

## **Practical Implementation of SCADA System for Falluja Substation**

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### **Abstract:**

The Digital control systems for substations have been installed in different areas of Iraq in the recent years. Most of these techniques used a Supervisory Control And Data Acquisition (SCADA) with Remote Terminal Unit (RTU) for monitoring the metering devices for incoming and outgoing feeders, while the other system used a Programmable Logic Control (PLC) technique for controlling and monitoring the system inside substations by professional engineers. A practical monitoring system of SCADA with RTU has been introduced in this paper for Falluja substation. There are 3 devices of RTUs are used to collect data from ION 6200 devices installed inside incoming and outgoing panels for low Voltage (LV 3<sup>∧</sup>0V), 33KV and 11KV, then the data from each RTU will be send to the SCADA (main Computer) via special router, the SCADA system used ION enterprise software supplied by AREVA company in addition to all panels which supplied by the same company. Many difficulties were appeared during the work, such as mistakes of IPs, setting parameters, selection of protocols, and matching of devices have solved until the normal work was obtained to the substation.

### **Keywords:**

**SCADA, RTU, PLC, MiCOM, Falluja Substation**

### **1. INTRODUCTION**

Computer-based Supervisory Control And Data Acquisition (SCADA) systems have evolved over the past 40 years, from standalone, compartmentalized operations into networked architectures that communicate across large distances. In addition, their implementations have migrated from custom hardware and software to standard hardware and software platforms. These changes have led to reduced development, operational, and maintenance costs as well as providing executive management with real-time information that can be used to support planning, supervision, and decision making. These benefits, however, come with a cost. The once semi-isolated industrial control systems using proprietary hardware and software are now vulnerable to intrusions through external networks, including the Internet, as well as from internal personnel. These attacks take advantage of vulnerabilities in standard platforms, such as Windows, and PCs that have been adopted for use in SCADA systems [1]. SCADA systems are used not only in most industrial processes: e.g. steel making, power generation (conventional and nuclear) and distribution, chemistry, but also in some experimental facilities such as nuclear fusion [2]. Automation of power systems has increasingly been adopted by power utilities worldwide in recent years as part of its effort to provide a more reliable supply to its customers and to enhance operational efficiency [3].

SCADA systems are used to monitor and control a plant or equipment in industries such as telecommunications, water and waste control, energy, oil and gas refining and transportation. These systems encompass the transfer of data between a SCADA central host computer and a number of Remote Terminal Units (RTUs) and/or Programmable Logic Controllers (PLCs), and the central host and the operator terminals. A SCADA system gathers information (such as where

a leak on a pipeline has occurred), transfers the information back to a central site, then alerts the home station that a leak has occurred, carrying out necessary analysis and control, such as determining if the leak is critical, and displaying the information in a logical and organized fashion. These systems can be relatively simple, such as one that monitors environmental conditions of a small office building, or very complex, such as a system that monitors all the activity in a nuclear power plant or the activity of a municipal water system. Traditionally, SCADA systems have made use of the Public Switched Network (PSN) for monitoring purposes. Today many systems are monitored using the infrastructure of the corporate Local Area Network (LAN)/Wide Area Network (WAN). Wireless technologies are now being widely deployed for purposes of monitoring. SCADA systems consist of [4]:

- One or more field data interface devices, usually RTUs, or PLCs, which interface to field sensing devices and local control switchboxes and valve actuators
- A communications system used to transfer data between field data interface devices and control units and the computers in the SCADA central host. The system can be radio, telephone, cable, satellite, etc., or any combination of these.
- A central host computer server or servers (sometimes called a SCADA Center, master station, or Master Terminal Unit (MTU))
- A collection of standard and/or custom software [sometimes called Human Machine Interface (HMI) software or Man Machine Interface (MMI) software] systems used to provide the SCADA central host and operator terminal application, support the communications system, and monitor and control remotely located field data interface devices

## **2. SCADA PROTOCOLS**

In a SCADA system, the RTU accepts commands to operate control points, sets analog output levels, and responds to requests. It provides status, analog and accumulated data to the SCADA master station. The data representations sent are not identified in any fashion other than by unique addressing. The addressing is designed to correlate with the SCADA master station database. The RTU has no knowledge of which unique parameters it is monitoring in the real world. It simply monitors certain points and stores the information in a local addressing scheme. The SCADA master station is the part of the system that should “know” that the first status point of RTU number 27 is the status of a certain circuit breaker of a given substation. This represents the predominant SCADA systems and protocols in use in the utility industry today.

