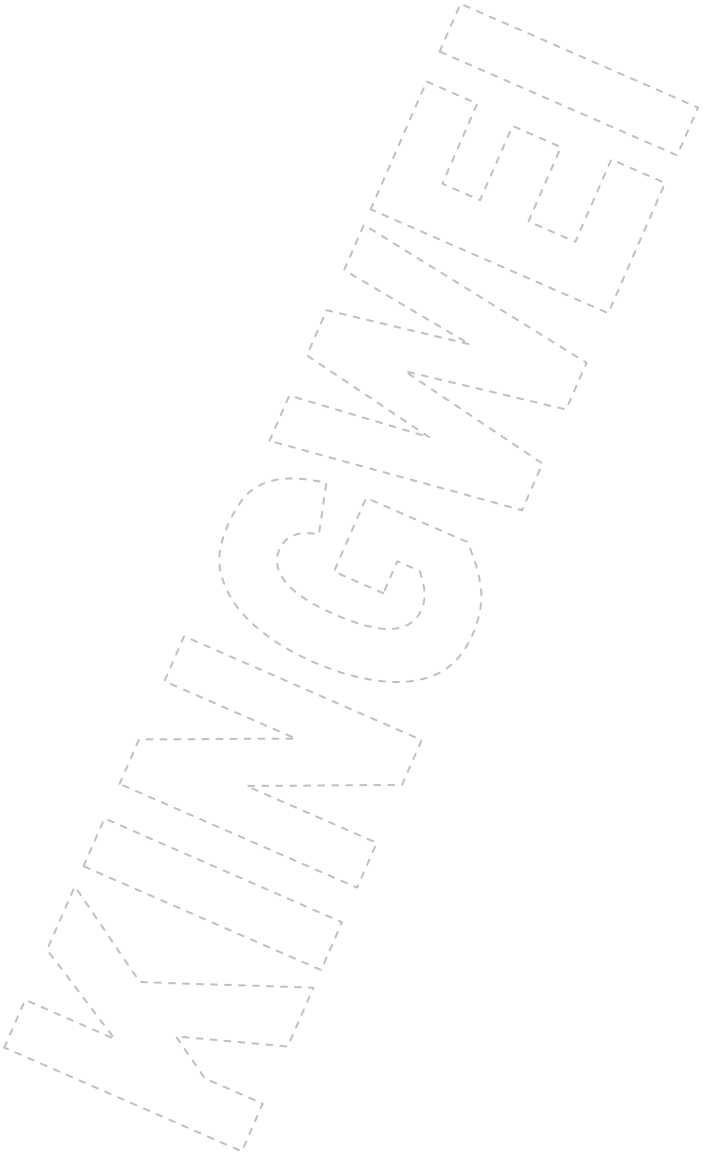
RCM Roller Current Monitoring system

HDP High Density data Platform construction

KINGWEI PDA-10000

Answers for industry.

KINGWEI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PDA
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PDA REF-MANU-0AB0
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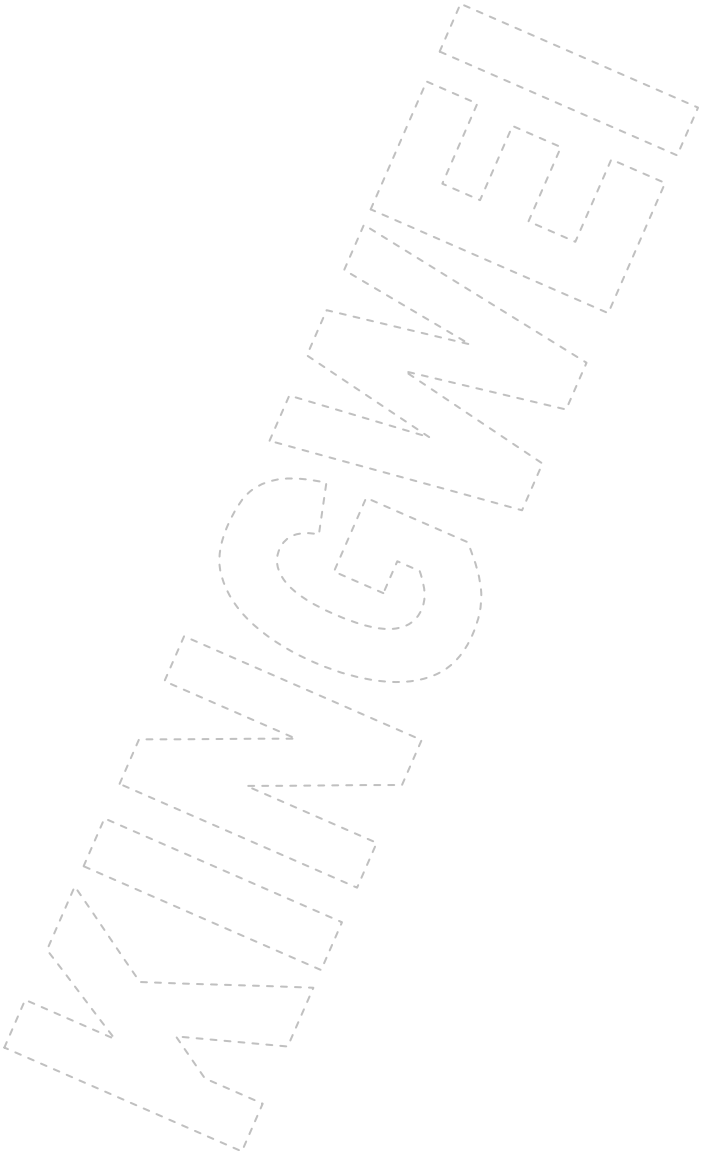

PENGINEERING

1 Background and significance

The PDA (Process Data Acquisition) high-speed data acquisition and analysis system is an industrial real-time high-speed data acquisition and analysis platform that integrates data acquisition, compression, storage, and analysis. It has online and offline analysis functions, and almost all of the underlying technologies of control systems and communication protocols are involved. This is a major technological weakness in China. High performance controllers in the industrial control field are basically monopolized by foreign countries, and the field bus standard The communication protocol is almost controlled by foreign companies, and high-speed collection of industrial data faces many technical barriers and high intensity encryption from abroad. It is an extravagant hope to independently obtain high-frequency and high-density data from our own machines and factories, and this situation urgently needs to be changed.

KingWei Impress Moon Technology Co.,Ltd. uphold the principle of "cooperation, integrity, pragmatic, innovation" philosophy, Service to customers with valiant pursuit of high quality, high reliability of the product quality. It is a domestic successful example of research development innovation.

After twenty years of development and innovation, mixed brand contacts reputation quality government and user support as a whole, the scale is moderate with production development and sales at home and abroad. become a supplier of industrial high-speed data acquisition and analysis system with support of relatively complete data source types, A whole set of technology standard has been constructed.

In many years, our R & D team focus on communication protocol research and development, field bus analysis, high speed data acquisition, real-time data compression, mass data storage, online data analysis techniques, unlimited energy and enthusiasm have been poured into them, a series of PDA hardware and software products have successfully developed with sincere cooperation of related Companies after diligently exploring, The comprehensive performance indicator reaches the international leading level.

Products design meets international standards, compatible with the domestic and foreign main electrical brand, to meet the industrial demand, has been widely used in metallurgical industry and the user's consistent praise is high.

Don't stop pursuing the development trend of electronic control technology, strive to perfect technical and economic integration is the permanent mission of the KingWei.

"To meet customer needs, create value for customers" is our eternal hope and action guide.

2 PDA data acquisition and analysis system

PDA (Process Data Acquisition) system is an industrial real-time platform with high speed data acquisition compression storage and analysis, online and offline analysis is its basis function, it's also a high performance general product at same time, it is a basic platform of industry 4.0 and big data.

(1) Provide equipment test method for the equipment manufacturing factory

(2) Provide effective methods of fault diagnosis and status detection for operation and maintenance of production plant

(3) Provide a convenient tool for the analysis of dynamic process

(4) provides the accurate basis for objection to the quality of product identification

(5) Provide strong data support for the development of new products

(6) Intelligent unmanned data recorder, radar, image recognition, speech recognition, deep learning, laser ranging, path planning, driving instruction, navigation and location, and equipment status

2.1 Overview of PDA system

The system can collect multiple units of PLC or controller data, the sampling period can be down to 0.05ms, the sampling points up to 100000 points, used to support the mainstream PLC, network, bus, hardware interface module, Multi-server and multi-client mode are supported, PDA drive may be developed cooperatively for special equipment, User specific analysis functions can be customized.

Figure 2.1 application interface

2.2 Fields of application

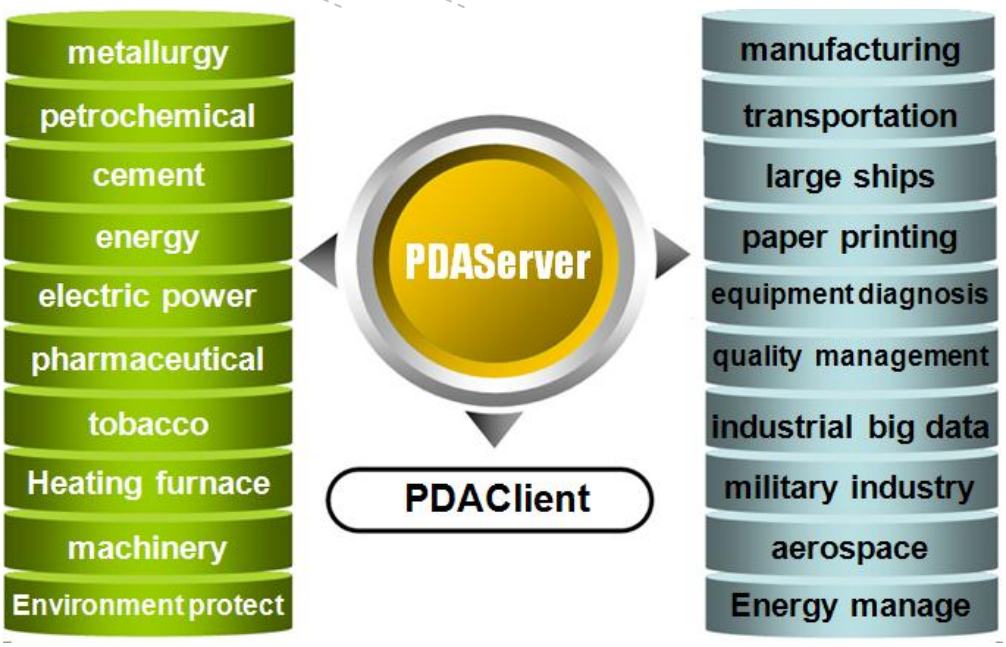


Figure 2.2 Application fields

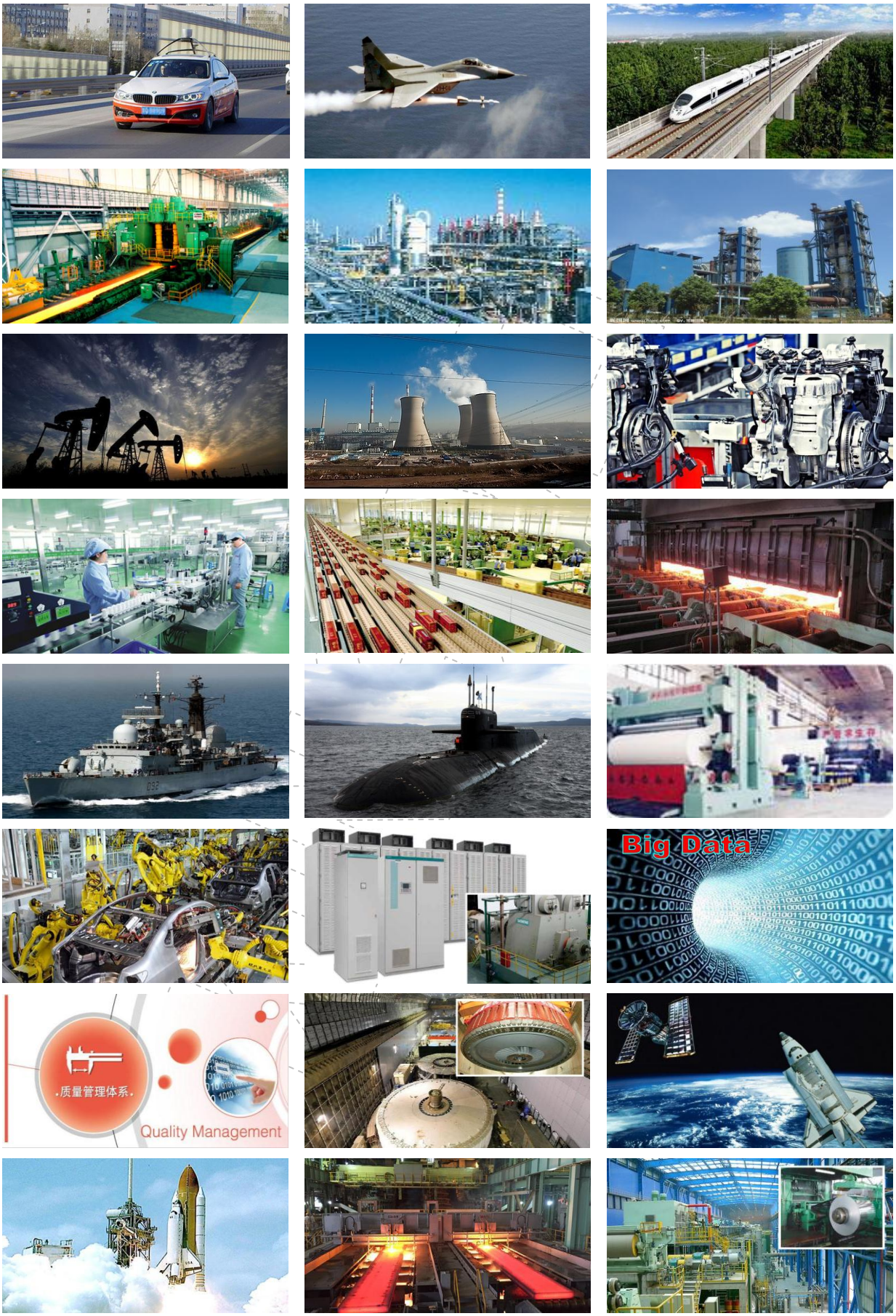


Figure 2.3 application fields of PDA systems

2.3 System functionality and performance

Open, compatible, universal
Millisecond data sampling
Acquire 100000 points
Effective real time data compression
Microsecond time resolution
Support for commonly used mainstream PLCs
Support the reflective memory network
Support the field bus and the hardware IO
Wireless data acquisition
Take client / server architecture
Support multiple master multiple slave multi window
Dedicated board, dedicated network
Develop cooperatively PDA driver for special equipment
Signal search, layering, grouping
Export signal tree
Config with Excel
Telegraph message(mixed type taxis)
Packeted data acquisition
Analysis data export
History data export
Logical virtual signal
Real-time trend
Historical trend
Dynamic playback
Multi-column view
Dual x-axis marks
Dual y-axis marks
Dynamic y-axis mark
Auto scale
Alignment
Time sequence analysis
2D view
3D view
Curve fit
3D surface view
Surface fit
Profile analysis
Frequency chart
Phase analysis
Energy analysis
Acceleration analysis
Same compare analysis
View navigator
Roller span
Roller zoom
Span trend chart
Zoom
Adjust area height
Data statistic
Export statistic data
Data dictionary
Digital filter
Video synchronous analysis
Absolute and calculative time base
Analysis strategy
X-Y convert
Digital meter
Curve annotation
Fault diagnosis
To capture transient signals
Event note
Expert system
System alarm
Database upgrade
Data remote transmission
Quality data report
QDR−Quality data recording
Judge the quality of questions
Calculation of bearing oil film
Mill stiffness measurement
Mill stiffness trace report
Performance test report of large hydraulic cylinder
Dynamic running record and meter reading system
Dynamic energy report
To configure flexibly collection signal
Acquiring state indication
Wireless model configure
Oscilloscope waveform analysis
History data interface
Compatible with third-party data formats
Plugins
Video synchronization analysis interface
Online data interface
Data file generation completion interface
Fully open real-time data interface
Oracle Database real-time interface
Quality management system and big data interface
HMI Interface
High speed data forwarding
ModbusTcpServer interface
OpcUaServer / OpcUaClient
KafkaServer / KafkaClient
mqttServer / WebSocketServer
Ftp Server / Http Server
Whole process quality management and data analysis
Customizing special analysis function
Develop cooperatively for special board
PLC Communication protocol service of data platform
Distributed data acquisition
Secondary day data file
Minute grade year data file
Big Data Office
Cloud synchronizing
Chinese / English / Any language

2.4 Technology parameters

PLC field bus and intelligent devices are supported.

2.4.1 Data type

String: LSTRING[Length]: 2 + Length bytes are occupied, the first byte is max string length, the second byte is actual string length
STRING[Length]: 1 + Length bytes are occupied, the first byte is actual string length
CHAR[Length]: Length bytes are occupied

Analog: SINT: signed char, int8, smallint
INT: short, int16, shortint
DINT: long, int32, longint, integer
BYTE: USINT, unsigned char, uint8
WORD: UINT, uint16, unsigned int, DATE, S5TIME
DWORD: UDINT, unsigned long, uint32, longword, cardinal, ulong, TIME,TIME_OF_DAY
REAL: FLOAT, single
DOUBLE: LREAL, DateTime

Digital: BIT(BOOL, Boolean)

Mixed arrangement

2.4.2 Sampling period

0.05ms level(0.05ms, 0.2ms, 0.8ms.....50.0ms)

1ms level (1.0ms, 2.5ms, 3.6ms.....50.0ms)

10ms level (10ms, 11ms, 12ms.....50ms)

2.4.3 Data compression

Realtime compression: focus on real-time and efficiency.

Efficient compression: high compression ratio, pay attention to compression ratio.

No compression: pay attention to openness.

2.4.4 Collection points

More than 100000, As the acquisition cycle becomes shorter, it may be less and depends on the computer performance.

2.4.5 PLC data source connection number

Less than or equal to 80

2.4.6 Data acquisition mode

Industrial Ethernet, Profibus-DP, RFM and other network acquisition.

Hardware interface module.

PLC forwardly sends data, PDA server receives them.

PDA server directly reads data from PLC.

Data packet transmitted.

2.4.7 System clock

Calculated clock

Real time clock (wide area synchronization)

2.4.8 Data interface

Dos, Windows32/64, Linux32/64, Android, Mac OS, iOS and other platforms are supported.
Fully open real time data interface
Oracle or other database realtime interface
Fully open historical data interface
Fully compatible with third party data
Quality management system and big data interface(Memory pointer + data file)
HMI interface(Memory pointer + data file)
Video synchronous data interface
Plugins
Data file generation completion interface
ModbusTcp interface

2.4.9 System device

To take general equipment and protocols as possible.
To discard special interface module and network.

2.4.10 Distributed data acquisition

Local ethernet clock synchronization error is less than 1ms.
GPS and other clock synchronization is supported.

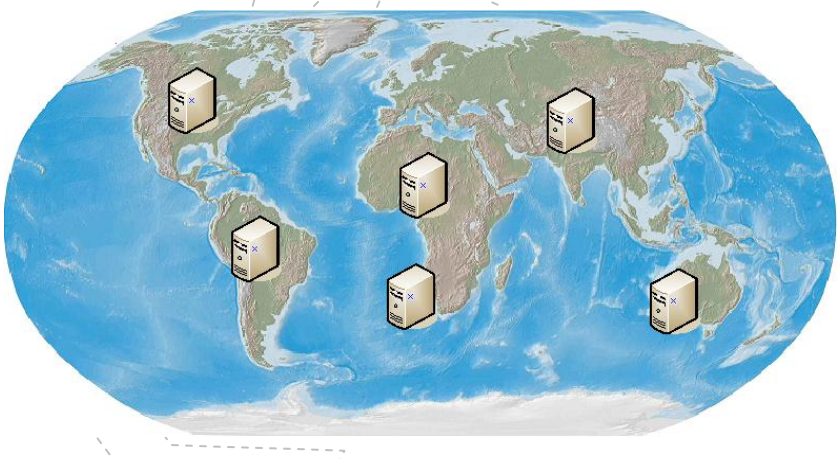


Figure 2.4 PDA Data Collection Server Distribution

2.5 System structure and network topology

Real time data of controller is collected at high speed by bus or network or interface module, the following analysis functions are provided: Selection of drawing mode(X axis based time, X axis based on length, ordinary view, 2D view, 3D view); Statistics function(calculation of the selected area maximum, minimum, instantaneous, mean, standard deviation, variance); Color control; View navigation; Signals arithmetic operations(addition, subtraction, multiplication, division, square, square root, the four operations of common mathematical functions); Various filters (Low pass, high pass, band pass, band stop); fast Fourier transform and so on.

The system is mainly composed of data acquisition server, data acquisition and analysis software, network configuration as shown below.

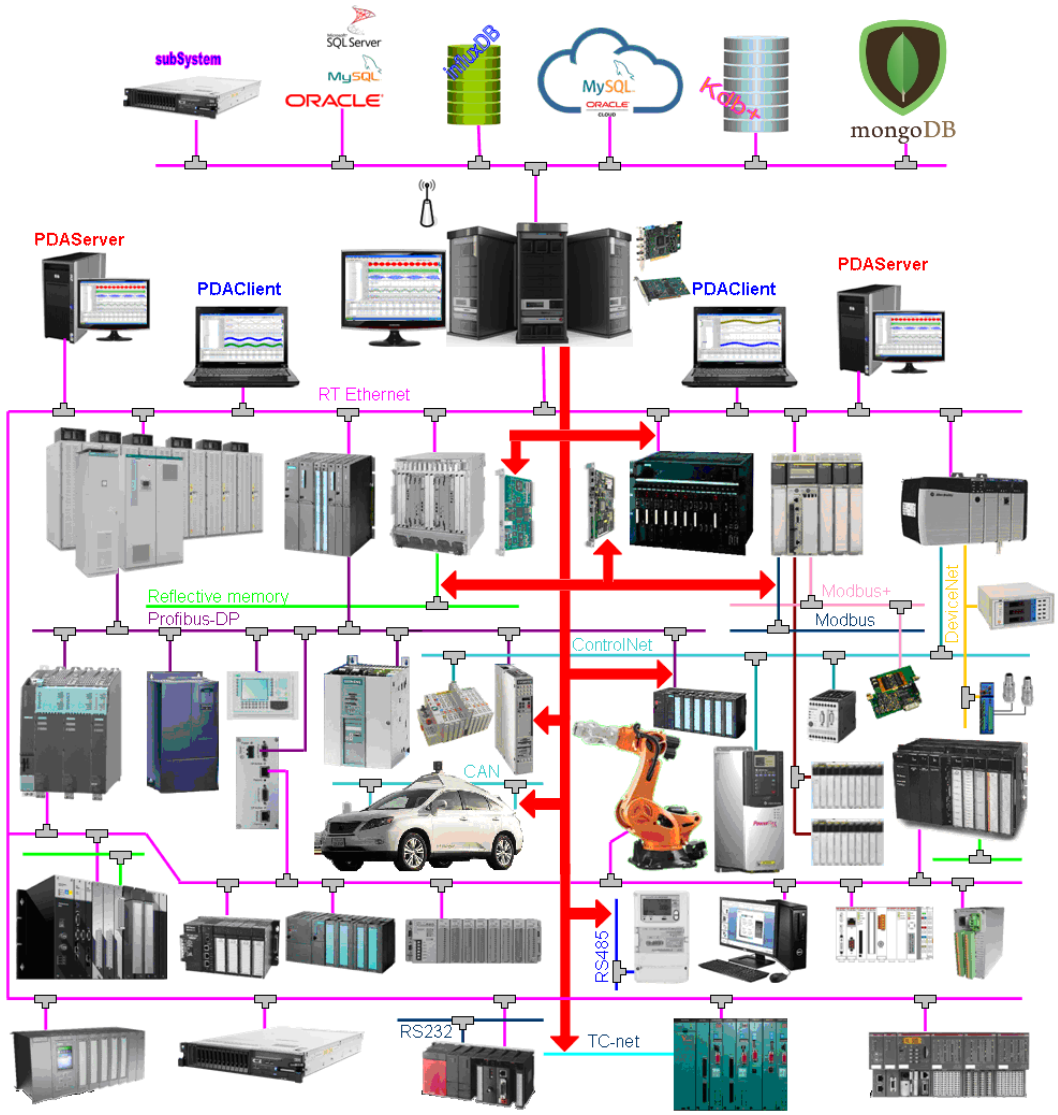


Figure 2.5 System network configuration and topology

2.6 PLC, field bus and vendors

- ☐ Collect mainstream PLC data
- ☐ Collect Intelligent controller data
- ☐ Field bus data acquisition
- ☐ Signal acquisition for remote AI, DI module
- ☐ Wireless data acquisition
- ☐ Acquisition of reflective memory network
- ☐ Acquisition of PC data
- ☐ A variety of multiple PLC, infinite point
- ☐ Develop cooperatively PDA driver for special equipment
- ☐ Acquisition AI, DI signal of hardware card (orders)
  - 0~5V / 0~±5V / 1~5V / 0~10V / 0~±10V
  - 0~10mA / 0~±10mA / 4~20mA / 0~±20mA
  - 0~1A / 0~5A / 0~±1A / 0~±5A
  - mV weak signal
  - 16Bit A/D conversion, PDA time base 1~255ms
  - 16 channel analog non-isolation
  - 16 channel analog : 3000VDC full isolation
  - 32 channel digital input
  - Channel may be grouped according to the type of signal
  - Module can be extended to hundreds of points by series
- ☐ Thermal resistance Pt100/Cu50
- ☐ Thermocouple J/ K/ T/ E/ R/ S/ B
- ☐ Angular displacement, electronic scale
- ☐ potentiometer, Frequency signal
- ☐ SSI synchronous serial interface
  - The communication rate:250KHz, 500KHz, 1MHz, 2MHz
  - Data length:16 / 32 bit
- ☐ Realtime data file
- ☐ Siemens S7-400 / FM458
  - Sampling period may be 2ms, Point to point
- ☐ Siemens S7-300 S7-1200 S7-1500
- ☐ Siemens TDC, S7-200smart
- ☐ GDM(Global data memory)
- ☐ Simotion SCOUT
- ☐ Mitsubishi
- ☐ Electric energy meter DL/T645-2007
- ☐ PowerPC、VxWorks
- ☐ GE PACSystem
- ☐ GE 9070/9030
- ☐ ALSTOM HPCi
- ☐ ABB AC500/AC31
- ☐ BECKHOFF
- ☐ WAGO　MOOG
- ☐ OPC
- ☐ LogiCAD TCS CoDeSys IsaGraF
- ☐ Modicon 984/Quantum/Premium/ Momentum/M340
- ☐ Rockwell Automation/Allen-Bradley MicroLogix 1000, 1100, 1200, 1500 SLC 500　CompactLogix FlexLogix　PLC-5 ControlLogix　SoftLogix 5800 RSLogix
- ☐ Westinghouse WDPF
- ☐ Ethernet UDP
- ☐ Ethernet TCP
- ☐ S7 Ethernet TCP、iso
- ☐ Profinet
- ☐ Beckhoff Realtime Ethernet
- ☐ EtherCAT
- ☐ Beckhoff Ads
- ☐ MPI / DP
- ☐ Profibus-DP
- ☐ Modbus, ModbusTCP
- ☐ RS232 / RS485
- ☐ CANopen DeviceNet
- ☐ EGD
- ☐ EtherNet/IP
- ☐ Reflective memory
- ☐ Inverter and so on
- ☐ Other special bus


PROFINET
S7 Ethernet
S7 Iso-on-tcp
PROFIBUS
RFM
EGD
CANopen
CC-Link
DeviceNet
SRTP
RS-232
RS-485
EtherCAT
EtherNet/IP
IO-Link
ELMOS ist Mitglied des IO-Link Konsortiums
KNX
LONWORKS
M-Bus
Modbus
Modbus-TCP
SERCOS interface
SNP
INTERBUS
LIGHTBUS
ASi INTERFACE
BACnet
DALI DMX
MP-BUS
Ethernet TCP
Ethernet UDP
Green. Smart. Wireless.
enocean

2.7 PLC protocol service of data platform

2.7.1 Automation bus protocol classification

The automation system bus and protocol types are numerous, some are open, and some are dedicated. The following table is classified according to the communication medium.

No.	Media	Speed	PDA data acquisition scheme		Example
			hardware	Software protocol	
1	RS-232		Common serial port	PDA integrated	Modbus
2	RS-485	<=115200bps	Convert to RS-232	PDA integrated	
3	RS-485	>115200bps	Special network	PDA integrated API/OPC gateway Third party interface	
4	Special RS-485		Special network	PDA integrated API/OPC gateway Third party interface	Profibus-DP CAN DeviceNet
5	Ethernet	fast	Common ethetnet	PDA integrated	Profinet
6	Ethernet	faster	Special network	PDA integrated API/OPC gateway Third party interface	EtherCAT
7	Reflective Memory network	faster	Special network	PDA integrated API/OPC gateway Third party interface	GE Reflective Memory Siemens GDM TMEIC TC-net
8	other				

PDA differently treats the different protocol understand for the same vendor in different periods or different manufacturers.

No program is needed for some PLC, Read directly data according to the variable address or symbol.

The real-time data interface is fully opened for the third party data platform which is convenient for the users to carry out data storage or processing neatly and diversely.

PDA system with a perfect communication protocol software development template may quickly develop unknown and future protocol.

2.7.2 Mainstream automation protocols

2.7.2.1 Process automation

AS-interface • BSAP[Bristol Standard Asynchronous Protocol] • CC-Link Industrial Networks • CIP[Common Industrial Protocol] • CAN bus[Control Area Network](CANopen • DeviceNet) • ControlNet • DF1 • DirectNET • EPA Ethernet for plant automation • EtherCAT[Ethernet for Control Automation Technology] • EGD[Ethernet Global Data, GE/ALSTOM HPCi] • Ethernet Powerlink •

EtherNet/IP[Rockwell ControlLogix/CompactLogix/MicroLogix] • FIP[Factory Instrumentation Protocol] • FINS • FF[FOUNDATION fieldbus](H1 • HSE) • GDM[Siemens Global Data Memory] • GE RFM[Reflective Memory, 5565/5576 VxWorks LogiCAD CoDeSys IsaGRAF]• GE SRTP[Service Request Transport Protocol, GE Fanuc 90/VersaMax/PACSystems] • HART Protocol • Honeywell SDS • HostLink • INTERBUS • IO-Link • Lightbus • Lonworks • MECHATROLINK • MelsecNet • Modbus/Modbus Tcp[Schneider-Modicon 984/Quantum…] • MP-bus[Modular Power Bus]• Optomux • PieP • Profibus • PROFINET • RAPIEnet[Real-time automation protocol for industrial ethernet] • Realtime Ethernet[Beckhoff] • SafetyBUS p • SERCOS interface • SERCOS III • Sinec H1 • Symotion • SynqNet • TMEIC TC-net • TTEthernet[Time-Triggered Ethernet] • WorldFip.

2.7.2.2 Industrial control system

EtherNet/IP-backplate[Rockwell ControlLogix/CompactLogix/MicroLogix] • GE SNP/SNPX • MTConnect • OPC[OLE for Process Control] • Profibus-MPI/DP • S7 Ethernet Tcp/iso[Siemens S7-400/S7-300/TDC/FM458].

2.7.2.3 Building automation

1-Wire • BACnet • C-Bus • CC-Link • DALI[Digital Addressable Lighting Interface] • DSI[Digital Signal Interface] • Dynet • Enocean • FIP • Idranet • KNX[EIB/BatiBus/EHSA] • LonTalk • Modbus • Modbus/Tcp • oBIX • VSCP • X10 • xAP[xAP Home Automation protocol] • xPL • ZigBee.

2.7.2.4 Power-system automation

CDT[Cyclic Digital Transmission] • IEC 60870 • (IEC 60870-5-101 • IEC 60870-5-102 • IEC 60870-5-103 • IEC 60870-5-104 • IEC 60870-6) • DNP3 • FIP • IEC 61850 • IEC 62351 • Modbus • Profibus.

2.7.2.5 Automatic meter reading

ANSI C12.18 • IEC 61107 • DLMS/IEC 62056 • DL/T645[Multi-function watt-hour meter communication protocol] • M-Bus • Modbus • ZigBee.

2.7.2.6 Automobile / Vehicle

AFDX[Avionics Full-Duplex Switched Ethernet] • ARINC 429 • CAN bus(ARINC 825 • SAE J1939 • NMEA 2000 • FMS) • FIP • FlexRay • IEBus • IDB-1394 • J1587 • J1708 • KWP2000[Keyword Protocol 2000] • SMARTwireX • UDS[Unified Diagnostic Services] • LIN[Local Interconnect Network] • MOST • VAN[Vehicle Area Network].

2.8 Data acquisition and analysis view

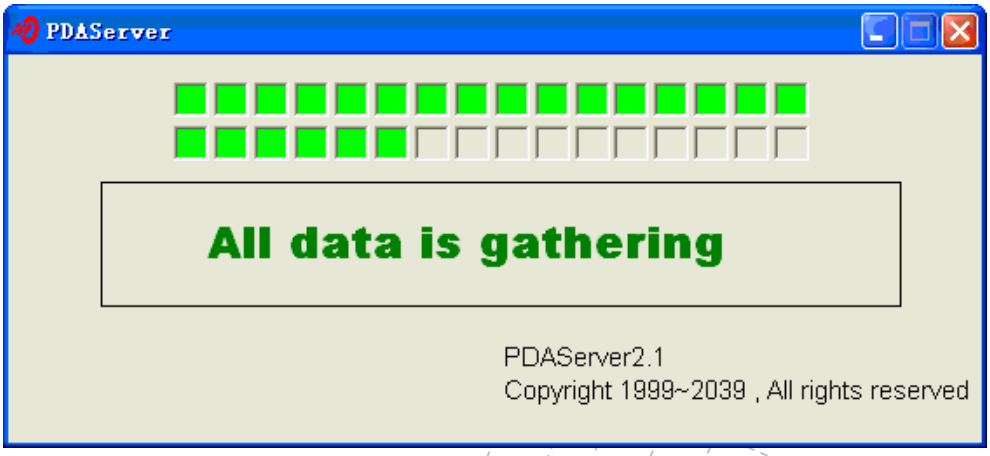


Figure 2.7 Operation interface of data acquisition software

Figure 2.6 ~ Figure 2.23 is for operation interface of analysis software.

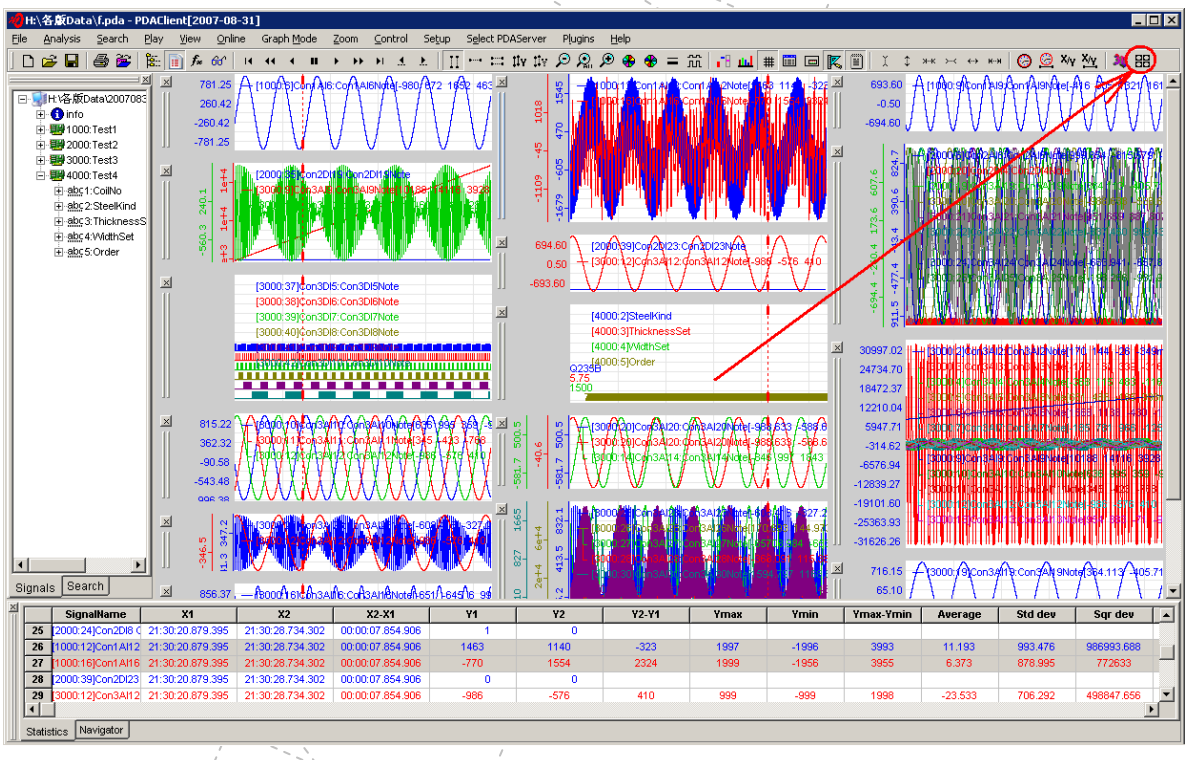


Figure 2.8 Main interface of analysis software and Multi column display of curves

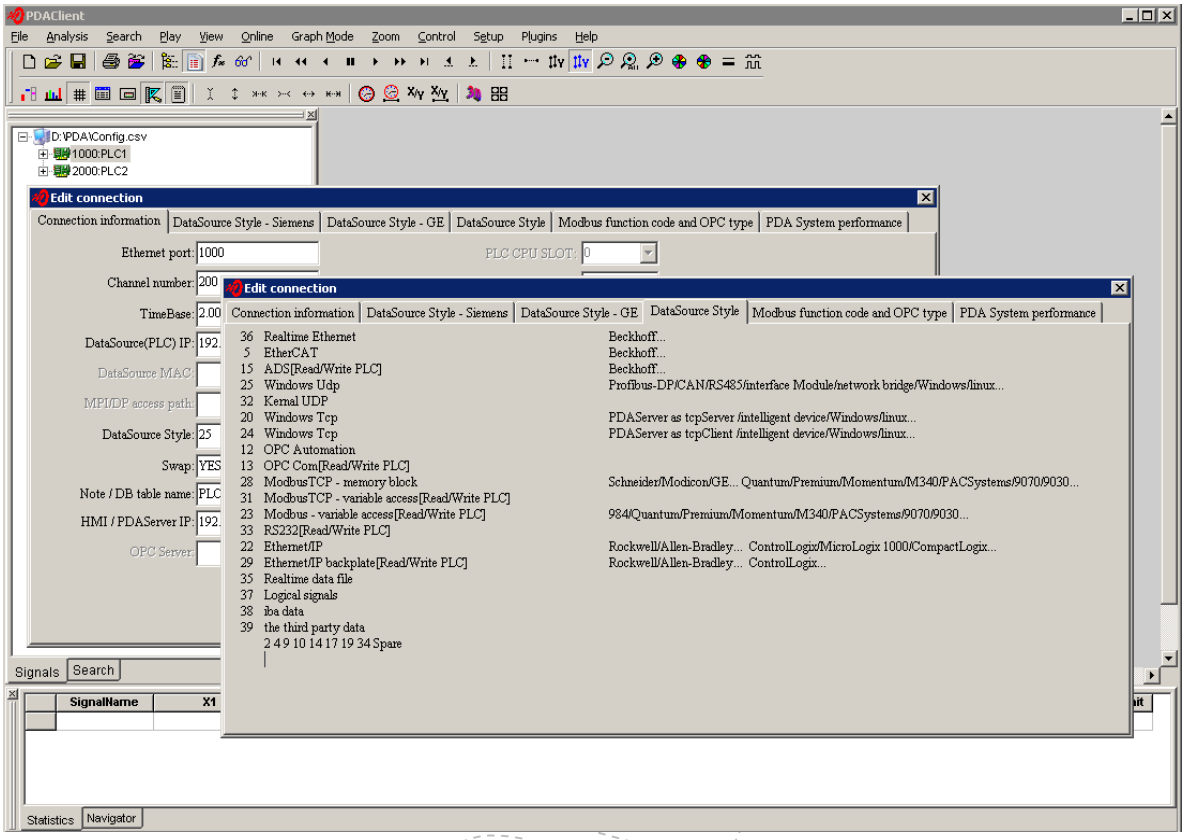


Figure 2.9 System configure

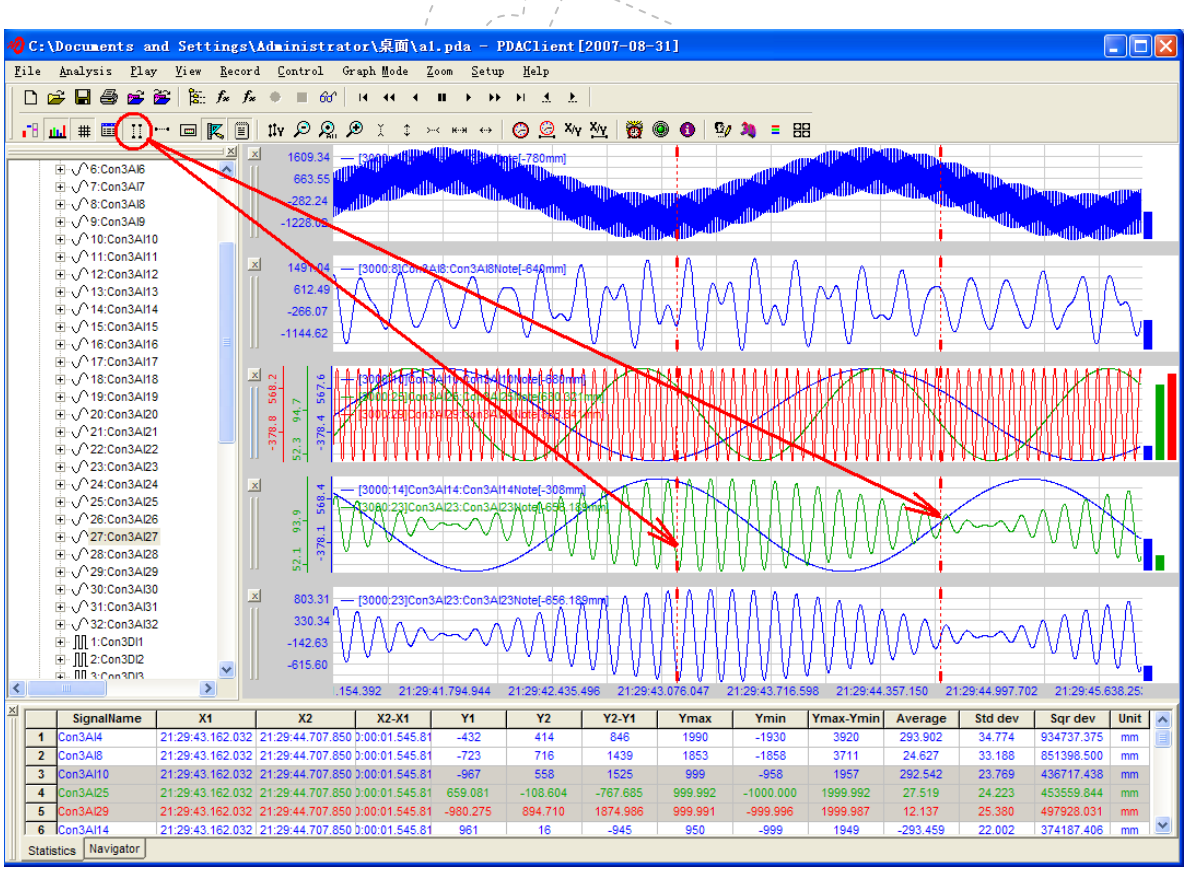


Figure 2.10 Dual x-axis mark

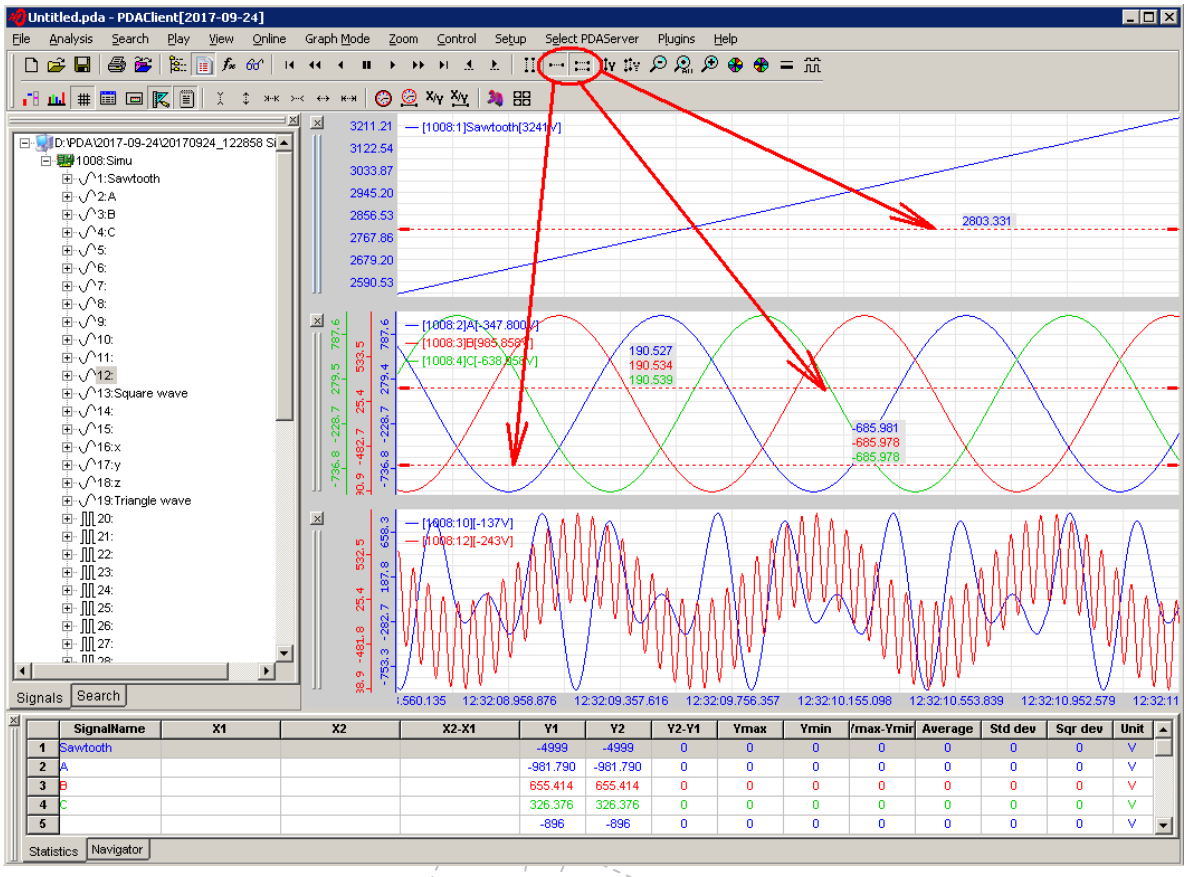


Figure 2.11 Dynamic y-axis and dual y-axis mark

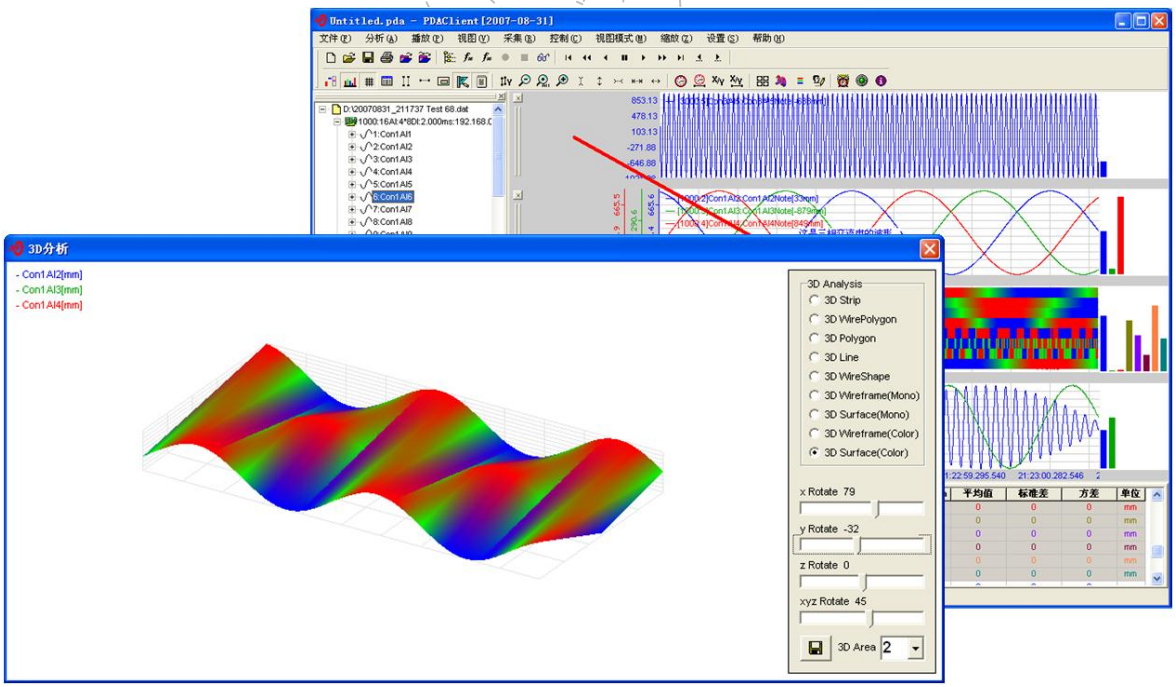


Figure 2.12 2D 3D view analysis

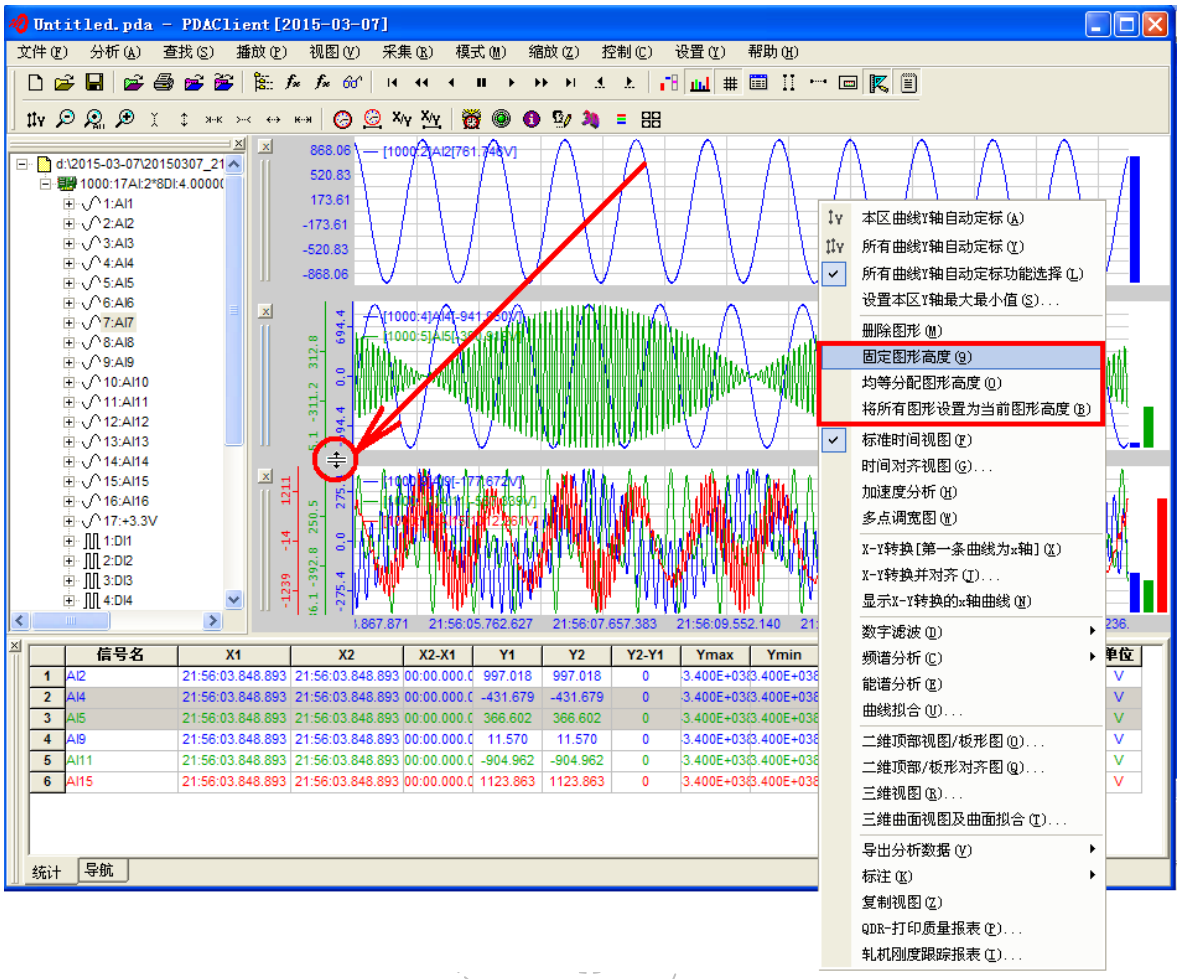


Figure 2.13 Height adjustment view

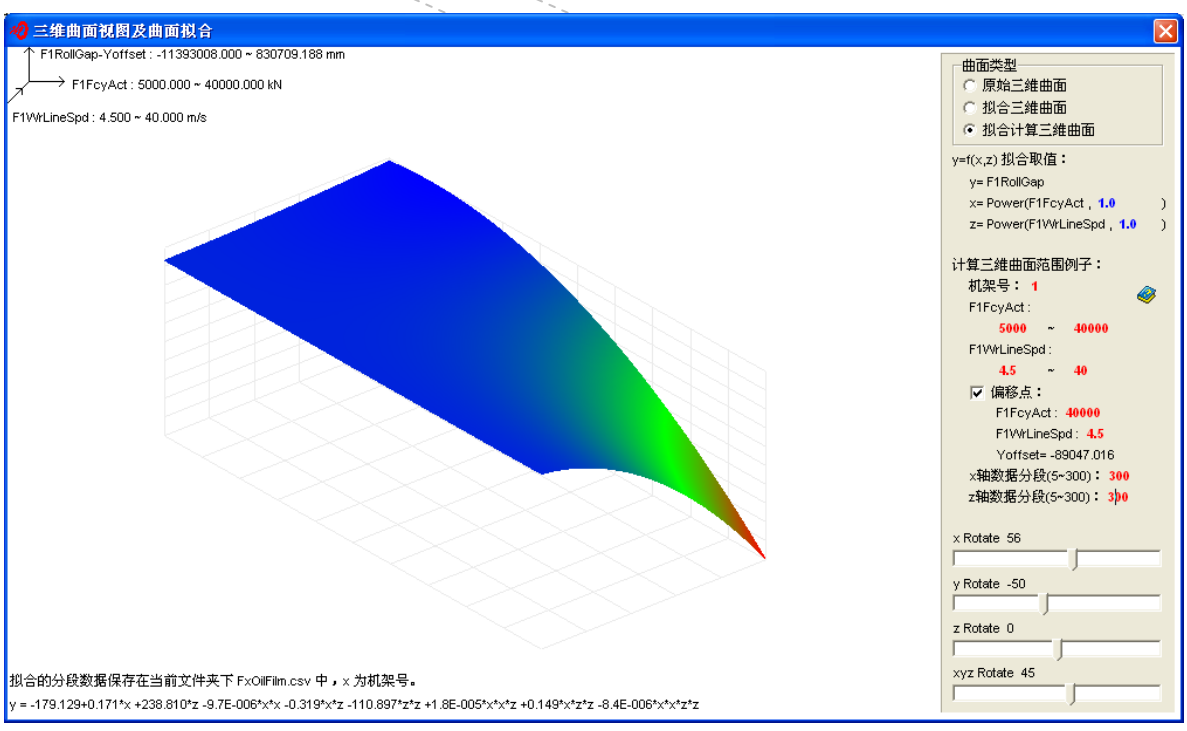


Figure 2.14 3D surface view and surface fitting

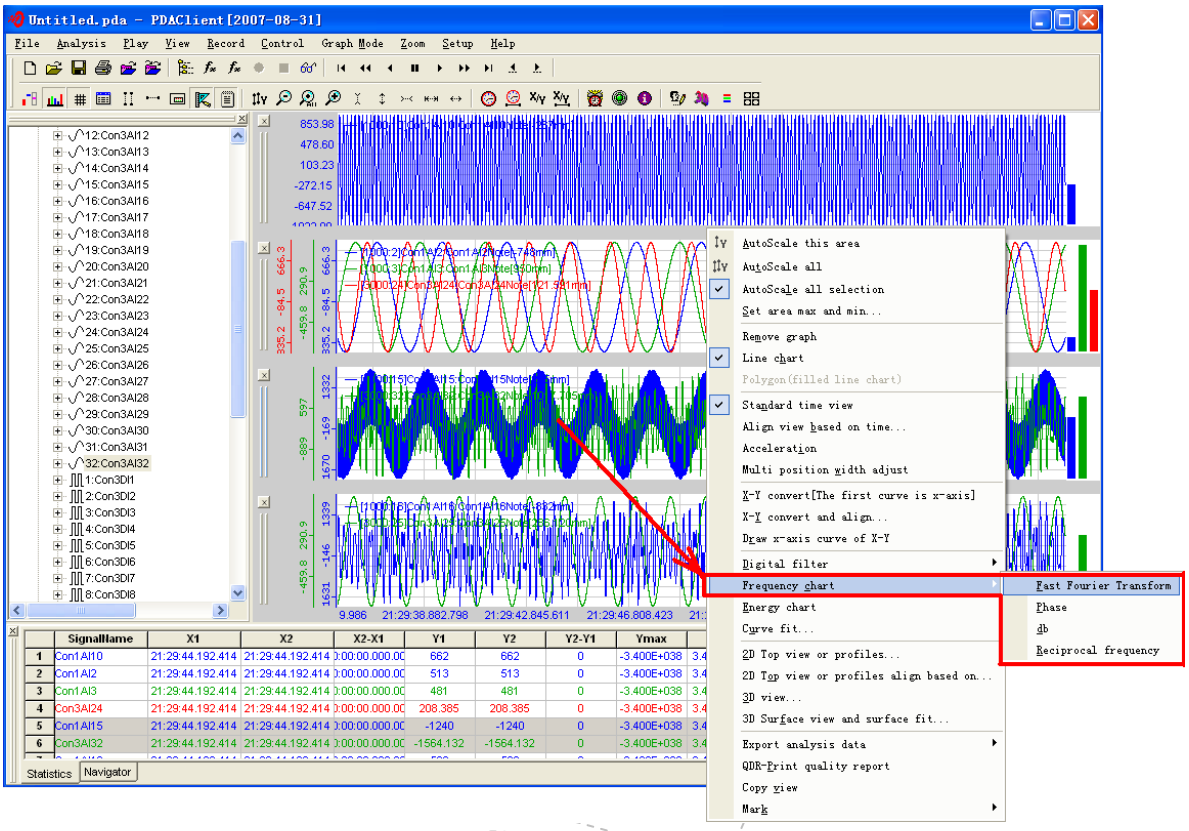


Figure 2.15 FFT- spectrum analysis

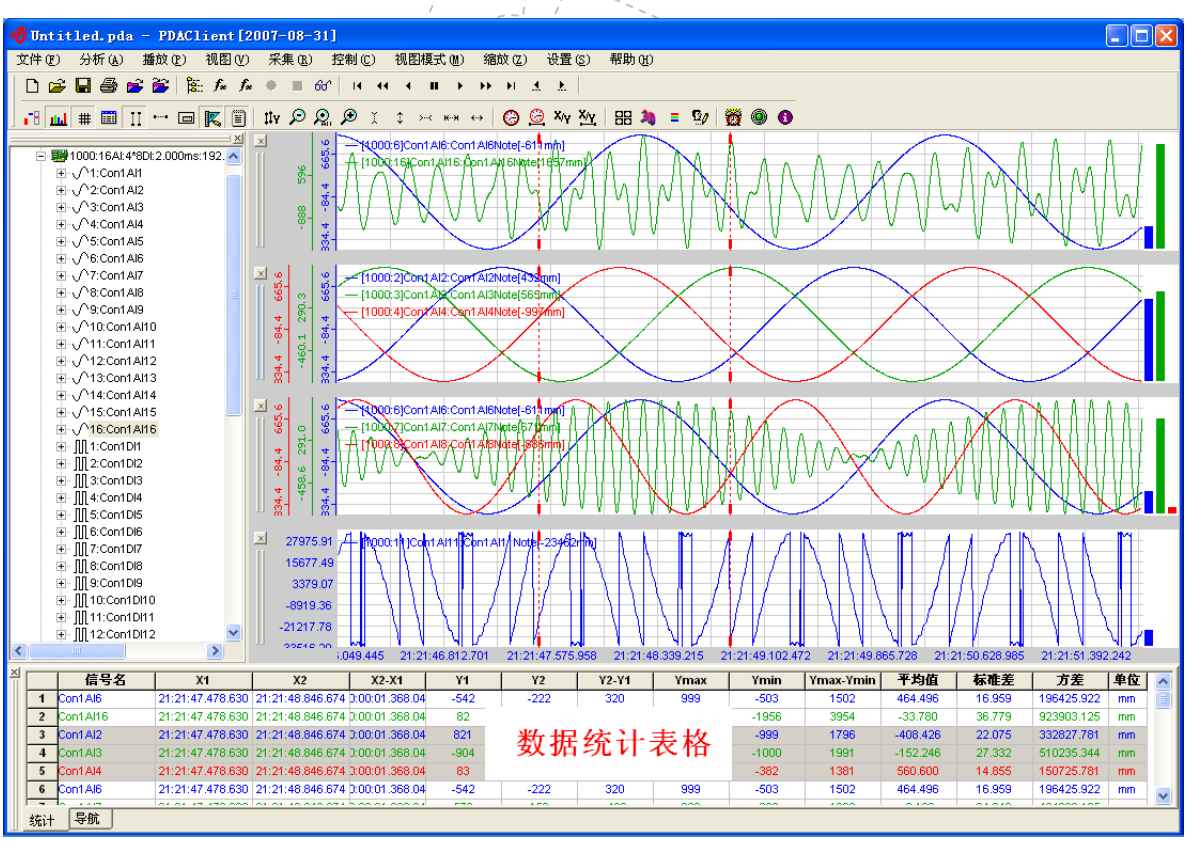


Figure 2.16 Data statistics

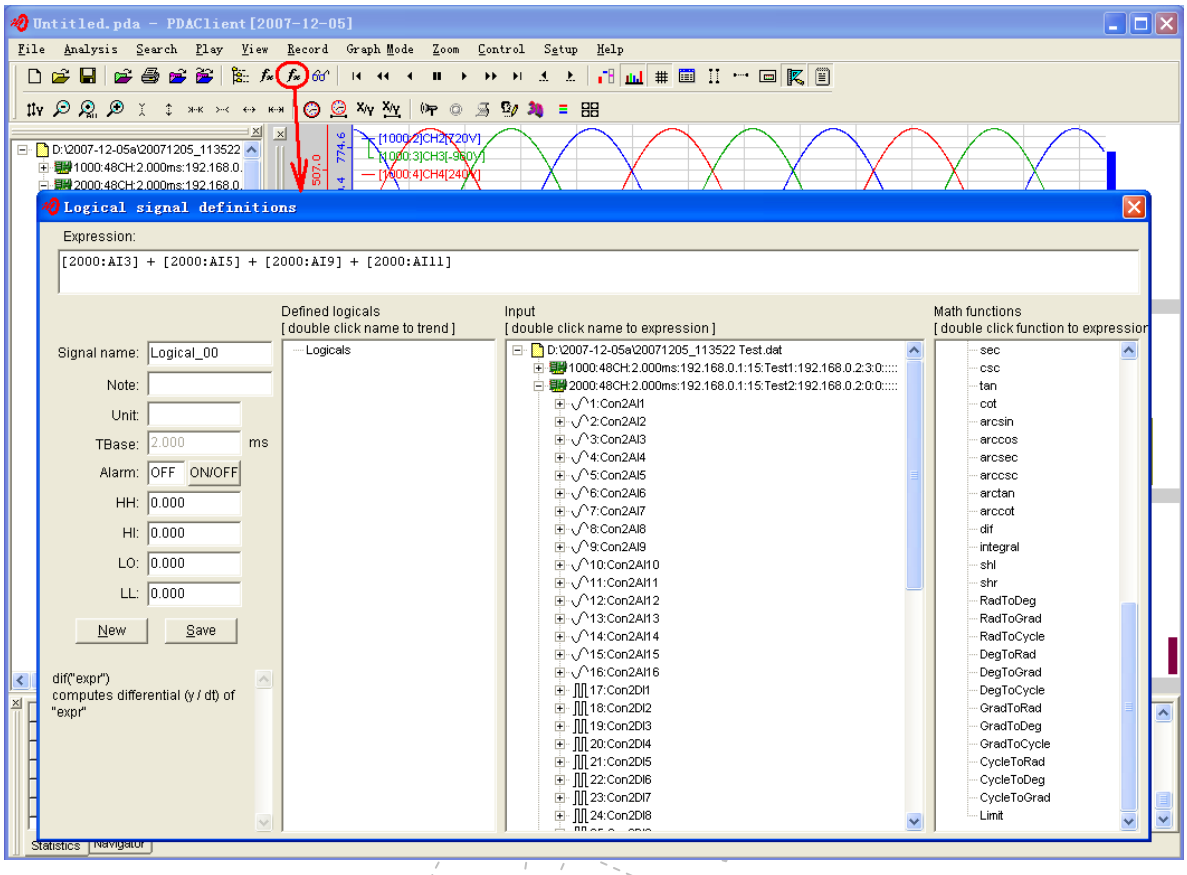


Figure 2.17 Logic signal - Expression

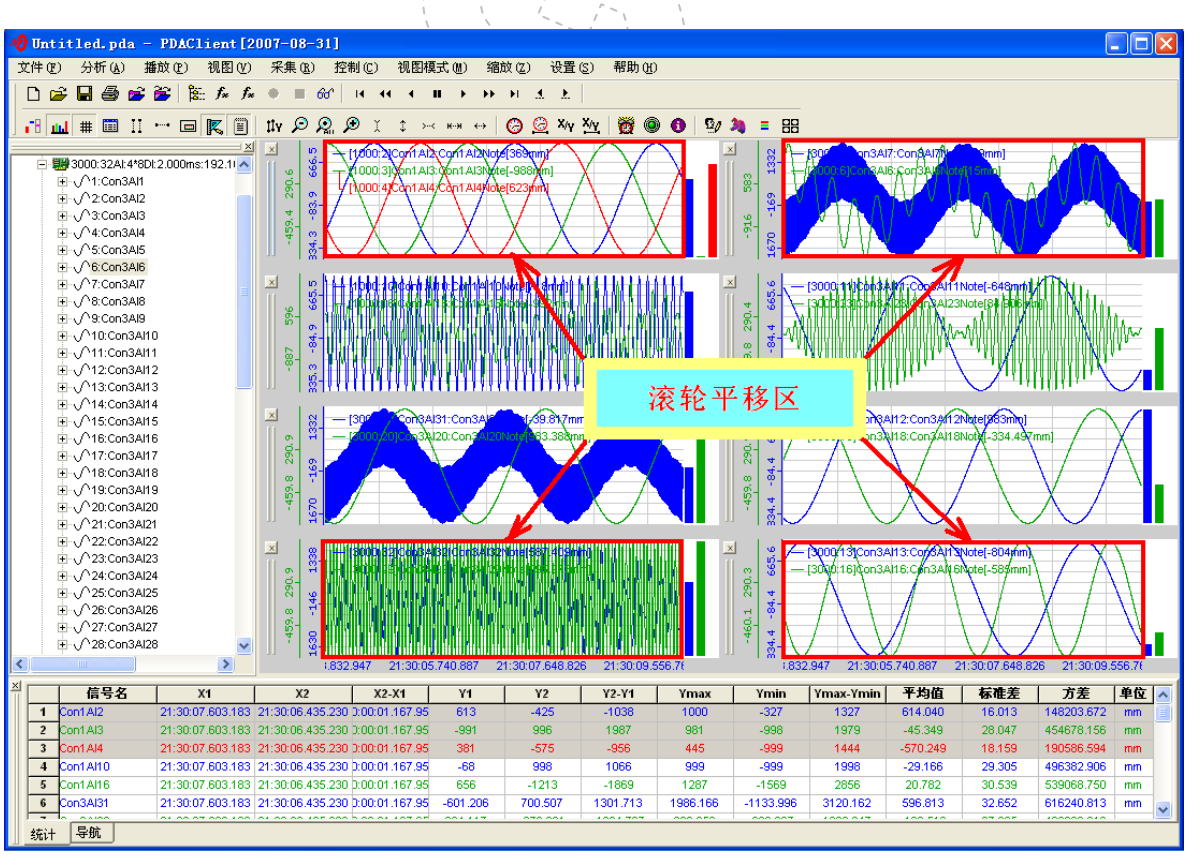


Figure 2.18 X-axis wheel trend figure translation

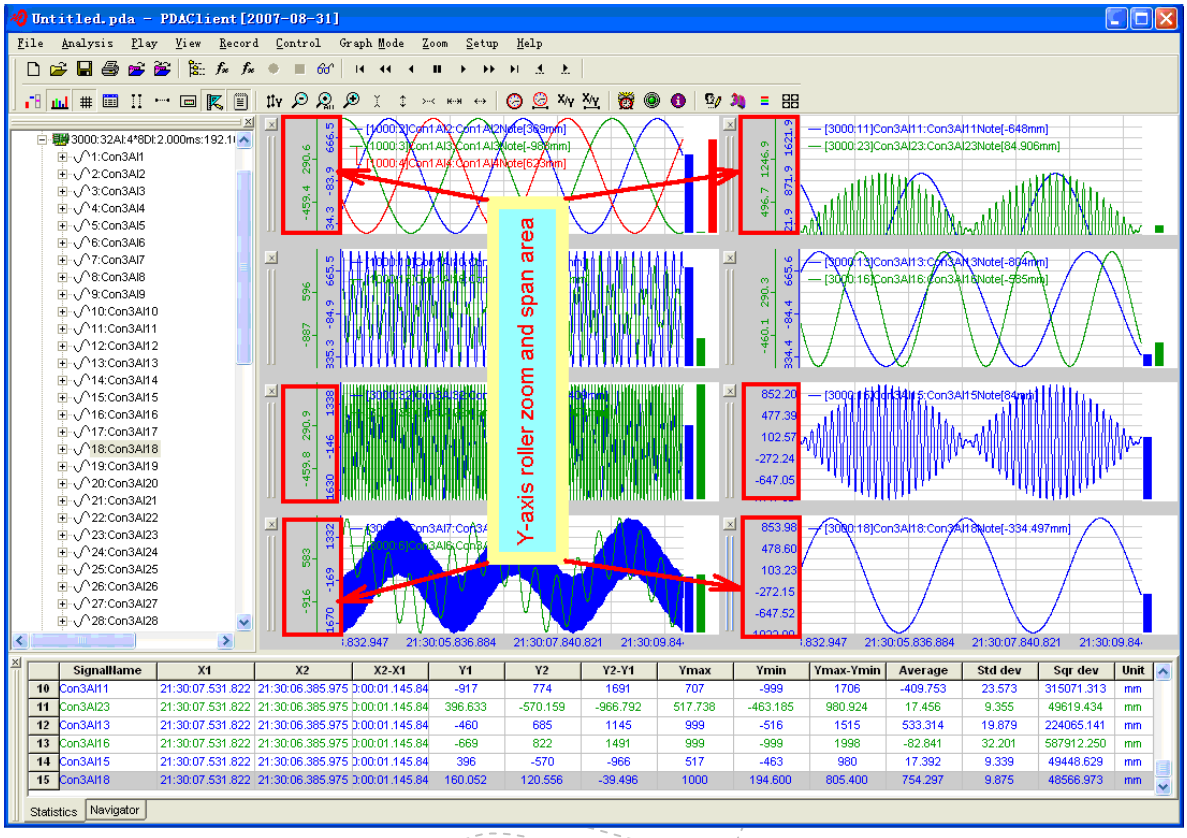


Figure 2.19 Y-axis wheel zoom and span

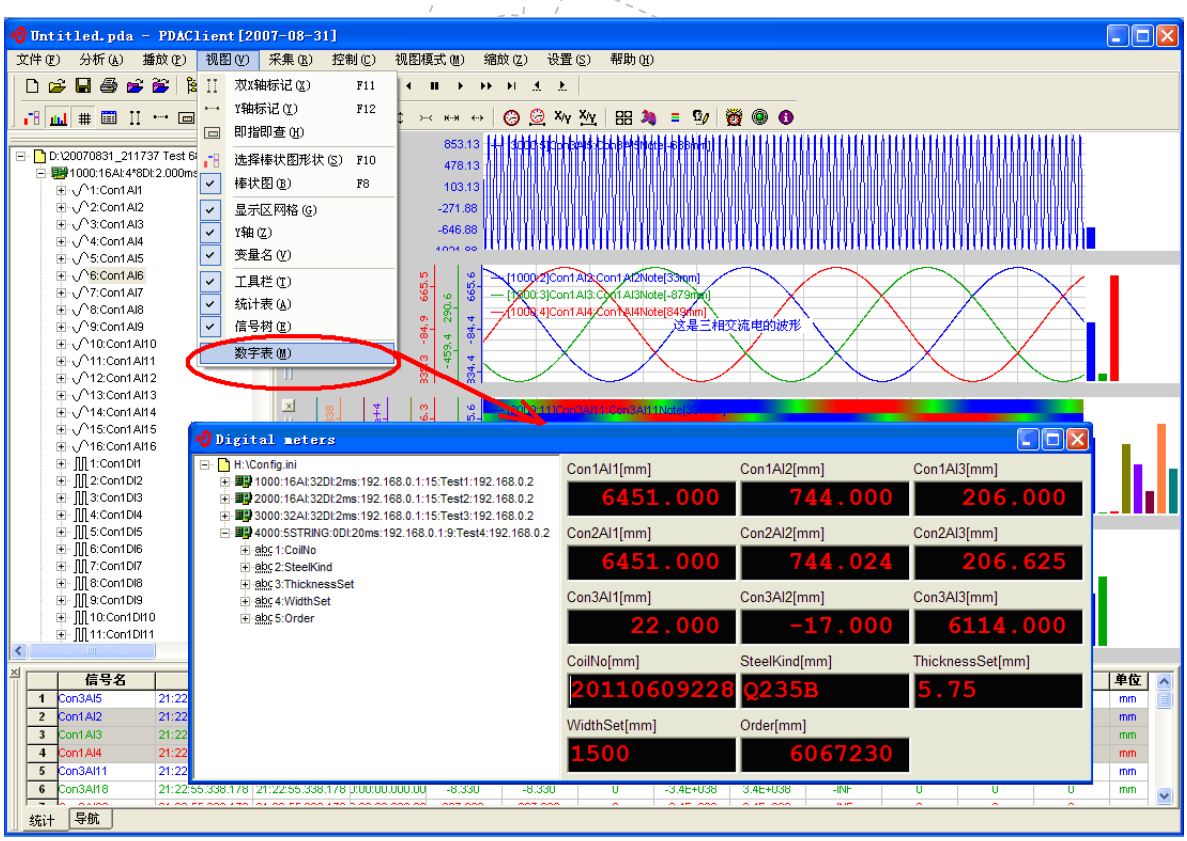


Figure 2.20 Digital table

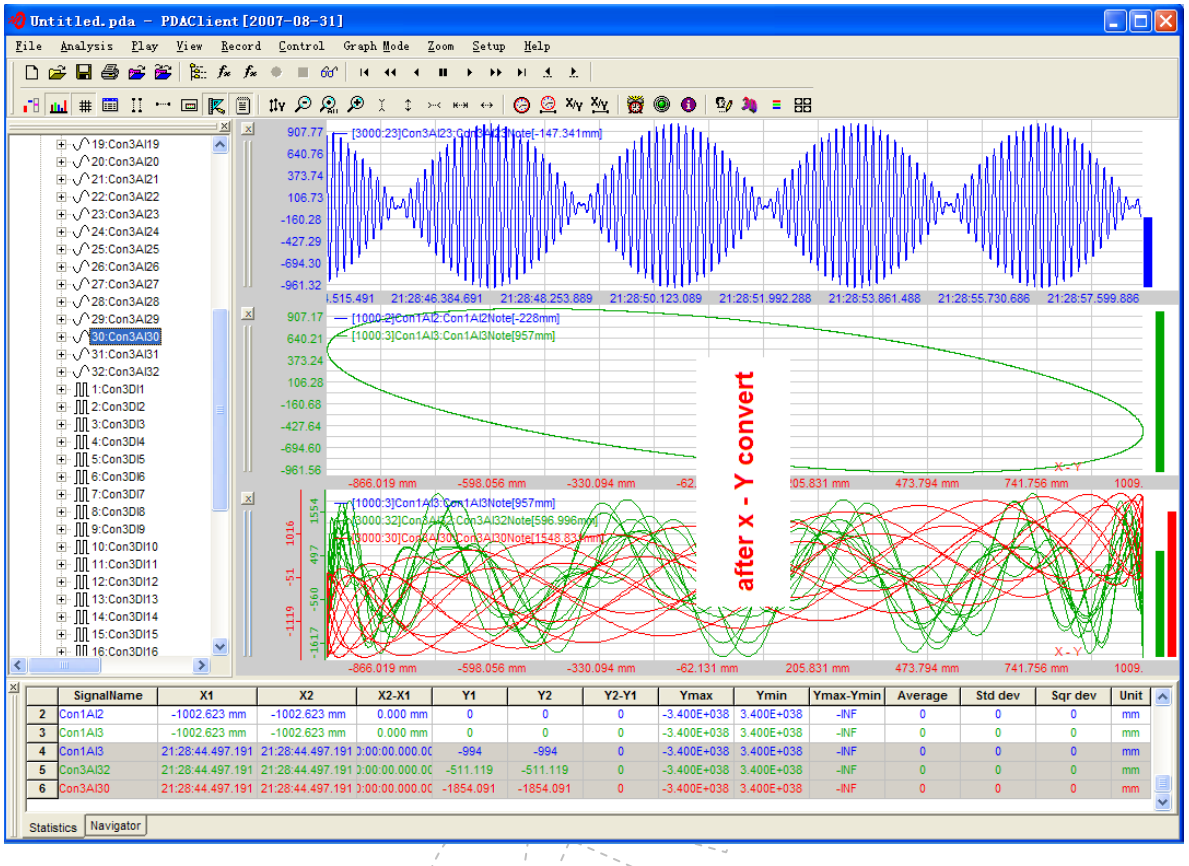


Figure 2.21 X-Y convert and align

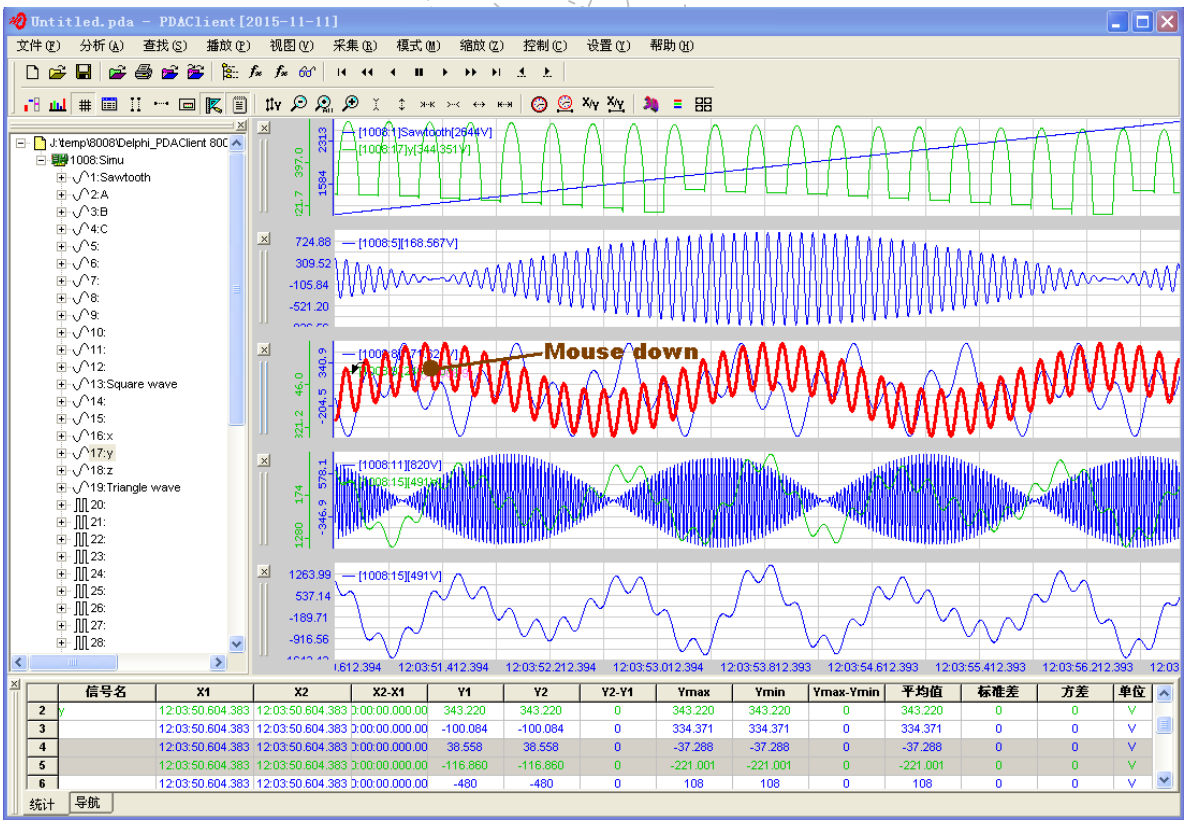
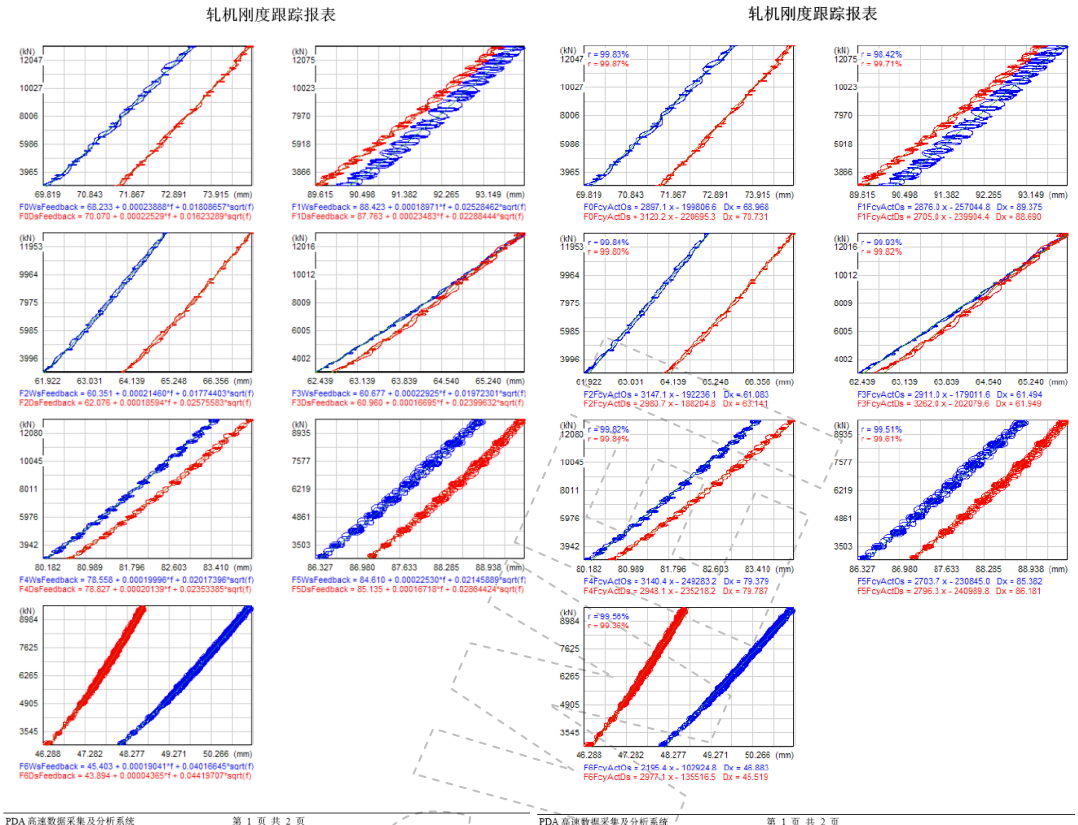


Figure 2.22 Curve annotation



(单侧)kN kN / mm		1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000	15000	辊径 (mm)	起始时间	持续时间 (秒)
F0FcyActOs	Os	1905	2267	2475	2619	2727	2812	2882	2941	2992	3037	3076	3111	3143	3172	3198	1476.28	2014-12-09 15:02:13	220
	Ds	2075	2458	2678	2828	2941	3030	3103	3164	3217	3263	3304	3340	3373	3403	3430	751.76		
	Σk	3980	4725	5153	5447	5667	5842	5985	6106	6209	6300	6380	6451	6516	6574	6628	752.18		
	δk	-170	-191	-202	-209	-214	-218	-221	-223	-225	-226	-228	-229	-230	-231	-232	1472.24		
F1FcyActOs	Os	1696	2117	2378	2567	2714	2833	2934	3021	3096	3163	3223	3277	3327	3372	3414	1464.06	2014-12-09 15:02:21	239
	Ds	1676	2038	2254	2405	2521	2614	2691	2757	2813	2863	2908	2947	2983	3016	3046	717.51		
	Σk	3372	4155	4632	4972	5235	5448	5625	5777	5910	6026	6131	6225	6310	6388	6460	716.83		
	δk	20	79	124	161	193	219	243	264	283	300	316	330	343	356	367	1473.84		
F2FcyActOs	Os	2020	2421	2655	2818	2941	3038	3119	3187	3245	3297	3342	3383	3420	3453	3484	1458.29	2014-12-09 15:02:28	205
	Ds	1686	2110	2375	2567	2717	2839	2942	3031	3109	3177	3239	3295	3346	3392	3435	769.88		
	Σk	3705	4532	5030	5385	5657	5878	6061	6218	6354	6474	6581	6678	6766	6846	6919	769.46		
	δk	334	311	281	251	224	199	176	156	137	119	103	88	74	61	48	1459.92		
F3FcyActOs	Os	1848	2223	2443	2596	2712	2805	2881	2945	3001	3050	3093	3132	3167	3199	3228	1429.73	2014-12-09 15:02:30	178
	Ds	1830	2298	2591	2804	2971	3107	3222	3321	3408	3485	3554	3617	3674	3726	3775	768.94		
	Σk	3678	4521	5034	5400	5683	5912	6103	6267	6409	6535	6648	6749	6841	6925	7003	768.39		
	δk	18	-74	-147	-208	-259	-303	-341	-376	-407	-435	-461	-485	-507	-527	-547	1417.16		
F4FcyActOs	Os	1927	2350	2603	2782	2919	3029	3120	3198	3265	3324	3377	3424	3467	3506	3542	1437.15	2014-12-09 15:02:17	168
	Ds	1744	2153	2403	2581	2719	2830	2924	3003	3073	3134	3189	3238	3283	3324	3362	633.13		
	Σk	3671	4503	5006	5363	5638	5859	6044	6201	6338	6458	6566	6662	6750	6830	6904	632.73		
	δk	183	197	201	201	200	198	196	194	192	190	188	186	184	182	180	1442.76		
F5FcyActOs	Os	1771	2150	2374	2532	2652	2749	2829	2896	2955	3007	3053	3094	3131	3165	3196	1443.42	2014-12-09 15:02:25	162
	Ds	1613	2052	2333	2540	2705	2840	2955	3055	3143	3222	3292	3357	3415	3469	3520	642.03		
	Σk	3384	4201	4707	5072	5357	5589	5784	5952	6098	6228	6345	6450	6546	6634	6716	641.81		
	δk	159	98	41	-8	-52	-92	-127	-159	-188	-215	-240	-263	-284	-305	-324	1432.57		
F6FcyActOs	Os	1211	1564	1795	1969	2108	2224	2323	2410	2487	2556	2619	2676	2728	2777	2822	1466.86	2014-12-09 15:02:25	203
	Ds	1347	1859	2237	2544	2808	3040	3249	3440	3615	3779	3932	4075	4211	4340	4463	647.51		
	Σk	2558	3423	4032	4513	4915	5264	5572	5850	6102	6335	6550	6751	6939	7117	7284	647.87		
	δk	-135	-296	-441	-575	-700	-816	-926	-1030	-1129	-1223	-1313	-1400	-1483	-1563	-1641	1470.60		
	Os																		
	Ds																		
	Σk																		
	δk																		

PDA 高速数据采集及分析系统 第 2 页 共 2 页

Figure 2.23 Stiffness measurement of rolling mill

Report_4522T01030

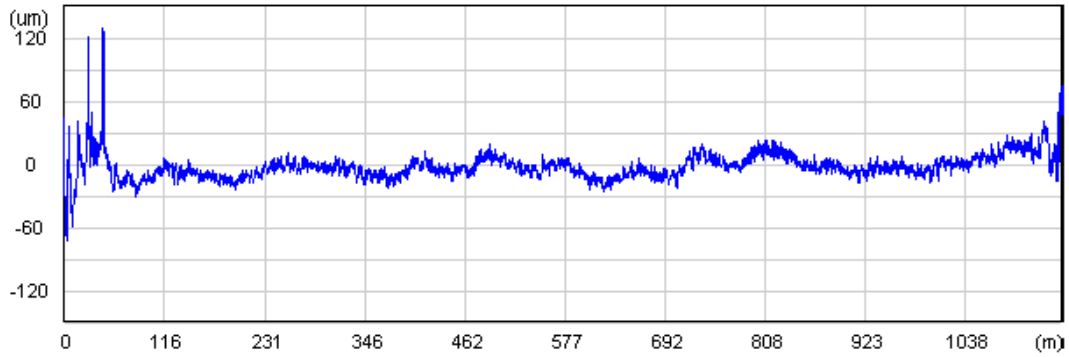
Coil No: 4522T01030
Alloy Code: SPHC
Thickness: 1.82 mm
Width: 1252 mm

Body Average thickness Deviation: -1.5 um
Body Min thickness Deviation: -58.3 um
Body Max thickness Deviation: 130.7 um
Strip width(average): 1258.8 mm
Strip length: 1153.3 m