Each protocol consists of two message sets or pairs. One set forms the master protocol, containing the valid statements for master station initiation or response, and the other set is the RTU protocol, containing the valid statements an RTU can initiate and respond to. In most but not all cases, these pairs can be considered a poll or request for information or action and a confirming response. The SCADA protocol between master and RTU forms a viable model for RTU-to-Intelligent Electronic Device (IED) communications. Currently, in industry, there are several different protocols in use. The most popular are International Electrotechnical Commission (IEC) 60870-5 series, specifically IEC 60870-5-101 (commonly referred to as 101) and Distributed Network Protocol version 3 (DNP3) [4, 5].

## **3. ION ENTERPRISE SOFTWARE**

ION Enterprise is a fully networked client-server information system that performs a full range of power monitoring, control, and energy management functions. ION Enterprise software obtains data from multiple intelligent devices in the power system and distributes it to one or

more computers. ION Enterprise software supports real time data display and control actions for multiple users, which is important for applications such as real-time pricing, generator control, and load shedding. The ION Enterprise software can be integrated with existing SCADA and energy management systems by supporting standard protocols (Ethernet, Modbus RTU, Modbus/TCP) which means ION Enterprise can communicate with existing equipment (relays, transducers, RTUs, etc.) and other systems (SCADA, DCS, EMS, etc.). An ION Enterprise network typically consists of one or more networks of intelligent devices (basic energy meters, multi-function monitoring/analysis/control devices, or intelligent relays), and a Windows 2000 computer network with single primary server is used for this substation. **Fig. (1)** shows The diagram of how the ION Enterprise software components operate in a network [5]. In the center of the diagram are the Communications Services. The Communications Services communicate with all network software components (e.g. user interfaces like the Management Console or Vista) and all hardware components (e.g. meters). In addition, the Communications Services communicate with the other services (the DDE, VIP, Log Server, and MSDE Database Server). Every software component writes information to, and receives information from, the Microsoft Database Engine (MSDE) Server. The Management Console uses the MSDE Server to store and retrieve network configuration information (to and from the Network Configuration database), and to retrieve system events for display (from the System Event database). The Communications Services use the MSDE Server to write system events to the System Event Database. In this diagram, the one-way and two-way arrows indicate how data is retrieved and logged. For example, the Log Server uses the Communication Services to connect to a meter so that the Log Server can retrieve the meter's logged data. After the Communication Services have connected to the meter, the Log Server retrieves the data and via the Sybase Database Server, transfers it to the ION database for Reporter and/or Vista to use. The diagram also shows that the VIP communicates directly with the Communications Services to connect to a meter. In addition, the VIP can communicate directly with the Log Server to transfer its logged data to the Log Server. The logged data then gets written into the ION database via the Sybase Database Server.

#### **4. ION ENTERPRISE NETWORK CONFIGURATIONS**

This section discusses how to model the physical communications network with ION Enterprise software. Modeling the communications network with ION Enterprise, the power-monitoring network that you build in ION Enterprise *reflects the way that the physical communications network is wired*, so ION Enterprise software can communicate with the devices. The ION Enterprise network is built in the Management Console software component using sites, servers, modems, and intelligent devices; these are described below.

- a. Servers:** Servers refer to computers with services. When you install ION Enterprise, the Primary Server must be installed before any Secondary server or Client computers.
- b. Sites:** A site contains one or more intelligent devices that are accessible via a serial, modem, or TCP/IP port on the Primary Server. There are three different types of sites, based on the type of communications medium each uses. The site types are as follows:
  - Direct (Serial) Site: a direct-connected RS-232 or RS-485 network.
  - Modem Site: a remote serial site connected by a modem.
  - Ethernet Gateway Site: a gateway that transfers data between an Ethernet device and an RS-485 chain of connected devices. (This module is used in Falluja substation).

**c. Devices:** Devices refer to intelligent devices (basic energy meters, multi-function monitoring/analysis/control devices, intelligent relays, etc.) that can be connected to ION Enterprise network serially, via Ethernet, or through a gateway.

The physical ION Enterprise Network Configurations of Falluja substation is shown in **Fig. (2)** [5]. From this diagram, the ION Enterprise software installed on the main computer (SCADA) which is used for monitoring the data that collected from ION 6200 meters inside the panels of the switchgear via three gateways represented by RTU 7550 (Data Concentrators). The first RTU collects data from 3 meters for incoming low and high voltages (132KV and 380V) to the three power transformers of 63/50/25MVA for each one (132KV/33KV/11KV). The second RTU collects data from 3xION 6200 meters for incoming three transformers, 3xION 6200 meters for capacitor bank (for power factor correction), and other 15xION 6200 meters for outgoing to different areas nearest Falluja. The last RTU for 11KV used 3xION 6200 meters for auxiliaries' transformers, 3 meters for incoming 11KV and other 18 meter for outgoing feeders. A Bus network topology is used for transferring the data between meters and RTUs via RS-485 communication cable. The output data from RTUs will send to the SCADA system via fast Ethernet LAN switch using Ethernet cables.

Remote terminal unit (RTU): Functions as a slave in the master/slave architecture. It sends control signals to the device under control, acquires data from these devices, and transmits the data to the MTU. An RTU may be a PLC. The data rate between the RTU and the controlled device is relatively high and the control method is usually closed loop [6].

## 5. SETTING PARAMETERS

The technical specifications of RTU (ION 7550) which are used in Falluja substation are shown in **table (1)**. The monitoring meters (ION 6200) connected to RTUs using RS-485 communication ports, also from this table it can be use Ethernet RJ45, Ethernet fiber or modems. The other input and output pins can be used for configuring the ION 6200 metering devices during the setup.

In the network setting, the IP address of 172.16.2.11 and the subnet mask is: 255.255.0.0. **Fig. (3)** shows the network setting of SCADA system. This figure shows that its work lies in the range of class B. Web-based SCADA System makes use of the Internet and Hypertext Transfer Protocol (HTTP) and other Web technologies as a communication layer of the system. It also uses development tools, framework, platforms and computer languages used to be used by regular Internet applications as development environment of SCADA application [7, 8].

While the next figure (**fig. (4)**) shows the MS loop back adapter setting of the network. ION Enterprise requires TCP/IP to function, so the MS Loop back Adapter should be installed for redundancy. For example, if the computer's network interface card (NIC) loses connection, the MS Loop back Adapter can keep ION Enterprise running.

The main window of the ION enterprise software package is shown in **fig. (5)**. From this figure, it can be seen that there are three Icons used to inter inside the package, these are REPORTER, MANAGEMENT CONSOLE, and VISTA. They have the following functions:

- 1) Reporter:** *database reporting.* Reporter allows you to define and create comprehensive database reports using Microsoft Excel. Configured Power Quality, Load Profile, Energy and Demand, and EN50160 reports are included with the Reporter. Custom reports can be created easily, and support is provided for other third-party reporting tools.
- 2) Management Console:** *building the network.* With the Management Console, you build an ION Enterprise power-monitoring network that reflects the way that your physical

communications network is wired, so ION Enterprise software can communicate with your devices. The network is created using sites, servers, modems, and intelligent devices that can be added, removed, configured, or duplicated. From the Management Console menus, you can access these Management Tools:

- Device Upgrader allows you to upgrade the operating software inside ION devices
- Remote Modem Configuration allows you to set up modems for remote sites
- Database Archive allows you to archive and trim your database
- System Log Trim allows you to trim your System Event database
- User Administrator allows you to configure ION Enterprise software user accounts that define different operations permitted within the ION software, e.g. viewing meter data, performing control actions, or configuring the configuration From the Management Console, you can also access Designer.

*Designer*: programming devices and software. Designer allows you to customize the operation of an ION device, the VIP, or the Log Server.

- 3) **Vista**: *display, analysis, and control*. Vista is the main user interface to the ION Enterprise system. Vista presents a graphical view of your power system, allowing you to view real-time data from power meters and historical data from the ION Enterprise database. Vista reports on the status of your power system components, informing you of alarm conditions and providing you with control capabilities for initiating intelligent device functions or actuating field machinery. Vista includes sophisticated tools for analyzing real-time and logged power data and system events.

If we press the management console Icon, then the next menu will appear after entering the using password (see **fig. (6)**). This figure shows the sites of the network. There are three 7550 RTUs available under the type option, each one has a unique IP address within class B. the port number is 7700 refers to the used ION enterprise port. The other ION Enterprise Ports assignments are given in **table (2)**. This table identifies the port assignments that ION Enterprise and associated applications or services use to communicate with ION devices, ION Enterprise clients, and other ION Enterprise servers.