10.0 m	1133.3 m	10.0 m

4522001030

Tolerance: ± 30.0 um
Percent: 98.64 %



Start time of recording: 2014-06-12 13:31:40
Duration(Seconds): 126

Page: 1 of 1

Figure 2.24 QDR Report of quality data record

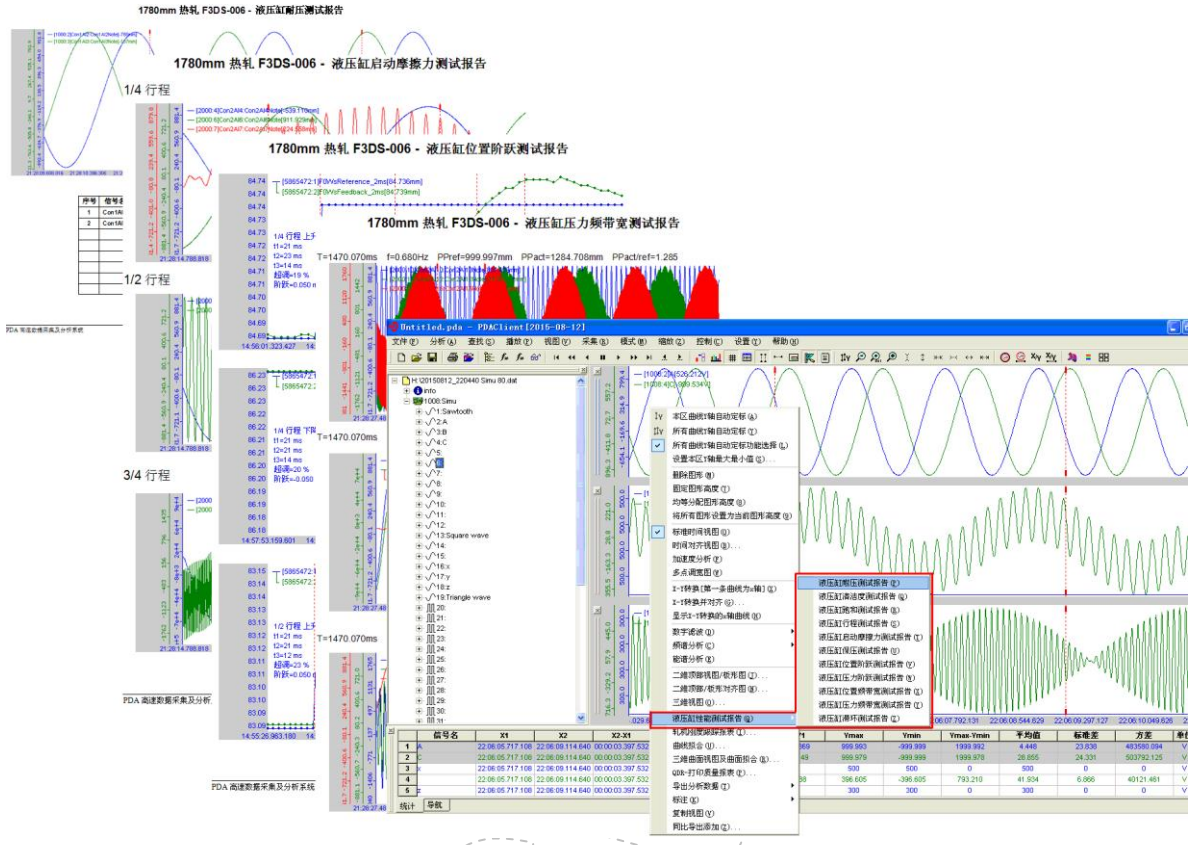


Figure 2.25 Performance test of large hydraulic cylinder

2.9 WinCC-PDA FTView-PDA Web-PDA

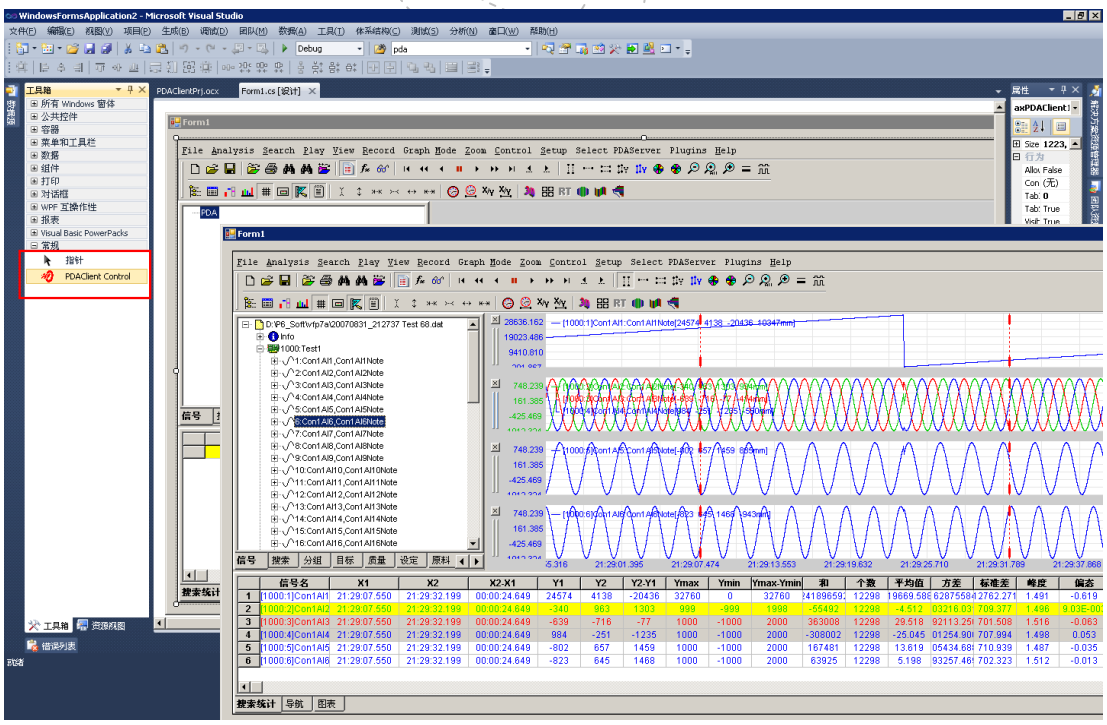


Figure 2.26 Call PDAClient.ocx in C#

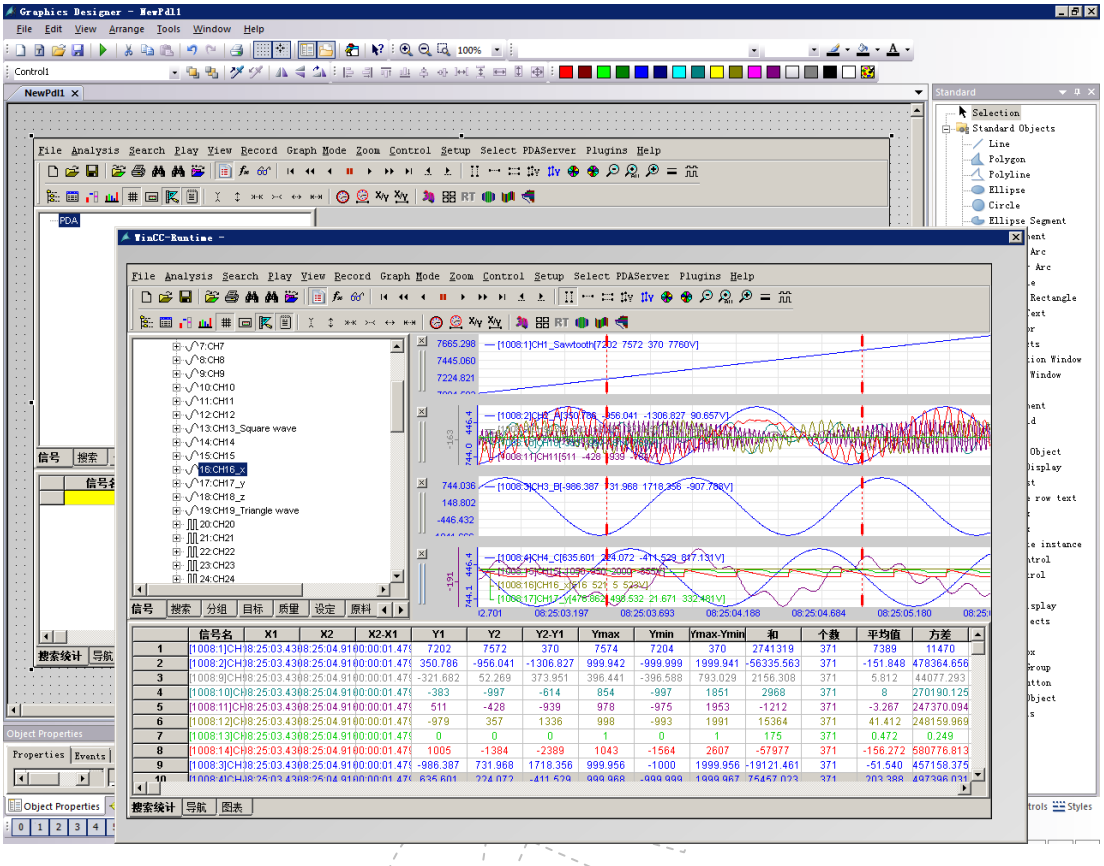


Figure 2.27 WinCC calls PDAClient.ocx

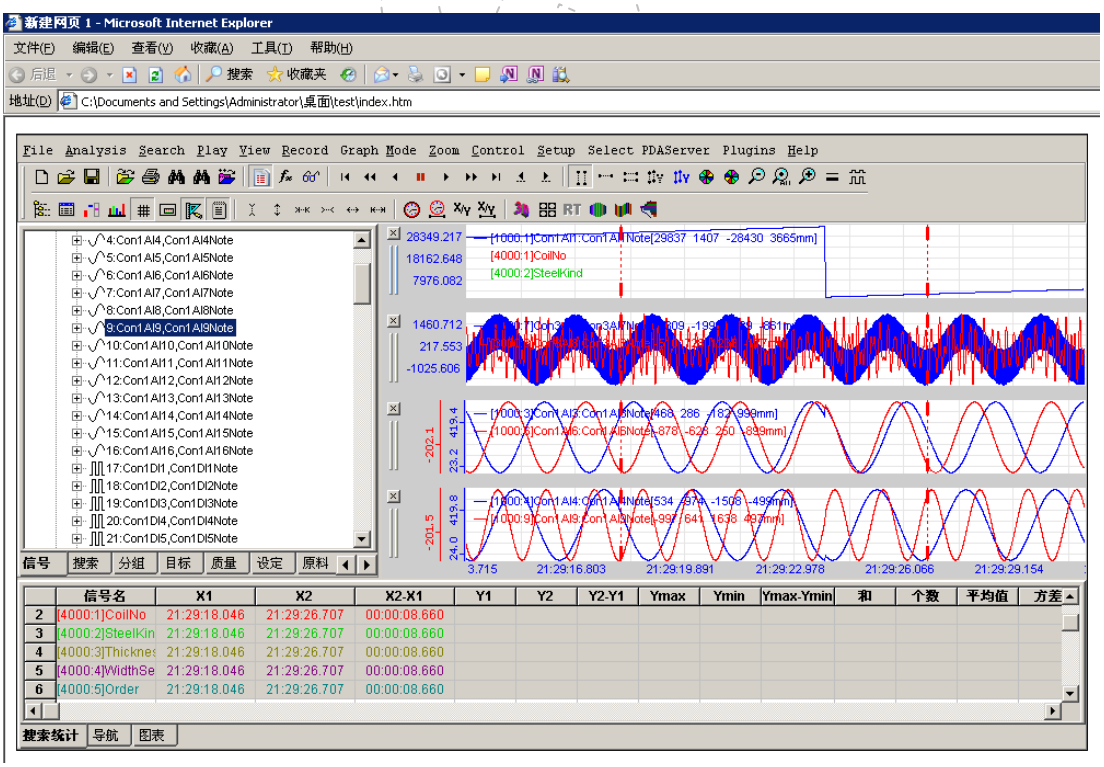


Figure 2.28 Call PDAClient.ocx in the browser

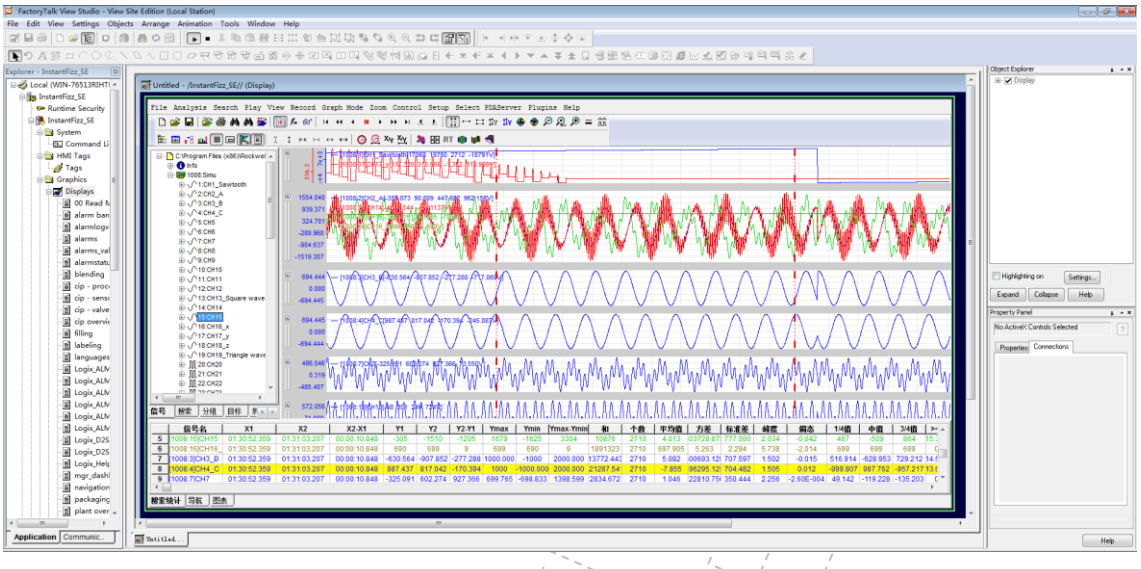


Figure 2.29 FactoryTalk View calls PDAClient.ocx

2.10 Using PDAClient under Linux

Connect to the Internet under Ubuntu and sudo apt install wine64 to install a 64 bit Windows emulator.

Copy PDAClient.exe to Linux, enter the directory where PDAClient.exe is located, right-click Open in Terminal, and run wine PDAClient.exe to directly open the PDAClient analysis tool.

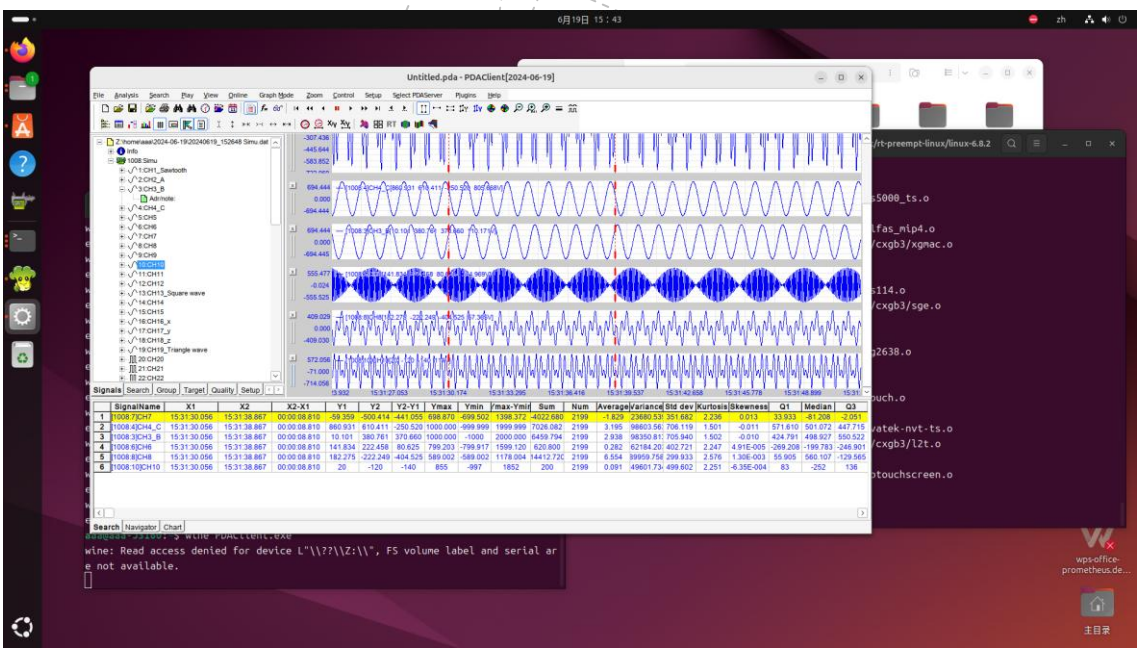


Figure 2.30 Using PDAClient.exe in Linux

2.11 pdaCloud

pdaCloud in Config.csv specifies whether pdaCloud.exe starts automatically.

pdaCloud.exe may gengeate ①day file list file, ②day second level data file, ③appropriate data file found and copy them and ④log file to the cloud synchronization folder specified by CloudDir of Config.csv.

pdaCloud.exe sends ①the day list file and ②log file to the Email specified by Config.csv.

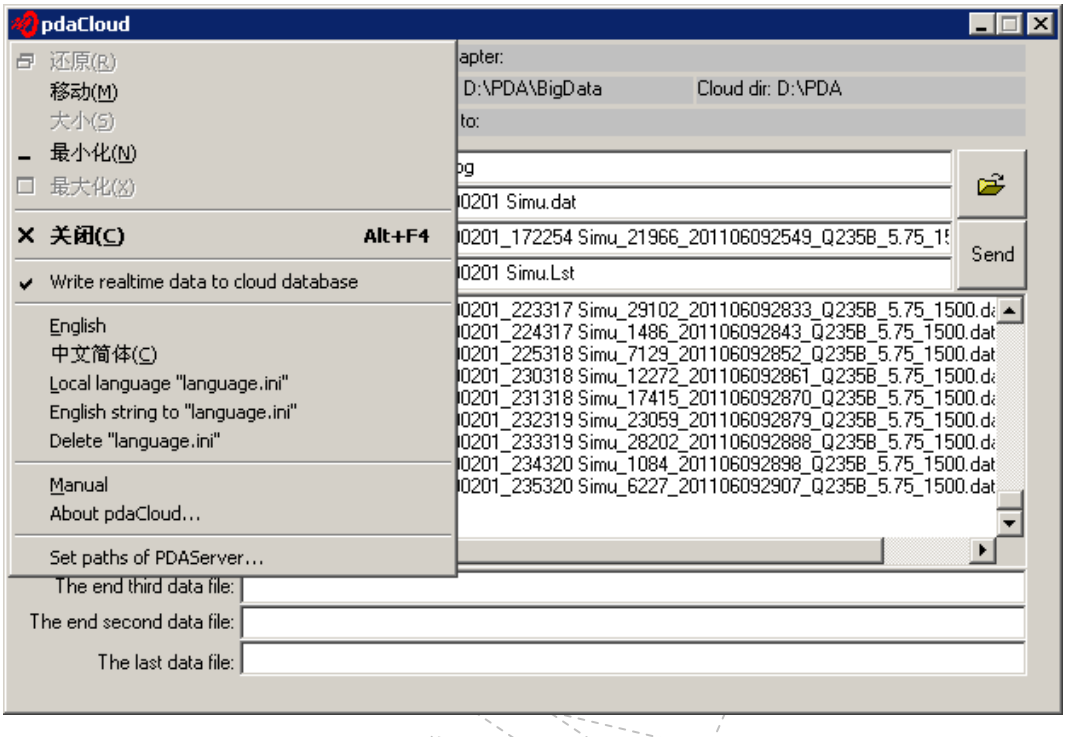


Figure 2.31 Prepare data for pdaCloud

2.12 Millisecond level high-speed data acquisition for the entire factory

PDA supports data collection of 30000 points within 10 milliseconds. Slow or trigger signals in the entire factory can be saved at a unified high speed. If the data exceeds 30000 points, multiple PDA servers can be used. PDA servers reduce the frequency of the collected signals and write them to multiple relational databases such as SQL Server, MySQL, and ORACLE. Millisecond level signals are written to temporal databases such as InfluxDB. Other subsystems require real-time data to be forwarded by PDA servers at a high speed or reduced frequency.

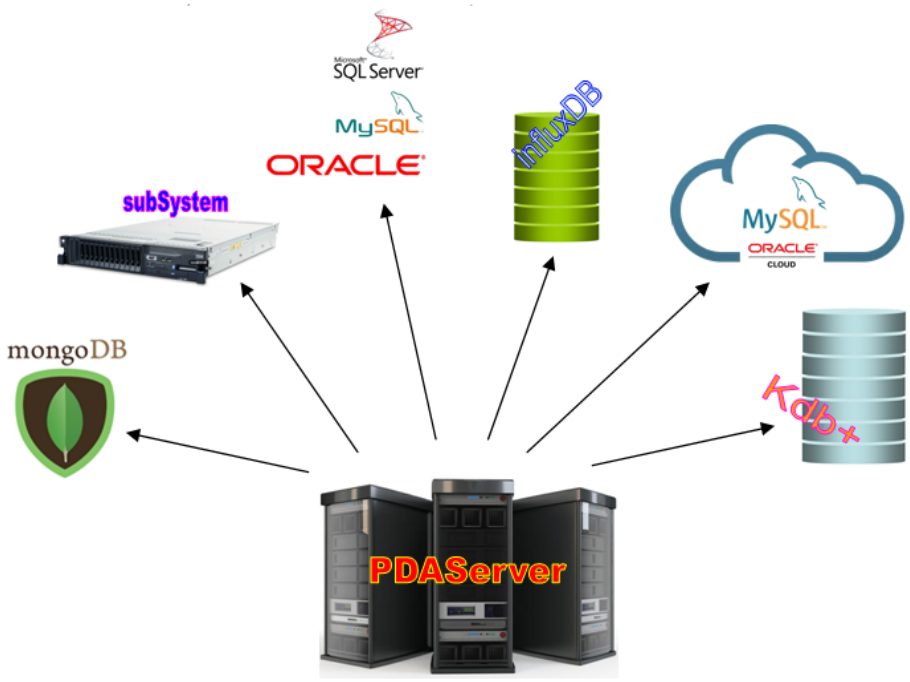


Figure 2.32 Data collected by PDA saved to database

2.13 High speed data forwarding

The PDA server adds a multi port network card. In principle, the data required by other systems is not directly connected to the L1 controller, but is obtained through PDA forwarding. Different network segments are forwarded through different network ports, which can save a lot of PLC resources.

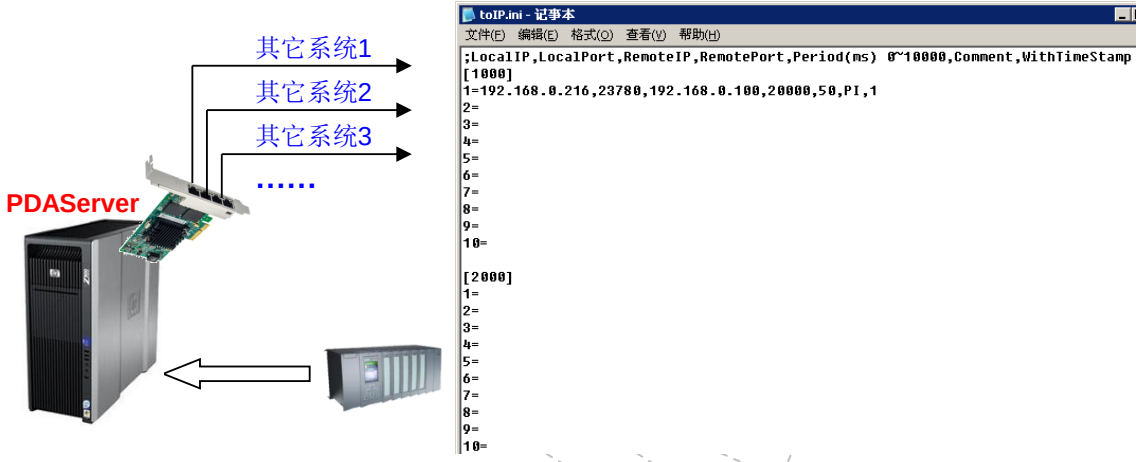


Figure 2.33 Setting up high-speed data forwarding to multiple locations

3 LTA - Long historical Trend Analysis system

In addition to millisecond level data records, slowly changing production processes require monthly, quarterly, and annual curve analysis. The PDA system can collect multiple frequency reduction data at once, allowing for rapid analysis of long-term trends (Long Trend Analysis). It can be widely used in process industries such as blast furnaces, heating furnaces, petrochemicals, beer, and the analysis of parameters such as liquid level and temperature.

The main significance of long-term trend analysis is twofold: firstly, to understand the trend and regularity of phenomena over time; The second is to predict the future development prospects and trends of phenomena. The reason why temporal data has long-term trends is because it is influenced by certain basic and decisive factors. The stronger the influence of these dominant factors, the more obvious the long-term trend. Therefore, by analyzing the long-term trends of time series data, the internal mechanisms of phenomenon development and changes can be grasped, and the effectiveness of policies and measures taken in the past can be evaluated; The third is to remove long-term trend components from the time series, in order to facilitate the decomposition of other types of influencing factors, such as seasonal changes, cyclical changes, and irregular changes.

The main methods for measuring long-term trend values include: extended time interval method, moving average method, and least squares method. The extended time interval method refers to the method of eliminating fluctuations in the values of various indicators caused by accidental factors due to the short time interval by expanding the time of each indicator in the dynamic sequence, so that the smoothed dynamic sequence can significantly reflect the overall trend of phenomenon development and changes. The moving average method refers to the method of moving a dynamic sequence period by period to expand the time interval, while calculating the time series average for each indicator value of a new dynamic sequence that has already expanded the time interval, thereby forming a derived dynamic sequence from the moving average. The series of moving time series averages obtained through moving average are the trend values of their corresponding periods. The least squares method, also known as the least squares method, is a commonly used method for estimating regression model parameters. The basic principle is to require the sum of squares of the deviations between the actual value and the trend value to be the smallest, in order to fit an excellent trend model and determine long-term trends.

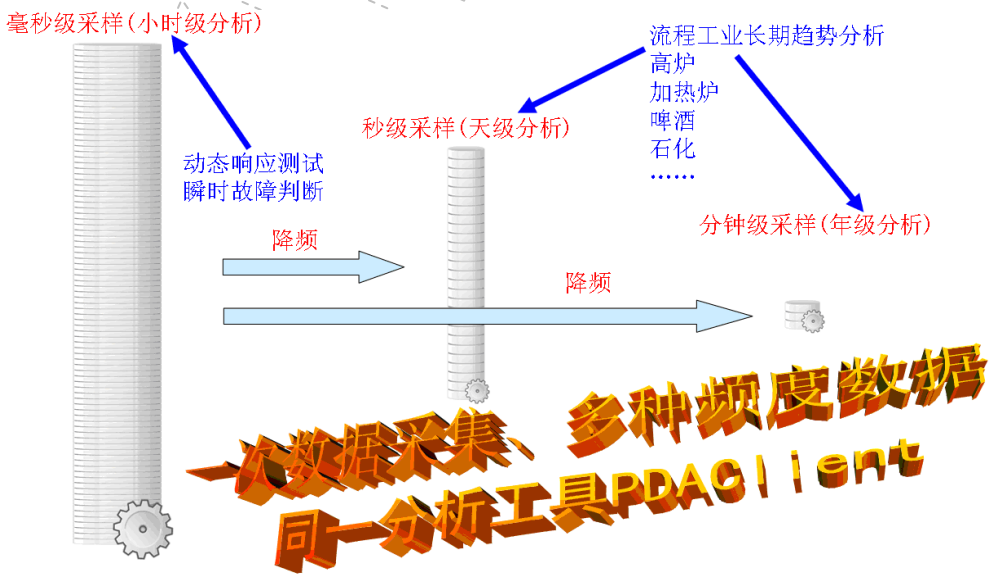


Figure 3.1 PDA Long term historical Trend Data Frequency Reduction

A high-speed acquisition can obtain data of multiple frequencies, and changing the backup point to a formal point or adding or reducing points at the end of the connection does not affect the normal conversion work. LTAServer.exe is located in the PDA system file directory, and is converted based on the data files generated by PDA and saved in the directory specified by BigDataDir in Config.csv. The generated data files are saved in the directory specified by BigDataDir.

LTAServer scan and convert at startup and every 12 hours interval thereafter.

3.1 Millisecond level - hourly data analysis

Collect data every 10 milliseconds and generate a data file every 10 minutes.

3.2 Second level - monthly data analysis

Collect data once a second and generate a data file once a day.

3.3 10 second level - quarterly annual data analysis

Collect data every 10 seconds, generate one data file every week, and 52 data files every year.

3.4 60 second level - annual data analysis

Collect data every 60 seconds, generate one data file in January, and 12 data files in a year.

3.5 7-days data curve at the second level for a certain project

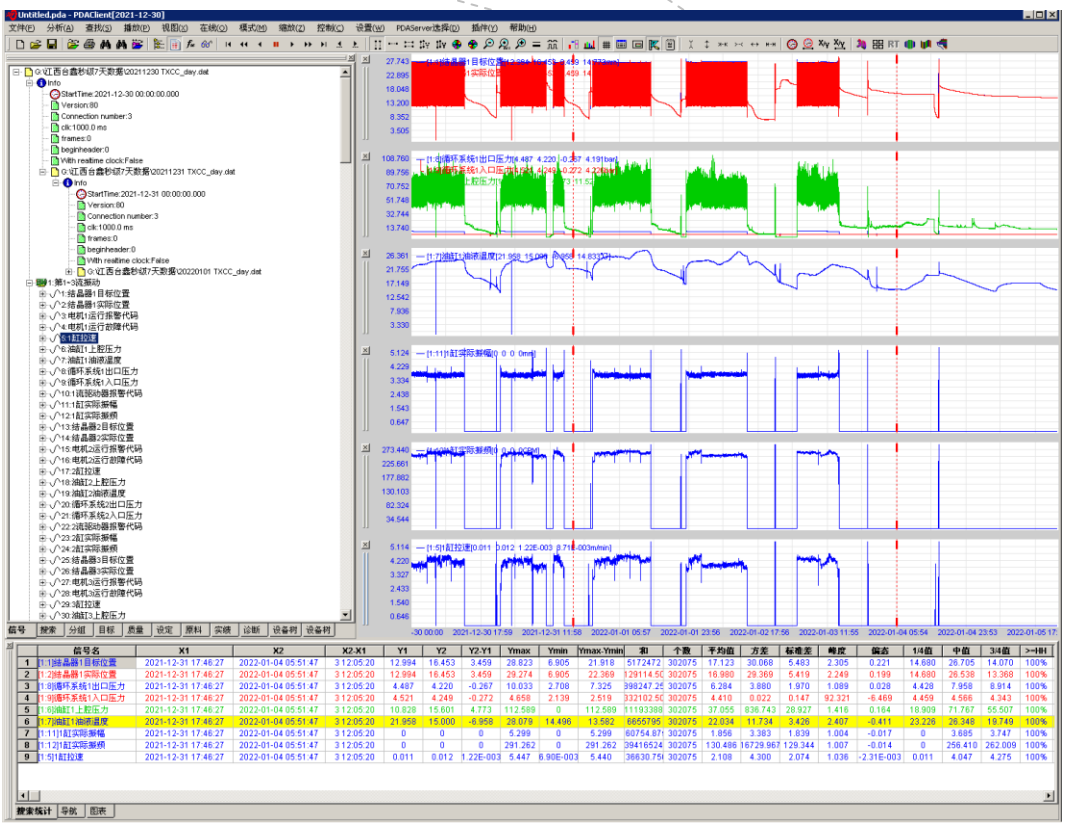


Figure 3.2 7-days data curve with reduced frequency to second level

3.6 Converting long-term historical trend files of a blast furnace AB to PDA format

AB company has a .dat file that records long-term historical trends, but its opening speed is slow. HistorianToPDA.exe can convert this dat file into a PDA format. dat file, which can be used to quickly

open trend charts for several months using PDAClient. The following figure shows the original data file for a day, with a sampling cycle of 1 second.

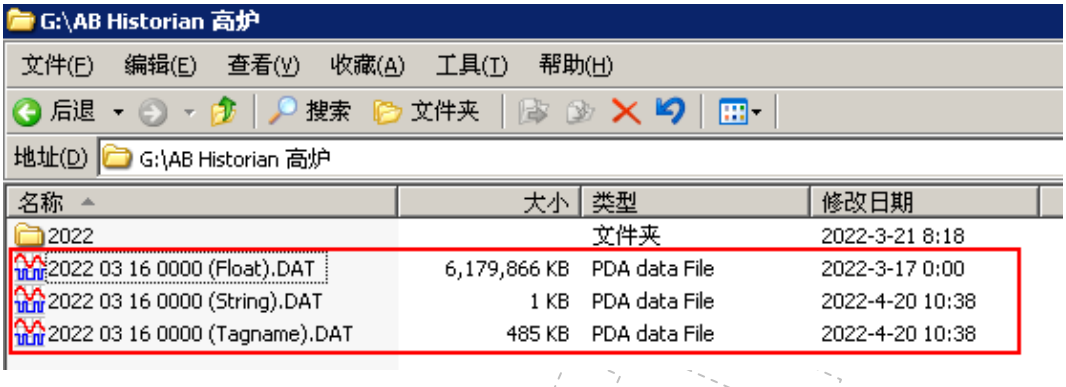


Figure 3.3 Long term raw data of AB company

The following figure shows a data file converted to PDA format with a compression rate close to 100 times.

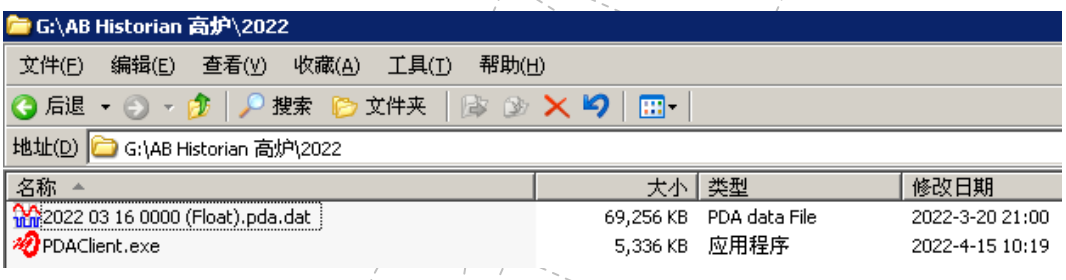


Figure 3.4 Conversion of AB Company's Long Term Raw Data to PDA Format

The following figure shows the trend curve.

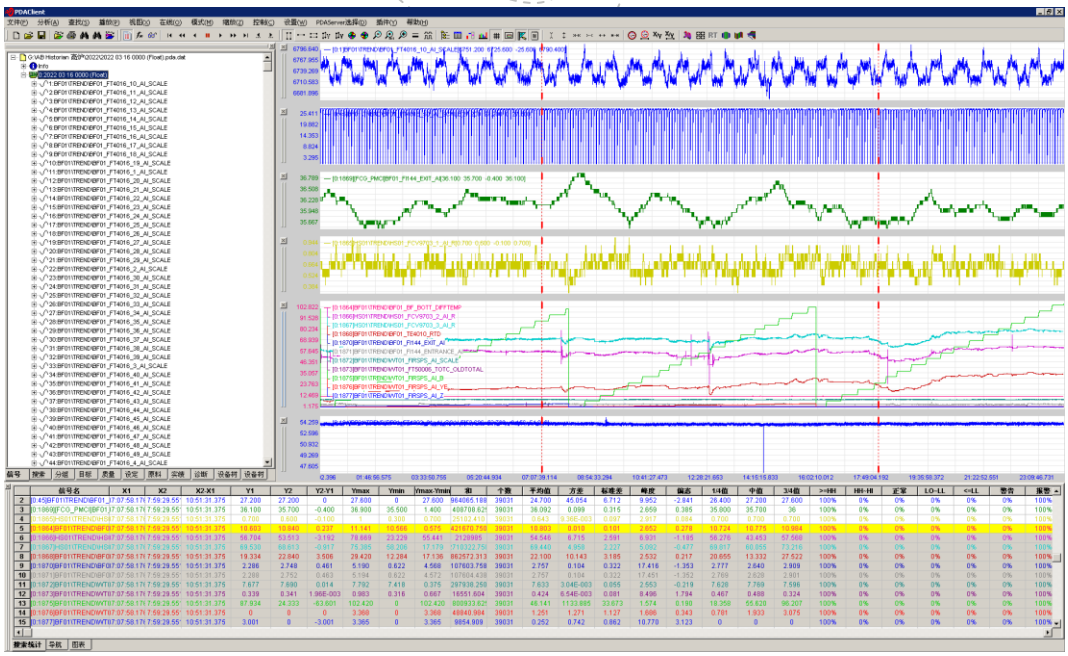


Figure 3.5 Analysis of AB Company's Long Term Raw Data Conversion Using PDA

4 HDS - open time series high frequency Historical database

The full name of a time series database is a time series database, which is mainly used to process data with time labels (changing in chronological order, i.e. time serialization). Data with time labels is also known as time series data.

Time series data is mainly collected and generated by various types of real-time monitoring, inspection, and analysis equipment in the metallurgical, power, chemical, meteorological, and geographic information industries. The typical characteristics of these industrial data are: fast generation frequency (each monitoring point can generate multiple pieces of data within one second), severe dependence on collection time (each piece of data requires a unique time) Multiple monitoring points have a large amount of information (conventional real-time monitoring systems have thousands of monitoring points, which generate data every second and tens of GB of data every day).

Commonly used temporal databases include InfluxDB, KDb+, Prometheus, Graphite, RRDtool, TimescaleDB, Apache Druid, Fauna, OpenTSDB, GridDB, DolphinDB, KairosDB, etc.

Open high frequency time series Historical Database Server stores PDA millisecond level high-frequency data into the temporal database and can access it through SQL statements.

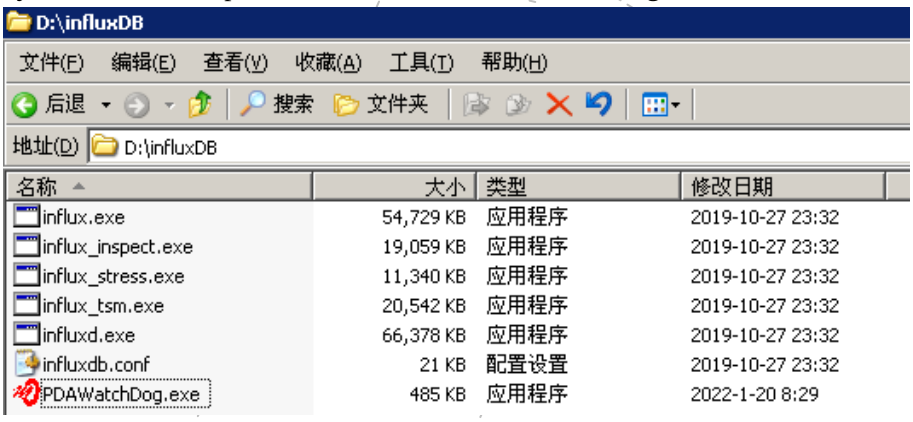


Figure 4.1 InfluxDB Time Series Database System Files

dbUpgradeTSA.exe~dbUpgradeTSL.exe is located in the PDA or HDServer directory. It converts the data files collected by PDA to. csv files supported by InfluxDB at the original sampling frequency or frequency reduction losslessly, and imports them offline in bulk into InfluxDB. The table structure is identical to the configuration of Config.csv.

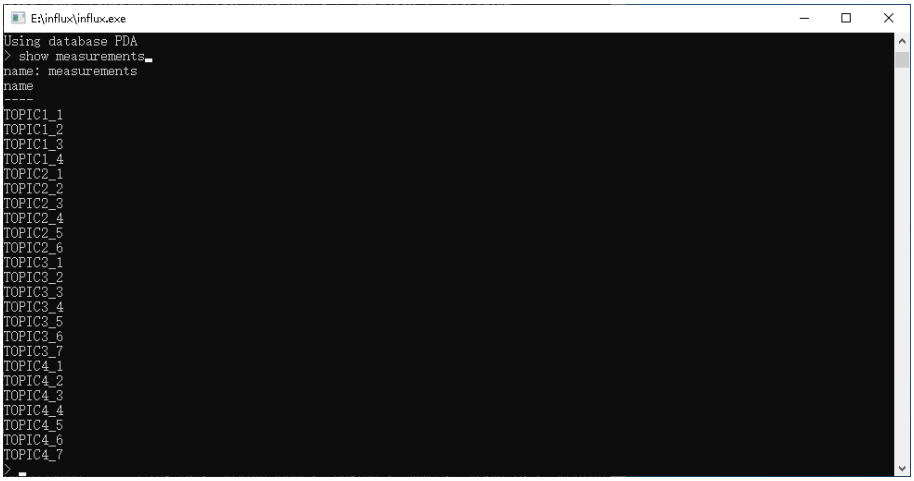


Figure 4.2 Upgrading PDA Configuration to InfluxDB

dbUpgradeTS has multiple processes, each converting several connections to ensure that the write timing database can keep up with the speed of PDA generating data files, Each process scans PDA data files every 2 minutes.

Figure 4.3 Batch Import of PDA Data to InfluxDB

Cancel the quick editing mode and insertion mode in the Console window of the influx service program to avoid input interference.

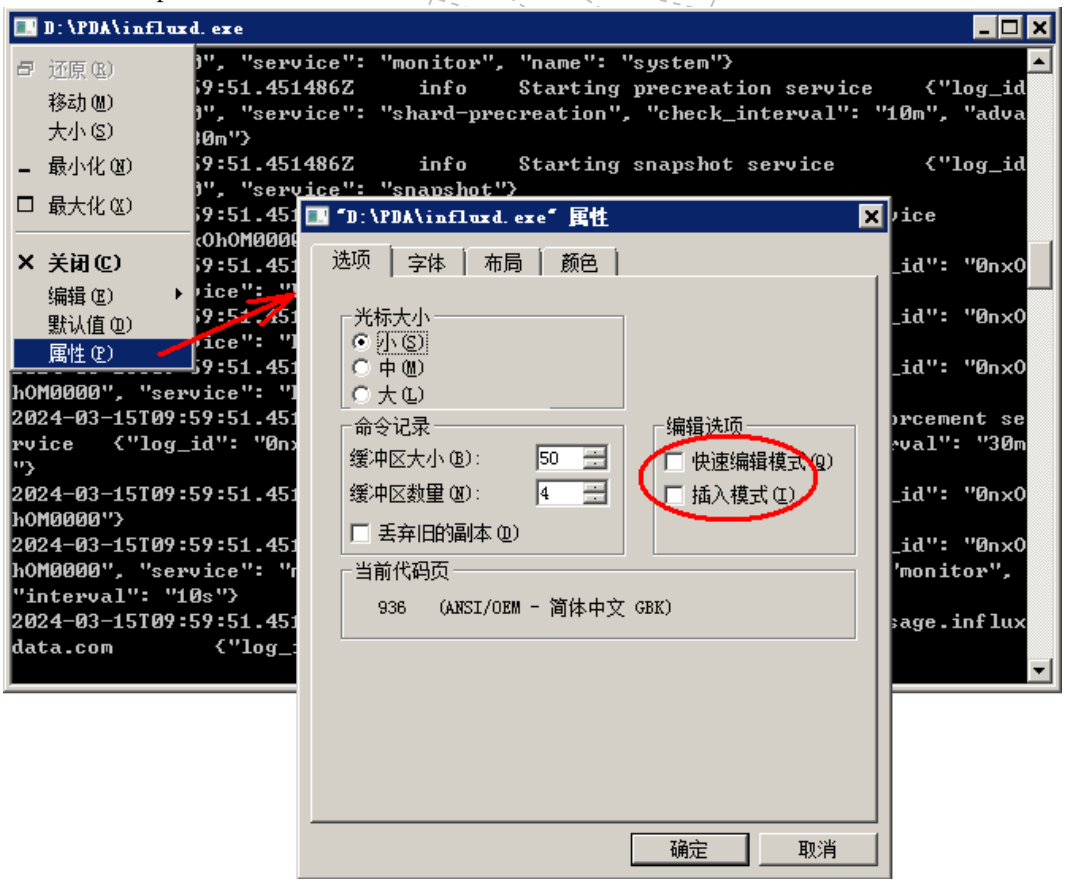


Figure 4.4 set influxd console mode

5 DBU - Database system and Upgrade tools

The database supports SQL statements and has good openness. The Database Upgrade tool upgrades the high-frequency data collected by PDA to a relational and sequential database, achieving the unity of PDA collection points and database table names, field names, and data. It supports offline and online methods.

5.1 PDA → SQLServer Realtime Data

dbUpgradeRt.ini configures the trigger conditions for real-time database writing and which variables are written to which database table.

PDA can save the collected data to relational databases such as SQL Server/MySQL/Oracle in real-time according to the configured number of cycles through dbUpgradeRtA.exe, dbUpgradeRtB.exe~dbUpgradeRtJ.exe. There are seven triggering methods for data storage as shown in the following figure. During the first run, the database table is automatically created according to the configuration of dbUpgradeRtA.ini, dbUpgradeRtB.ini~dbUpgradeRtJ.ini. After the configuration changes, the table structure is manually modified according to the ini configuration.

```
[TableName1] 变化就写列式数据库表
Trigger=1000,3
1=1000,1,第1个变量
2=1000,3,第2个变量
3=1000,6,第3个变量
4=2000,2
5=3000,5,第5个变量
6=4000,3,第6个变量

[TableName2] 0->非0 写列式数据库表
Edge=2000,32
1=1000,21,TableName2第1个变量
2=1000,13,TableName2第2个变量
3=3000,69,TableName2第3个变量
4=2000,22
5=3000,15,TableName2第5个变量
6=3000,20,TableName2第6个变量

[TableName3] TriggerPort,TriggerCH,0->非0 写行式数据库表, 第1个变量决定了字段的数据类型          aPLCTimestamp
EdgeRowDB=   1000,       26,       aDateTime,aTimestamp,aPort,aCH,aId,aName,aValue,aPLCTimestamp,53
1=                                                    1000,  1, 重新取个名字不用Config.csv中的名字1
2=                                                    1000,  3, 重新取个名字不用Config.csv中的名字2
3=                                                    3000, 69, 重新取个名字不用Config.csv中的名字3
4=                                                    4000,  2, 重新取个名字不用Config.csv中的名字4
5=                                                    3000, 70, 重新取个名字不用Config.csv中的名字5

[TableName4] TriggerPort,TriggerCH,PLCTimestampPort,PLCTimestampCH,0->非0 下述各行写一次数据库表, 第1行决定所
EdgeRow=     1000       ,26       ,3000            ,22            ,DateTime,Timestamp, aIdl,aFieldl,aField2,aI
1=                                                                                        3000,70, 1000,3, 1
2=                                                                                        1000,27, 1000,3, 1
3=                                                                                        3000,69, 3000,70
4=                                                                                        1000,29, 4000,5
5=                                                                                        1000,30, 4000,3

[AlarmTableName1] EdgeRising 下述每行第1个变量各自 0->非0 写行式数据库表, 第1行决定所有20个字段的数据类型
dbWrite=1,   aFieldl,aField2,aField3,aField4, aField5, aField6, aField7, aField8, aField9,aFieldlO,aFieldll,aI
1=1000,26,    1000,3, 1000,5, 4000,3, 3000,9, 4000,1 , 1000,11, 2000,12, 1000,13, 3000,15, 1000,17
2=1000,27,    2000,3, 1000,5, 2000,7, 3000,9, 1000,10, 1000,11, 2000,12, 1000,13, 3000,15, 1000,17
3=1000,28,    3000,6, 4000,1
4=1000,29,    2000,9, 4000,2
5=1000,30,    4000,5, 4000,3

[AlarmTableName2] EdgeDropping 下述每行第1个变量各自 非0->0 写行式数据库表, 第1行决定所有20个字段的数据类型
dbWrite=2,   aFieldl,aField2,aField3,aField4, aField5, aField6, aField7, aField8, aField9,aFieldlO,aFieldll,aI
1=3000,11,    2000,2, 2000,3, 4000,2, 2000,7,  2000,9, 1000,10, 2000,11, 1000,12, 2000,13, 1000,15
2=3000,23,    2000,2, 2000,3, 2000,5, 2000,7,  2000,9, 1000,10, 2000,11, 1000,12, 2000,13, 1000,15
3=2000,36,    2000,2
4=2000,12,    3000,3
5=3000,15,    3000,3

[AlarmTableName3] EdgeChanging 下述每行第1个变量各自 变化 就写行式数据库表, 第1行决定所有20个字段的数据类型
dbWrite=3,   aFieldl, aField2, aField3,aField4, aField5, aField6, aField7, aField8, aField9,aFieldlO,aFieldll,
1=1000,1,     2000,6, 2000,3,  2000,5,  2000,7,  4000,4, 1000,10, 2000,11, 1000,12, 2000,13, 1000,15
2=1000,3,     2000,6, 3000,69, 3000,70
3=2000,6,     2000,7
4=3000,2,     2000,7, 2000,3, 2000,5, 2000,7,  2000,9, 1000,10, 2000,11, 1000,12, 2000,13, 1000,15
5=3000,5,     2000,9
```

Figure 5.1 Seven triggering methods for real-time database writing

5.2 PDA → SQLServer Historical Data

dbUpgrade.exe can upscale historical data to a relational database, and automatically create database tables by pressing Config.csv during the first run. It can be downscaled and upscaled.