## 6. PRACTICAL NETWORK CONNECTION

In order to access to any ION 6200 metering device, we should open the VISTA window. The main network diagram of substation is formatted as shown in **fig. (7)**. Any other suitable form can be done from *Title bar* → *Option* → *Edit Icons*. Also the colors, notes, location of Icons can be formatted from the same steps. If we open VISTA window as the first time, the network diagram can be generated by pressing *Title bar* → *File* → *Generate network diagram*. From this figure, there are 3 RTUs, RTU-1 for aggregating the data from 3 meters of ION 6200 via RS-485 cable. The icons under RTU-2 are used as incoming and outgoing feeders in addition to the other three meters used for capacitor bank (power factor improvement). Under RTU-3, there are 3 meters for incoming and other 18 meters for outgoing, and finally 3 meters for auxiliary transformers.

The details description of the network diagram is shown in **fig. (8)**. This figure contains:

- 1) Server IP of substation (Master)
- 2) The slave IPs (RTU-1, RTU-2, RTU-3)

- 3) The communication link type between RTUs and ION 6200 metering devices (RS-485 is used)
- 4) Ports numbers of each ION 6200 meter
- 5) The function of each meter
- 6) The symbol H for 33KV, K for 11KV, NE1 for 380V
- 7) The incoming and outgoing 33KV and 11KV
- 8) The capacitor meters for 33KV (H1, H10, and H19 meters are used)
- 9) Three meters for auxiliary 11KV transformers (K02, K12, and K29 meters are used)
- 10) The connection between each RTU and LAN switch via COM 2 port (lies at the meter back of RTU), the com 2 port has the following specifications:
  - Protocol type: EtherGate protocol
  - Baud rate= 19200 bit/sec.
  - EtherGate COM 2 Protocol=7802
  - Unit ID=101
  - Transmit delay=0.01 second, (range=0 to 1)

## 7. SETTING PARAMETERS OF THE ION 6200

Any meter of the network inside the switchgear shown in **fig. (8)** can be sets if we are able to access it. This means if there are any error in the communication link from the SCADA till the required meter, then it is impossible to sets its values. During the work, many mistakes are appeared and repaired. Some of these mistakes are related with the software and the others are hardware. Most of these mistakes are given in section 9.

Let us consider that we need to access to meter H5 and there is no error in the link, from **fig. (8)** we just press on the icon *H5, incoming 33KV, TR1* the new window will appear as shown in **fig. (9)**. All setting parameters are shown in this figure. If we change the Unit ID or the protocol type, then it cannot be access to its data and the communication between SCADA and meters will stop. But in the same time if we change the Unit ID or the protocol type from this window, then we must sets the same values from the front view of the ION meter. The other meters have the same settings for communication setup, energy pulsing setup, demand setup, display setup, and the polarity of the basic configuration. They have different setup in the Unit ID, PT Primary, and CT Primary alone. For example CT primary=600 for outgoing meters (33KV).

Before entering *VISTA* window we should open the *MANAGEMENT CONSOLE* window to enable the RTU-2 (for 33KV) and H5 device. This software package allows us to enable five devices alone at the same time. The next figure (**Fig. (10)**) shows the devices that used in the network.

## 8. REAL TIME DATA

The real time data of ION meters can be displayed from the data menu of **fig. (9)**. For example **Fig. (11)** shows the real time measured values for H5, Incoming 33KV to transformer-1. This figure contains the line voltages, phase voltages, line currents, the voltages and current of the total harmonic distortion (TDH) for each phase, frequency, power factor (PF), power (KVA, KW, and KVAR), and the energy (delivered KWh, and the reactive KWh). **Fig. (12)** shows the real time data of H12, incoming 33KV feeder. **Fig. (13)** shows the real time data of H20, 33KV *outgoing* feeder.

**Fig. (14)** shows the real time data of K15, incoming 11KV for transformer-2. from this figure it can be seen that there is no voltages or currents appears due to shutdown of transformer 2. **Fig.**

(15) shows the real time data of K25, incoming 11KV for transformer-3, while the last figure (Fig. (16)) shows the real time data of the auxiliary transformer-2, 11KV.

## **9. PRACTICAL DIFFICULTIES AND SOLUTIONS**

This item can help the reader to solve some hardware and software problems that appear during practical installation of the network.

a) *The software difficulties are:*

- 1) If we don't activate any required ION 6200 device from the management console under the devices menu, and we required to read the data from that meter in the network diagram under main window of VISTA then, an error menu will appear, it contains the following note

***“A generic diagram for the selected device could not be found”***

This error menu also will appear if any hardware mistake exists between the SCADA and the ION devices.