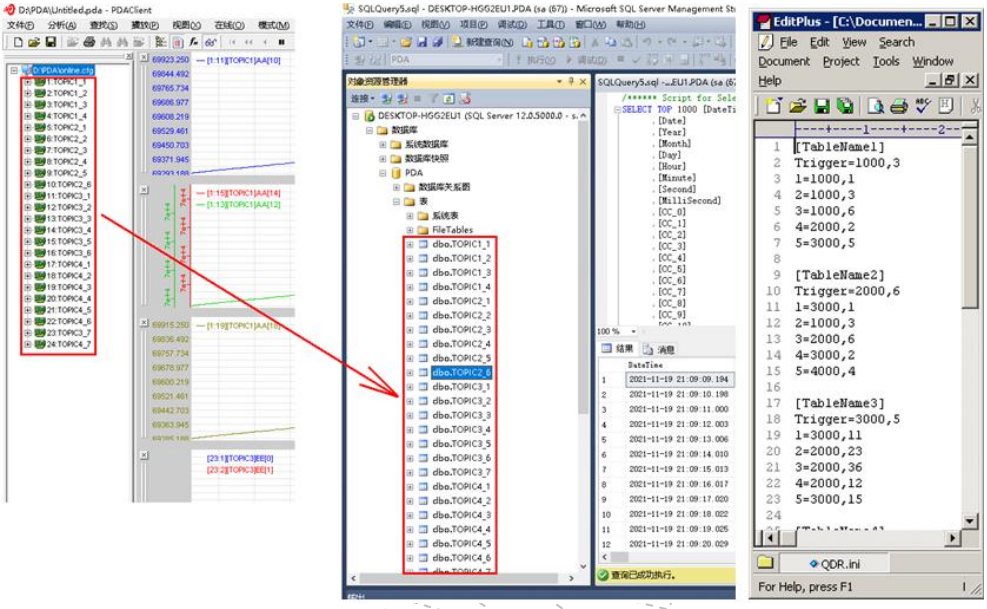


Figure 5.2 PDA configuration upgrade to relational database

5.3 PDA → InfluxDB realtime data

dbUpgradeRtTS.ini configures the trigger conditions for real-time database writing and which variables are written to which database table.

dbUpgradeRtTS.exe calls influx_Rt.exe writes the database table in real-time according to the configuration file dbUpgradeRtTS.ini when one of the seven triggering conditions is met, or unconditionally once per second, with the ability to write tens of thousands of points per second. It supports triggering frequency at the 0.1 second level, and the field name written to influx should be correctly configured in the FFS column of Config.csv. The IP and file path configuration is shown in the following figure.

dbUpgradeRtTSSr.exe can update files that have not been uploaded in the past 7 days, scan every 12 hours, and automatically delete temporary files 10 days ago.

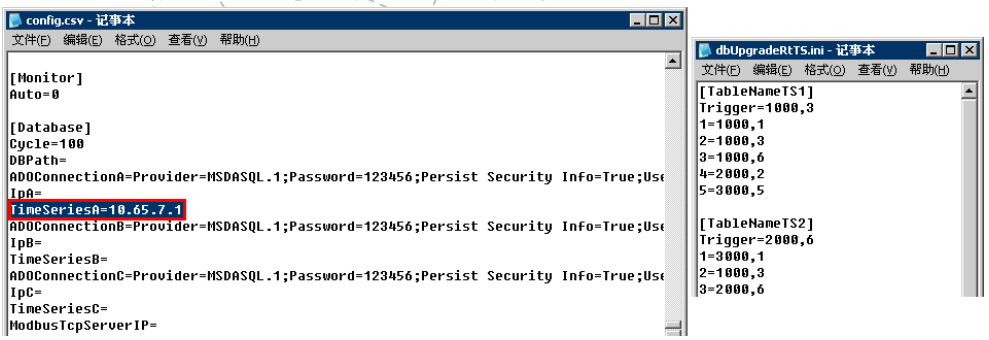


Figure 5.3 Configuration of InfluxDB IP and Collection Points in PDA

5.4 Automatic report

The automatic reporting system is a big data analysis and statistical tool.

Provide sufficient support for various reporting tools such as Microsoft Power BI and Fansoft through database and PDA underlying technology.

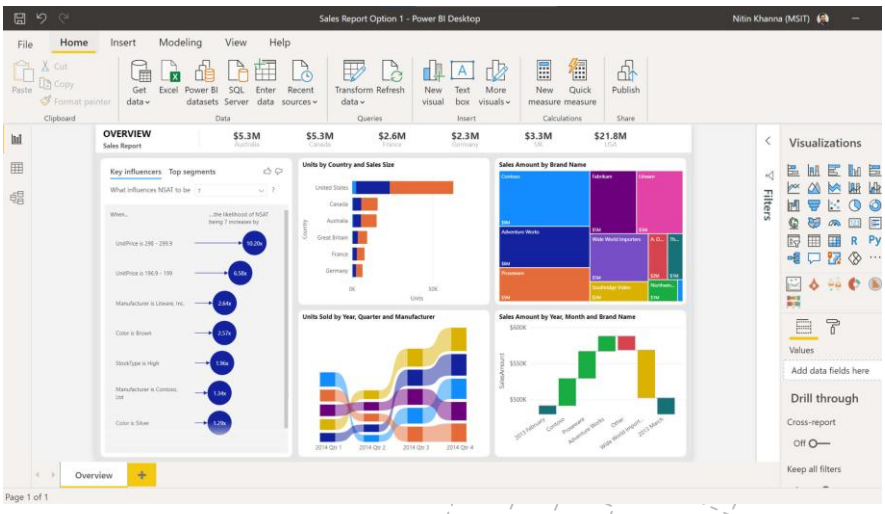


Figure 5.4 Power BI Report Example

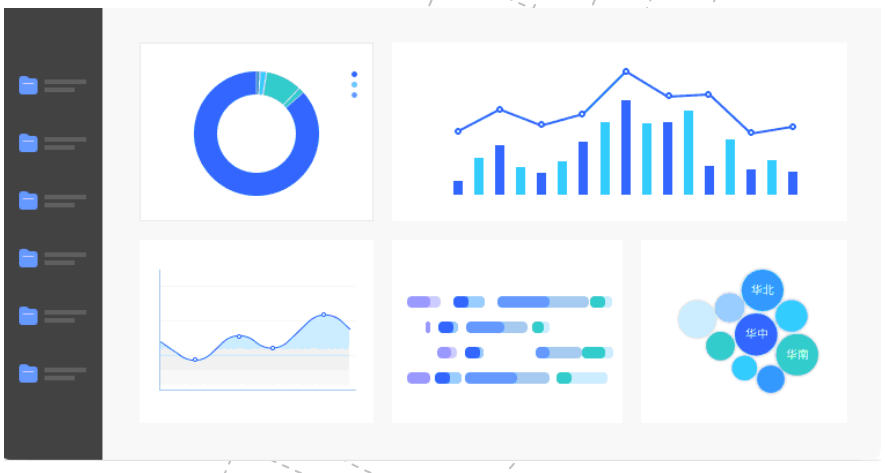


Figure 5.5 Fansoft Report Example

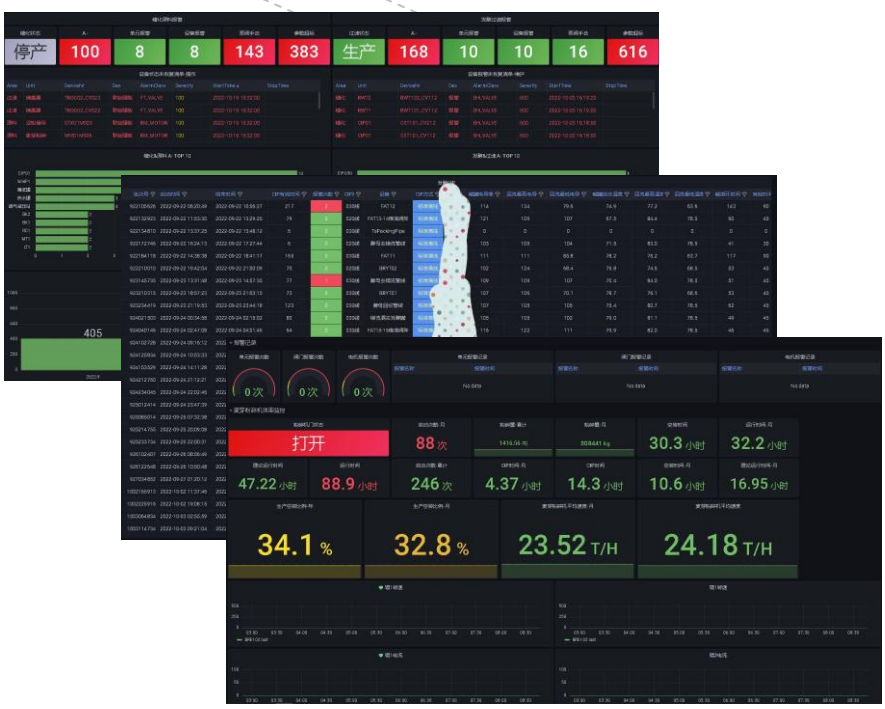


Figure 5.6 Real time and statistical reports for Grafana configuration

6 DCC - Digital Coil Conversion and full process quality management

6.1 Application of digital steel coil

The Digital steel coil conversion system is an important component of the hot and cold rolling information system and can also operate independently.

The so-called digital steel coil refers to a series of data sets that are attached to the physical steel coil with relevant production digital information. It realizes the "full process visualization" and "digitization" of the steel coil, providing a complete, accurate, and reliable data foundation for subsequent big data analysis and mining. It is the most crucial step in realizing an intelligent factory. It can be delivered with physical steel coils or stored in big data centers for 5G download, with the advantage of product traceability. Because there are millisecond and centimeter level numbers recorded on the steel coil, if applied to household appliances, construction, especially automotive, silicon steel, and stainless steel products, this will further ensure quality. Accelerate the construction of a manufacturing powerhouse, accelerate the development of advanced manufacturing industries, and promote the deep integration of the Internet, big data, artificial intelligence, and the real economy. "Digital steel coil" is a typical case of cross-border integration between manufacturing and big data.

(1) Digital steel coils are divided into length digital steel coils, timing digital steel coils, equipment digital steel coils, and equipment diagnostic digital steel coils, each with corresponding purposes.

(2) According to timeliness, it can be divided into real-time digital steel coils (calculated in seconds) and online digital steel coils (calculated in minutes).

(3) According to production processes, it can be divided into hot-rolled digital steel coils, cold-rolled digital steel coils, digital steel plates, digital steel pipes, etc.

(4) Regardless of rough rolling, finishing rolling, or coiling, each signal is equally divided into 30000 parts according to length, truly accurate to the centimeter level, while achieving natural length alignment.

(5) Search for 20 year old steel coils based on certain indicators such as head, middle, and tail (which can be divided into 20 sections) and total length. The results will be returned within 10 seconds, without the need for hours. Generally, it takes only 3 seconds.

(6) Compared with other digital steel coils at home and abroad, the concept of this system is the most distinctive. It is truly accurate to the centimeter level and millisecond level, and the core of the analysis tool is consistent with the PDA system, making it very suitable for processing large amounts of data.

(7) Digital steel coil is a relatively independent system that can operate independently or as a part of the information system of factories, companies, and groups. It provides various fully open interfaces such as file sharing, database, FTP, HTTP, MQTT, etc. for other systems.

✓ The synchronous delivery of digital steel coils and physical steel coils is beneficial for downstream process control of product quality. For example, high-end cold rolled steel plates are mainly used for automotive outer panels, with high quality requirements and high processing difficulty. When delivering the steel coils to customers, the data attached to the physical products is also submitted together. This type of "digital steel coil" not only contains common data of the same batch of steel, but also carries the material, process, and Personalized data such as performance is equivalent to comprehensively collecting the "process fingerprint" of the steel coil, thereby helping automobile manufacturers better control the quality of the entire vehicle.

✓ Quickly identify quality statistical indicators through classification to guide decision-making.

✓ Improving yield: width control, analyzing the control accuracy that physical steel coils can achieve, reducing the width margin by 1mm, will generate considerable economic benefits: for example, the width

margin of a certain specification, statistical analysis of all similar steel coils in history, and finding the optimal value when setting the model and control strategy unchanged.

✓ Improving quality: such as controlling flatness, analyzing the reasons for each meter, changing control methods, controlling convexity, thickness, temperature, etc.

✓ Improve control level: set values, accurately track steel coil numbers.

✓ Improved model: able to easily identify commonalities, optimize models and parameters.

✓ Quality objection handling: The digital steel coil records all quality data at the centimeter level, which can be quickly analyzed and processed without having to go to the user's site, shortening the time frame and reducing costs.

✓ The existing data related to steel coils is dispersed in various systems, and the names of the data are not unified, which brings great difficulties to the comprehensive application of these data. "Digital steel coils" will establish a unified data platform, on which a series of information such as equipment data, operation records, energy consumption data, defect data, process data, cost data, and user information will be integrated into a unified data. The collected data is uniformly encoded according to the steel coil number, using the steel coil as the carrier, and assigned values in both chronological and length dimensions to produce a "digital steel coil" that is synchronized with the actual steel coil, providing a data foundation for in-depth applications such as equipment intelligent monitoring, production intelligent scheduling, cost management, and intelligent spot checks.

✓ With the increasing demand for product quality from users, those with stable product quality and high performance indicators will be the first to promote digital steel coil delivery nationwide. With the widespread implementation of information technology, it can be foreseen that physical steel coils that provide digital steel coils will be more popular. Leaving the forefront of information technology will win market advantages, not only providing convenience for users to improve product quality but also reducing costs, Moreover, it greatly promotes the continuous improvement of product quality momentum upstream, not only being traceable, but also providing full process data for analysis throughout the entire industry chain.

✓ Provide data sources for B/S and big data analysis.

6.2 Digital coil conversion calculation

The conversion work and length calculation are calculated by QDRServer based on the temporal data file. Support two tracking methods: zone occupancy and continuous calculation. By collecting and merging the individual quality data record files formed by each process, the entire process quality data files can be obtained, providing data sources for B/S and big data systems.

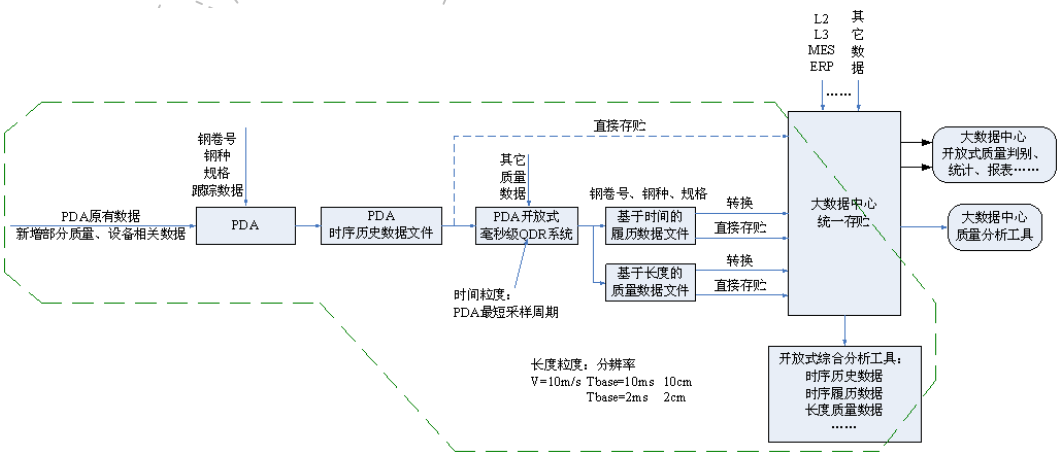


Figure 6.1 Process quality data calculation

- ✓ Data recording based on coil number and length
- ✓ Millisecond time resolution
- ✓ Centimeter size of length
- ✓ Whole process data integration
- ✓ Efficient quality analysis tool - product Explorer
- ✓ Rich analysis function

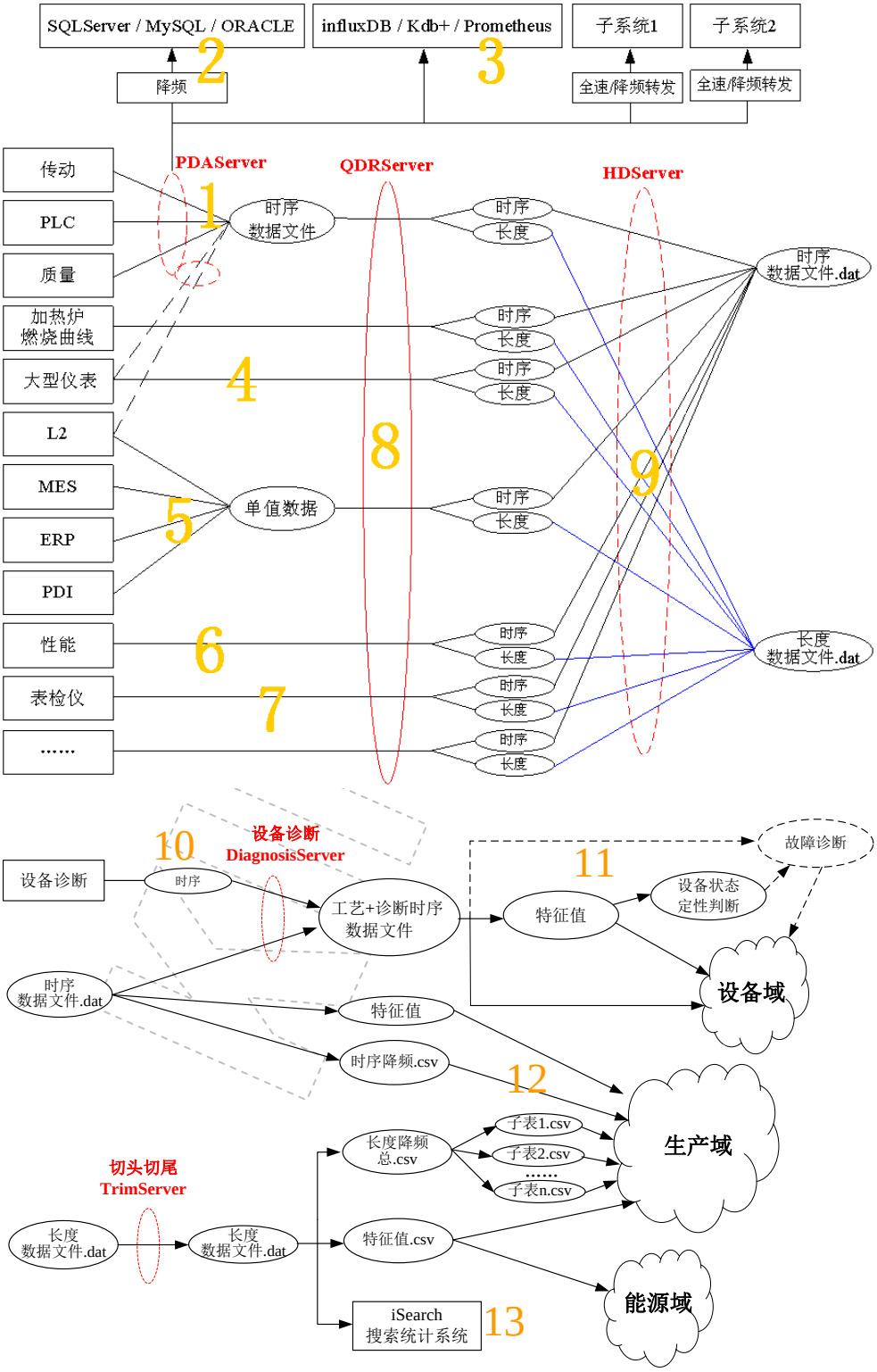


Figure 6.2 Digital Steel Coil System Architecture

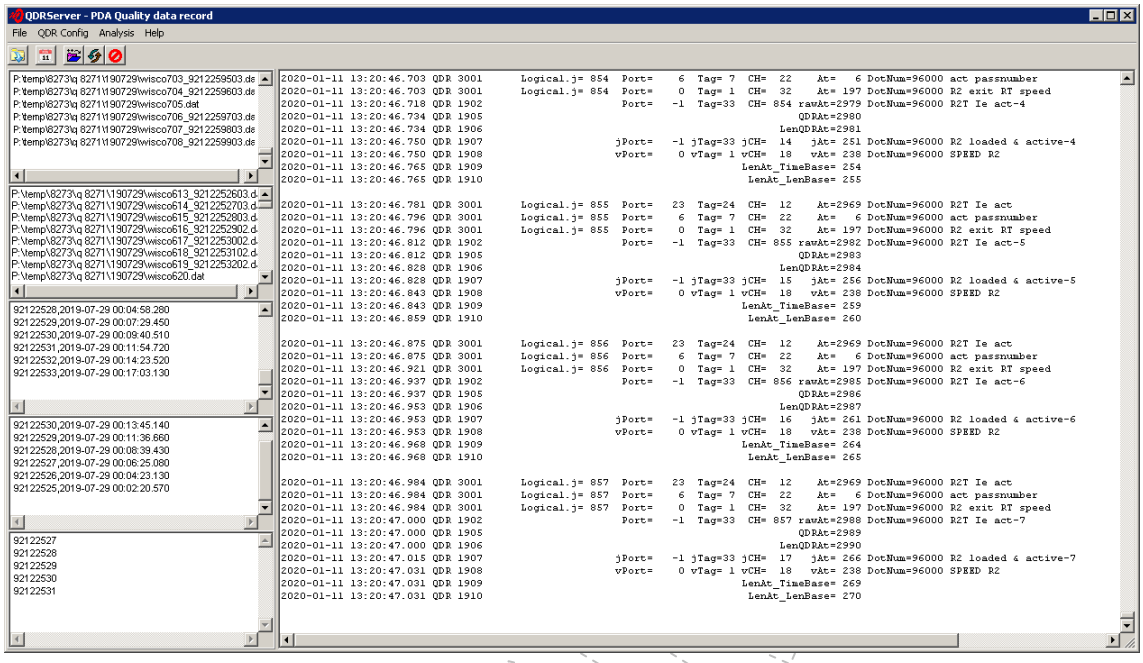


Figure 6.3 Converting and caclulating of quality data recording files

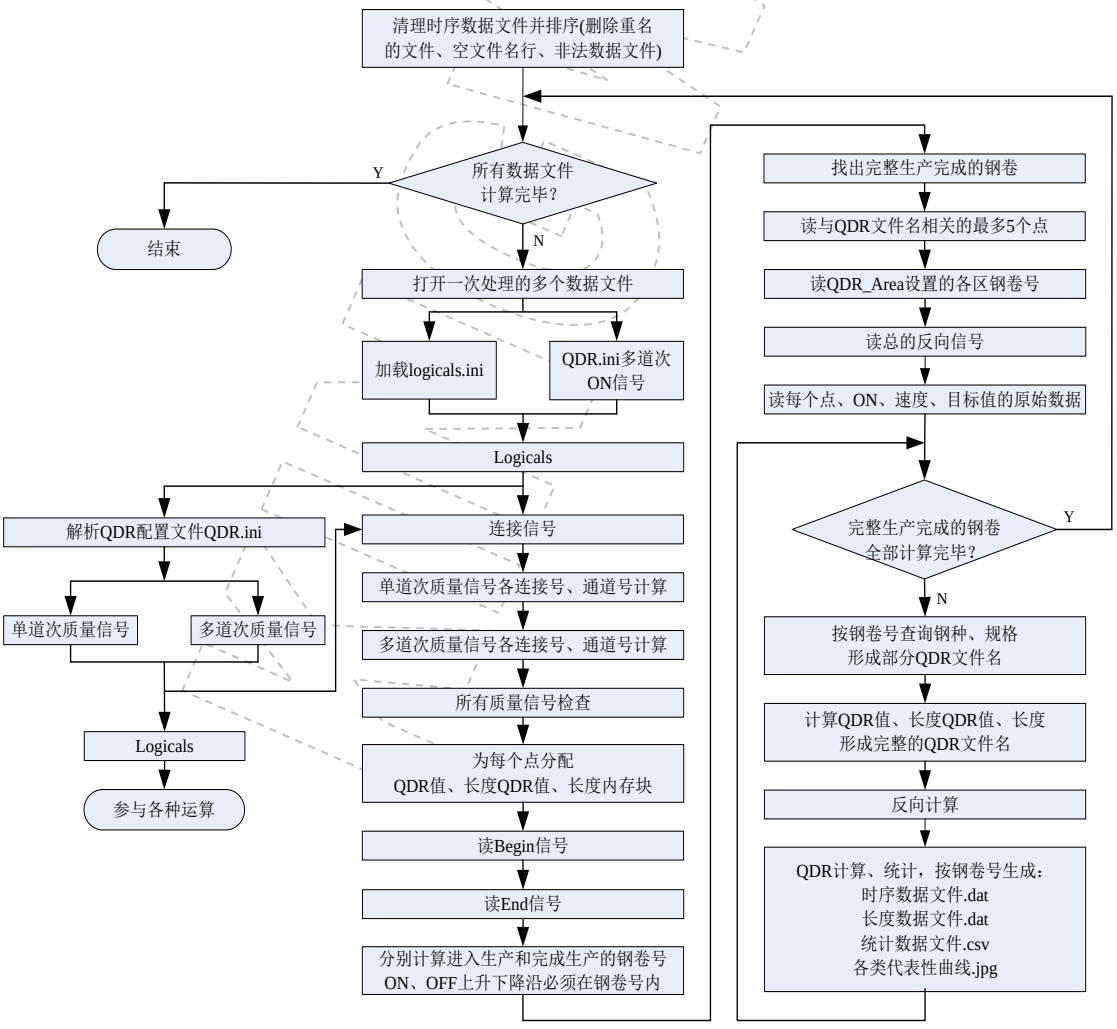


Figure 6.4 Quality data converting flow chart

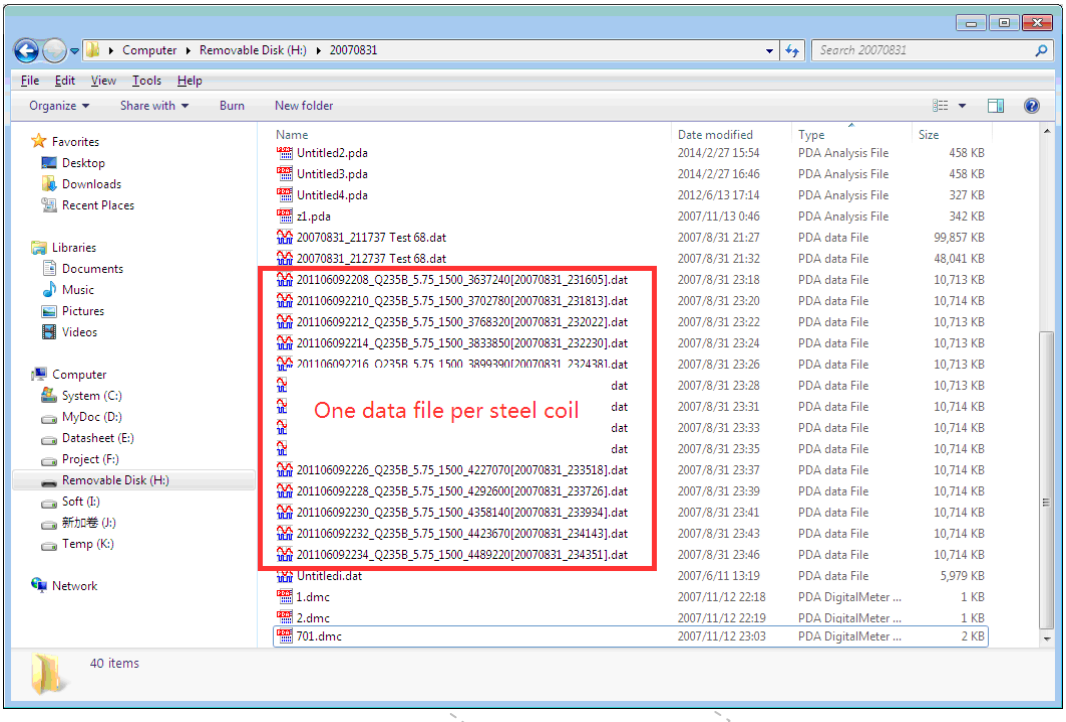


Figure 6.5 The quality data recording files generated

6.3 Length timing equipment and equipment diagnosis digital steel coil

The digital steel coil includes high-resolution data files of length, time-series high-frequency data files, equipment diagnosis ultra-high frequency data files and their header, body, tail, full-length feature value statistical data, and frequency reduction data of length and time series, as shown in the file list below.

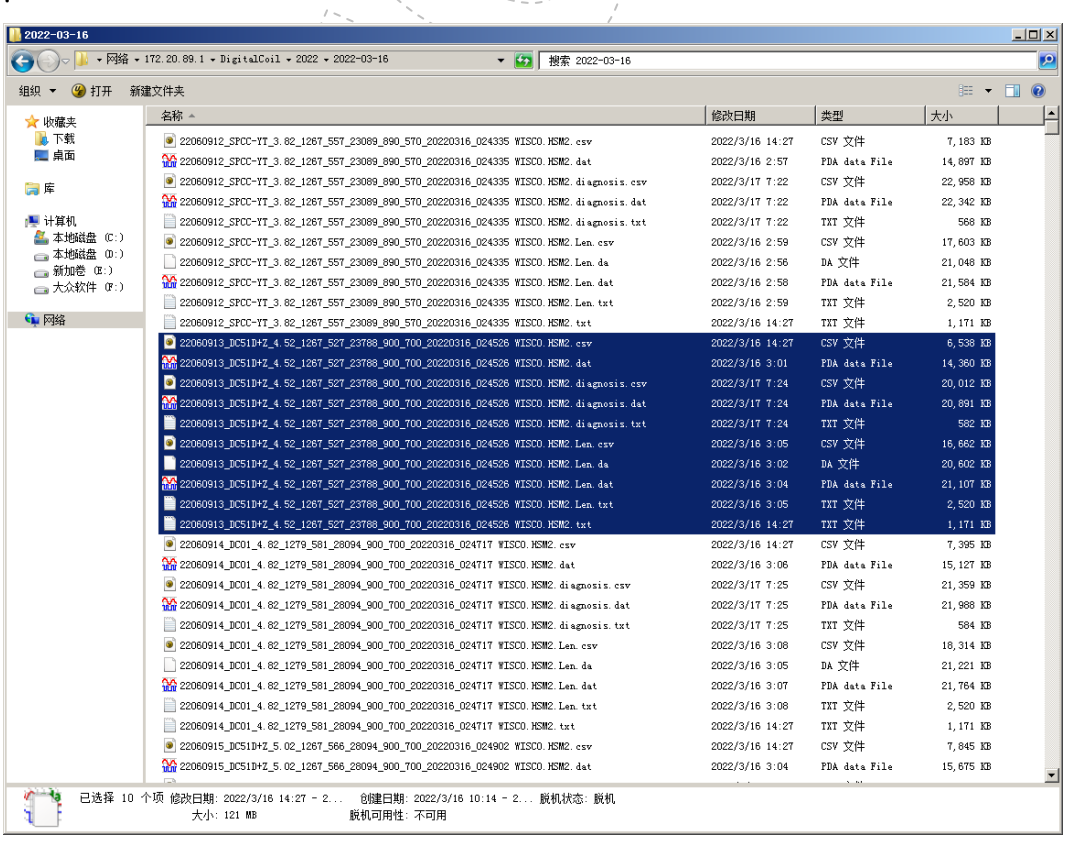


Figure 6.6 Digital steel coil file for length, timing, and equipment diagnosis

6.4 Alignment

Each signal in the length direction is divided into 30000 equal parts, and different process sections and production lines of the same production line are naturally aligned. It is also compatible with the entire process of hot rolling, cold rolling, and processing lines; The timing direction is aligned according to the sampling time, and the equipment diagnosis ultra-high frequency raw data is aligned according to the sampling time.

6.5 Real time digital steel coil

Within 1 second after throwing steel in each zone of rough rolling, finishing rolling, and coiling, the PDAServer of each zone starts the QDRServer digital steel coil calculation. The QDRServer completes the calculation within 2 seconds, and completes the judgment of quality, equipment, model accuracy, etc. within 1 second, while also completing the curve display.

The startup signal in PDAServer is set in the configuration file Config.csv, and the unwinding signal of each coiler in the coiling area is an OR relationship.

Curve display: Display the real-time curves of 2 historical and current strip steels before steel throwing, and display the curves of 2 historical and current strip steels within 1 second after QDRServer calculation is completed.

Rough rolling: final pass curves such as outlet width, centerline deviation, and outlet temperature.

Precision rolling: thickness, width and deviation, FT0, FT7, flatness, convexity measurement and target values, etc.

Coiling: Coiling temperature, width and deviation, measured centerline, and target values.

Template switching can be used for roll gap, rolling force, current, servo valve signal, etc.

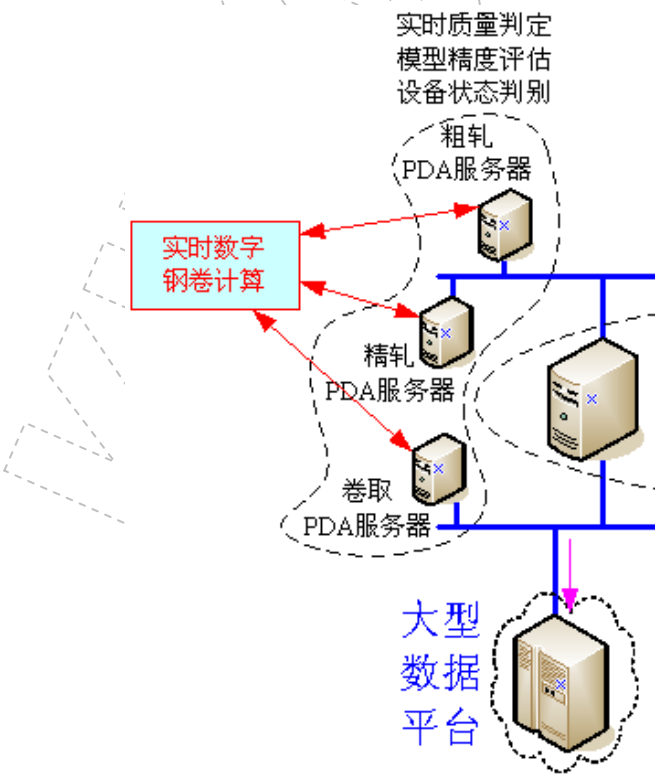


Figure 6.7 Real time digital steel coil system configuration

Figure 6.8 Directory structure of digital steel coil system for a certain project

6.6 Basic, Standard, Professional, and Enterprise Editions

Basic version: L1 data for rough rolling, finishing rolling, and coiling areas (length+timing)

Standard version: Basic version+L2, L3, L4, large instrument data (length+timing)

Professional Edition: Standard Edition+Search System

Enterprise Edition: Professional Edition+Device Diagnosis (Timing)

6.7 High resolution real-time quality judgment and device status discrimination

The determination of length direction can be accurate to the centimeter level.

The timing direction determination can be precise to the millisecond level.

Immediately start the digital steel coil calculation in each area after throwing steel, and complete quality judgment, model accuracy evaluation, servo equipment status discrimination, etc. within 10 seconds.

6.8 Digital steel coil analysis tool BigOffice

Obtaining data from a data warehouse is a difficult task for anyone. Intuitively extracting raw data, efficiently displaying raw curves, conveniently selecting analysis methods, and quickly displaying analysis results are the last mile for industrial big data to enter the desktop of professional engineers. Otherwise, it is difficult to land, and massive data will be shelved.

In the era of big data, engineering and technical personnel urgently need a set of BigOffice.

PDA is a set of industrial millisecond level real-time big data tools and also the basic platform for big data collection.

PDA simplifies complex operations, efficiently performs a large amount of mathematical operations, and visualizes the presentation of data.

PDA provides high-speed data services for various architectures such as C/S and B/S.

PDA can also be naturally compatible with second or minute level data frequency. For example, for Tieqian big data, all data related to ironmaking, sintering, and coking can be extracted from the data warehouse by day, week, or month and saved in PDA format data files. Equipment and process engineers can analyze from their respective angles. PDA has conventional mathematical analysis methods, and big data specific analysis methods can be integrated into PDA in the form of plugins, In this way, users' diverse ideas can be incorporated into the PDA platform, and the ecosystem will gradually be established. PDA data and functions are completely open and transparent.

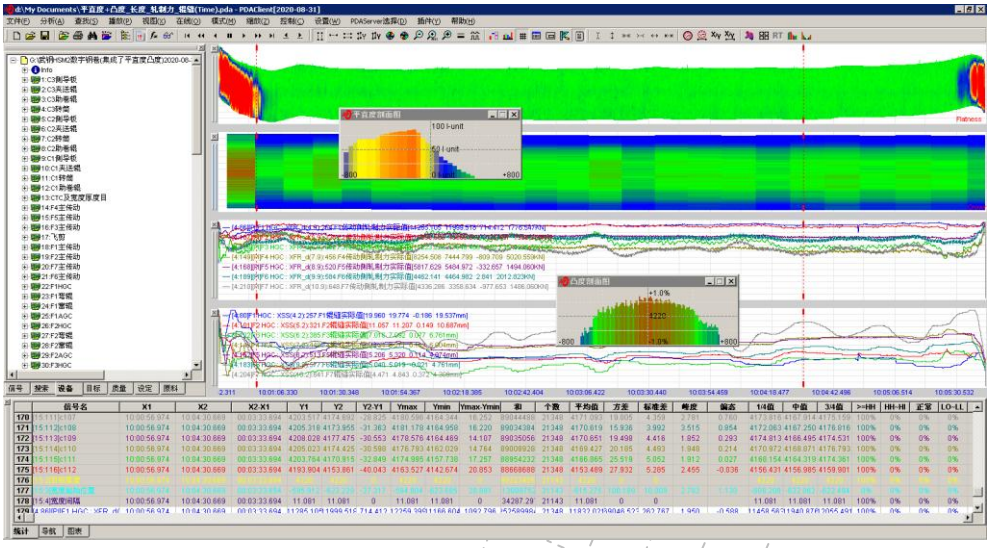


Figure 6.9 Curve of relationship between flatness and crown and rolling force and roll gap

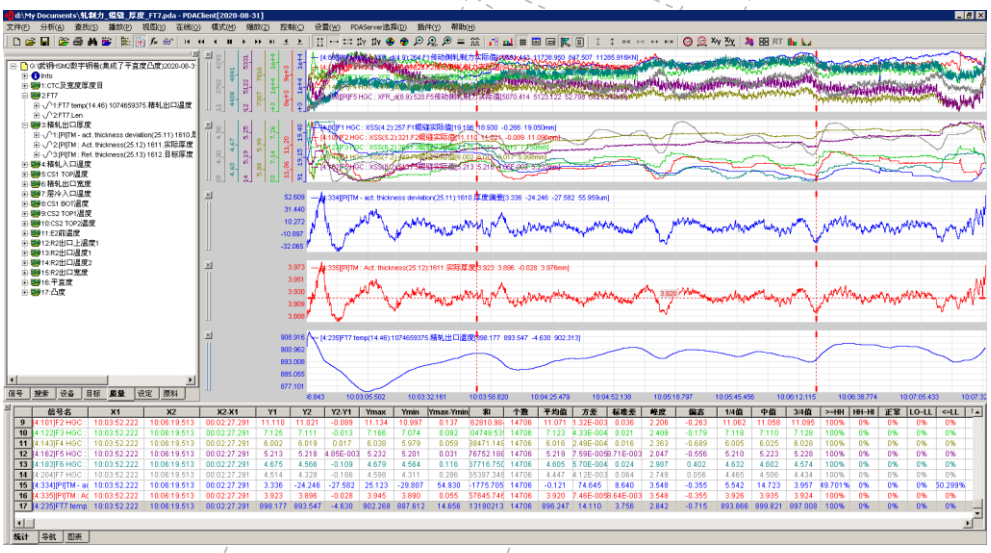


Figure 6.10 Relationship between rolling force roll gap and outlet thickness and FT7

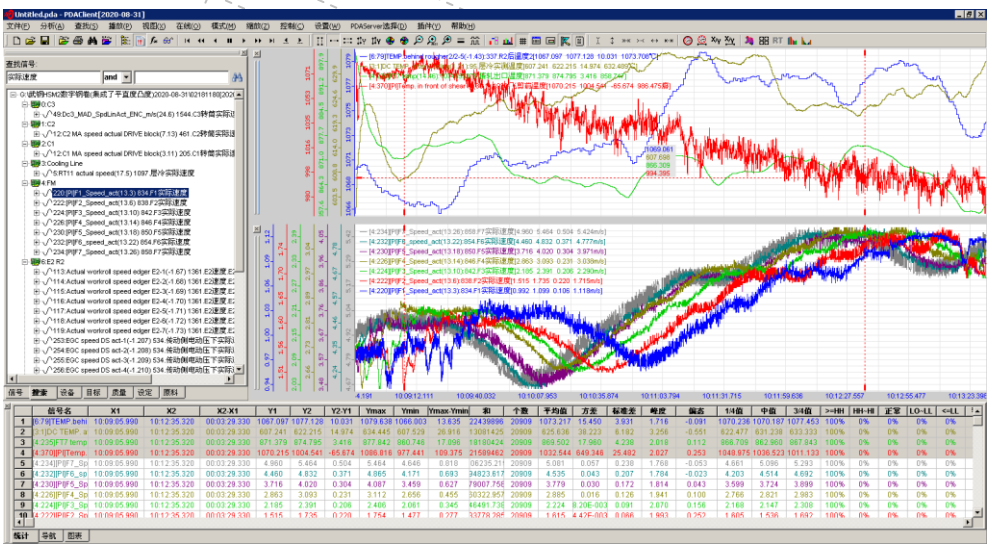


Figure 6.11 The relationship curve between RM FM DC temperature and FM speed

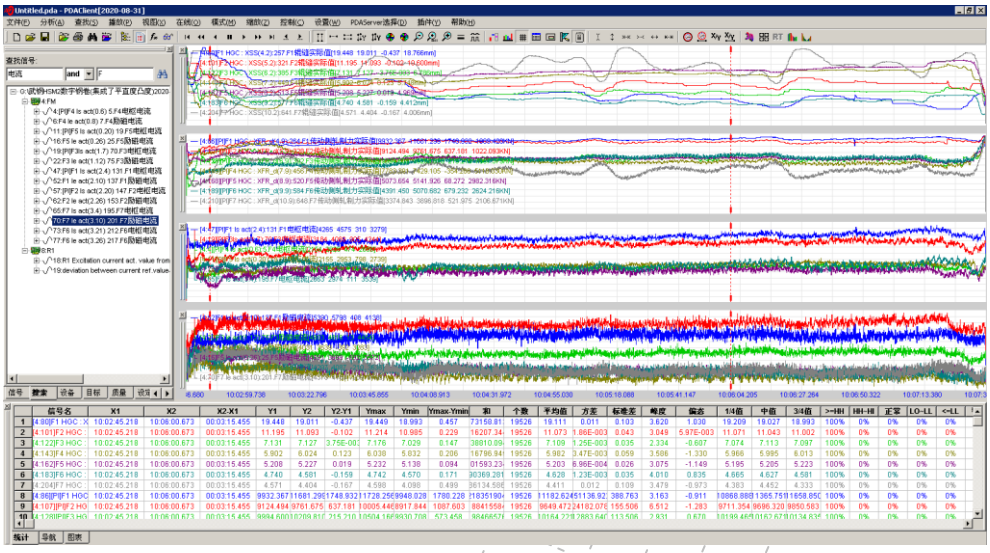


Figure 6.12 The relationship curve between rolling force gap and main transmission current

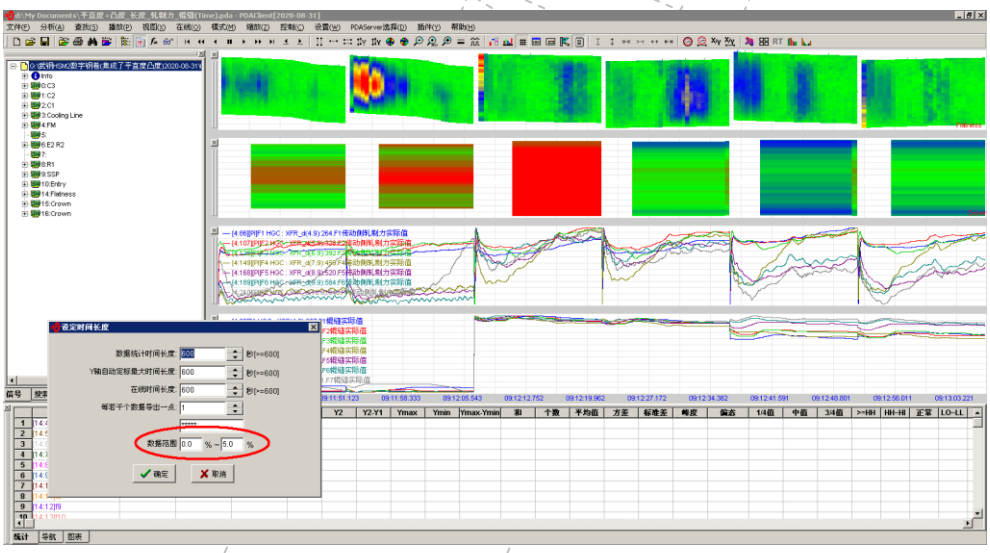


Figure 6.13 Shape and curve of 6 strip head

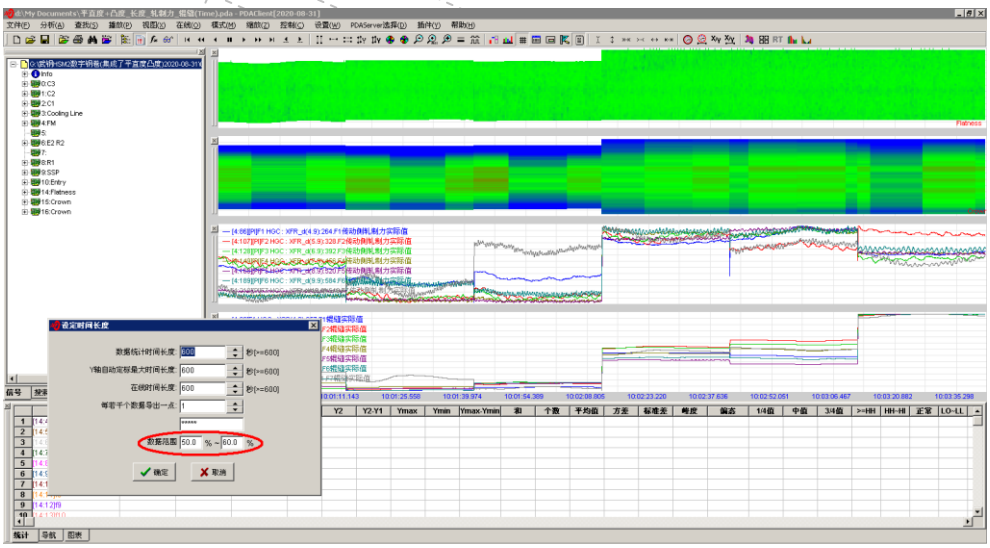


Figure 6.14 Shape and curve of 6 pieces of strip in the middle

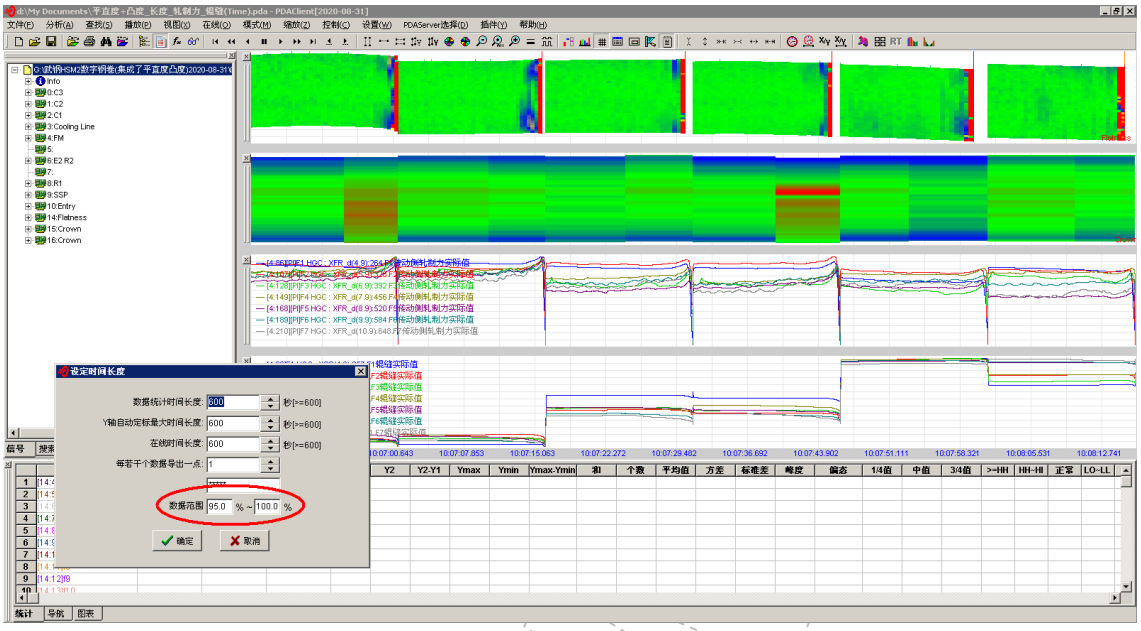


Figure 6.15 Shape and curve of 6 strip tail

6.9 Application of digital steel coil in quality inspection

Quality inspectors need to manually check all quality index curves of each steel coil. The calculation of product length, time translation, and length alignment for each index are almost manually completed, which is labor-intensive and tedious.

The digital steel coil iSearch high-speed search locates the steel coil, displays all quality curves according to the upper and lower limits of PDI indicators, displays the measured plate shape in three-dimensional graphics, and quickly switches quality inspection content using analysis templates.

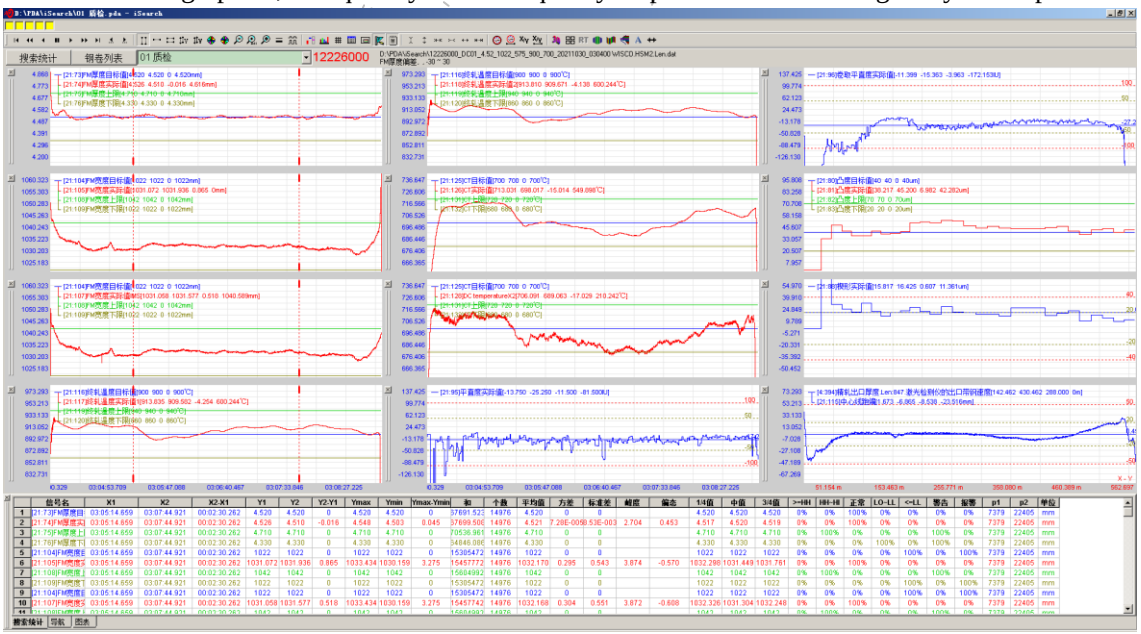


Figure 6.16 PDI Indicator Upper and Lower Limits Showing All Quality Curves

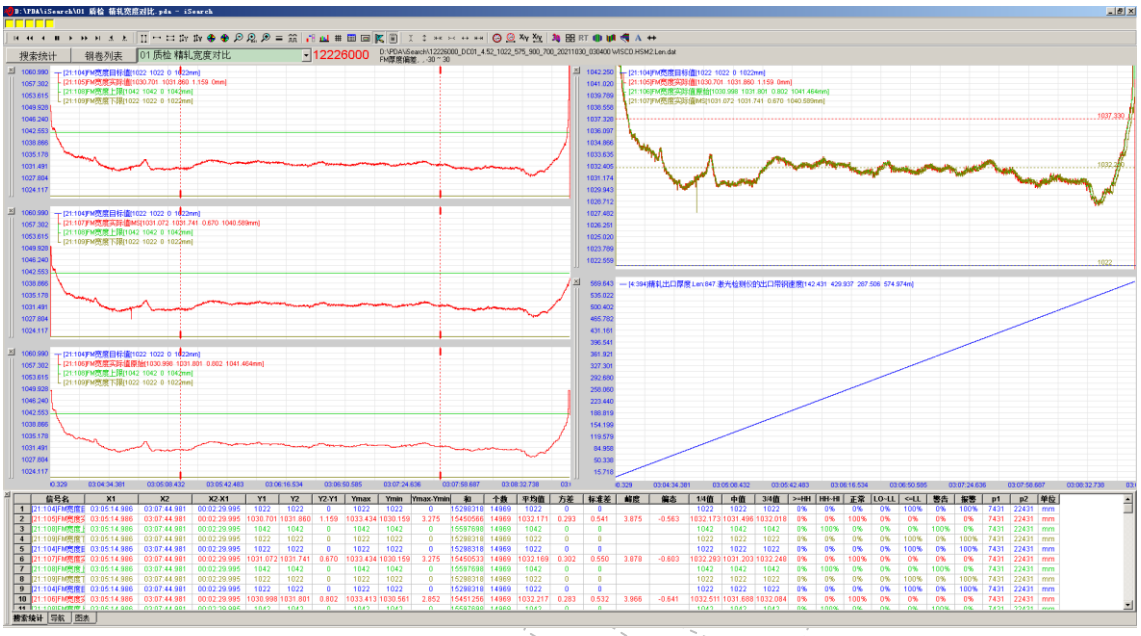


Figure 6.17 Analysis Template Quick Switching Quality Inspection Content

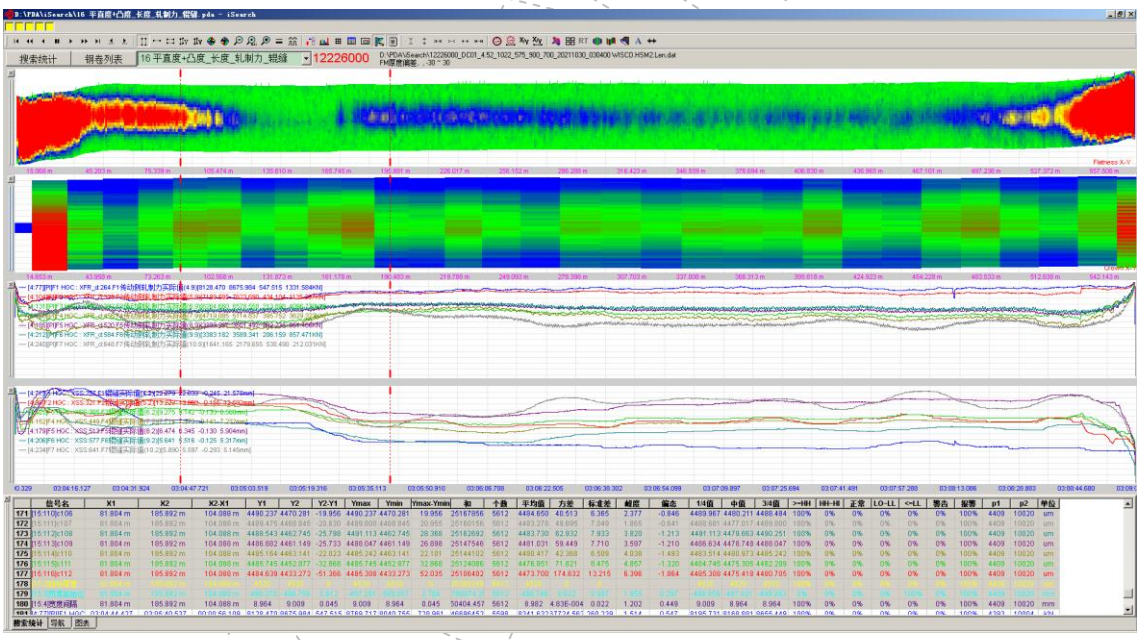


Figure 6.18 3D Graphic Display of Measured Plate Shape

6.10 Digital steel plate

There are traditional wide and thick plate rolling mills and hot continuous rolling+heat treatment production methods for wide and thick plates, with higher requirements for flatness and convexity. PDA supports 5000 plate shape measurement curves horizontally, as shown in the above figure, which can be locally enlarged.

The complete set of equipment for the medium and thick plate production line mainly includes: vertical roller rolling mill, four roller rolling mill, straightening machine, fixed length shear, double-sided shear and splitting shear, fast cooling speed device, etc. The basic production process is as follows: continuous casting billet → feeding → heating furnace → descaling → (rough rolling) → precision rolling (controlled rolling) → (rapid cooling) → hot straightening → cooling bed → inspection and grinding → cutting head, tail, sample, length and edge → surface inspection and cleaning → marking → collection → warehousing → shipment.

Figure 6.19 Wide and Thick Plate Production Line and Finished Products

6.11 Digital steel pipe

The production process of hot-rolled seamless steel pipes includes basic processes such as pre rolling preparation of billets, heating of billets, piercing, rolling, sizing and reducing, cooling of steel pipes, cutting heads and tails of steel pipes, sectioning, straightening, flaw detection, manual inspection, spray printing, bundling and packaging.

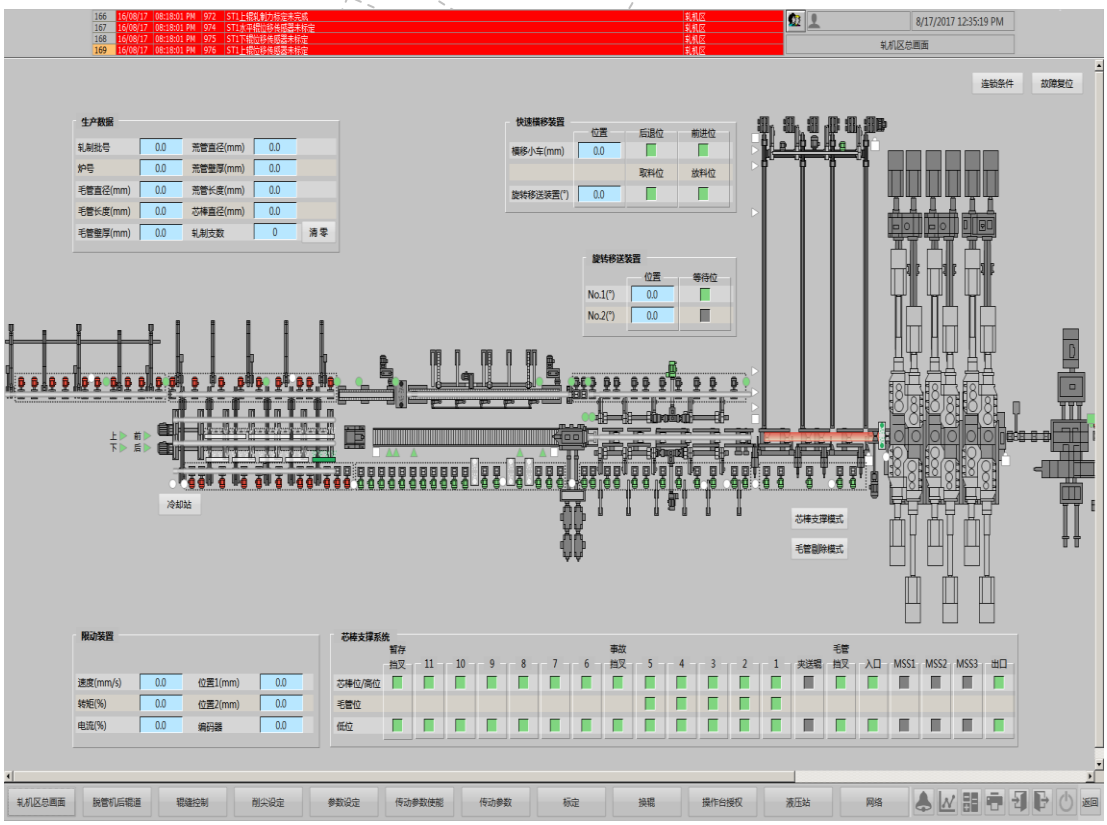


Figure 6.20 Steel Pipe Production Process

6.12 Continuous casting digital slab

Divide the slab according to the cutting signal of the flame cutting machine, the length direction can be precise to the centimeter millimeter level, and can be aligned with the length of HSM and CSM digital steel coils.

Figure 6.21 Continuous Casting Production Process Flow Chart

6.13 Cold strip mill digital steel coil

Support the function of dividing a steel coil into multiple small coils.

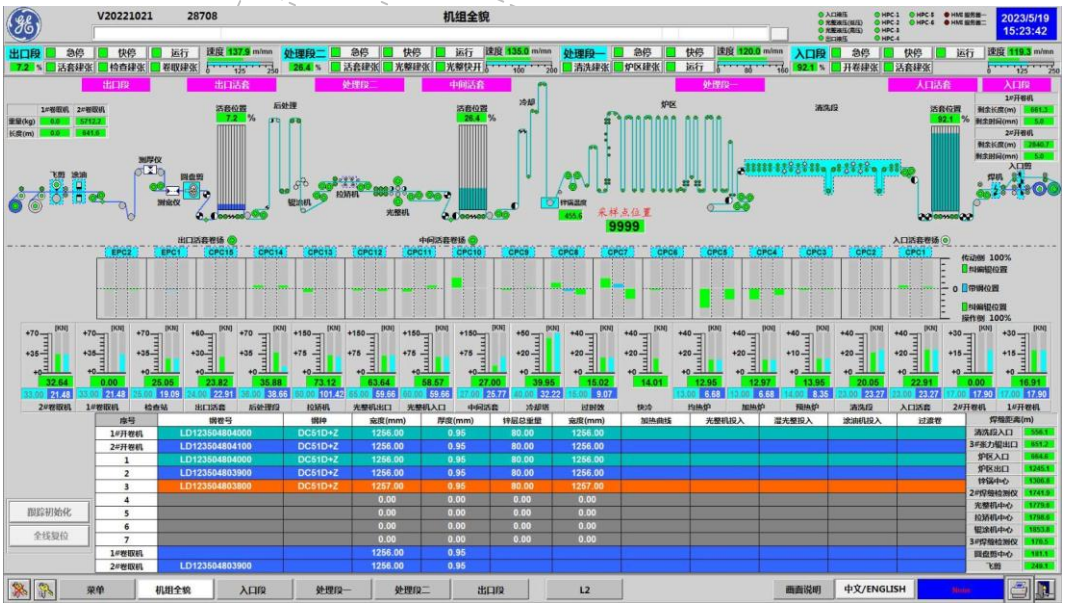


Figure 6.22 Cold Rolling Production Flow Chart

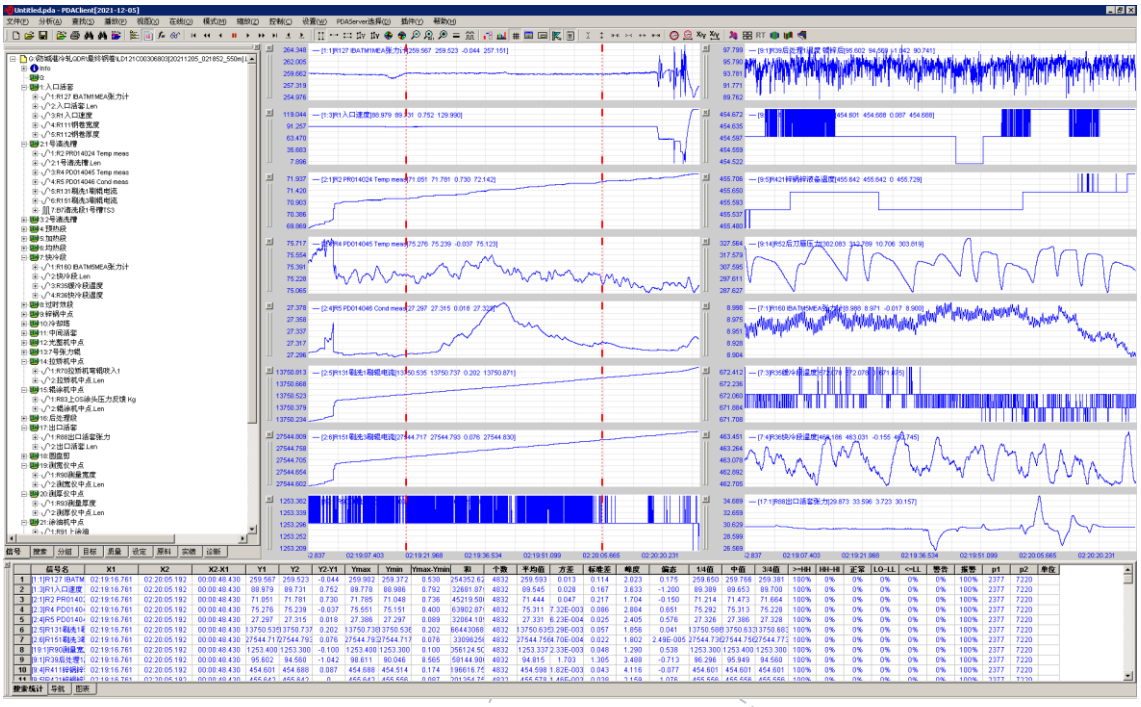


Figure 6.23 Process Data Curve of a Steel Coil

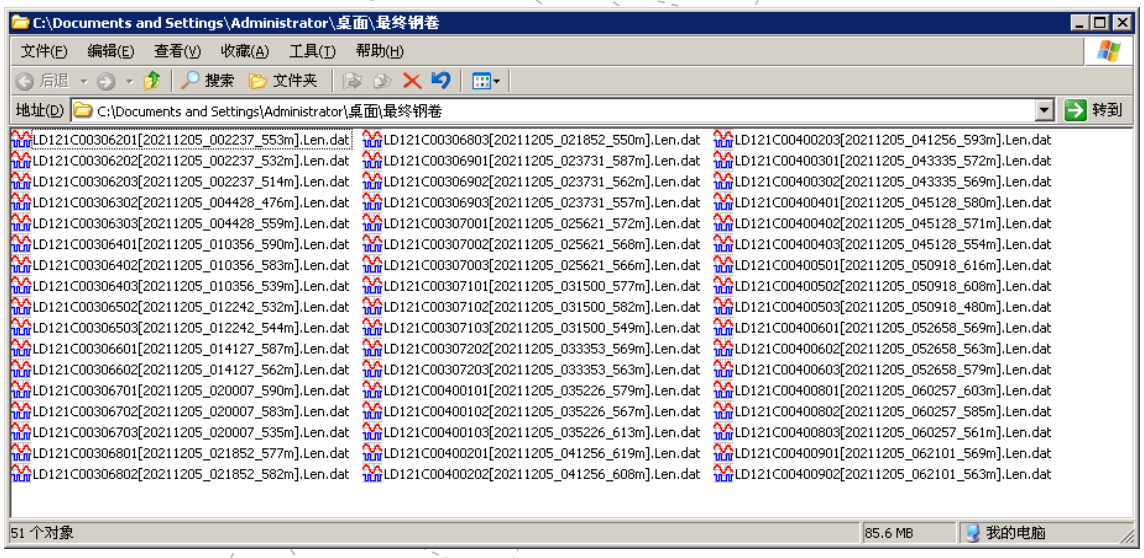


Figure 6.24 List of Finished Digital Steel Coils

7 CFS - Coil Fast Search and statistics system

Google, Baidu, and Taobao are civil big data searches, with most of their data being triggered event based. iSearch is an industrial big data search, with similarities and significant differences. The latter is mainly high-frequency temporal and high-density conversion based.

Digital steel coils are vast amounts of data on the millisecond and centimeter scales. If traditional databases are used to search and count certain indicators among tens of millions of steel coils, the calculation time will be on the hour scale, which is difficult to accept in practical work.

The search and statistics speed of CFS (Coil Fast Search system) is hundreds of times faster than traditional databases, achieving the ability to search for 10000 steel pieces that meet the requirements in tens of millions of steel coils in seconds, and calculate certain indicators of these 10000 steel pieces, return extraction data and statistical results. For example, the search and statistics of all steel coils in 20 years are performed once, and the results are returned in 3 seconds. The configuration file iSearch Searchini. Simultaneously supporting control networks, office networks, wide area networks, etc.

The search statistics results can be saved to local or remote files, databases, or received through MQTT. It supports file sharing, direct opening, FTP, and HTTP downloading, and provides download services for raw high-frequency data.

7.1 Changes in working methods

The traditional method is to save a certain statistical calculation result every day and summarize it when needed. If you want to modify a certain statistical accuracy range, you need to organize and calculate all the historical data once. The workload is huge and time-consuming, and some of the original data may have been lost. iSearch performs statistical calculations on the original high-frequency data every time, and the accuracy range can vary according to needs.

7.2 Changes in work platforms

Transforming from fixed and explicit computing to distributed high-speed computing primarily focused on search, the number of floating-point operations per second can reach tens or even hundreds of billions.

7.3 Changes in data frequency granularity

Transforming from event triggered, second or meter level data accuracy to millisecond or centimeter level data accuracy.

7.4 System structure

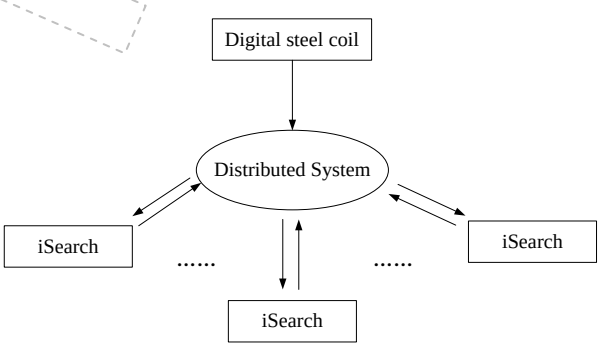


Figure 7.1 CFS Signal Flow Chart

7.5 Implementation scheme

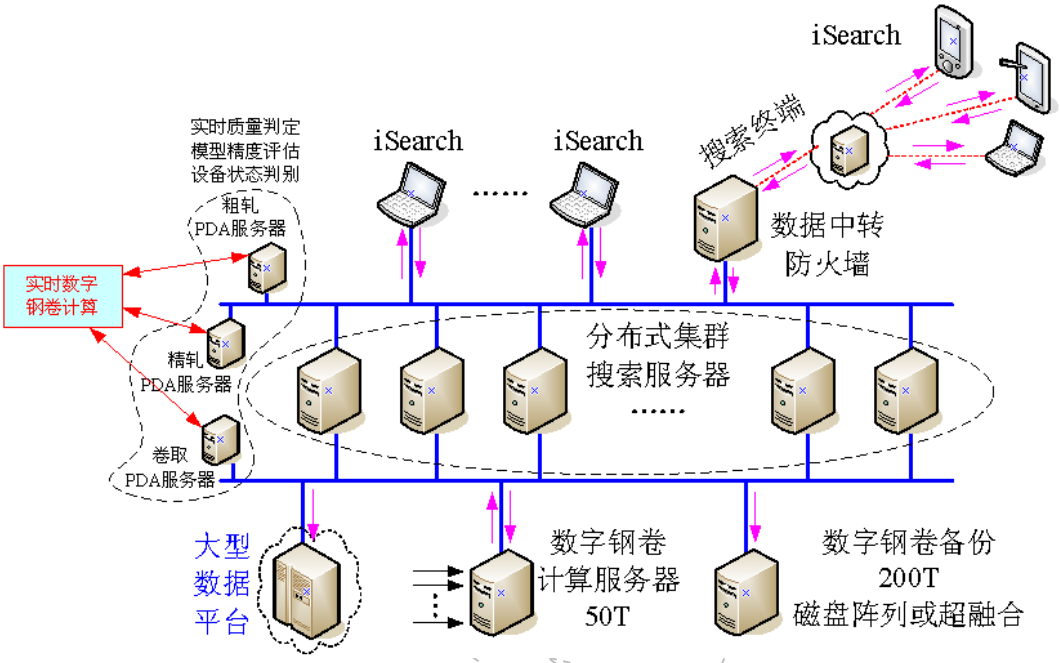


Figure 7.2 Schematic diagram of CFS system structure

The iSearch supports B/S and C/S architectures.

7.6 Slice Indicator Search Statistics

The search range and statistical output value of the steel coil can be selected according to the following figure, and each steel can be divided into a maximum of 21 slices.

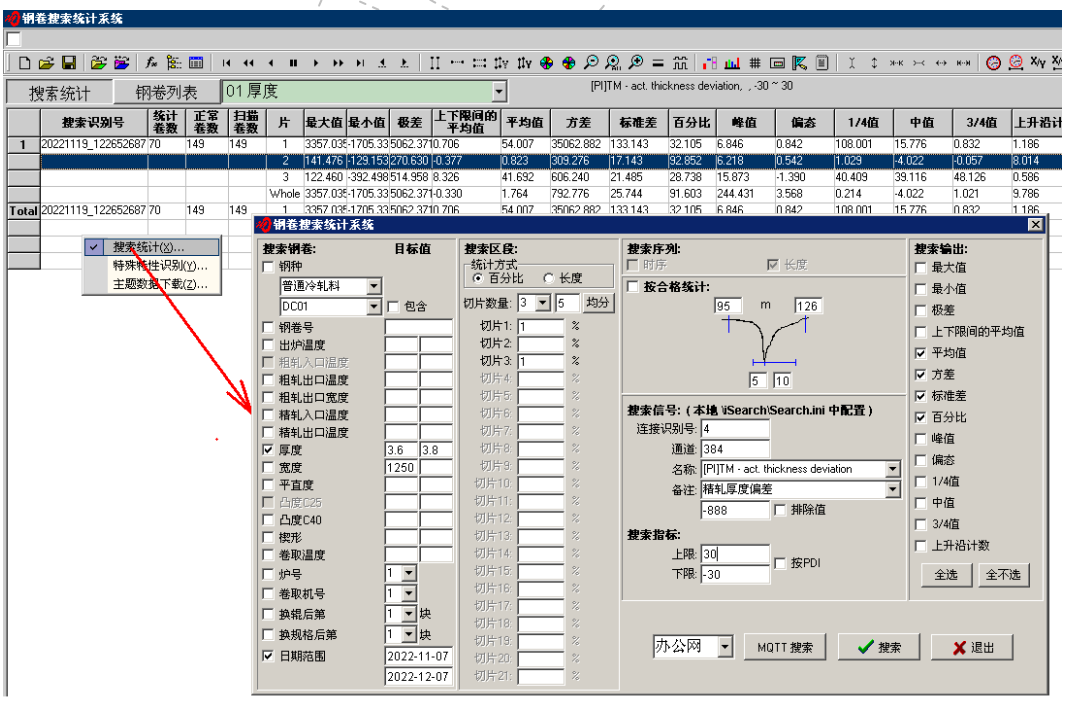


Figure 7.3 iSearch Search Interface

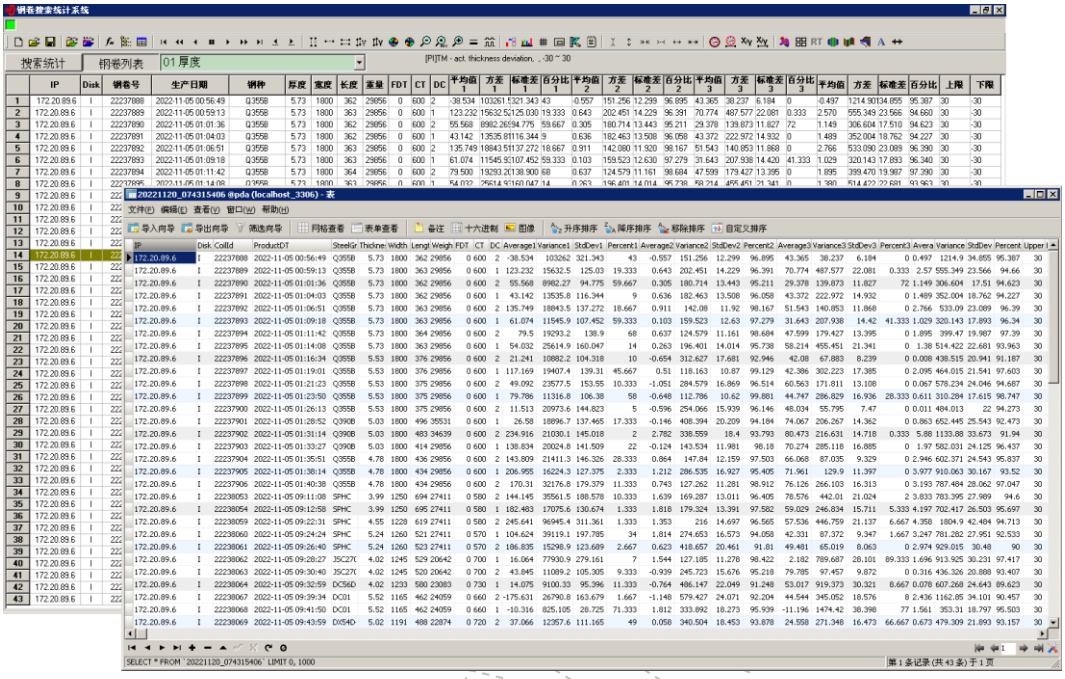


Figure 7.4 Storage of search statistics results in csv files and databases

7.7 Special Characteristics Identification - Steel Grade Development and Evaluation

Special characteristic templates are defined by users, and any steel grade can be identified according to various templates. Steel grade developers establish statistical parameters for their respective steel grades to guide decision-making.

Figure 7.5 Special Characteristic Identification Search - Steel Grade Development

7.8 Guidance on the position where strip steel should be cut off

Some special steel grades such as BS700MCK2 are particularly sensitive to temperature, and the excess parts should be cut off as much as possible before delivery to avoid a large number of quality objections.

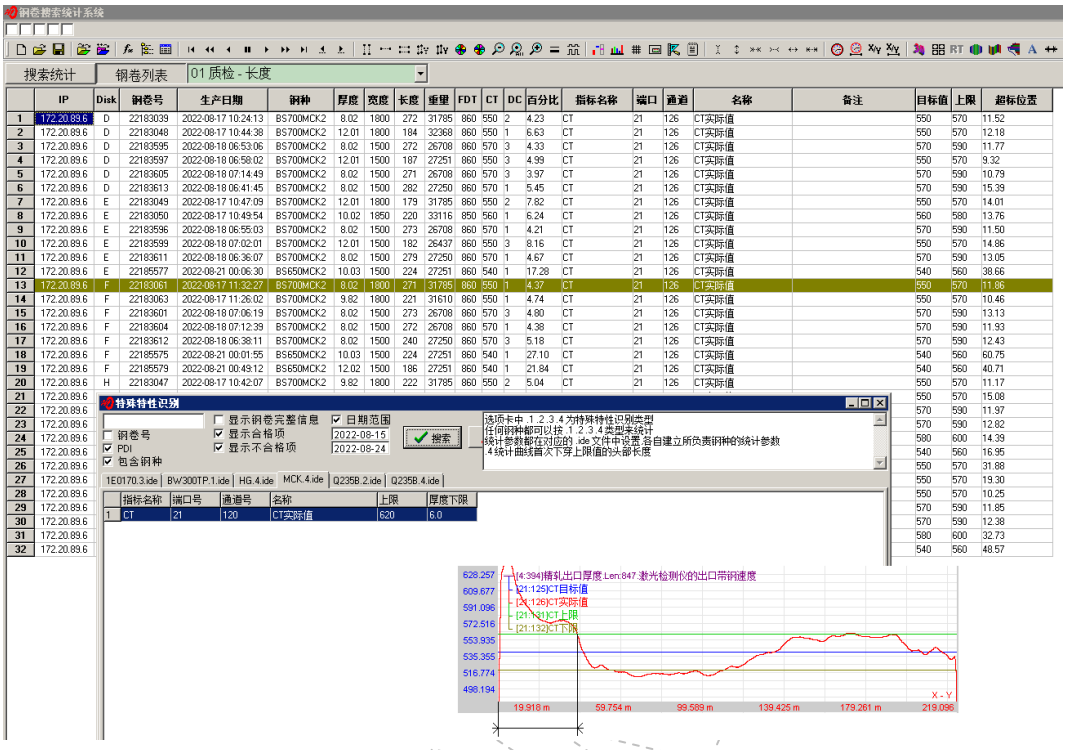


Figure 7.6 Guidance on the position of strip steel to be cut

7.9 Search and download the original data of theme slicing

Raw data is an important basis for analysis. A complete digital steel coil records thousands of variables. The CFS search system can quickly generate a list of steel coils and signals that users are interested in a certain topic .csv files can be stored in the database at the same time. All signal raw data in the topic is saved in .bin format for direct analysis and download. The length range can be specified when searching for raw data, The export method can be 1 point per meter, multiple points per meter, or how many points to export.

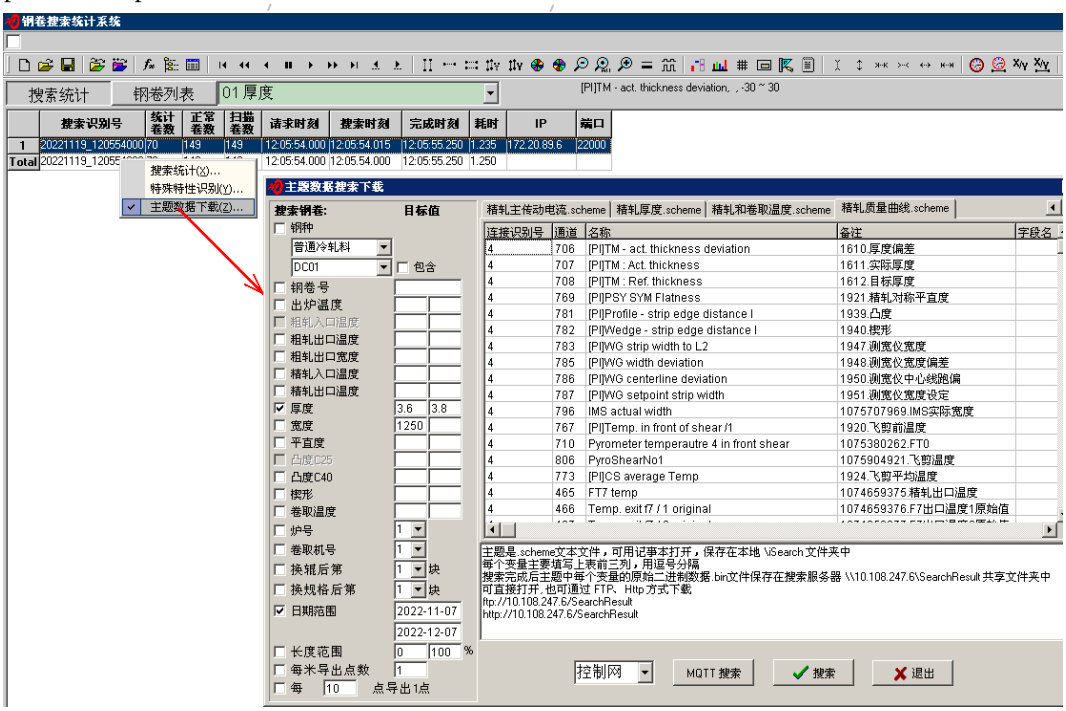
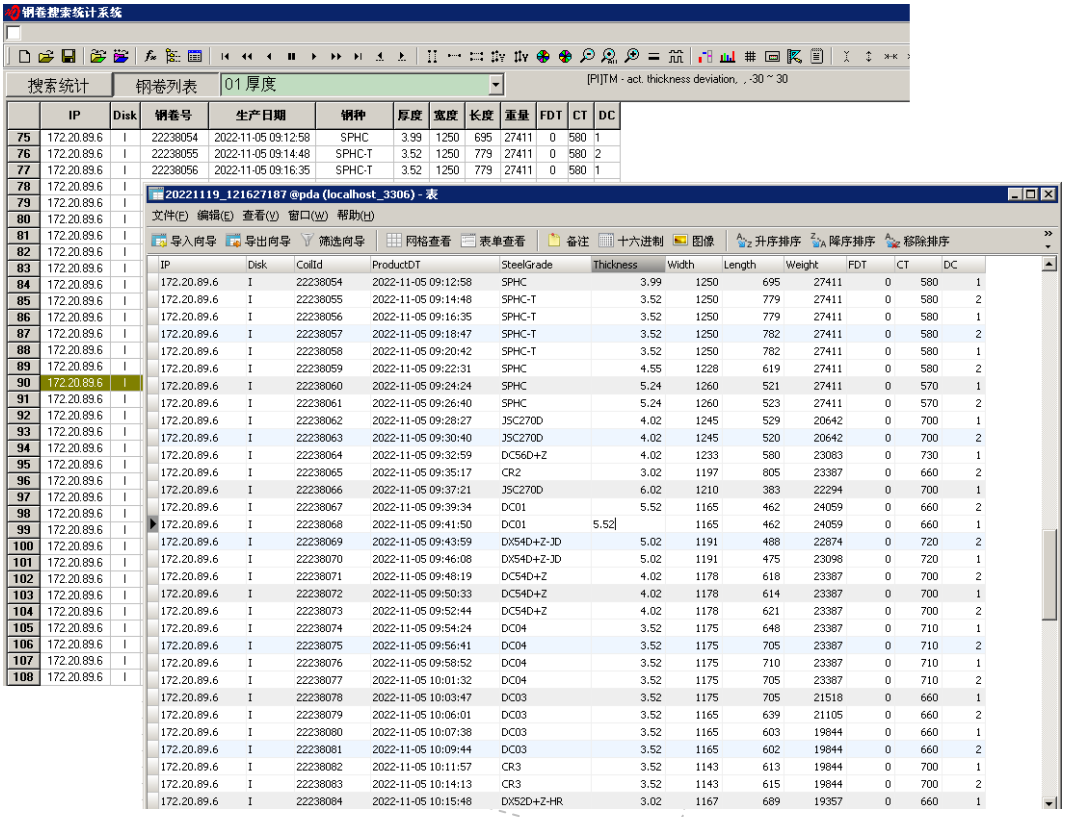


Figure 7.7 Search Download Theme Slice Raw Data



	IP	Disk	钢卷号	生产日期	钢种	厚度	宽度	长度	重量	FDT	CT	DC
75	172.20.89.6	I	22238054	2022-11-05 09:12:58	SPHC	3.99	1250	695	27411	0	580	1
76	172.20.89.6	I	22238055	2022-11-05 09:14:48	SPHC-T	3.52	1250	779	27411	0	580	2
77	172.20.89.6	I	22238056	2022-11-05 09:16:35	SPHC-T	3.52	1250	779	27411	0	580	1
78	172.20.89.6	I										
79	172.20.89.6	I										
80	172.20.89.6	I										
81	172.20.89.6	I										
82	172.20.89.6	I										
83	172.20.89.6	I										
84	172.20.89.6	I										
85	172.20.89.6	I										
86	172.20.89.6	I										
87	172.20.89.6	I										
88	172.20.89.6	I										
89	172.20.89.6	I										
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91	172.20.89.6	I										
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93	172.20.89.6	I										
94	172.20.89.6	I										
95	172.20.89.6	I										
96	172.20.89.6	I										
97	172.20.89.6	I										
98	172.20.89.6	I										
99	172.20.89.6	I										
100	172.20.89.6	I										
101	172.20.89.6	I										
102	172.20.89.6	I										
103	172.20.89.6	I										
104	172.20.89.6	I										
105	172.20.89.6	I										
106	172.20.89.6	I										
107	172.20.89.6	I										
108	172.20.89.6	I										

IP	Disk	CoilId	ProductDT	SteelGrade	Thickness	Width	Length	Weight	FDT	CT	DC
172.20.89.6	I	22238054	2022-11-05 09:12:58	SPHC	3.99	1250	695	27411	0	580	1
172.20.89.6	I	22238055	2022-11-05 09:14:48	SPHC-T	3.52	1250	779	27411	0	580	2
172.20.89.6	I	22238056	2022-11-05 09:16:35	SPHC-T	3.52	1250	779	27411	0	580	1
172.20.89.6	I	22238057	2022-11-05 09:18:47	SPHC-T	3.52	1250	782	27411	0	580	2
172.20.89.6	I	22238058	2022-11-05 09:20:42	SPHC-T	3.52	1250	782	27411	0	580	1
172.20.89.6	I	22238059	2022-11-05 09:22:31	SPHC	4.55	1228	619	27411	0	580	2
172.20.89.6	I	22238060	2022-11-05 09:24:24	SPHC	5.24	1260	521	27411	0	570	1
172.20.89.6	I	22238061	2022-11-05 09:26:40	SPHC	5.24	1260	523	27411	0	570	2
172.20.89.6	I	22238062	2022-11-05 09:28:27	JSC270D	4.02	1245	529	20642	0	700	1
172.20.89.6	I	22238063	2022-11-05 09:30:40	JSC270D	4.02	1245	520	20642	0	700	2
172.20.89.6	I	22238064	2022-11-05 09:32:59	DC56D+Z	4.02	1233	580	23083	0	730	1
172.20.89.6	I	22238065	2022-11-05 09:35:17	CR2	3.02	1197	805	23387	0	660	2
172.20.89.6	I	22238066	2022-11-05 09:37:21	JSC270D	6.02	1210	383	22294	0	700	1
172.20.89.6	I	22238067	2022-11-05 09:39:34	DC01	5.52	1165	462	24059	0	660	2
172.20.89.6	I	22238068	2022-11-05 09:41:50	DC01	5.52	1165	462	24059	0	660	1
172.20.89.6	I	22238069	2022-11-05 09:43:59	DX54D+Z-JD	5.02	1191	488	22874	0	720	2
172.20.89.6	I	22238070	2022-11-05 09:46:08	DX54D+Z-JD	5.02	1191	475	23098	0	720	1
172.20.89.6	I	22238071	2022-11-05 09:48:19	DC54D+Z	4.02	1178	618	23387	0	700	2
172.20.89.6	I	22238072	2022-11-05 09:50:33	DC54D+Z	4.02	1178	614	23387	0	700	1
172.20.89.6	I	22238073	2022-11-05 09:52:44	DC54D+Z	4.02	1178	621	23387	0	700	2
172.20.89.6	I	22238074	2022-11-05 09:54:24	DC04	3.52	1175	648	23387	0	710	1
172.20.89.6	I	22238075	2022-11-05 09:56:41	DC04	3.52	1175	705	23387	0	710	2
172.20.89.6	I	22238076	2022-11-05 09:58:52	DC04	3.52	1175	710	23387	0	710	1
172.20.89.6	I	22238077	2022-11-05 10:01:32	DC04	3.52	1175	705	23387	0	710	2
172.20.89.6	I	22238078	2022-11-05 10:03:47	DC03	3.52	1175	705	21518	0	660	1
172.20.89.6	I	22238079	2022-11-05 10:06:01	DC03	3.52	1165	639	21105	0	660	2
172.20.89.6	I	22238080	2022-11-05 10:07:38	DC03	3.52	1165	603	19844	0	660	1
172.20.89.6	I	22238081	2022-11-05 10:09:44	DC03	3.52	1165	602	19844	0	660	2
172.20.89.6	I	22238082	2022-11-05 10:11:57	CR3	3.52	1143	613	19844	0	700	1
172.20.89.6	I	22238083	2022-11-05 10:14:13	CR3	3.52	1143	615	19844	0	700	2
172.20.89.6	I	22238084	2022-11-05 10:15:48	DX52D+Z-HR	3.02	1167	689	19357	0	660	1

Figure 7.8 Steel coil list stored in csv file and database

8 DSO - Device diagnostic Synchronous Oversampling system

DSO - Device diagnostic Synchronous Oversampling system is based on PDA system.

PDA system supports data acquisition of 50 kHz and 0.02 ms sampling period, the full historical data are stored, the real-time FFT calculation and curve analysis are supported, flexible and continuous time slice may be selected, the special AD converter board and special storage system may be used, the standard PLC system is also used to complete signal access and quickly realize system deployment.

The over sampling AI module of PLC system can realize the sampling rate of 16KHz, 20kHz, etc., which can meet the access of acceleration sensor, speed sensor, displacement sensor, etc. in the equipment diagnosis system. At the same time, the process data such as speed, current, pressure, flow, temperature and other conventional acquisition cycle signals can also be accurately and synchronously collected, avoiding the complicated offline alignment work in the later stage.

The system is simple and transparent, online and offline data can be directly connected to the diagnostic analysis system, and the calculation results can be obtained immediately, supporting 2 million spectral lines.