- 2) If the ION server could not be enabled from the Management Console, the error will appear in device menu under the site status (Unroutable error).
- 3) If the server name be changed, the same previous error will appear; also the VISTA window cannot be opened.
- 4) If the port number of any ION 6200 device is not correct, the above bold error menu will appear.
- 5) If the IP addresses in the SCADA are not matches the IPs in the corresponding RTUs, the RTUs cannot be accessed, this error can be discriminated by looking to the flashing LED in the back of each RTU, if it is not flashes, then no communication between SCADA and RTU.
- 6) The same previous error also will appear, if the LAN switch does not worked correctly.
- 7) The RTU cannot be accessed if the selected protocols in the RTUs are not correct (EtherGate Protocol is used).
- 8) The RTU cannot be accessed if the selected port number in the RTUs is not correct (port number=7802).
- 9) The RTU cannot be accessed if the selected Unit ID in the RTUs is not correct (Unit ID=101).
- 10) When the setting parameters inside ION 6200 meter are not correct, the above bolded menu will appear.

b) *The Hardware Difficulties are:*

- 1) The Ethernet cable between LAN switch and SCADA is not fine.
- 2) The RS-485 cable between RTUs and SCADA has bad contacts
- 3) Bad contact between ION meters and RTUs via RS-485 cable
- 4) The polarity of signal cable (RS-485) is not connected properly inside the switchgear panels.
- 5) Terminator resistance (220 ohm) not connected.
- 6) The RS-485 cable does not passed the Bus section and Bus riser between panels.
- 7) The connection inside the panels from the joints to the back of meters is not correct.

- 8) The DC. Voltage (110 volt is used) is not supplied to the RTUs or ION meters.
- 9) The LAN switch does not worked properly. This problem can be checked by direct connecting any enabled RTU to the SCADA.

## **10. CONCLUSIONS**

As power system evolves, more and more real time information is needed to support the advanced services and functions in order to make the power system more stable and reliable. The new challenges bring the new requirements to the power system communication infrastructure. This paper has addressed the design and implementation of SCADA system based communication infrastructure for the monitoring and control system of the power generation station system. During the implementation of the system, a number of conclusions have been considered based on the practical and simulation results obtained from the implemented system and the following are the most important ones:

1. The use of RTU6750 system is a very compatible and reliable solution since the RTU accepts the interfacing with the SCADA network by either the Ethernet or serial data interface module which increase the system compatibility.
2. The use of the internet protocol (IP) enables the interfacing of the system to the internet and increase the system operability and compatibility with internet based systems and remote operation techniques using the virtual private network technology (VPN).
3. The particular characteristics of the fiber optic network such as low attenuation, high bandwidth, small physical cross section, electromagnetic interface immunity, and security, make it the most suitable transmission medium for the power generation stations automation, control, protection and monitoring functions. Moreover already installed optical fiber infrastructure in Iraq saves the cost behind installing other communication media. Further it supports new services and functions that drive increased bandwidth and time latency requirements.
4. The system (PLC, RTU, HMI and the communication network) is easy to use and setup. The knowledge base needed by the system administrators and operators is very common in the IT field. There are many large companies that provide courses and certifications which cover most of knowledge required to setup and use the implemented system.
5. The implemented system proved to be able to work continuously for a very long time without breakdown.

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**Table (1):** The technical specifications of RTU (ION 7550)

	Option				
	Form Factor	Current Inputs	COM	I/O	Security
ION 7550	<ul style="list-style-type: none"> <li>Integrated Display</li> <li>TRAN (transducer) Model, the TRAN model has no display</li> <li>5MB memory</li> <li>10MB memory</li> <li>Up to 256 sampling rate</li> </ul>	<ul style="list-style-type: none"> <li>Standard (5 Amp)</li> <li>1 Amp</li> </ul>	<ul style="list-style-type: none"> <li>Standard (RS-232, RS-485, optical)</li> <li>Ethernet RJ45</li> <li>Ethernet Fiber</li> <li>Modem</li> </ul>	<ul style="list-style-type: none"> <li>Standard (8 digital inputs, 3 Form C relays, 4 Form A outputs)</li> <li>Extra 8 digital inputs</li> <li>Four 0-1mA analog inputs</li> <li>Four 0-20 mA analog inputs</li> <li>Four -1 to 1mA analog outputs</li> <li>Four 0-20 mA analog outputs</li> </ul>	<ul style="list-style-type: none"> <li>Standard (password protected, no locking or sealing)</li> <li>RMANSI (ANSI C12.16 approved; meets ANSI C12.20 class 0.2 accuracy standards)</li> </ul>