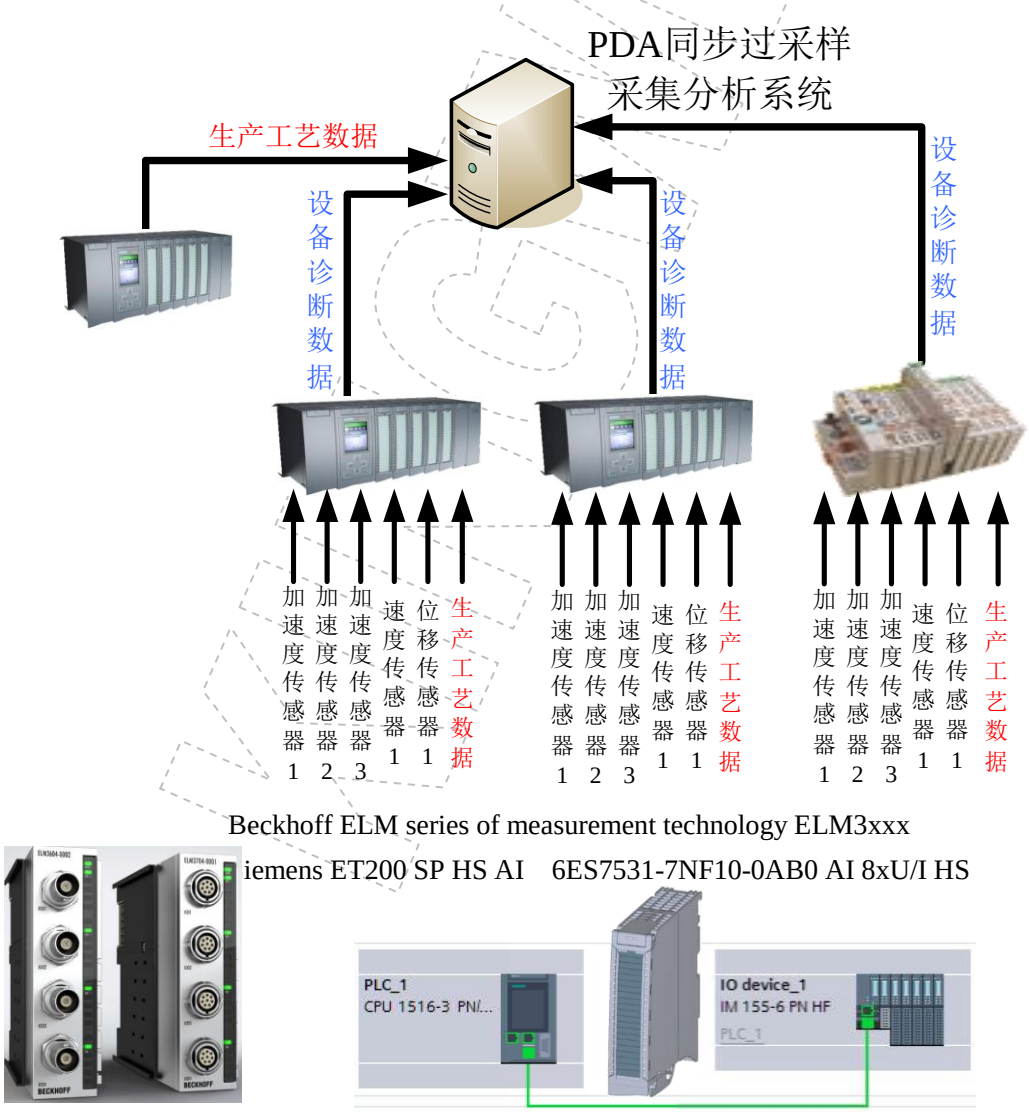


Figure 8.1 Equipment Diagnosis Data Acquisition System Based on PLC

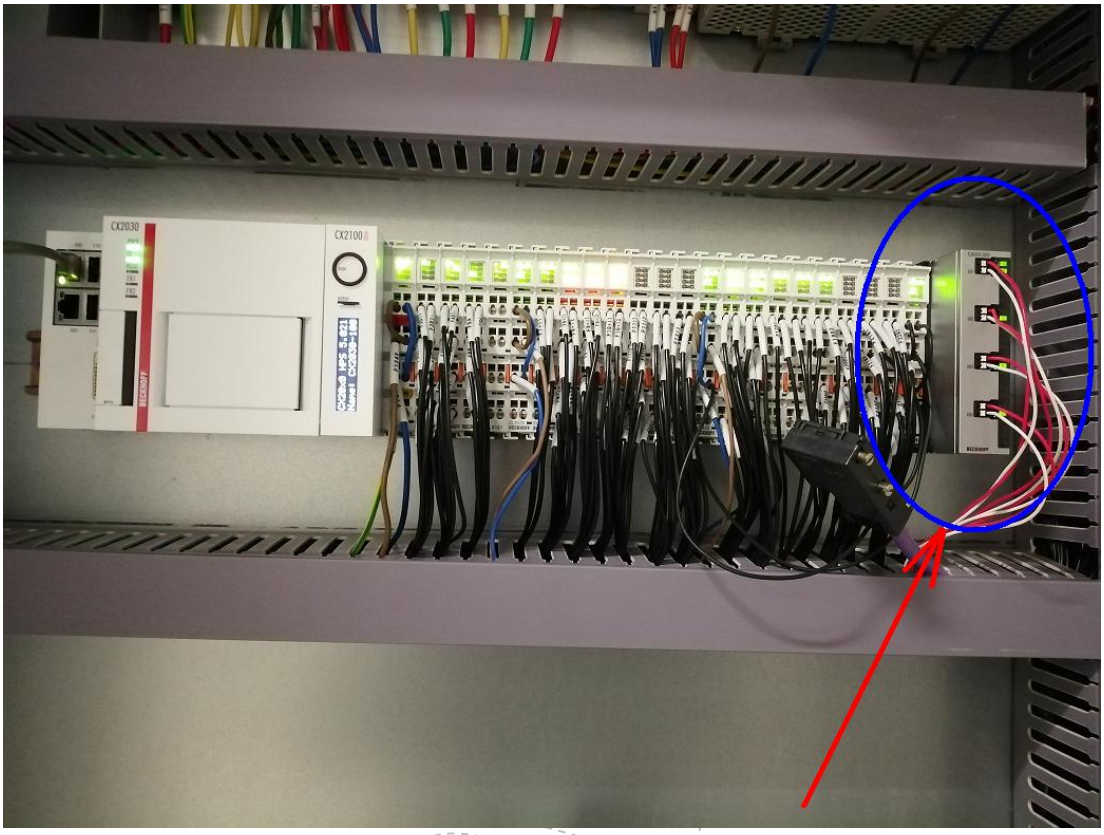


Figure 8.2 Beckhoff PLC oversampling data acquisition

Real-time FFT calculation and curve analysis.

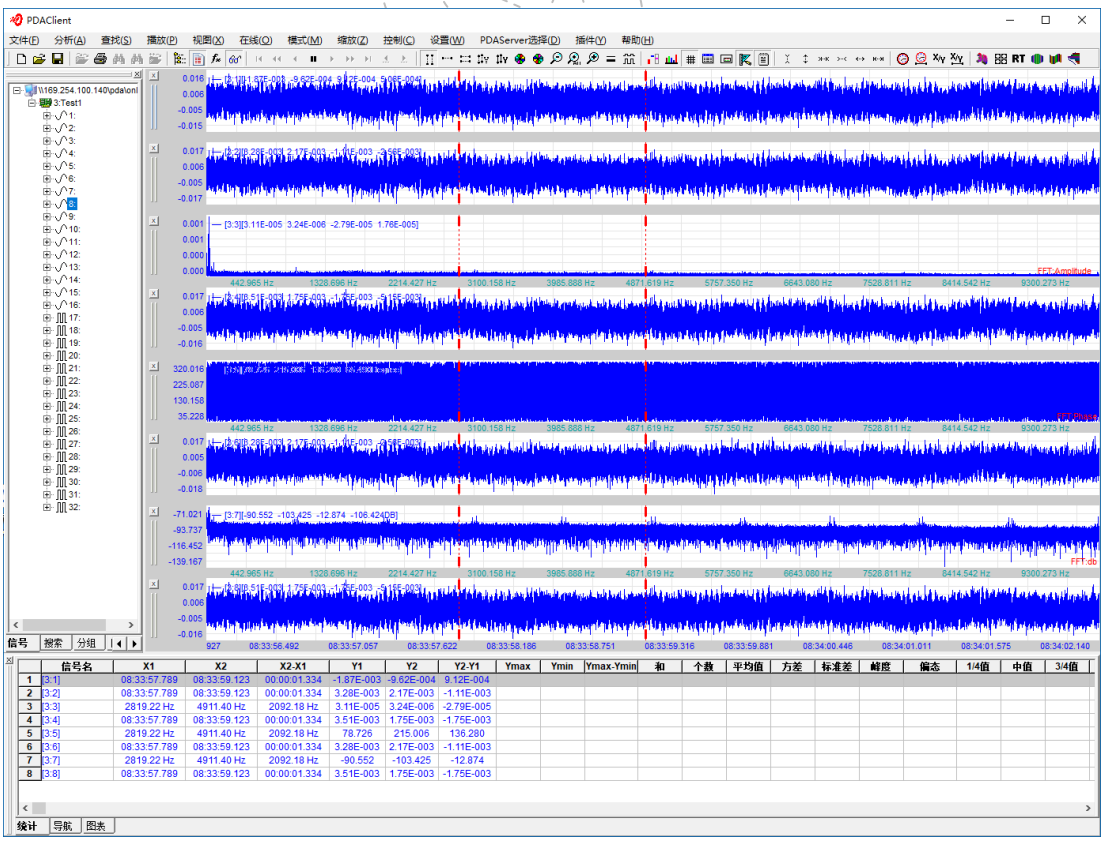


Figure 8.3 real-time FFT calculation and curve analysis

9 RSA - Roll Spalling Alarm and Quick Stop System

During the rolling production process of the rolling mill, the rollers are in a complex stress state. The periodic thermal stress caused by contact heating between the rollers and the rolled piece, water cooling of the rollers, contact stress caused by rolling load, shear stress, and residual stress, etc., such as unreasonable material selection, design, manufacturing process, or local heating caused by steel sticking during rolling, can easily cause roller failure. Roll peeling is the primary form of roller failure.

Based on the characteristics of the process data before roll peeling, the Roll Spalling Alarm and Rapid Stop System can issue warning and rapid stop signals. At this time, only the roll needs to be pulled out for inspection normally to avoid the impact of complete roll peeling on other systems and long-term fault handling.

Figure 9.1 Roll spalling form

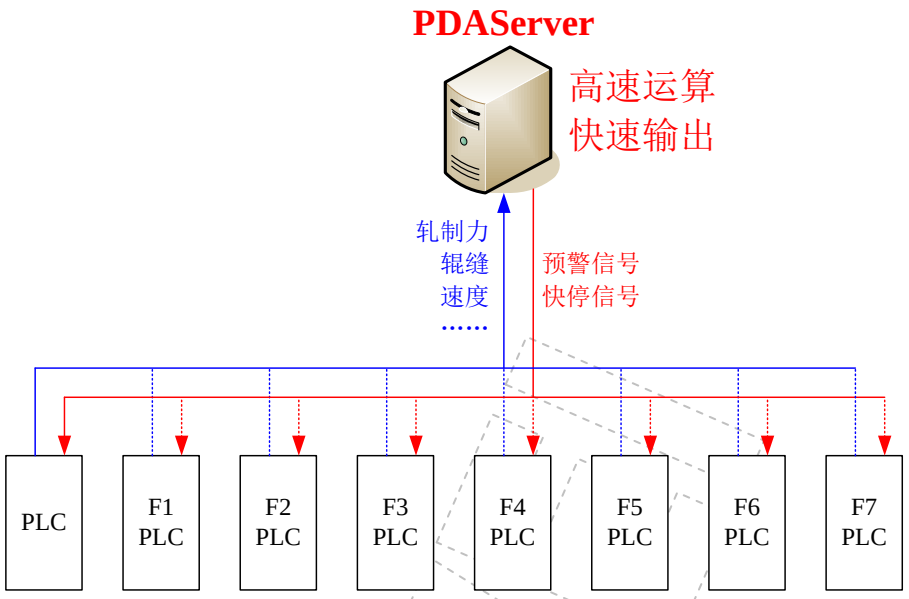


Figure 9.2 Block Diagram of Roll Peeling Warning and Quick Stop System

10 RCM - Roller Current Monitoring system

The Roller Current Monitoring system monitors the status of the roller bed, which can timely avoid surface scratches on the strip and identify other conditions of the roller bed. Ultimately, it achieves roller bed status prediction, proactive maintenance, improves equipment online rate, reduces fault time, and improves product surface quality.

The hot rolling laminar flow roller bed is located between the finishing mill and the coiler, and its main function is to deliver the finished strip steel to the coiler. At the same time, when the strip steel is transported on the laminar flow roller bed, cooling water will continue to spray above the roller bed to cool the strip steel. The total length of the laminar roller bed is generally over a hundred meters, with hundreds of rollers. Hundreds of rollers are controlled by several controllers, each controlling multiple motors to control the operation of a group of rollers, with approximately 10 to 30 rollers in a group. Due to the high water vapor and temperature in the working environment of the laminar flow roller table, it is easy for the roller table to overheat and lose lubricating grease. Water vapor often seeps into the motor, causing faults such as motor grounding, low motor insulation, and motor jamming. This can further cause scratches on the strip steel, seriously affecting product quality.

For motor monitoring, it is usually arranged to manually monitor the current of the motor on the display interface with the naked eye. When abnormal changes in current are found, a manual alarm is given. Due to the presence of multiple sets of roller tracks with multiple motors, the amount of motor data is enormous, and some abnormal current changes are difficult to detect with the naked eye, making it difficult for manual detection of motor faults in a timely manner.

The layout of a rough rolling roller table is shown in the following figure:

Figure 10.1 Hot Continuous Rolling Rough Rolling Roller Track

The layout of a certain layer of cold roller table is shown in the following figure:

Figure 10.2 Cold Roller Table for Hot Continuous Rolling Layer

The installation diagram of current transformer is as follows:

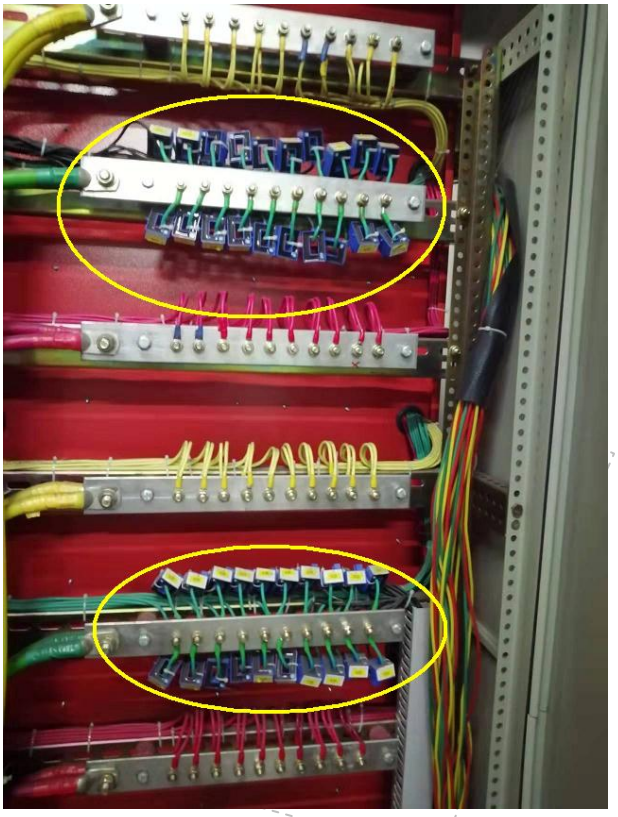


Figure 10.3 Layout of Motor Current Transformer

The block diagram of the current monitoring system is as follows:

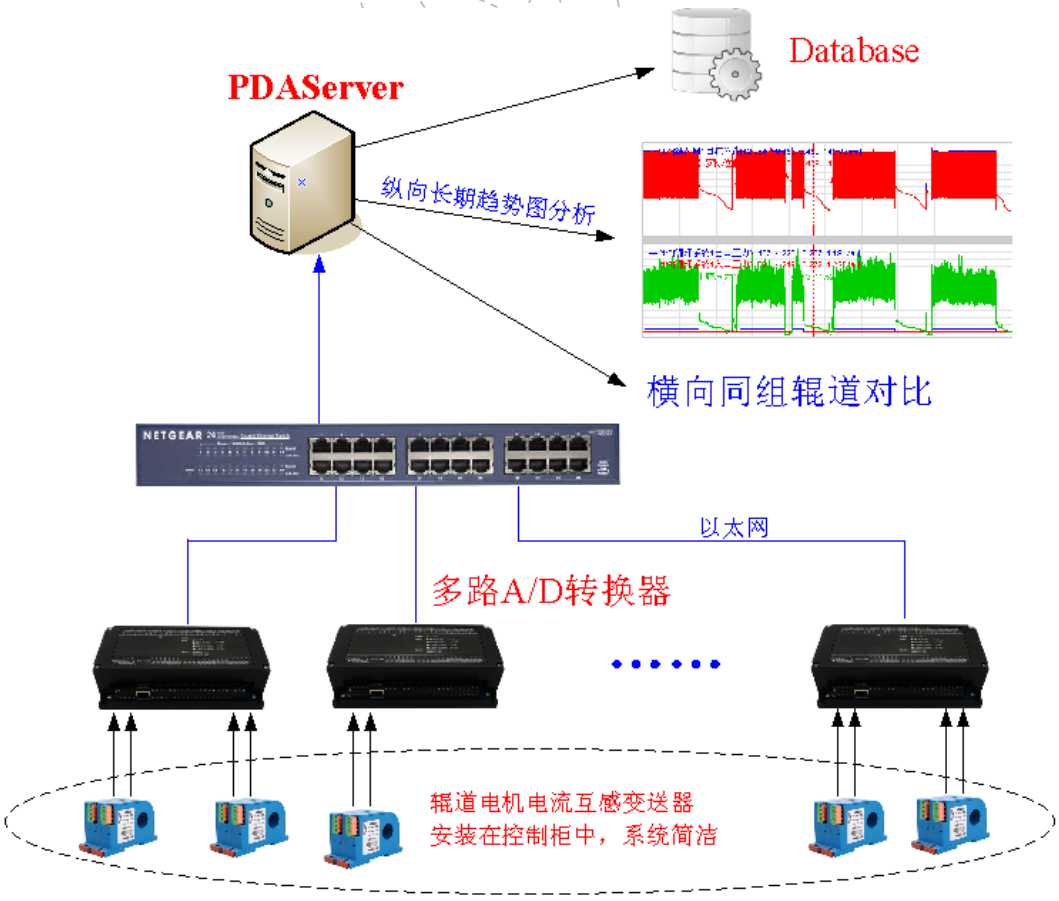


Figure 10.4 Schematic diagram of current monitoring system

11 HDP - High frequency density and speed Data Platform construction

High frequency refers to sampling time, high density refers to space, and high speed refers to the speed of accessing the platform.

11.1 Traditional - Data Platform

Based on databases, it is basically in seconds.

11.2 High frequency - Data Platform

There is a huge market demand for secondary analysis and development based on high-resolution data, but the threshold is high. Currently, data analysis is mostly done in seconds, and upgrading the data platform to High Density Data Platform is an ideal choice.

If the platform's rich analysis methods and close connection with business can be integrated with high-resolution data, it will definitely create a domestically unique high score and high density platform, achieving a sudden rise.

11.3 High Frequency and High Density - Data Platform

As a transitional platform, it can store high-frequency and high-density data without requiring access speed. It is easy to build a conventional platform in combination with PDA.

Advantages: There are no special requirements for platform hardware performance, which can remain unchanged, with almost no additional costs, minimal workload, and no technical bottlenecks.

Disadvantage: There will be no improvement in access speed.

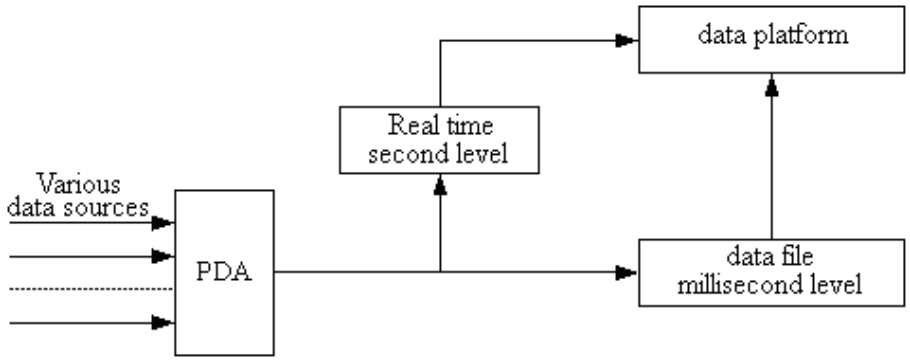


Figure 11.1 Data Flow of High Frequency and High Density Data Platform

11.4 High Frequency High Density High Speed - Data Platform

This is the ultimate goal, which can store high-frequency and high-density data, and the access speed requires a return result in seconds.

All applications must establish a result time of 3 seconds, otherwise the user experience will be poor. For example, if a search command on Google, Baidu, or Taobao produces results in 10 seconds, it will be difficult to promote. These are civilian applications, and industrial high-frequency and high-density data platforms should have higher standards.

For data at the second, minute, and meter levels, if it meets business requirements, it should still be retained. However, the platform performance has changed, and such applications can produce results in less than one second.

The cost should be appropriate, the plan should be carefully selected, and the technology should be optimized.

11.5 Implementation method

The full installation of PDA in each project will lay a solid foundation for a high-resolution data platform, which can form centimeter level, millisecond level, or even microsecond level data platforms in the short term. By fully utilizing and exploring the super strong capabilities of PDAs that are very suitable for processing large amounts of data, it will form a strong competitive advantage in domestic and international markets.

High resolution and high-density data platform is a practical requirement for data analysis. Once a high resolution and high-density high-speed data platform is formed, it will be able to establish technological advantages, and the threshold for a second level data platform is relatively low. As long as fully open PDAs are popularized in every project, such a platform will have a foundation and can be developed smoothly.

11.6 Cooperation with the outside world

High performance controllers in China's industrial control field are basically monopolized by foreign countries, and field bus standards and communication protocols are almost controlled by foreign companies. The high-speed acquisition of industrial data faces many technical barriers and high-intensity encryption from foreign countries. It is a luxury to independently obtain high-frequency and high-density data from our own factories, and this situation urgently needs to be changed.

For many years, our R&D team has been dedicated to the exploration of communication protocol research and development, field bus analysis, high-speed data acquisition, real-time data compression, massive data storage, online data analysis, and other technologies. We have devoted infinite energy and enthusiasm, worked tirelessly, and finally achieved some breakthroughs. We hope to share and encourage with everyone, and make some modest contributions to improving the production and quality of industrial products, equipment testing, fault diagnosis, Industry 4.0, and big data quality analysis in China. This can promote the joint action of engineering and technical personnel to completely solve a bottleneck problem in the industrial control field.

Some high-speed data collection systems in foreign countries are becoming increasingly closed, with layers of encryption. As a strategic partner, it is necessary to require unconditional open data interfaces.

In order to significantly reduce the cost of high-frequency data collection, we have made unremitting efforts and launched major customer systems, annual package systems, etc., laying the foundation for the widespread popularity of PDAs. This way, the cost of each project can be basically ignored, and installing several sets of high-frequency data collection for each project will not be a problem, laying a solid foundation for high-resolution data platforms.

PDA is only responsible for basic data collection, storage, and analysis functions, and all subsequent tasks are done by the platform, including rapid exchange, conversion, storage, analysis, calculation, display, and interaction between the platform and high-frequency data. PDA provides underlying support, which will be a milestone and revolution for the data platform, with profound strategic significance. We hope to shine a light on the construction of platforms in China. The more platforms we build, the better, and the faster we build, the better.

12 Project performance and typical project application

The PDA system is widely used in the large and medium-sized enterprises. Its project performance is not listed one by one.

No.	Process equipment
1	The silicon steel sheet mill
2	Hot strip rolling mill
3	CSP - Compact strip production
4	Cold rolling mill
5	Composite mill (bullet shell)
6	Steelmaking, continuous casting
7	Steel pipe
8	Heating furnace
9	Temper mill
10	Laboratory
11	Flash butt welding machine
12	Measurement of battery consumption curve
13	Pneumatic conveying experiment
14	Cement
15	Energy management
16	Data telemetering service
17	Reforming of Data Acquisition System
18	Brewery information system
19	Point Map Analysis System of a Brewery
20	Data analysis for Brewery CO_2 recovery prediction and measured data
21	Main drive SL150
22	Quality management and digital coil
23	Unmanned locomotive and intelligent iron metal transportation system
24	All-weather umanned wharf
25	Electro hydraulic servo control system
26	Automobile monitoring system
27	HSM digital coil system
28	CSM digital coil system
29	IGBT Flexible DC Chopper Power Supply - Green Intelligent Super Arc Furnace
30	MPT(Mill Pacing Tracing)
31	

12.1 PDA system of a hot temper mill

Temper mill occasionally oscillated in 2011.3.8, and could not product, inappropriate pressure ring parameter setting was found after the historical curve (in red circle below) was analyzed, and normal production was restored after adjustment.

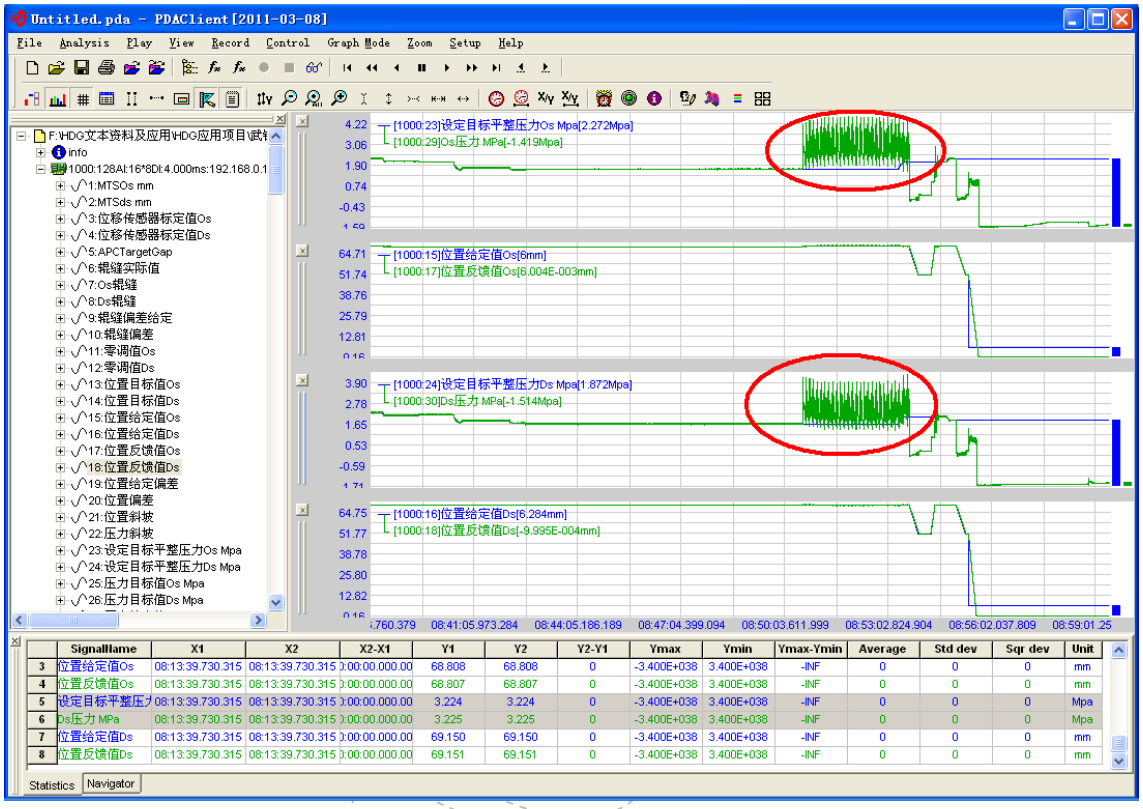


Figure 12.1 Application of PDA in Leveling Machine

12.2 Hydraulic vibration PDA system for thick slab continuous casting mould in a steel factory

The mould is the core equipment of continuous casting machine, Hydraulic vibration can effectively reduce the friction resistance of casting billet and mould room compared with the mechanical vibration, so as to improve the surface quality of billet, improve the drawing speed, increased yield; the plate spring guide is used, no mechanical wear, equipment maintenance workload and cost can be reduced; anisotropic small deviation; online adjustable amplitude, frequency and waveform, achieve sinusoidal and non sinusoidal oscillation can be realized when the prestressed spring orientation precision is used, to meet the requirements of the steel casting process.

Figures 12.2 and 12.3 show the vibration process of starting and stopping, commissioning personnel may adjust various parameters according to waveform, make feedback to follow reference as fast as possible and the overshoot is small, sometimes the servo valve blockage can be analyzed Intuitively from the curve because hydraulic oil is not clean, the reasons is found out quickly. Normal production worker can call historical curve after vibration stopping, the quantitative analysis may be done with signal interference, high friction, oil plug or irregular operation.

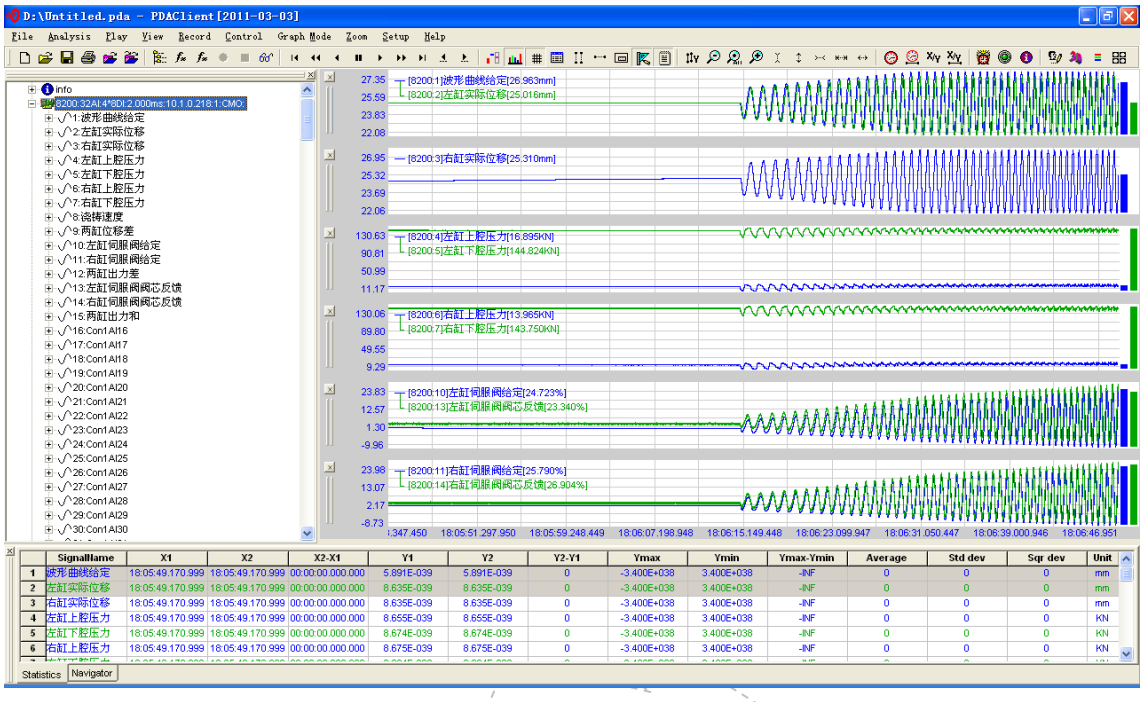


Figure 12.2 Mold Hydraulic Vibration Starting Process Curve

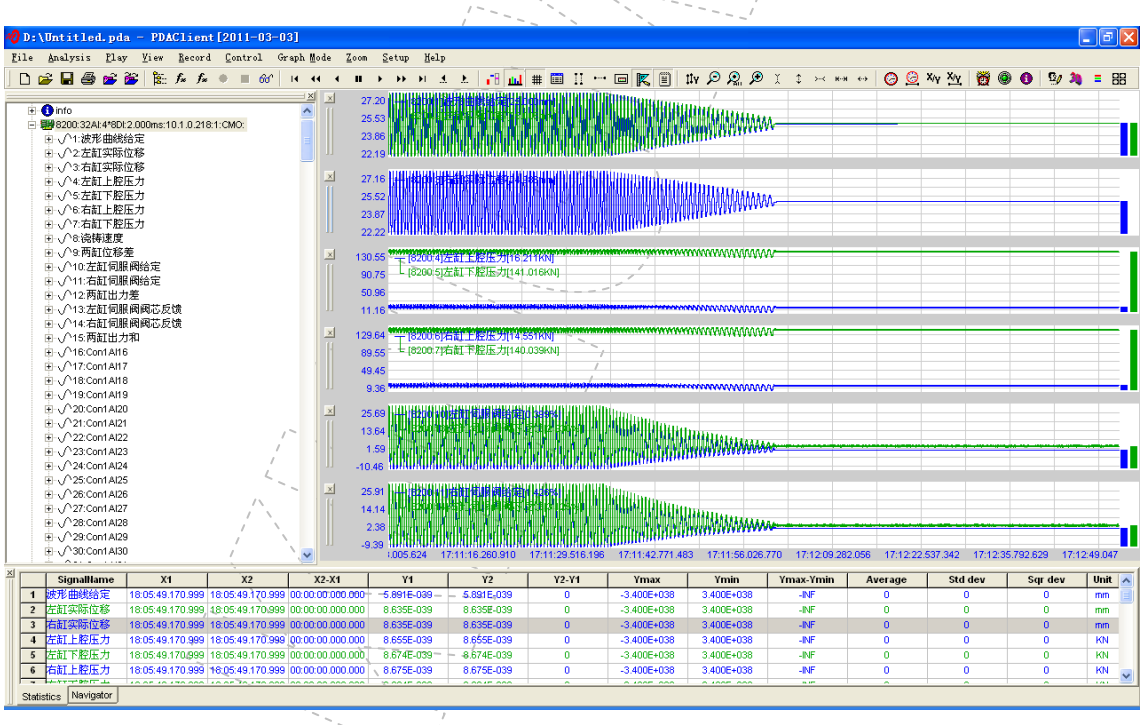


Figure 12.3 Hydraulic Vibration Stop Process Curve of Crystallizer

Figure 12.4 shows the vibration curve during normal production, with a sampling period of 2ms. Based on the curve, control system parameters can be adjusted, system working status can be determined, and fault causes can be identified. The control system is S7-400+FM458.

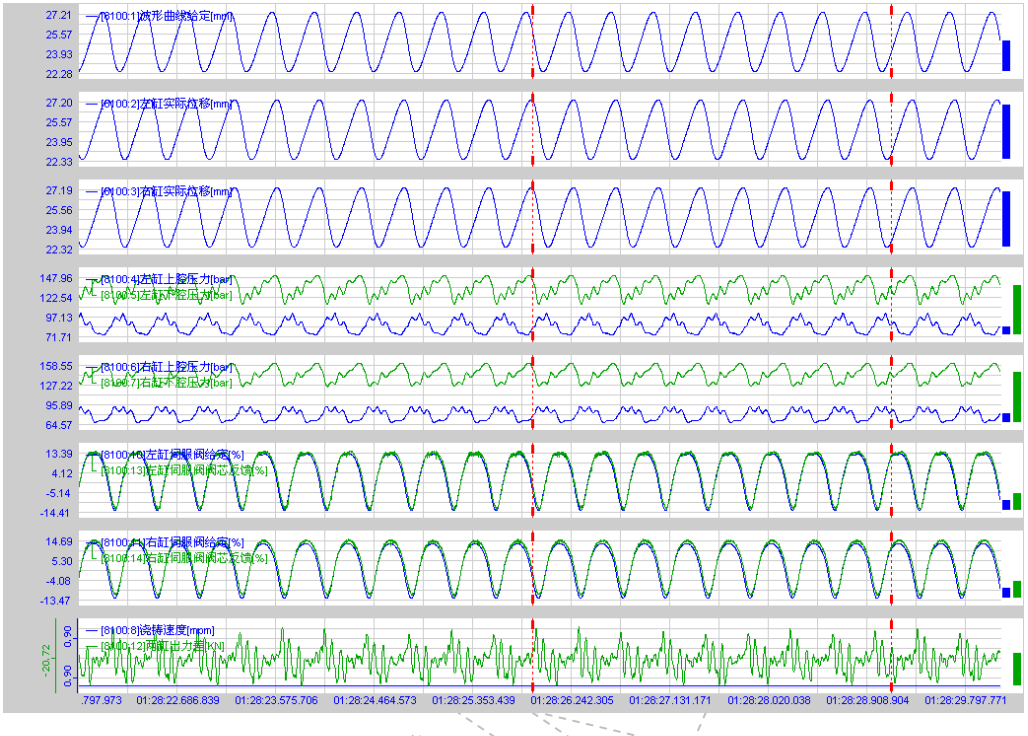


Figure 12.4 Hydraulic vibration curve of a certain thick plate continuous casting mould

12.2 PDA system at 1700mm hot strip mill

The below figure is PDA curve of 1700mm Hsm, 9200 points are collected, time base is 1.95ms, Three PDA systems of German brand are replaced after control system is reformed. Performance is significantly improved, the operation is simpler.

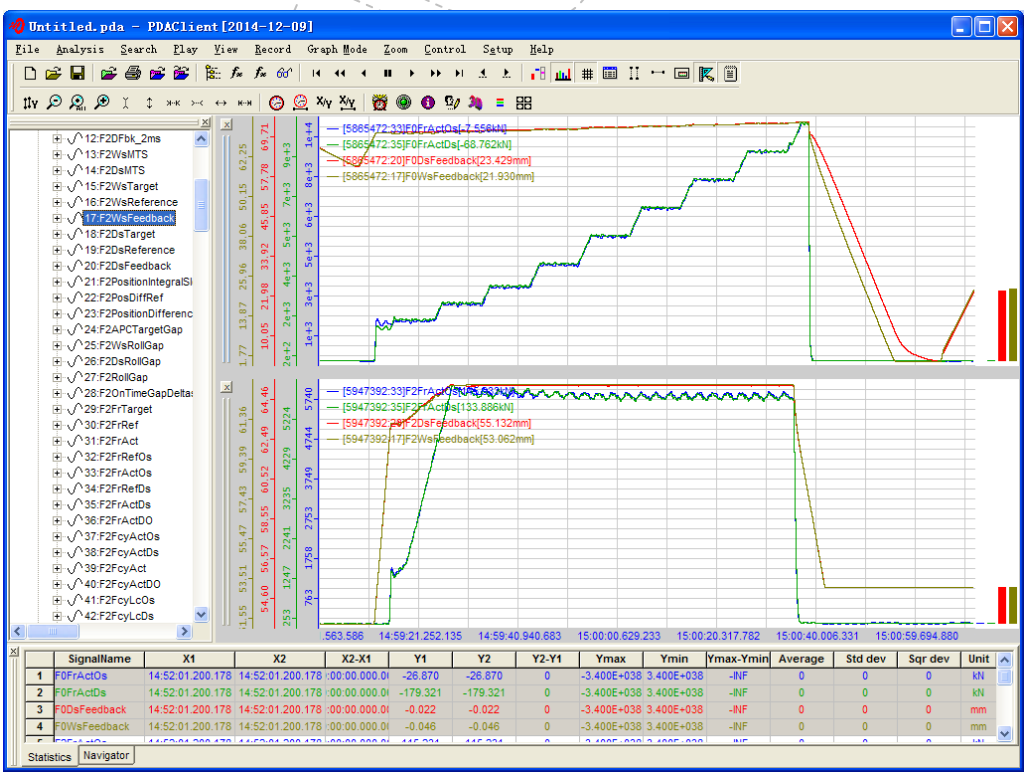


Figure 12.5 Application of PDA in the Hot Strip Rolling Control System

12.4 Performance testing system for a large AGC oil cylinder factory

Figure 12.6 shows the hysteresis test curve of an AGC cylinder from a certain oil cylinder factory. The hysteresis reflects performance indicators such as hydraulic cylinder friction, with a sampling period of 0.5ms. A report can be directly generated based on the measurement curve.

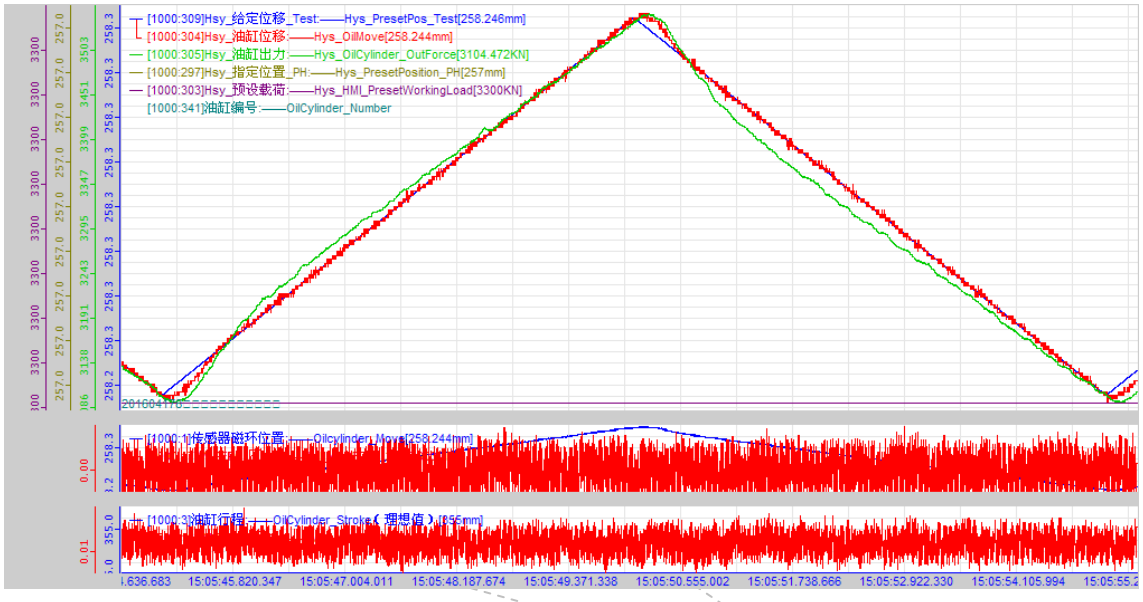


Figure 12.6 hysteresis test curve of a large AGC oil cylinder

12.5 A pneumatic conveying experimental data testing system

PDA supports complex mathematical formula, It may open a week of experimental data and find the law.

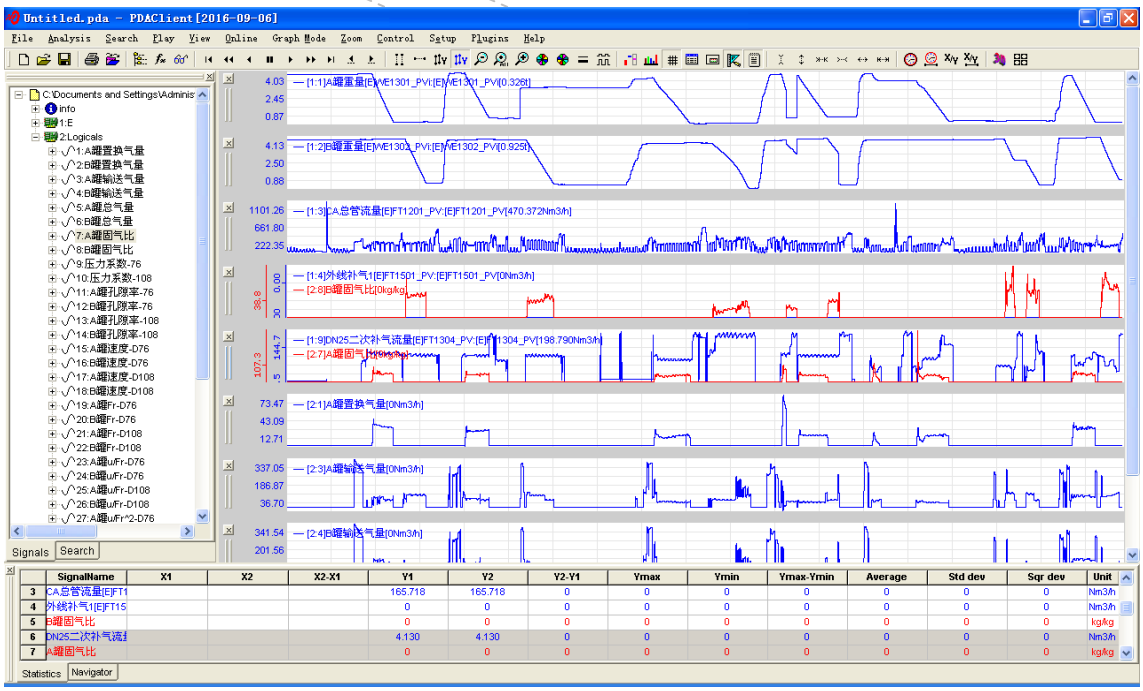


Figure 12.7 Application of PDA in pneumatic conveying systems

12.6 PDA system of a steel pipe plant

9906 points are collected, collection period is 2ms, PLC is the SIEMENS S7-1500 and TDC, the acquisition control function is: hydraulic pass control system, main drive and auxiliary drive, mill district hardware IO, control logic, stretch reducing mill main drive, stretch reducing mill cooling bed auxiliary transmission, hardware IO and control logic.

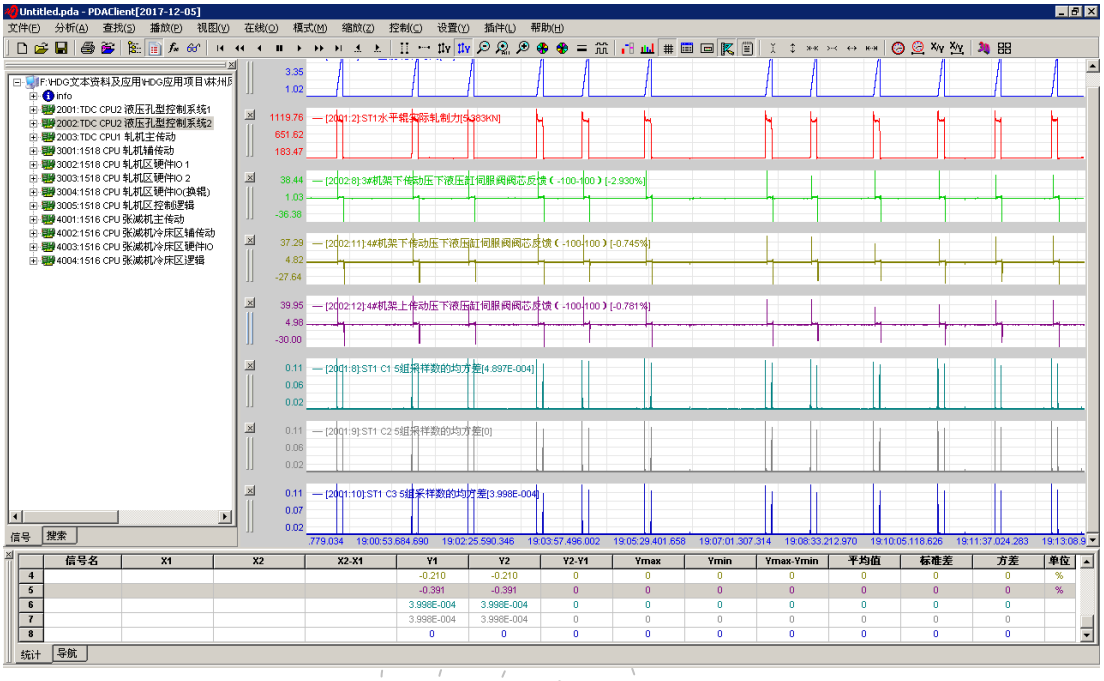


Figure 12.8 Application of PDA in Steel Pipe Plants

The function RisingEdgeInterval calculates the rolling time of each steel pipe.