**Table (2):** ION Enterprise ports

Port	Protocol	Port	Protocol
3721	Ethernet access for the 3720 ACM meter	7800	EtherGate simultaneously through available COM ports
7700	ION	7801	EtherGate through COM1
7701	Modbus RTU	7802	EtherGate through COM2
502	Modbus TCP	7803	EtherGate through COM3

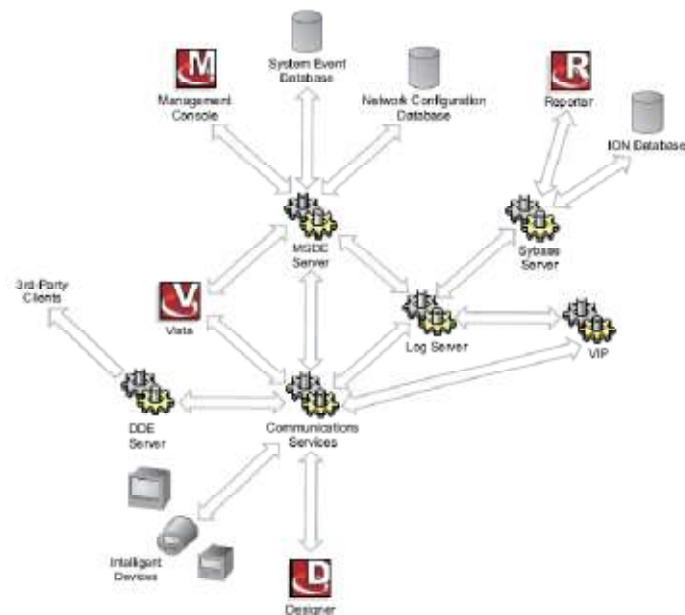


Fig. (1): The ION Enterprise Software Components Operation

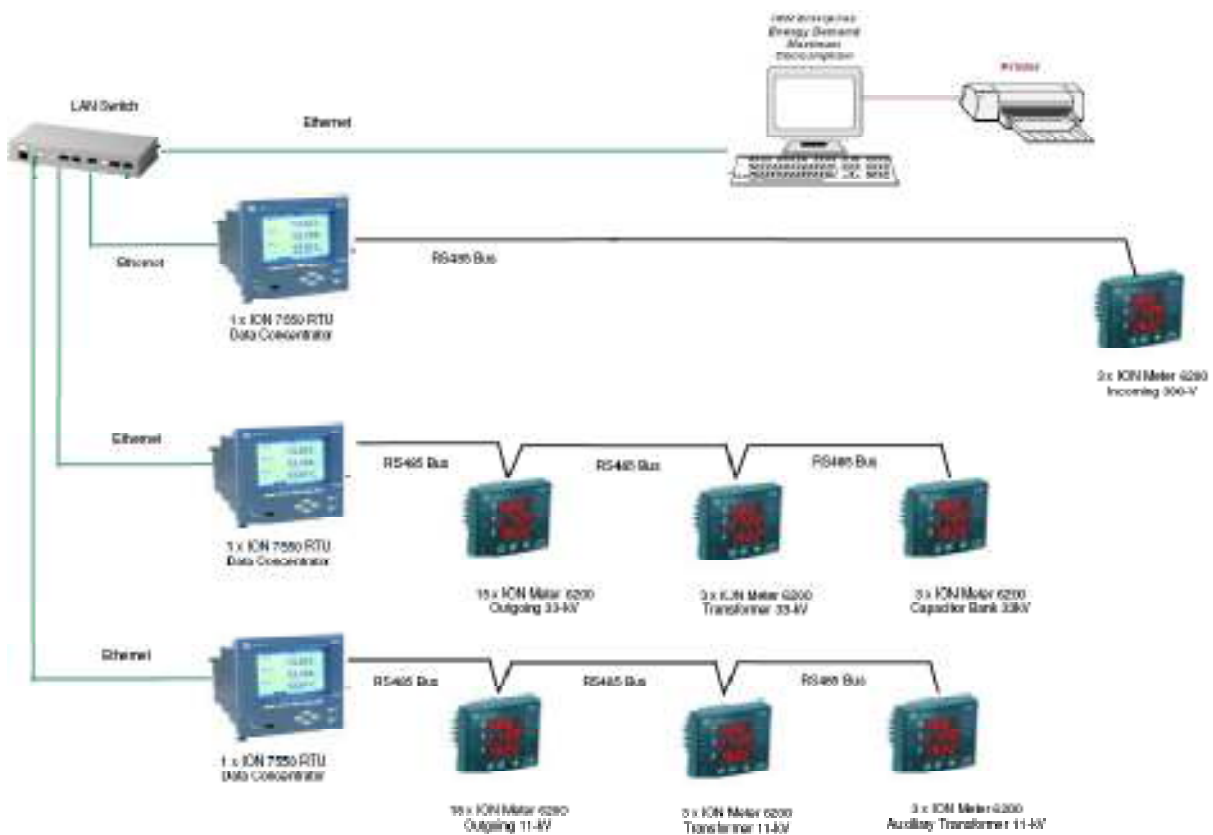


Fig. (2): The physical ION Enterprise Network Configurations of Falluja Substation