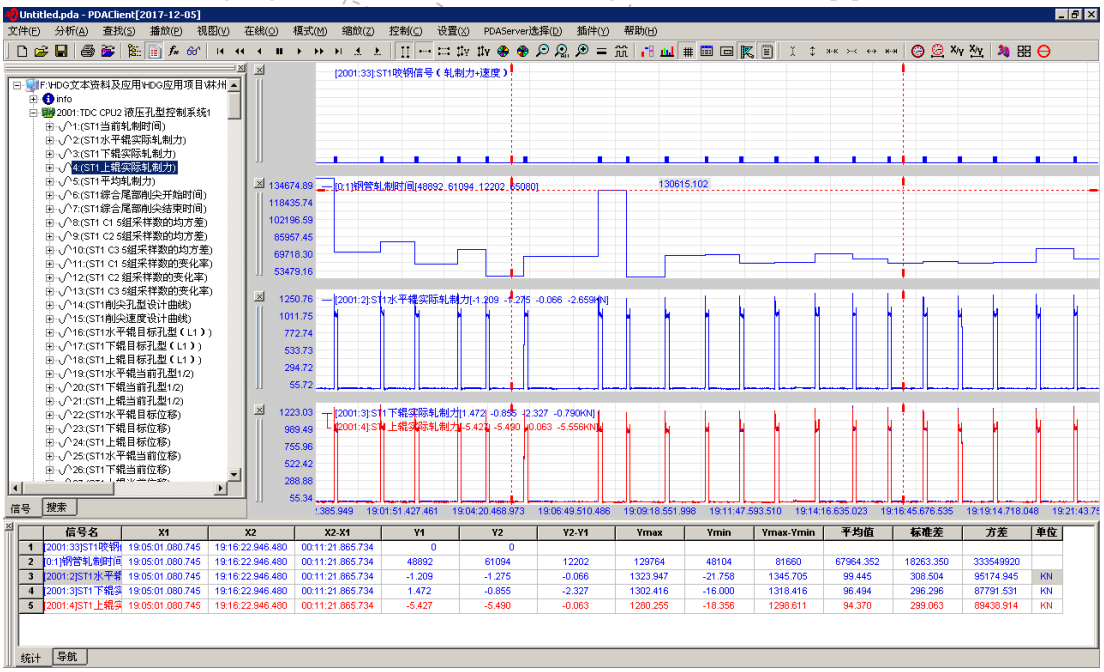


Figure 12.9 Customized function statistics of rolling time for steel pipe factories

12.7 Power management system 某水泥厂电能管理系统

Energy saving and emission reduction is an effective means to reduce costs. PDA provides a comprehensive analysis by equipment energy consumption characteristics, and also as a daily

management tool. The report column is dynamically set according to the .pda analysis strategy. The following figure shows the electricity statistics of hundreds of meters in a cement plant.

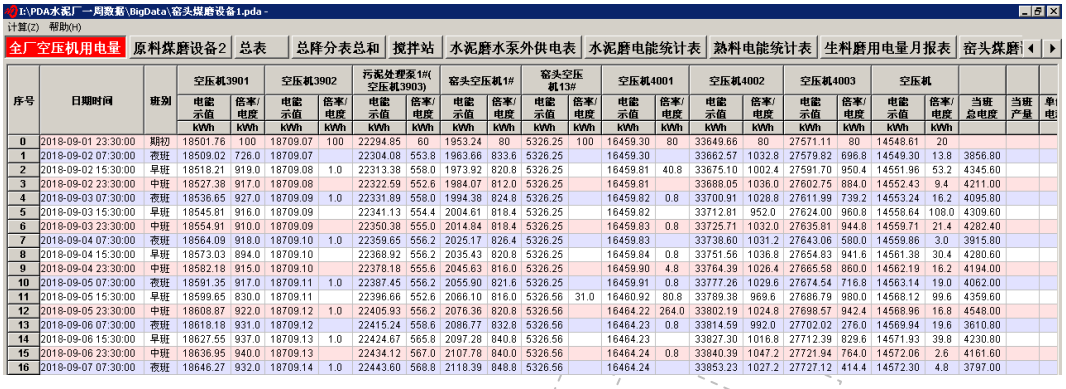


Figure 12.10 Statistical Report on Electricity Consumption of Air Compressors in the Whole Plant

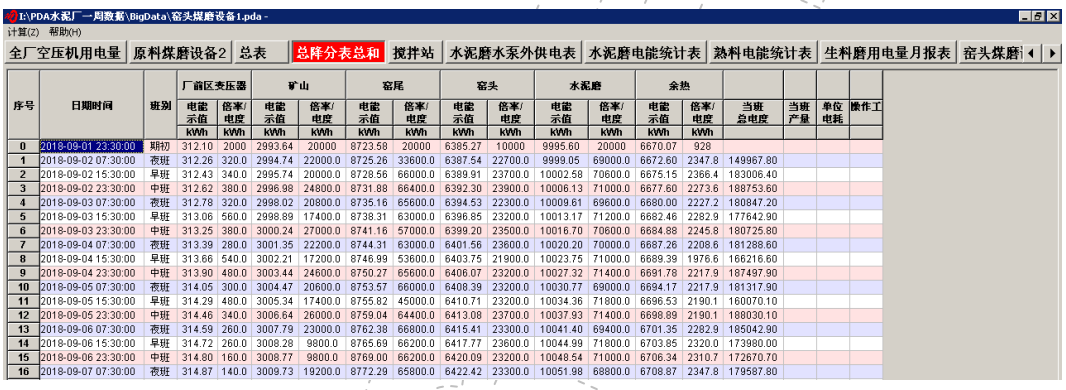


Figure 12.11 Summary Statistical Report of Total Score Reduction Table

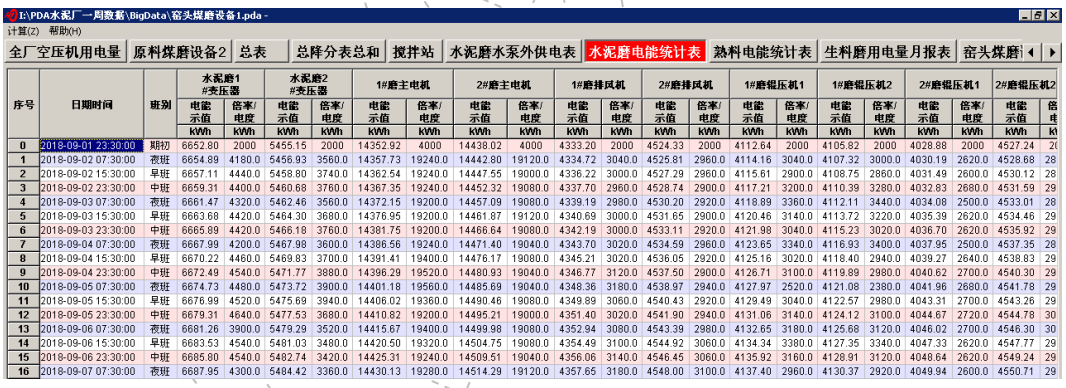


Figure 12.12 Statistical Table of Electric Energy of Cement Mill

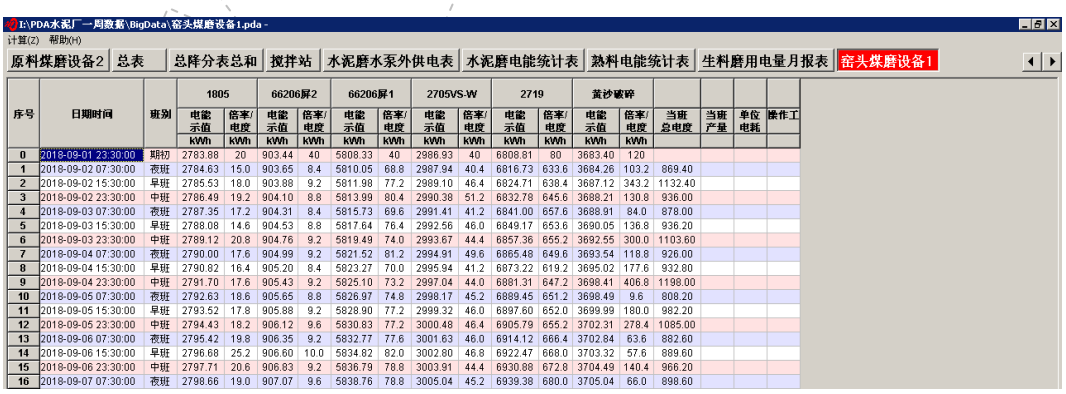


Figure 12.13 Electric Energy Statistics Report of Kiln Head Coal Mill Equipment 1

The Acuvim II series three-phase network power instruments jointly developed by Beijing Aibo Precision Electric Co., Ltd. have relatively complete functions: full parameter measurement, bidirectional

four quadrant 0.2S level electricity metering; The power quality event recording and waveform recording functions provide technical basis for accident recall; RS485, PROFIBUS, Ethernet, support for web browsing, scheduled email sending, ModbusTcp; Provide full parameter timed recording function; Real measurement of communication refresh per cycle, suitable for occasions with high response speed requirements.

Figure 12.14 A Full Parameter Energy Meter

12.8 A railway data teletransmission system

The control system of a certain railway station is S7-200smart, and the railway bureau needs to collect signals from it, but only supports the ModbusTcp protocol. The ModbusTcp protocol of S7-200smart is relatively troublesome. PDAServer communicates with PLC through the S7 protocol, and the collected real-time data is mapped to the Modbus register. The railway bureau can communicate with ModbusTcpServer, and the following figure is a schematic diagram of a railway data remote transmission system.

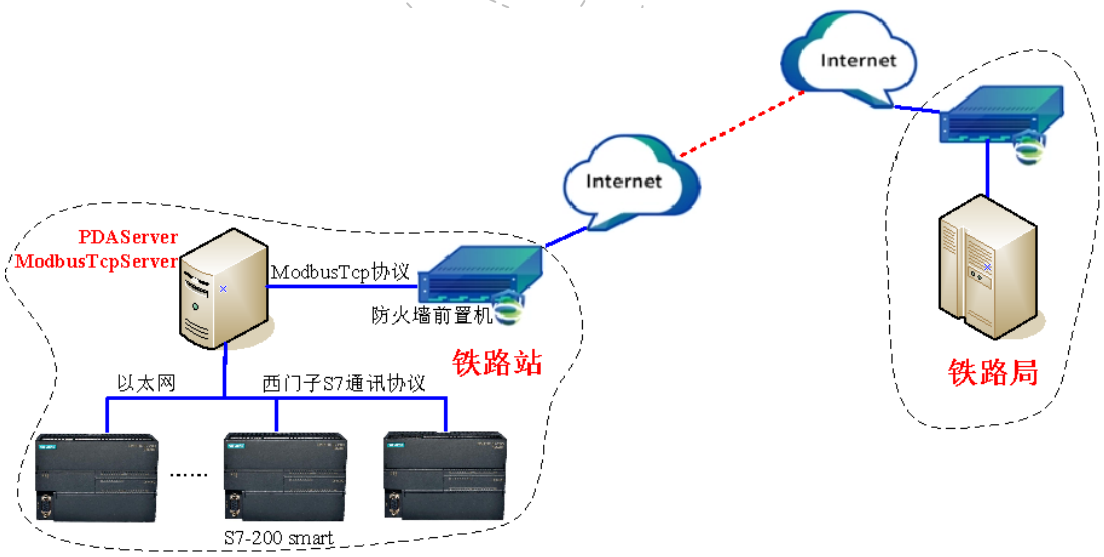


Figure 12.15 Schematic diagram of PDA data remote transmission network for a certain railway station

12.9 A data collection and statistics system for operation time of a certain machine set

The below figure is a operation time statistics report of a certain machine set, daily, monthly and team reports may be automatically generated.

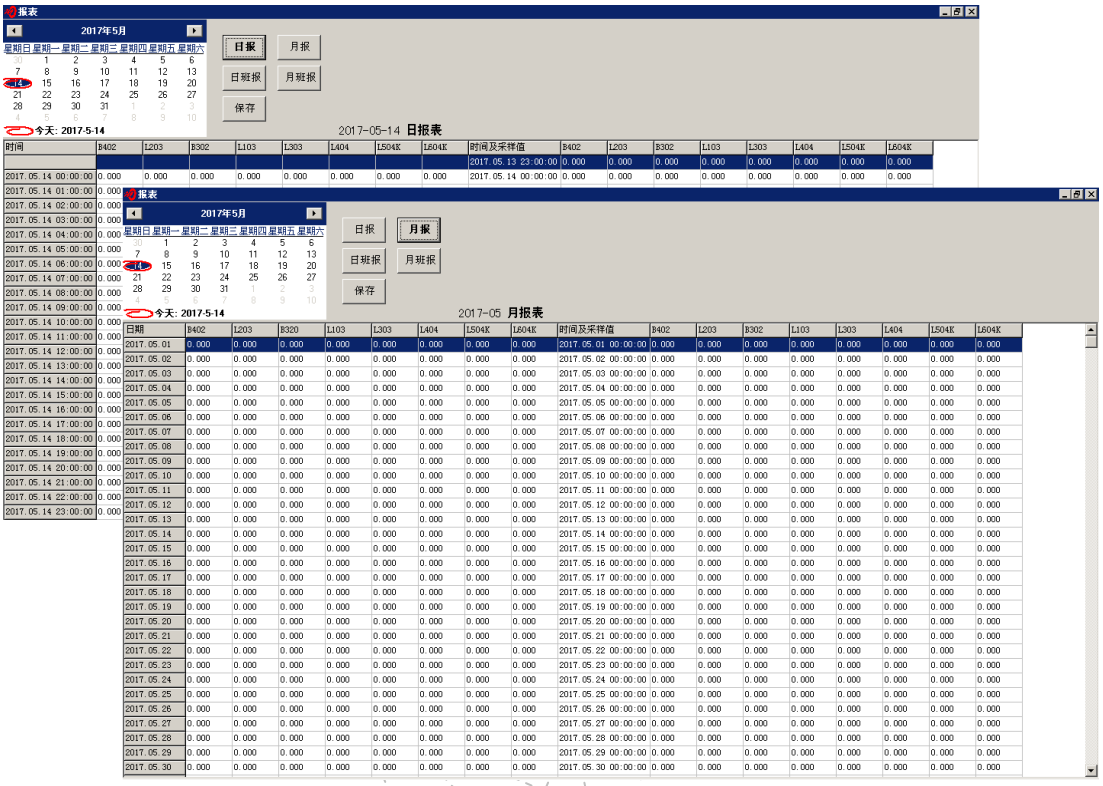


Figure 12.16 Daily and monthly operation time reports of a certain machine set

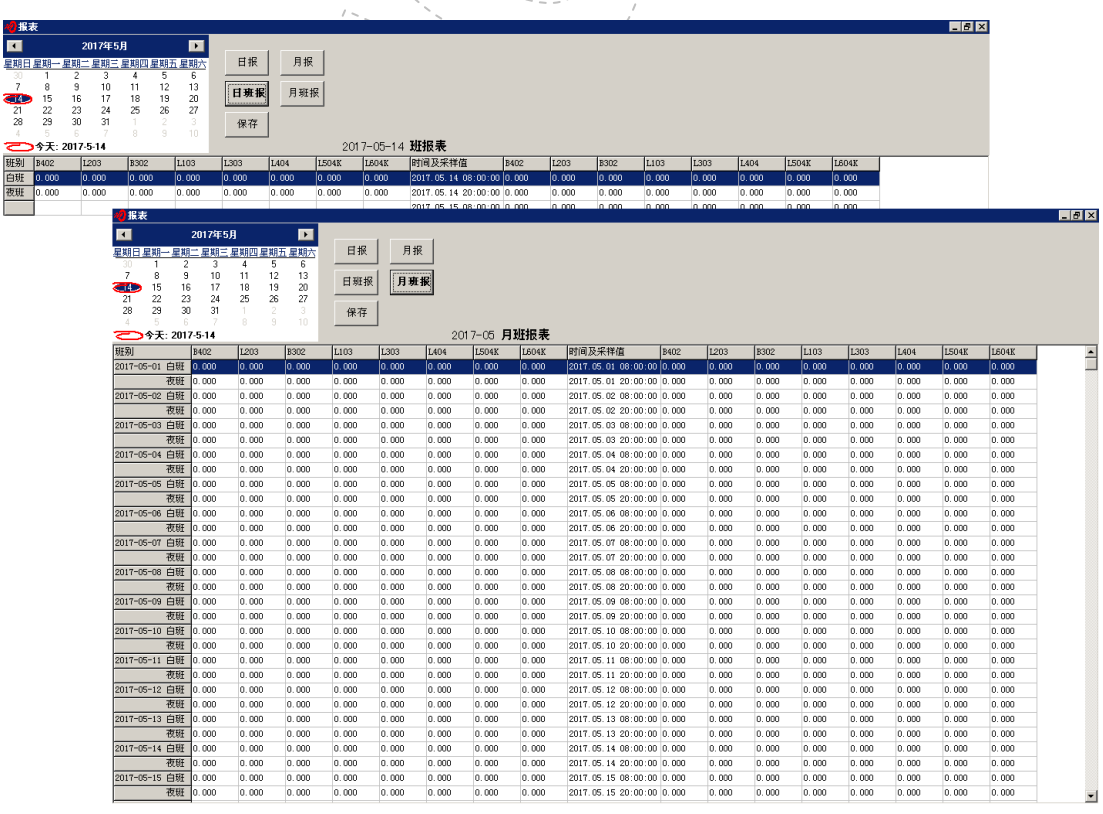


Figure 12.17 Daily and monthly team operation time report of a certain machine set

12.10 Dynamic running record report and meter reading system

Reports are automatically generated according to the analysis policy files(.pda) in \BigData, the default record time interval is one second. Counting accumulative values(I=1 in Config.csv) by minute or the average value(I=2) of the accumulative value or instantaneous value(I<>1 or 2), a value is calculated per hour. Only instantaneous value is calculated for bool and string.

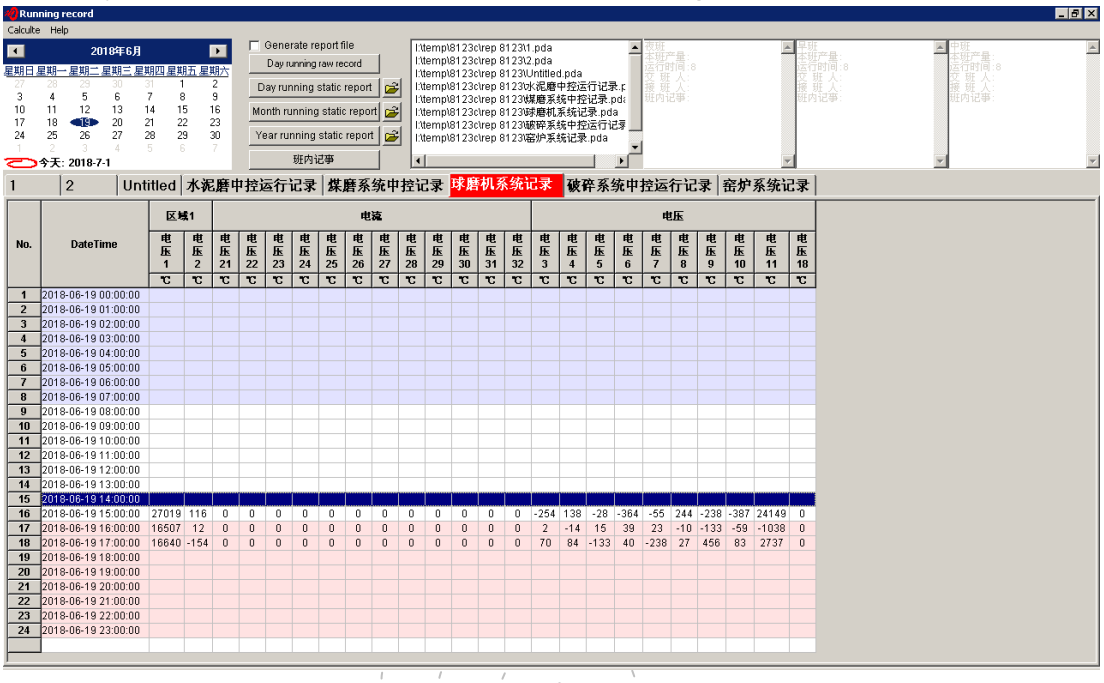


Figure 12.18 Dynamic operation record and meter reading system operation interface

12.11 A hot rolling mill main drive SL150

SL150 is Siemens' new generation high-power alternating current frequency main drive system, with core units of Simotion D445 (or D455) template and Sinamics CU320 template. The PDA system collects data through standard Ethernet and Profinet, with a data refresh cycle of 1ms.

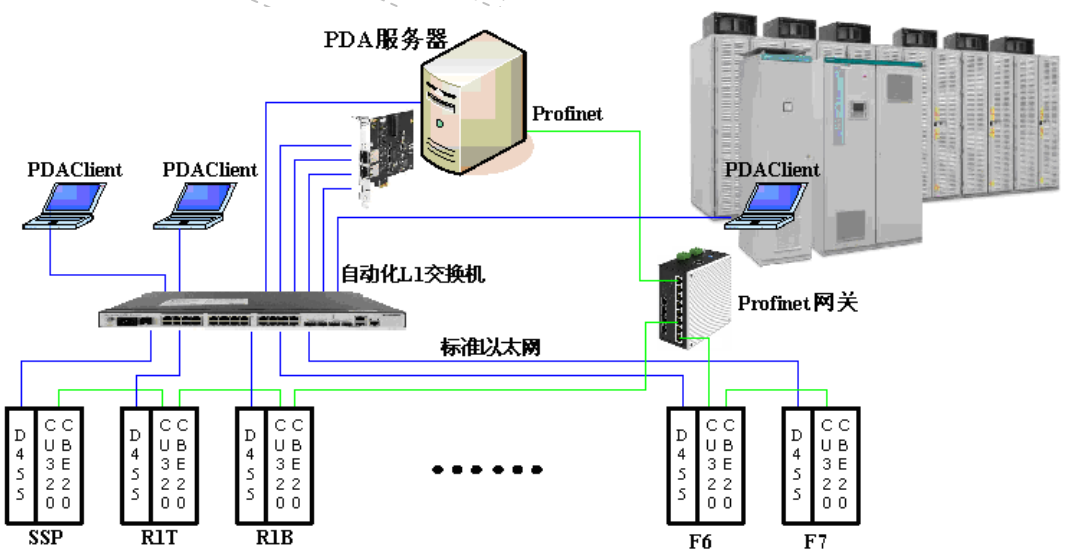


Figure 12.19 Main Drive Data Collection Network Diagram

12.12 Reforming of Data Acquisition System

Some special equipment, special communication network and special servers are used in some data acquisition systems. The system is very complex and expensive. Once it breaks down, it is very difficult to recover. The following figure is a transformative replacement of PDA system used in a steel plant.

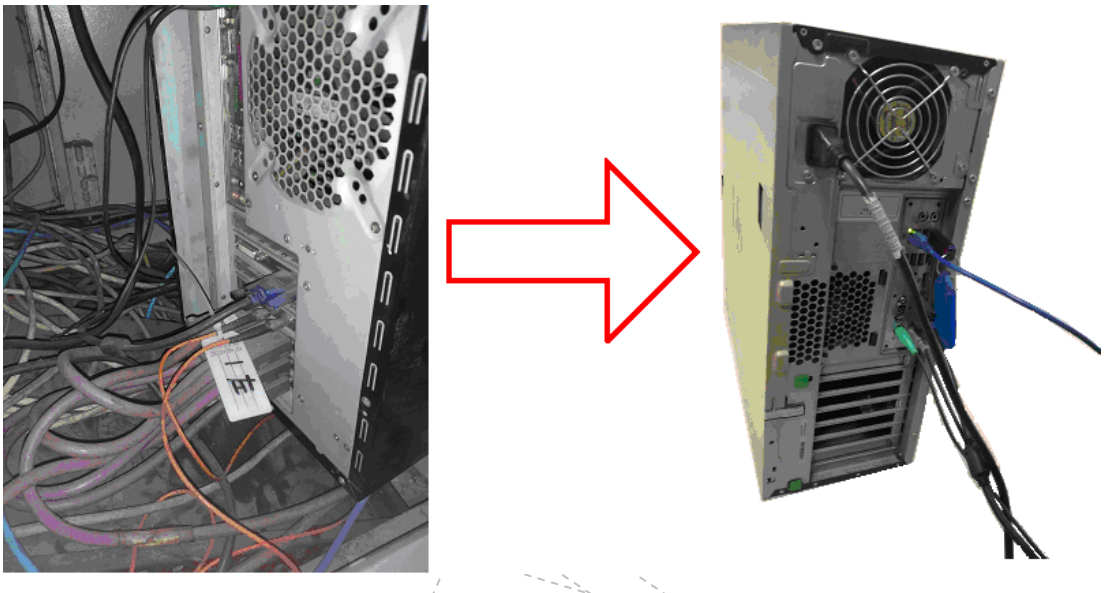


Figure 12.20 PDA System Transformation Host Network Diagram

12.13 Statistical Process Control

The purpose of SPC is to prevent, control and forestall.

The main functions of SPC are: real-time monitoring and early warning of the production process, timely taking measures for abnormal fluctuations, real-time improvement; judging whether the process fluctuations are random or abnormal fluctuations; realizing process stability and control.

SPC index is calculated for the data between x1 and x2 of the first curve in the current display area.

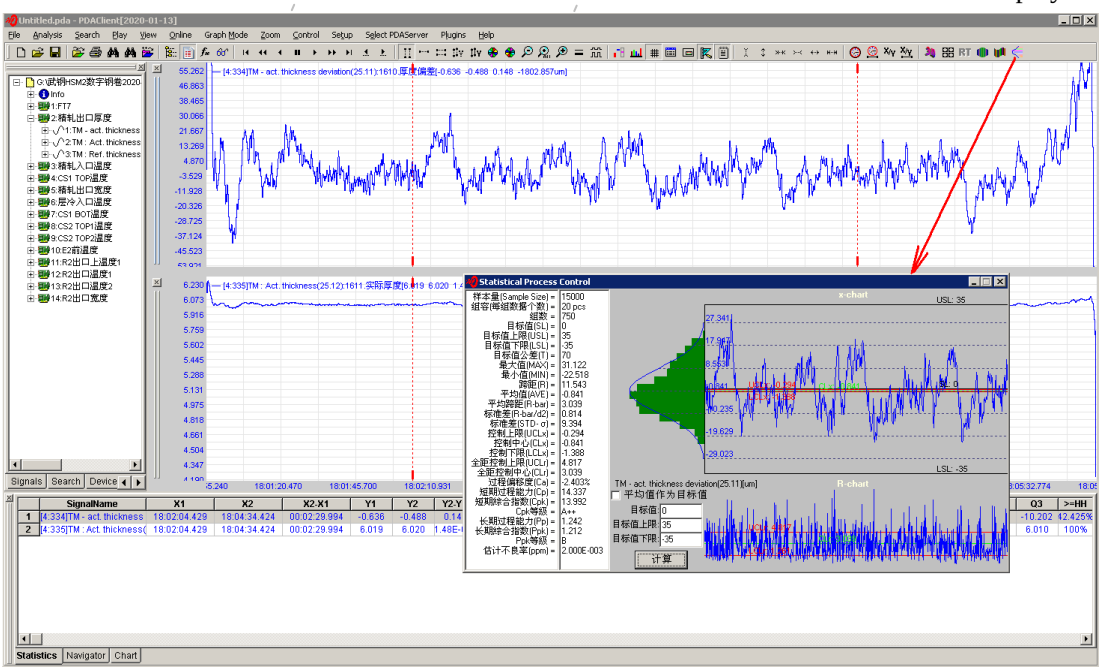


Figure 12.21 Statistical Process Control SPC Curve

12.14 Data Acquisition and Point Map Analysis System of a Brewery

Collect data from over 30 PLCs and electricity meters. The point maps include CO2 recovery and consumption, low-voltage electricity meters, high-voltage electricity meters, water volume, compressed air, steam, etc. Second-level data is promoted to SQL Server, millisecond level data is promoted to InfluxDB, and all tables are automatically created, with a structure consistent with the PDA system.

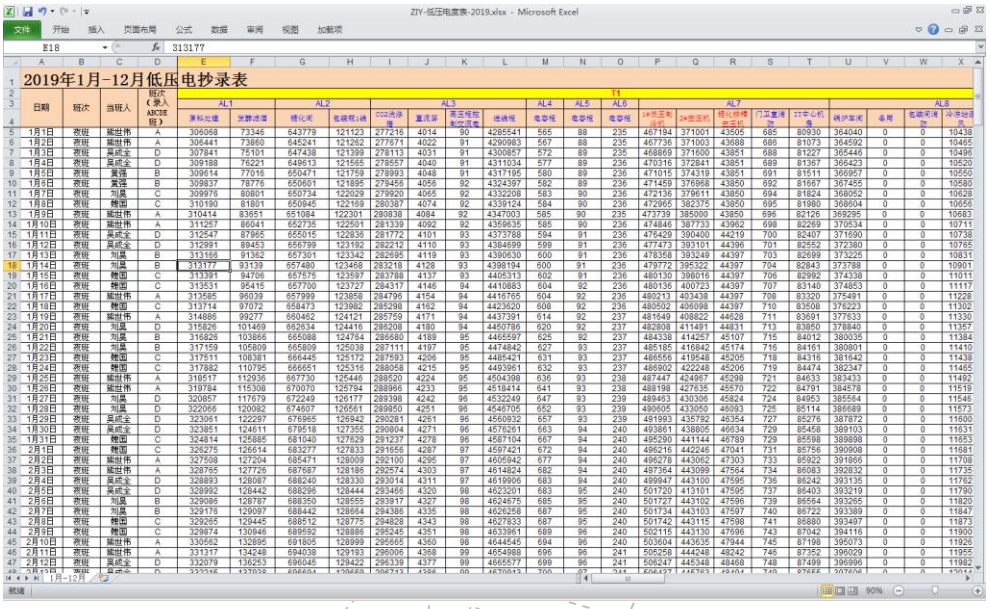


Figure 12.22 Energy consumption data collection for breweries

12.15 CO2 Recovery Prediction and Measurement Data Analysis System for a Beer Factory

Based on the mother liquor and fermentation tank data, the CO2 recovery curve can be predicted and compared with the real-time curve for analysis, achieving balanced and stable production of CO2 and beer.

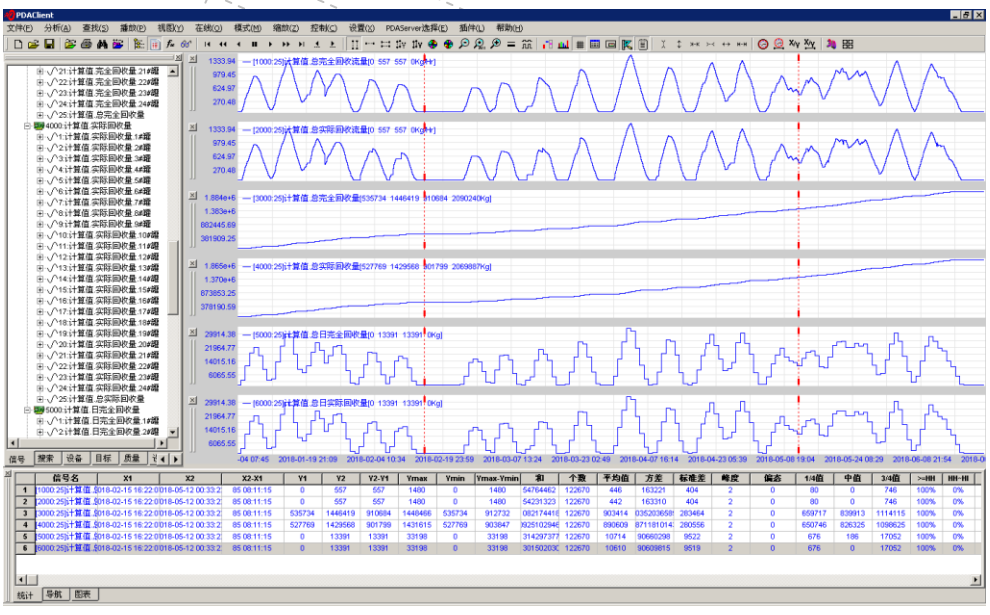


Figure 12.23 CO2 Recovery Prediction Curve

12.16 Unmanned locomotive and intelligent hot metal transportation system

Including driverless, uncoupling, parking anti slip, positioning, derailment detection, environmental awareness, equipment support, traffic scheduling, remote centralized control and other subsystems, any failure may cause catastrophic consequences.

The follow is locomotive operation.

Figure 12.24 Diagram of Molten Iron Transport Locomotive

The follow is locomotive operation status.

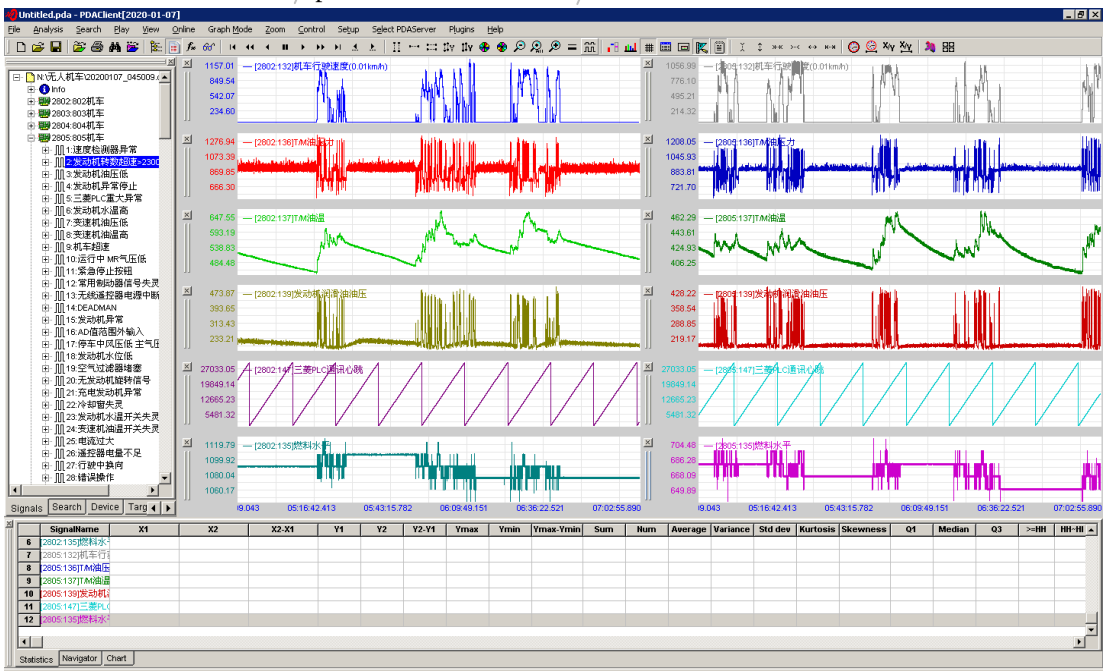


Figure 12.25 Data curve recorded by unmanned locomotives

12.17 All-weather unmanned wharf

It includes unmanned port machinery, steel coil automatic lifting, intelligent management and control of the terminal and other subsystems, which liberates the operators from the heavy and dangerous environment.

The follow is automatic lifting of steel coil at wharf.

Figure 12.26 All weather dock operation site

The follow is wireless signal strength and SNR of leaky wave cable.

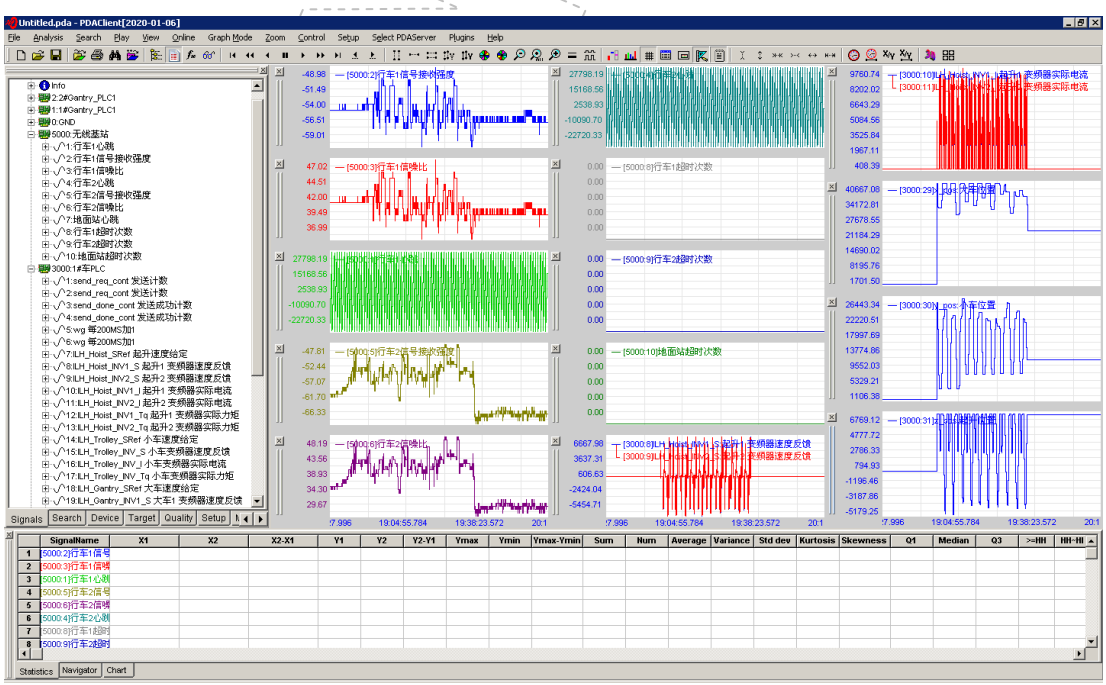


Figure 12.27 All weather dock PDA monitoring curve

12.18 Electro hydraulic servo control system

The servo motor drives the hydraulic cylinder for high-precision closed-loop control, Its positioning accuracy can reach um level, Servo valve and large-scale hydraulic station are cancelled, so the system has low cost, small maintenance and high reliability.

The follow is MS level data curve.

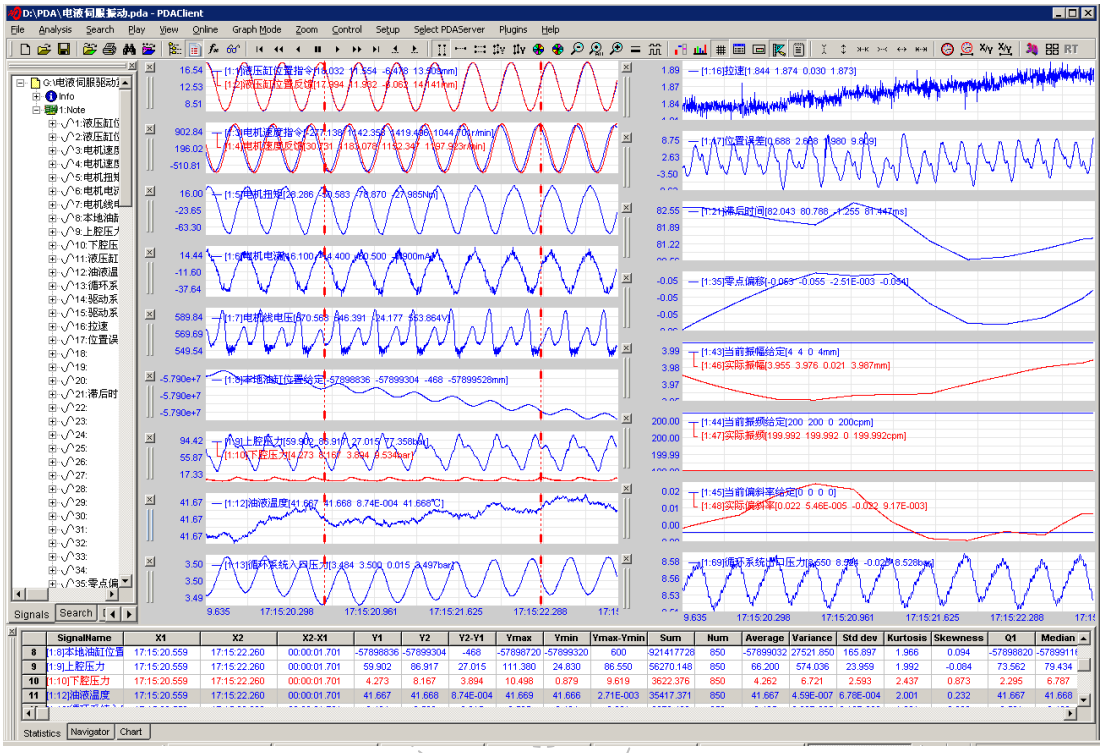


Figure 12.28 Millisecond level data curve of the electro-hydraulic servo control system

The follow is day data of second level.

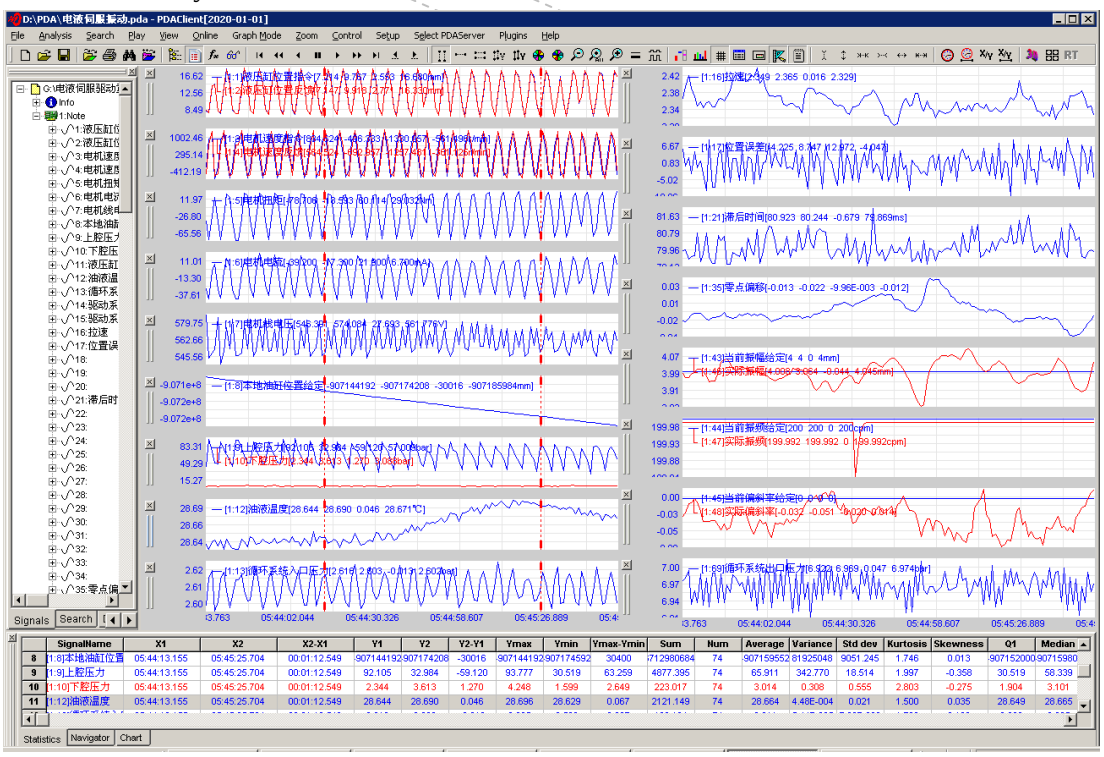


Figure 12.29 Second-level Data Curve of Electro-hydraulic Servo Control System

12.19 Automobile monitoring system

The car is controlled by CAN bus. PDA supports standard frame and extended frame. It can collect all frame IDs at high speed. It is an effective tool for car monitoring, development and driverless debugging.

Figure 12.30 Various Cars Based on CAN Bus

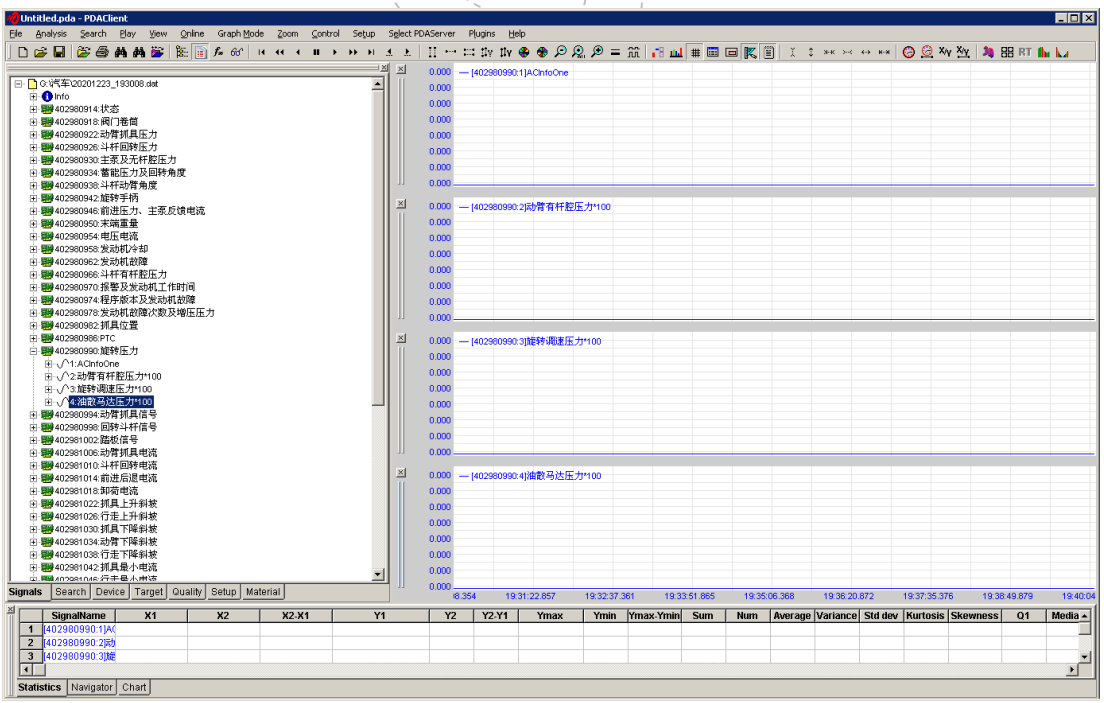


Figure 12.31 CAN Bus Data Collection for a Certain Car

12.20 Rolling mill stiffness tracking report

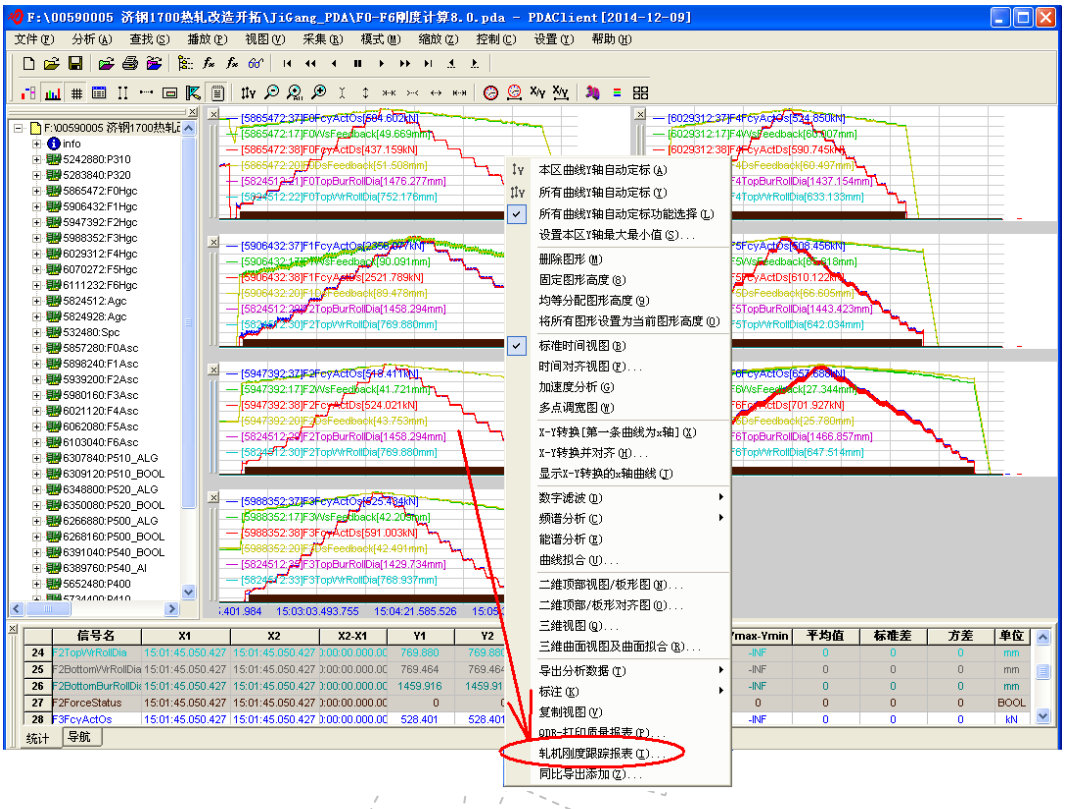
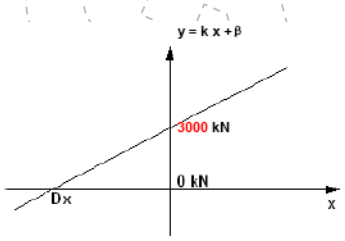


Figure 12.32 Measurement curve of rolling mill stiffness



	k		δ k	Σ k	支撑辊 辊径	工作辊 辊径	β		δ β	Dx		δ Dx	r (相关系数 %)		δ r (%)	起始时间	持续时间(秒)
	Os	Ds					Os	Ds		Os	Ds		Os	Ds			
F0FcyActOs	2897	3120	-223	6017	1476.28 1472.24	751.76 752.18	-199807	-220695	20889	68.968	70.731	-1.763	99.83	99.87	-0.04	2014-12-09 15:02:13	220
F1FcyActOs	2876	2705	171	5581	1464.06 1473.84	717.51 716.83	-257045	-239904	-17140	89.375	88.690	0.686	98.42	99.71	-1.30	2014-12-09 15:02:21	239
F2FcyActOs	3147	2981	166	6128	1458.29 1459.92	769.88 769.46	-192236	-188205	-4031	61.083	63.141	-2.058	99.84	99.80	0.03	2014-12-09 15:02:28	205
F3FcyActOs	2911	3262	-351	6173	1429.73 1417.16	768.94 768.39	-179012	-202080	23068	61.494	61.949	-0.455	99.93	99.82	0.12	2014-12-09 15:02:30	178
F4FcyActOs	3140	2948	192	6088	1437.15 1442.76	633.13 632.73	-249283	-235218	-14065	79.379	79.787	-0.408	99.82	99.84	-0.03	2014-12-09 15:02:17	168
F5FcyActOs	2704	2796	-93	5500	1443.42 1432.57	642.03 641.81	-230845	-240990	10145	85.382	86.181	-0.799	99.51	99.61	-0.10	2014-12-09 15:02:25	162
F6FcyActOs	2195	2977	-782	5173	1466.86 1470.60	647.51 647.87	-102925	-135516	32592	46.883	45.519	1.364	99.56	99.36	0.20	2014-12-09 15:02:25	203

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Figure 12.33 Linear fitting results of rolling mill stiffness

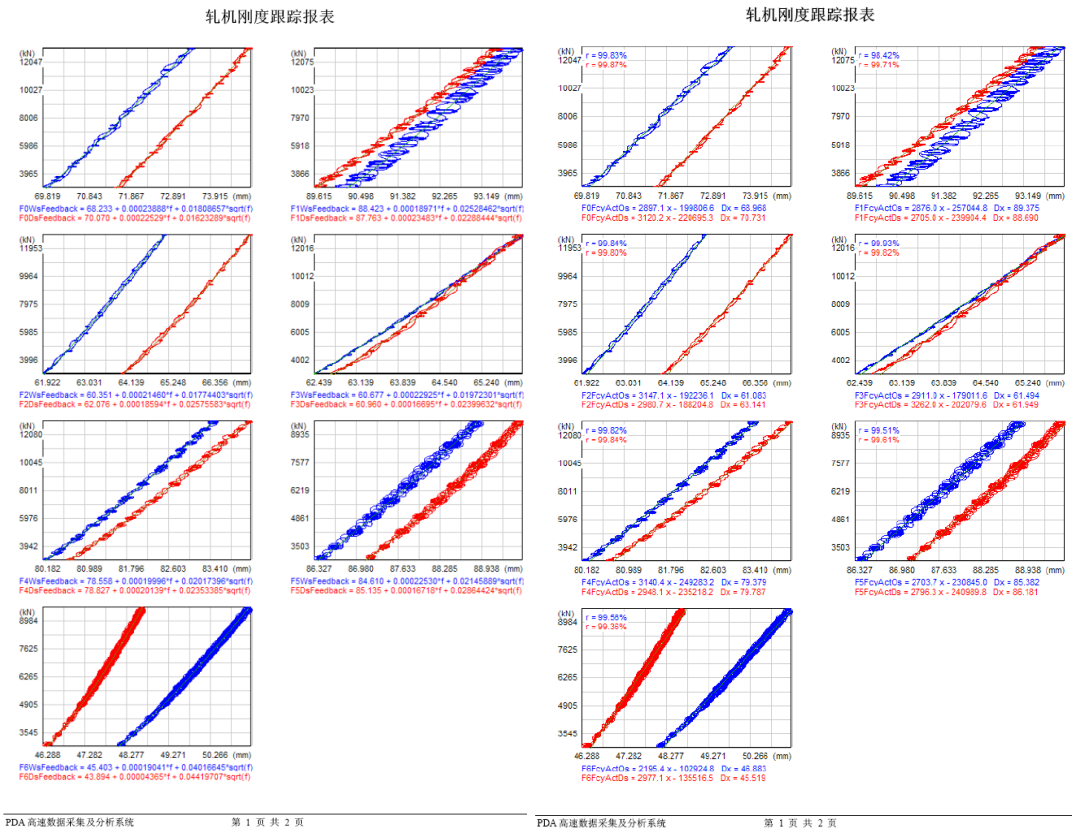

Figure 12.34 Original and fitted curves of rolling mill stiffness

(单侧)kN / kN / mm		1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000	15000	辊径 (mm)	起始时间	持续时间 (秒)
F0FcyActOs	Os	1905	2267	2475	2619	2727	2812	2882	2941	2992	3037	3076	3111	3143	3172	3198	1476.28	2014-12-09 15:02:13	220
	Ds	2075	2458	2678	2828	2941	3030	3103	3164	3217	3263	3304	3340	3373	3403	3430	751.76		
	Σk	3980	4725	5153	5447	5667	5842	5985	6106	6209	6300	6380	6451	6516	6574	6628	752.18		
	δk	-170	-191	-202	-209	-214	-218	-221	-223	-225	-226	-228	-229	-230	-231	-232	1472.24		
F1FcyActOs	Os	1696	2117	2378	2567	2714	2833	2934	3021	3096	3163	3223	3277	3327	3372	3414	1464.06	2014-12-09 15:02:21	239
	Ds	1676	2038	2254	2405	2521	2614	2691	2757	2813	2863	2908	2947	2983	3016	3046	717.51		
	Σk	3372	4155	4632	4972	5235	5448	5625	5777	5910	6026	6131	6225	6310	6388	6460	716.83		
	δk	20	79	124	161	193	219	243	264	283	300	316	330	343	356	367	1473.84		
F2FcyActOs	Os	2020	2421	2655	2818	2941	3038	3119	3187	3245	3297	3342	3383	3420	3453	3484	1458.29	2014-12-09 15:02:28	205
	Ds	1686	2110	2375	2567	2717	2839	2942	3031	3109	3177	3239	3295	3346	3392	3435	769.88		
	Σk	3705	4532	5030	5385	5657	5878	6061	6218	6354	6474	6581	6678	6766	6846	6919	769.46		
	δk	334	311	281	251	224	199	176	156	137	119	103	88	74	61	48	1459.92		
F3FcyActOs	Os	1848	2223	2443	2596	2712	2805	2881	2945	3001	3050	3093	3132	3167	3199	3228	1429.73	2014-12-09 15:02:30	178
	Ds	1830	2298	2591	2804	2971	3107	3222	3321	3408	3485	3554	3617	3674	3726	3775	768.94		
	Σk	3678	4521	5034	5400	5683	5912	6103	6267	6409	6535	6648	6749	6841	6925	7003	768.39		
	δk	18	-74	-147	-208	-259	-303	-341	-376	-407	-435	-461	-485	-507	-527	-547	1417.16		
F4FcyActOs	Os	1927	2350	2603	2782	2919	3029	3120	3198	3265	3324	3377	3424	3467	3506	3542	1437.15	2014-12-09 15:02:17	168
	Ds	1744	2153	2403	2581	2719	2830	2924	3003	3073	3134	3189	3238	3283	3324	3362	633.13		
	Σk	3671	4503	5006	5363	5638	5859	6044	6201	6338	6458	6566	6662	6750	6830	6904	632.73		
	δk	183	197	201	201	200	198	196	194	192	190	188	186	184	182	180	1442.76		
F5FcyActOs	Os	1771	2150	2374	2532	2652	2749	2829	2896	2955	3007	3053	3094	3131	3165	3196	1443.42	2014-12-09 15:02:25	162
	Ds	1613	2052	2333	2540	2705	2840	2955	3055	3143	3222	3292	3357	3415	3469	3520	642.03		
	Σk	3384	4201	4707	5072	5357	5589	5784	5952	6098	6228	6345	6450	6546	6634	6716	641.81		
	δk	159	98	41	-8	-52	-92	-127	-159	-188	-215	-240	-263	-284	-305	-324	1432.57		
F6FcyActOs	Os	1211	1564	1795	1969	2108	2224	2323	2410	2487	2556	2619	2676	2728	2777	2822	1466.86	2014-12-09 15:02:25	203
	Ds	1347	1859	2237	2544	2808	3040	3249	3440	3615	3779	3932	4075	4211	4340	4463	647.51		
	Σk	2558	3423	4032	4513	4915	5264	5572	5850	6102	6335	6550	6751	6939	7117	7284	647.87		
	δk	-135	-296	-441	-575	-700	-816	-926	-1030	-1129	-1223	-1313	-1400	-1483	-1563	-1641	1470.60		
	Os																		
	Ds																		
	Σk																		
	δk																		

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Figure 12.35 Calculated stiffness under various rolling forces

F6-20211222-轧机精度评价表

大类		LC系数a	LC系数b	LC系数c	PT系数a	PT系数b	PT系数c	刚度原始值
刚度系数采集	total	42.73	-543.9	993.9	36.68	482.7	891.5	
	DS	22.95	-272.7	509.4	16.32	-242.4	482.6	
	WS	19.78	-271.7	19.78	20.36	-239.6	408.8	

刚度计算模块	分析	轧制力设定	LC刚度评价		PT刚度评价		回归拟合值, F6-TOTALFORCE-LC = 993.9 - 543.9 F6-GAP + 42.73 F6-GAP**2 R-Sq = 99.9%
			计算辊缝	LC计算刚度	计算辊缝	PT计算刚度	
	Total-Force/T	2000	-1.639	651.14	-1.994	598.35	
		1500	-0.871	581.59	-1.159	533.31	回归拟合值, F6-FORCE-LC-DS = 509.4 - 272.7 F6-GAP-DS + 22.95 F6-GAP-DS**2 R-Sq = 99.9%
		1000	-0.011	502.33	-0.221	458.96	
		500	0.984	\	0.868	\	回归拟合值, F6-FORCE-LC-WS = 484.2 - 271.7 F6-GAP-WS + 19.78 F6-GAP-WS**2 R-Sq = 99.9%
	DS	1000	-1.587	328.06	-1.893	290.13	
		750	-0.825	290.84	-1.032	260.40	回归拟合值, F6-TOTALFORCE-PT = 891.5 - 482.7 F6-GAP + 36.68 F6-GAP**2 R-Sq = 99.9%
		500	0.035	247.98	-0.071	226.74	
		250	1.043	\	1.031	\	回归拟合值, F6-FORCE-PT-DS = 482.6 - 242.4 F6-GAP-DS + 16.32 F6-GAP-DS**2 R-Sq = 99.9%
	WS	1000	-2.967	375.92	-2.095	308.39	
		750	-2.302	348.58	-1.284	273.26	
		500	-1.585	318.88	-0.369	232.76	回归拟合值, F6-FORCE-PT-WS = 408.8 - 239.6 F6-GAP-WS + 20.36 F6-GAP-WS**2 R-Sq = 99.9%
		250	-0.801	\	0.705	\	

刚度评价模块		保持率评价		对向刚度差评价		同向刚度差评价		
	刚度评价	LC原始刚度	LC刚度保持率	LC刚度（DS-WS）/AVE(LC:DS+WS)	PT刚度（DS-WS）/AVE(PT:DS+WS)	DS:(LC-PT)/LC	WS:(LC-PT)/LC	
	压力段1000	660.47	106.6%	-13.60%	-6.10%	11.561%	17.96%	高级±5%
	压力段750			-18.06%	-4.82%	10.466%	21.61%	普通±10%
	压力段500			-25.02%	-2.62%	8.565%	27.01%	

零调评价模块		辊缝设定	对应压力	压力偏差	500吨时辊缝差	零调偏差	报调量	
	DS-Gap	0	509.4	185.05%	1.619	-2.815	0.352	偏差±2mm
	WS-Gap	0	19.78					换调量±0.3mm
	模型预报	轧制力预报	1115	轧制力实际（-0.5s+0.5s）	1133.000	预报精度	1.61%	±5%
	零调过程中的力及偏差分析	DS-LC	WS-LC	Total-LC	DS-PT	WS-PT	Total-PT	
		500.9	500.9	1001.8	468.900	413.7	882.6	
		DS（LC-PT）	WS（LC-PT）	Total（LC-PT）	LC（DS-WS）	PT（DS-WS）		±10%
		32	87.2	119.2	0.000	55.2		±10%
		Total（LC-PT）/Total-LC	DS（LC-PT）/DS-LC	WS（LC-PT）/WS-LC	LC（DS-WS）/aveLC:DS+WS	PT（DS-WS）/avePT:DS+WS		
		11.90%	6.39%	17.41%	0.00%	12.51%		

轧制过程评价模块	轧制过程中的力及偏差分析	DS-LC	WS-LC	Total-LC	DS-PT	WS-PT	Total-PT	
		568.7	574	1142.700	493.7	471.7	965.4	
		DS（LC-PT）	WS（LC-PT）	Total（LC-PT）	LC（DS-WS）	PT（DS-WS）		
		75	102.3	177.3	-5.300	22		
		Total（LC-PT）/Total-LC	DS（LC-PT）/DS-LC	WS（LC-PT）/WS-LC	LC（DS-WS）/aveLC:DS+WS	PT（DS-WS）/avePT:DS+WS		
		15.52%	13.19%	17.82%	-0.93%	4.56%		

结论：
1：LC高压段对向刚度差-13.6%，低压段达到-25%；PT高压段对向刚度差11.561%；
2：零调偏差-5.21mm；报调量0.35mm；DS加垫3mm；
3：轧报时，LC压差-4t，PT压差22.2t，正常。
4：设备变化：新换拖车，测量F6底平面，两侧水平差0.02mm；平面度0.39mm；
结论：（1）刚度检测异常，可能是上辊倾斜压下时造成的异常；需要优先解决加垫问题，怀疑DS上牌坊顶板。

C

Figure 12.36 Stiffness Evaluation of a Steel Plant

12.21 MPT - Mill Pacing Tracing

MPT (Mill Pacing Tracing) calculates the accurate tracking position of the head and tail once every 50ms.

Reduce waiting for steel placement.

The rolling pacing is increased by 3 seconds, and an additional 20 pieces of steel can be produced per day.

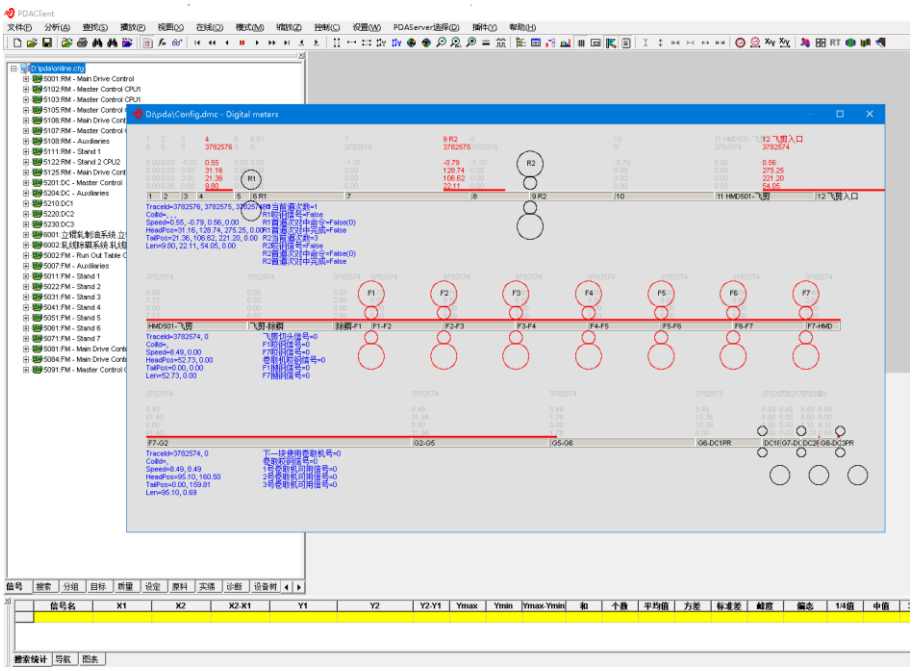

Figure 12.37 Rolling Pacing Tracing

12.22 IGBT Flexible DC Chopper Power Supply - Green Intelligent Super Arc Furnace

The project won the second prize of the National Science and Technology Progress Award. The PDA system can collect 20KHz data of current and voltage in each phase, and perform online and offline analysis of harmonics such as 3, 5, 7... 13, 15, 17.

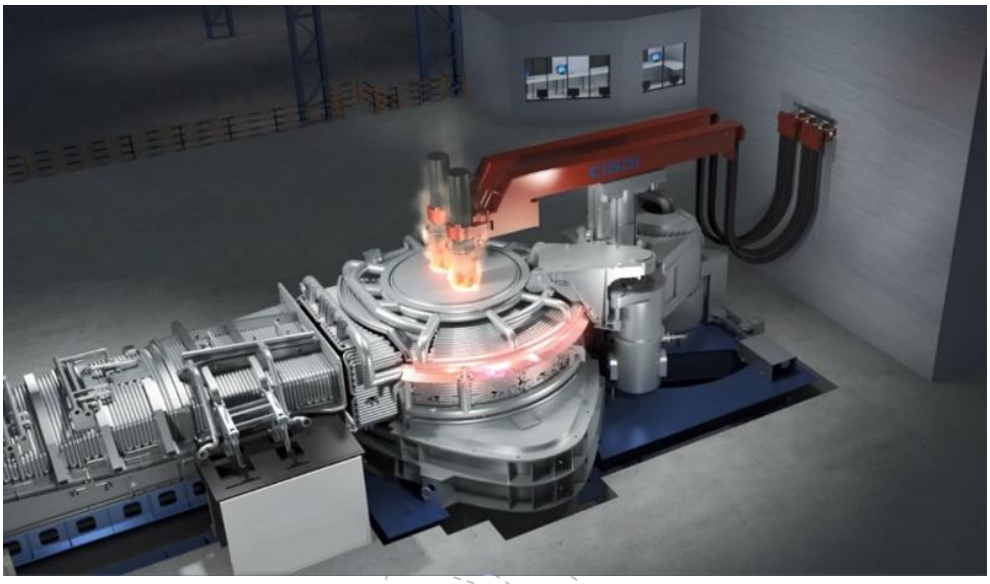

Figure 12.38 Green Intelligent Super Arc Furnace

The application of advanced technologies such as new IGBT flexible DC power supply technology, electrode stepless dual control intelligent regulation technology, continuous preheating technology for scrap steel, step wise continuous feeding technology for scrap steel, air-cooled contact needle bottom electrode technology, dioxin treatment and waste heat recovery technology, intelligent steelmaking technology, etc. can quickly respond to the smelting energy supply demand in the electric arc furnace and respond to short circuit and over current impact conditions, shorten the smelting cycle to within 30 minutes, and reduce power consumption to 250-300 kWh/t, The electrode consumption is 0.6-0.8kg/t, which is a new generation of green, energy-saving, environmentally friendly, and efficient electric furnace. Compared with conventional electric furnaces, it has great advantages in improving production efficiency, reducing electricity and electrode consumption, and improving metal recovery rate.

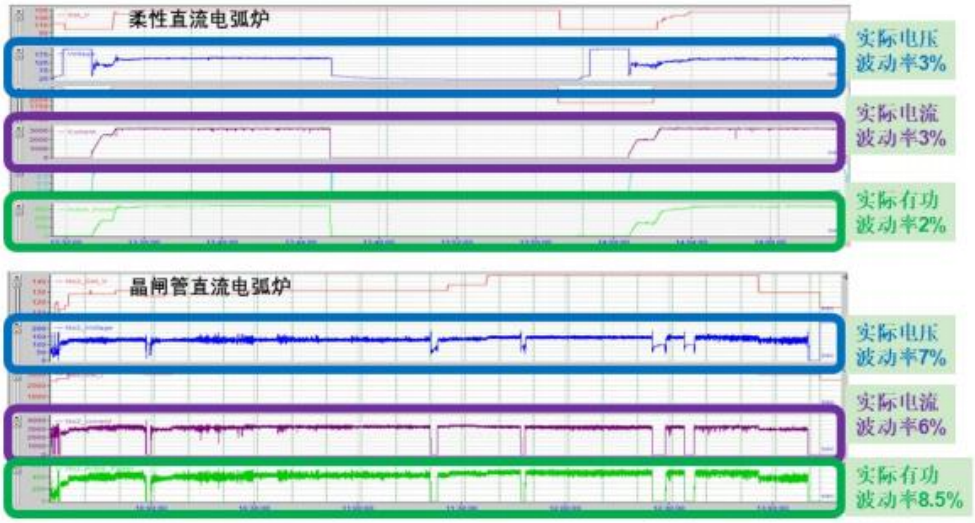

Figure 12.39 Performance Comparison Curve between Green Intelligent Super Electric Arc Furnace and Traditional Electric Arc Furnace

12.23 Mobile APP

PDA.apk is an Android installation package that requires storage permissions. The on-site configuration information for each project needs to be downloaded to a storage card for future use.

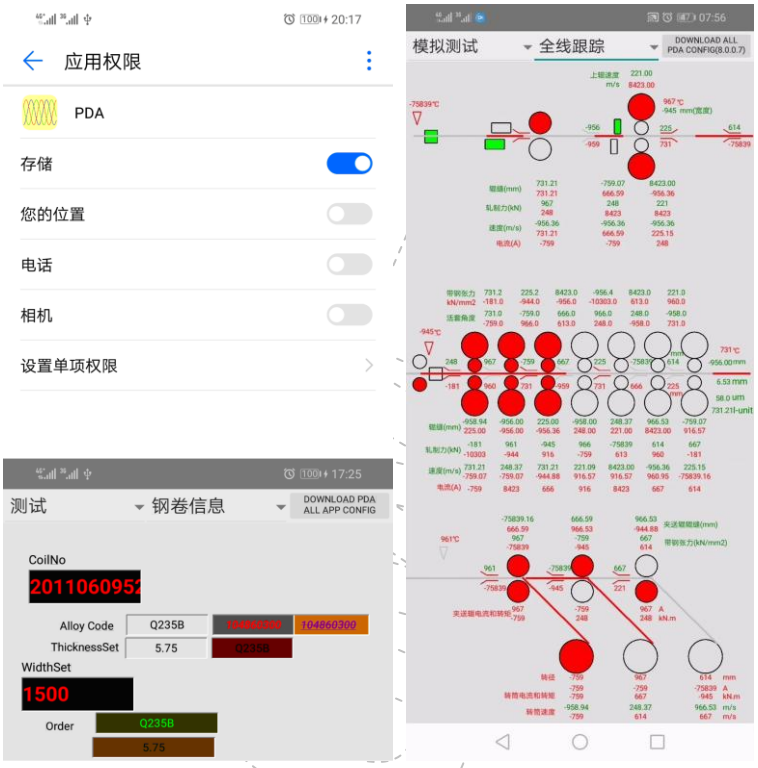

Figure 12.40 Real time data display and production monitoring system for various styles

12.24 PLC ring network fault detection

The ring network composed of multiple S7-1500 controllers and HMIs seems to be working properly. When the PDA was connected to the network for 2ms data collection, it was found that dozens of data packets were lost every 6 seconds. However, when the PDA was directly connected to the PLC, everything was normal. Further investigation revealed that disconnecting the ring network was also normal. Later, the PLC version was lowered and the ring network was normal. It's not that the higher the PLC version, the better.

12.25 Mathematical Model Log

Modern steel rolling mathematical models are becoming increasingly complex. The traditional method is to write key data into. log files and analyze the. log text files when problems are found, which is not intuitive and inefficient. By sharing memory or networks, a large amount of model data can be recorded in PDA systems, accelerating the debugging progress of the model and the convenience and accuracy of fault analysis.

12.26 Comprehensive plan for data acquisition of company level main and auxiliary transmission systems

In order to isolate from the automated L1 system, signals with a sampling period of less than 10ms are collected through a dedicated PN network established by CBE20. For signals

with no special requirements for sampling period, data is read from S120 through standard Ethernet using Siemens internal communication protocol.

The PDA system saves the collected signals as. dat files and can also be saved to relational and temporal databases such as InfluxDB, making it convenient for various automatic reports and big data analysis such as Power BI, Fansoft, Grafana, etc.

Multiple PDA servers need to be set up according to the geographical location and number of transmission systems in each factory.

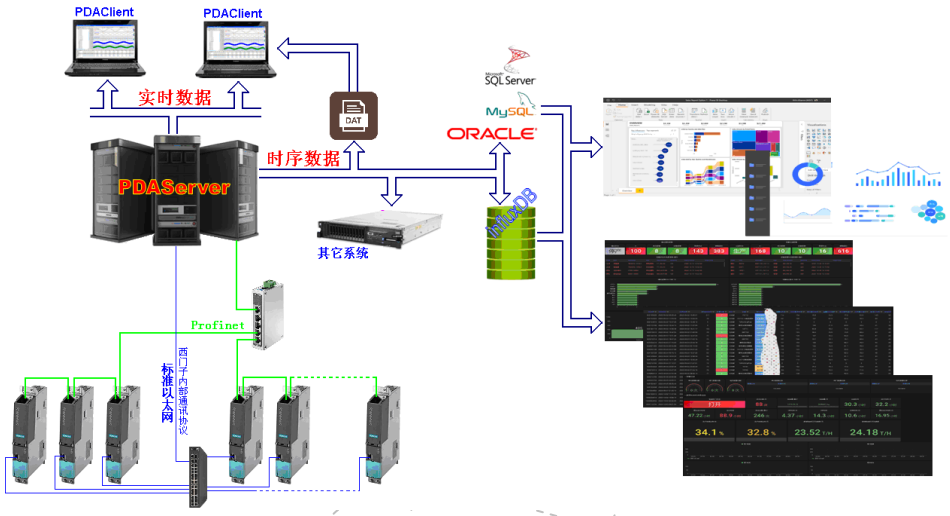

Figure 12.41 Comprehensive scheme for data acquisition of main and auxiliary transmission systems

12.27 S7-1500 and slave drop data collection scheme

The S7-1500 series PLC can achieve ms level data acquisition through standard ethernet UDP and Profinet(PDAServer as multiple PN slaves), the PN switch may directly forward all slave data to the PDAServer, the system scheme is shown in the following figure.

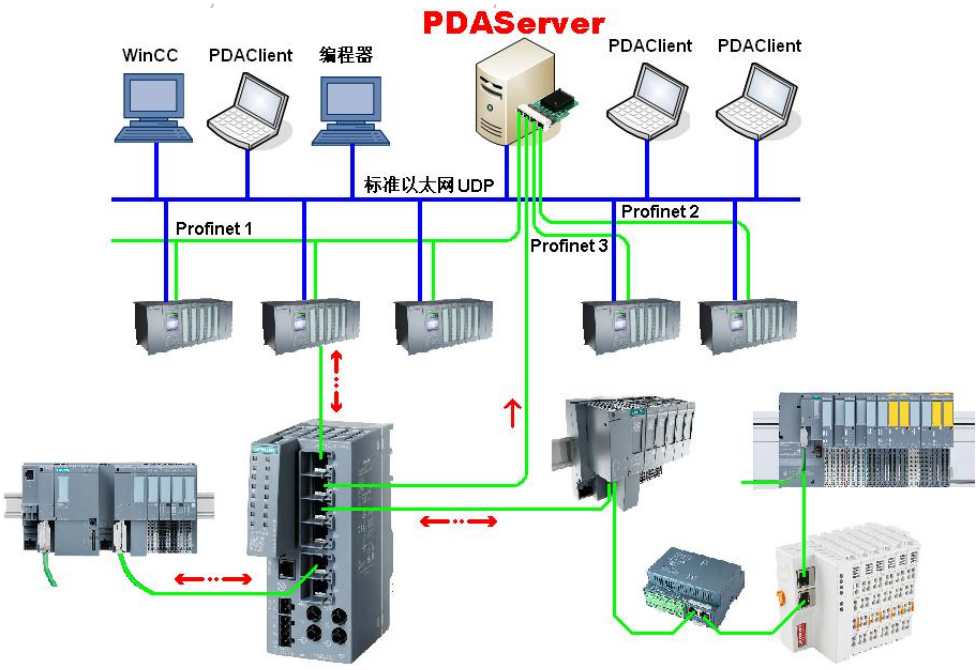

图 12.42 S7-1500 data collection scheme

13 Equipment model

Table 13.1 one set order form of standard configuration

No.	Model	Specification	MC60xx	PC	Order number
1	PDA-1	Channels: 10240 Time base: 10~20ms Connection: 1	√	×	PDA SYS-N01-0AB0
				√	PDA SYS-N01-0AB1
2	PDA-2	Channels: 5120 Time base: 0.05~20ms Connection: 1	√	×	PDA SYS-N02-0AB0
				√	PDA SYS-N02-0AB1
3	PDA-3	Channels: 5120 Time base: 0.05~20ms Connection: 100	√	×	PDA SYS-N03-0AB0
				√	PDA SYS-N03-0AB1
4	PDA-4	Channels: 1024 Time base: 0.05~20ms Connection: 100	√	×	PDA SYS-N04-0AB0
				√	PDA SYS-N04-0AB1
5	PDA-5	Channels: 10240 Time base: 0.05~20ms Connection: 100	√	×	PDA SYS-N05-0AB0
				√	PDA SYS-N05-0AB1
6	PDA-6	Channels: 20480 Time base: 0.05~20ms Connection: 100	√	×	PDA SYS-N06-0AB0
				√	PDA SYS-N06-0AB1
7	PDA-7	Channels: 30720 Time base: 0.05~20ms Connection: 100	√	×	PDA SYS-N07-0AB0
				√	PDA SYS-N07-0AB1
8	PDA-8	Channels: Time base: specially made Connection:	√	×	PDA SYS-N08-0AB0
				√	PDA SYS-N08-0AB1
9	PDA-9	Channels: 10240 Time base: 10~20ms Connection: 100	√	×	PDA SYS-N09-0AB0
				√	PDA SYS-N09-0AB1
10	PDA-10	Channels: 20480 Time base: 10~20ms Connection: 100	√	×	PDA SYS-N10-0AB0
				√	PDA SYS-N10-0AB1
11	PDA-11	Channels: 30720 Time base: 10~20ms Connection: 100	√	×	PDA SYS-N11-0AB0
				√	PDA SYS-N11-0AB1
12	PDA-12	Channels: 51200 Time base: 10~20ms Connection: 100	√	×	PDA SYS-N12-0AB0
				√	PDA SYS-N12-0AB1
13	PDA-20	Unlimited / 10~20ms	√	×	PDA SYS-N20-0AB0
14	PDA-21	Unlimited / 0.05~20ms	√	×	PDA SYS-N21-0AB0

No.	Model	Specification	MC60xx	PC	Order number
15	PDA-EVIS	工程车辆信息数据采集系统	√	×	PDA EVIS-N01-0AB0
16	PDA-LTA	长期历史趋势分析系统	√	×	PDA LTA-N01-0AB0
17	PDA-HDS	HDS 开放式高频时序数据库 HDServer	√	×	PDA HDS-N01-0AB0
18	WinCC-PDA	WinCC 升级 PDA 软件包	√	×	PDA WinCC-N01-0AB0
19	FTView-PDA	FTViev 升级 PDA 软件包	√	×	PDA FTView-N01-0AB0
20	ie-PDA	浏览器 PDA 功能包	√	×	PDA IE-N01-0AB0
21	C#-PDA	C#高频数据分析 PDA 软件包	√	×	PDA C#-N01-0AB0
22	PDA-DBU	数据库系统及升迁工具	√	×	PDA DBU-N01-0AB0
23	PDA-DCC	数字钢卷转换存贮系统	√	×	PDA DCC-N01-0AB0
24	PDA-CFS	钢卷快速搜索统计系统	√	×	PDA CFS-N01-0AB0
25	PDA-FSS	钢卷快速搜索统计服务器	√	√	PDA FSS-N01-0AB0
26	PDA-DSO	设备诊断同步过采样系统	√	×	PDA DSO-N01-0AB0
27	PDA-DIA	工艺及设备诊断数字钢卷系统	√	×	PDA DIA-N01-0AB0
28					
29	PDA-EVT	事件同步数据解析转换工具	√	×	PDA EVT-N01-0AB0
30	PDA-RSA	轧辊剥落预警及快停系统	√	×	PDA RSA-N01-0AB0
31	PDA-RCM	辊道电流监测系统	√	×	PDA RCM-N01-0AB0
32	PDA-DPI	设备诊断及工艺数据整合系统	√	×	PDA DPI-N01-0AB0
33	PDA-HDP	高频高密高速数据平台构建	√	×	PDA HDP-N01-0AB0
34					
35					
36					

* Includes: Hardware Encryption Dog (customized design and manufacture); Data Acquisition Software; Data Analysis Software; Acquisition Card MC60xx (optional).
* Please specify the type of PLC when ordering.
* Please specify when ordering for special sampling period.
* There is no programming in PLC for some manufacturers, PDA reads data directly by variable address.
* PDA drivers can be developed cooperatively for special devices.
* PDA data interface is attached including third party.

Table 13.2 Interface module and part order form

No.	Model	Order number	Comment
1	PDAServer	PDA SRV-VER80-0AB0	Data acquisition soft
2	PDAClient	PDA CLT-VER80-0AB0	Online and offline analysis soft
3	QDRServer	PDA QDR-VER80-0AB0	Quality data record server for steel pipe
4	QDRServer	PDA QDR-VER81-0AB0	Quality data record server for HSM
5	QDRServer	PDA QDR-VER82-0AB0	distributed Quality data record server
6	QDRServer	PDA QDR-VER83-0AB0	Quality data record server for CSM
7	HDServer	PDA HDS-VER80-0AB0	Merge PDA data files
8	SplitServer	PDA SPLIT-VER80-0AB0	Digital steel coil splitting system
9	TrimServer	PDA TRIM-VER80-0AB0	Digital steel coil cutting head and tail
10	StiffnessServer	PDA STIF-VER80-0AB0	Measurement data record of rolling mill stiffness
11	RollChangeServer	PDA RCH-VER80-0AB0	Rolling mill roll change data record
12	ModbusTcpServer	PDA MBS-VER80-0AB0	Modbus Server
13	mqttServer	PDA MQTT-VER80-0AB0	Mqtt Server
14	WebSocketServer	PDA WS-VER80-0AB0	WebSocket Server
15	Distribute	PDA DTB-VER80-0AB0	Distributed data acquisition system
16	Energy	PDA ENG-VER80-0AB0	Energy report system
17	RunningRecord	PDA RRD-VER80-0AB0	Running record report system
18	pdaAlarm	PDA ALM-VER80-0AB0	Routine trend alarm and operating record
19	WinRC	PDA WRC-VER80-0AB0	Windows real time control center
20	pdaTools	PDA PTS-VER80-0AB0	PDA toolset
21	IPCheck	PDA IPC-VER80-0AB0	IP address check and alarm tool
22	pdaCloud	PDA CLD-VER80-0AB0	Collate data and upload to cloud automatically
23	dbUpgrade	PDA DBU-VER80-0AB0	History data upgrade tool
24	dbUpgradeRt	PDA DBU-VER80-0AB0	Real-time data upgrade tool
25	dbUpgradeTS	PDA DUR-VER80-0AB0	Time series database upgrade tool
26	ProcessServer	PDA PDS-VER80-0AB0	Process data conversion server
27	spotCheck	PDA SCHK-VER80-0AB0	Spot check subsystem
28	PDA AUTHORITY	PDA USB-AUTH-0AB0	USB interface PDA authority
29	CFS	CFS SRV-VER80-0AB0	digital Coil Fast Search system
30	iPDA	PDA IPDA-VER80-0AB0	Real time data PDA for mobile device
31	iPDA	PDA IPDA-VER80-0AB1	Real time data multi-PDA for mobile device
32	MC6068	PDA PCI-MC6068-0AB0	PCI High speed data acquisition card
33	MC6069	PDA PCIE-MC6069-0AB0	PCIe High speed data acquisition card
34	MC6070	PDA USB-MC6070-0AB0	USB High speed data acquisition card
35	PDA System	PDA USB-SYS-0AB0	PDA system disk
36	PDA DOT	PDA DOT-1024-0AB0	PDA channel amount, 1024, Other is similar
37	PDA PROTOCOL STACK	PDA PROT-STACK-0AB0	PDA protocol stack
38	PDA LIB	PDA LIB-PLC-0AB0	PDA library and user program

39	PDA ISO-AI	PDAU ISO-16AI-0AB0	16 channel full isolated analog input module
40	PDA ISO-DI	PDAU ISO-16DI-0AB0	16 channel full isolated digital input module
41	PDA ISO-AIDI	PDAU ISO-16AIDI-0AB0	16 channel isolated analog and digital input module
42	PDA ISO-DI	PDAU ISO-32DI-0AB0	32 channel isolated digital input module
43	PDA SSI	PDAU SSI-8CH-0AB0	8 channels SSI input module
44	PDA COM	PDAU COM-2AI-0AB0	2 channel RS232 PDA analog input module
45	PDA DPM	PDA DPM-2B244-0AB0	PDA Profibus-DP interface module
46	PDA MANUAL	PDA REF-MANU-0AB0	PDA reference manual of Chinese print
47	PDA MANUAL	PDA REF-MANU-0AB1	PDA reference manual of English print
48	PDA SERVER	PDA SRV-HP-0AB0	PDA server, HP PC
49	PDA SERVER	PDA SRV-DELL-0AB0	PDA server, DELL PC
50	PDA DPM	PDA DPM-4B244-0AB2	PDA gateway Profibus-DP
51	PDA AS-Interface	PDA	PDA gateway AS-Interface
52	PDA ISO-AIDI	PDAU ISO-8AIDI-0AB0	8 channel full isolated analog and digital input module AI Type 0: Voltage 1: Current DI Type A: DC24V B: DC5V 0AB0 0: 0 ~ ±5V 0 ~ 10mA 1: 0 ~ 5V 0 ~ ±10mA 2: 1 ~ 5V 4 ~ 20mA 3: 0 ~ 10V 0 ~ ±20mA 4: 0 ~ ±10V 0 ~ 1A 5: 0 ~ 5A 6: 0 ~ ±1A 7: 0 ~ ±5A 8: 9:
53	PDA cc-link	PDA CC-LINK-0AB2	PDA gateway cc-link
54	PDA DALI DMX	PDA DALI-DMX-0AB2	PDA gateway DALI DMX
55	PDA enocean	PDA ENOCEAN-0AB2	PDA gateway enocean
56	PDA InterBus	PDA INTERBUS-0AB2	PDA gateway InterBus
57	PDA io-link	PDA IO-LINK-0AB2	PDA gateway io-link
58	PDA KNX/EIB	PDA KNX-EIB-0AB2	PDA gateway KNX/EIB
59	PDA lightbus	PDA LIGHTBUS-0AB2	PDA gateway lightbus
60	PDA Lonworks	PDA LONWORKS-0AB2	PDA gateway Lonworks
61	PDA M-BUS	PDA M-BUS-0AB2	PDA gateway M-BUS
62	PDA MP-BUS	PDA MP-BUS-0AB2	PDA gateway MP BUS
63	PDA PN-MSTR	PDA PN-MSTR-0AB0	PDA Profinet master switch
64	PDA COM-RUSB	PDA COM-RUSB-0AB0	PDA serial port USB reset device

Table 13.3 PDA libraries and user program order form

No.	Model	Order number	Comment
1	PDA LIB	PDA LIB-PLC-0AB0	S7-400 high speed
2	PDA LIB	PDA LIB-PLC-0AB6	S7-300 high speed
3	PDA LIB	PDA LIB-PLC-0AB22	Ethernet/IP
4	PDA LIB	PDA LIB-PLC-0DP0	Profibus-DP in S7-400/300
5	PDA LIB	PDA LIB-PLC-0BF25	Beckhoff
6	PDA LIB	PDA LIB-PLC-0WG25	Wago
7	PDA LIB	PDA LIB-PLC-0MG25	Moog
8	PDA LIB	PDA LIB-PLC-0AB8	Profinet
9	PDA LIB	PDA LIB-PLC-0BF36	Beckhoff realtime ethernet
10			

Table 13.4 PDA protocol stack order form

No.	Model	Order number	Comment
1	PDA PROTOCOL	PDA PROT-STACK-0AB0	S7-400 high speed
2	PDA PROTOCOL	PDA PROT-STACK-0AB6	S7-300 high speed
3	PDA PROTOCOL	PDA PROT-STACK-0AB21	S7-400/300/TDC/FM458 variable access by IP
4	PDA PROTOCOL	PDA PROT-STACK-0AB27	S7-1200/1500 variable access by IP
5	PDA PROTOCOL	PDA PROT-STACK-0AB1	S7-400 variable access by MAC
6	PDA PROTOCOL	PDA PROT-STACK-0AB54	S7-400/300 ISO transport connection
7	PDA PROTOCOL	PDA PROT-STACK-0AB3	MPI/DP variable access
8	PDA PROTOCOL	PDA PROT-STACK-0AB23	Modbus - variable access
9	PDA PROTOCOL	PDA PROT-STACK-0AB33	RS232
10	PDA PROTOCOL	PDA PROT-STACK-0AB25	Standard Udp
11	PDA PROTOCOL	PDA PROT-STACK-0AB32	Kernal Udp
12	PDA PROTOCOL	PDA PROT-STACK-0AB20	Standard Tcp server
13	PDA PROTOCOL	PDA PROT-STACK-0AB7	GDM(Global Data Memory)
14	PDA PROTOCOL	PDA PROT-STACK-0AB11	Reflective memory
15	PDA PROTOCOL	PDA PROT-STACK-0AB28	ModbusTCP - memory block
16	PDA PROTOCOL	PDA PROT-STACK-0AB31	ModbusTCP - variable access
17	PDA PROTOCOL	PDA PROT-STACK-0AB22	Ethernet/IP
18	PDA PROTOCOL	PDA PROT-STACK-0AB29	Ethernet/IP-backplate
19	PDA PROTOCOL	PDA PROT-STACK-0AB59	Ethernet/IP backplate block
20	PDA PROTOCOL	PDA PROT-STACK-0AB26	EGD(Ethernet Global Data)
21	PDA PROTOCOL	PDA PROT-STACK-0AB18	SRTP(Service Request Transfer Protocol)
22	PDA PROTOCOL	PDA PROT-STACK-0AB30	SNPX
23	PDA PROTOCOL	PDA PROT-STACK-0AB8	Profinet
24	PDA PROTOCOL	PDA PROT-STACK-0AB2	Profinet for simotion and other driver
25	PDA PROTOCOL	PDA PROT-STACK-0AB9	Profinet for TDC
26	PDA PROTOCOL	PDA PROT-STACK-0AB5	EtherCAT
27	PDA PROTOCOL	PDA PROT-STACK-0AB36	Beckhoff Realtime Ethernet
28	PDA PROTOCOL	PDA PROT-STACK-0AB15	Beckhoff ADS
29	PDA PROTOCOL	PDA PROT-STACK-0AB38	Iba data
30	PDA PROTOCOL	PDA PROT-STACK-0AB37	Logical signals
31	PDA PROTOCOL	PDA PROT-STACK-0AB39	the third party data
32	PDA PROTOCOL	PDA PROT-STACK-0AB24	standard Tcp client
33	PDA PROTOCOL	PDA PROT-STACK-0AB12	OPC Automation

34	PDA PROTOCOL	PDA PROT-STACK-0AB13	OPC Com
35	PDA PROTOCOL	PDA PROT-STACK-0AB35	Realtime data file
36	PDA PROTOCOL	PDA PROT-STACK-0AB4	MITSUBISHI MC format 4(RS232)
37	PDA PROTOCOL	PDA PROT-STACK-0AB17	MELSECT-QnA 3E(Ethernet)
38	PDA PROTOCOL	PDA PROT-STACK-0AB10	DL/T645-2007(RS232)
39	PDA PROTOCOL	PDA PROT-STACK-0AB34	Send data to PLC by UDP
40	PDA PROTOCOL	PDA PROT-STACK-0AB19	S7-200smart variable access by IP
41	PDA PROTOCOL	PDA PROT-STACK-0AB40	CU320 Profinet
42	PDA PROTOCOL	PDA PROT-STACK-0AB41	Vehicle CAN
43	PDA PROTOCOL	PDA PROT-STACK-0AB50	Tcp packet for 0.0625ms(16kHz) e.g. S7-1517
44	PDA PROTOCOL	PDA PROT-STACK-0AB51	Tcp packet for 0.0625ms(16kHz) e.g. S7-1517
45	PDA PROTOCOL	PDA PROT-STACK-0AB55	Udp packet for 0.05ms(20kHz)
46	PDA PROTOCOL	PDA PROT-STACK-0AB56	Realtime Ethernet packet for 0.05ms(20kHz)
47	PDA PROTOCOL	PDA PROT-STACK-0AB52	WebSocket
48	PDA PROTOCOL	PDA PROT-STACK-0AB53	RS232 packet
49	PDA PROTOCOL	PDA PROT-STACK-0AB57	mqtt
50	PDA PROTOCOL	PDA PROT-STACK-0AB58	Opc Ua
51	PDA PROTOCOL	PDA PROT-STACK-0AB60	PCI/PCIe memory
52	PDA PROTOCOL	PDA PROT-STACK-0AB61	TCnet
53	PDA PROTOCOL	PDA PROT-STACK-0AB62	Ethernet/IP backplate(3rd)
54	PDA PROTOCOL	PDA PROT-STACK-0AB63	Ethernet/IP backplate block(3rd)
55			
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63			
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65			
66			

KingWei Impress Moon Technology (Wuhan) Co.,Ltd.
Automation & Drives Group
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The information provided in the sample is a simple an introduction to the general description and characteristics of the product.
The content may differ from the actual application situation, and may change with the further development of the product.
KingWei is responsible for providing the product characteristics only when the relevant contract terms are clearly specified.

Order : PDA REF-MANU-0AB1