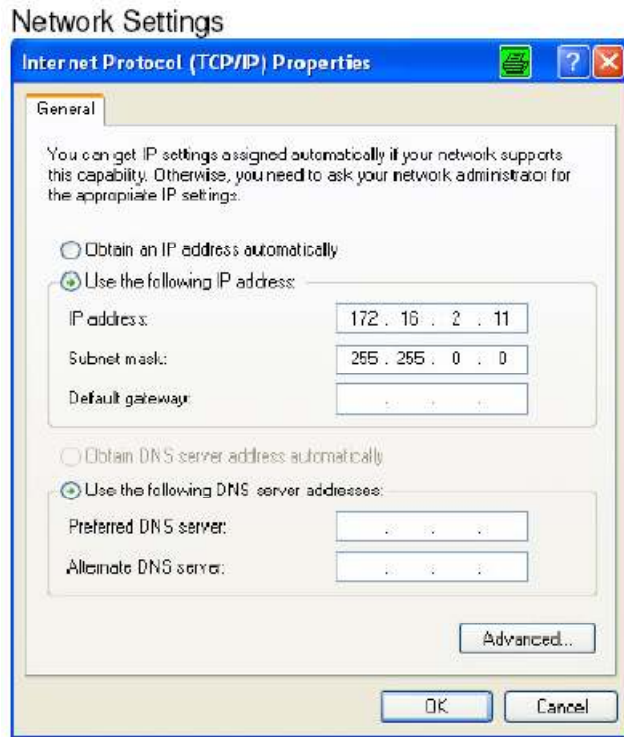


Fig. (3): The network setting of Falluja substation.

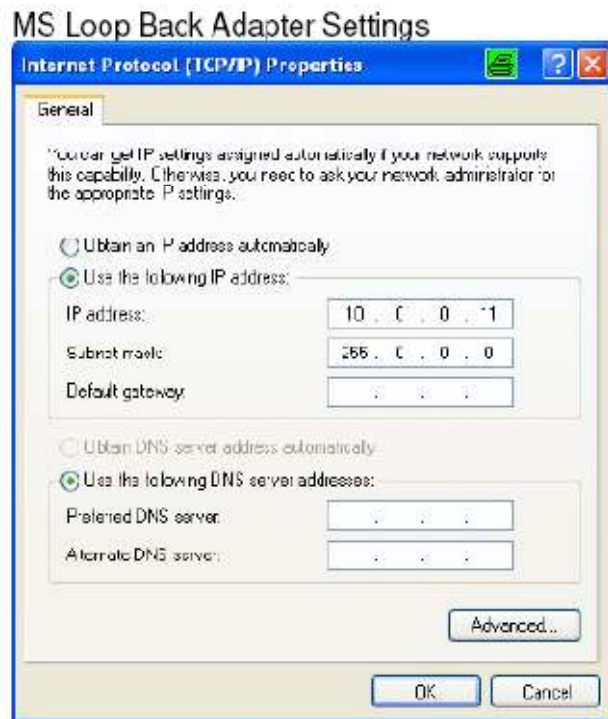


Fig. (4): The MS loop back adapter setting of the network



Fig. (5): The main window of the ION enterprise software

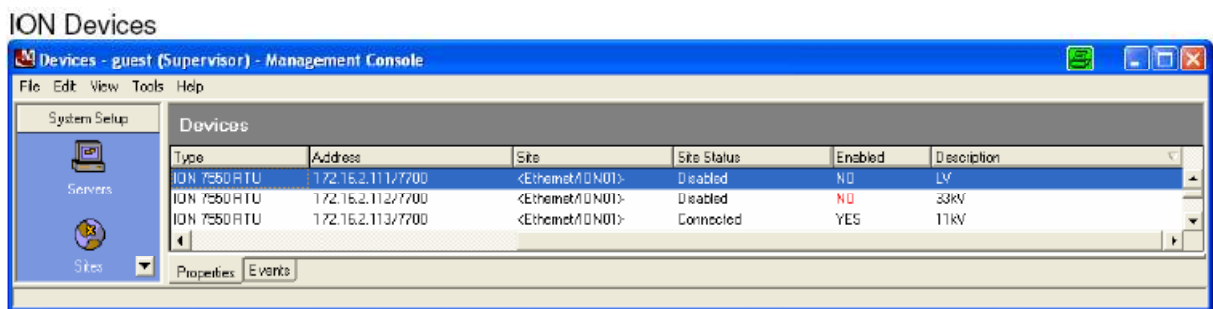


Fig. (6): Management console window of the ION enterprise package.

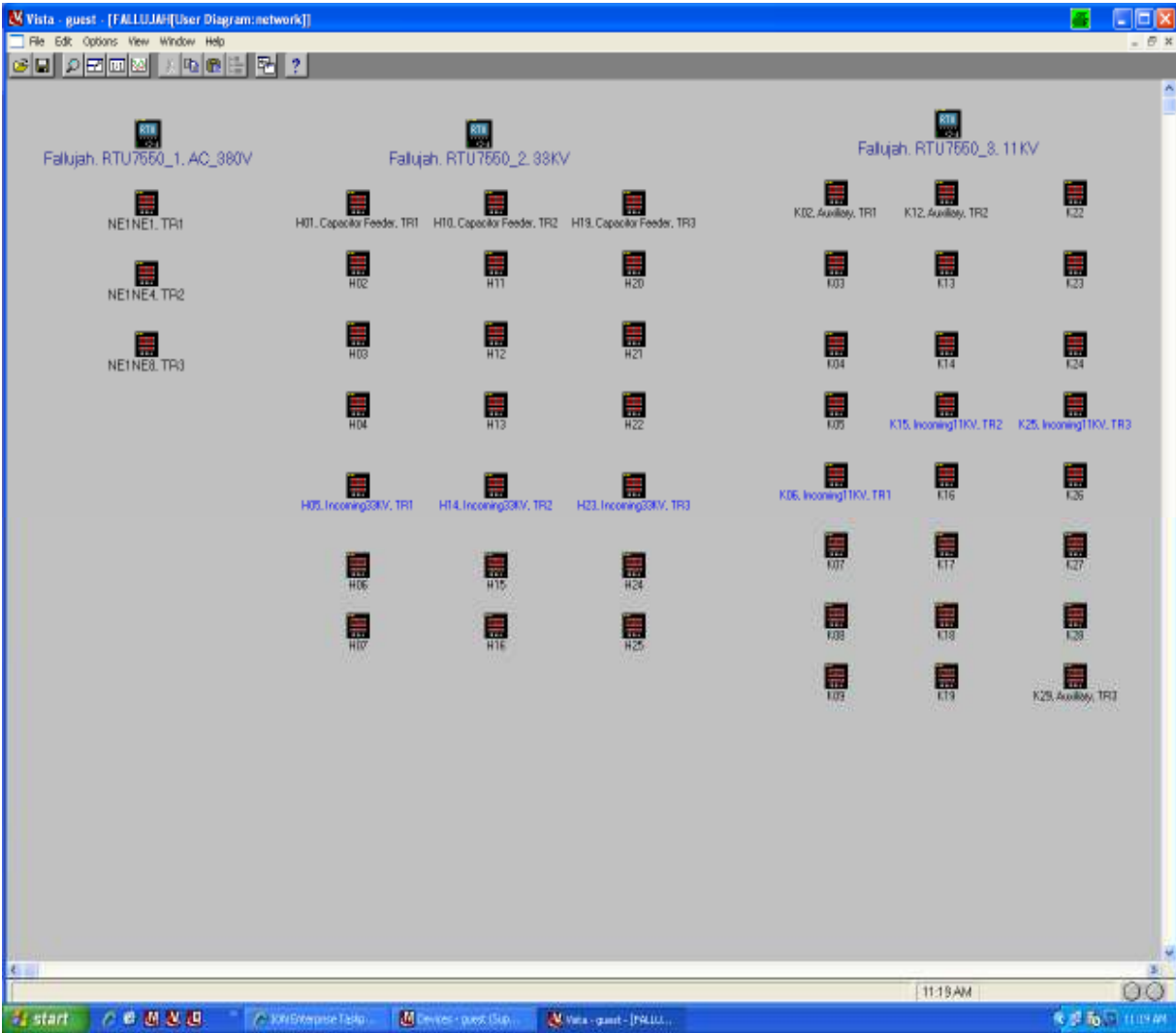


Fig. (7): The network diagram for Falluja substation

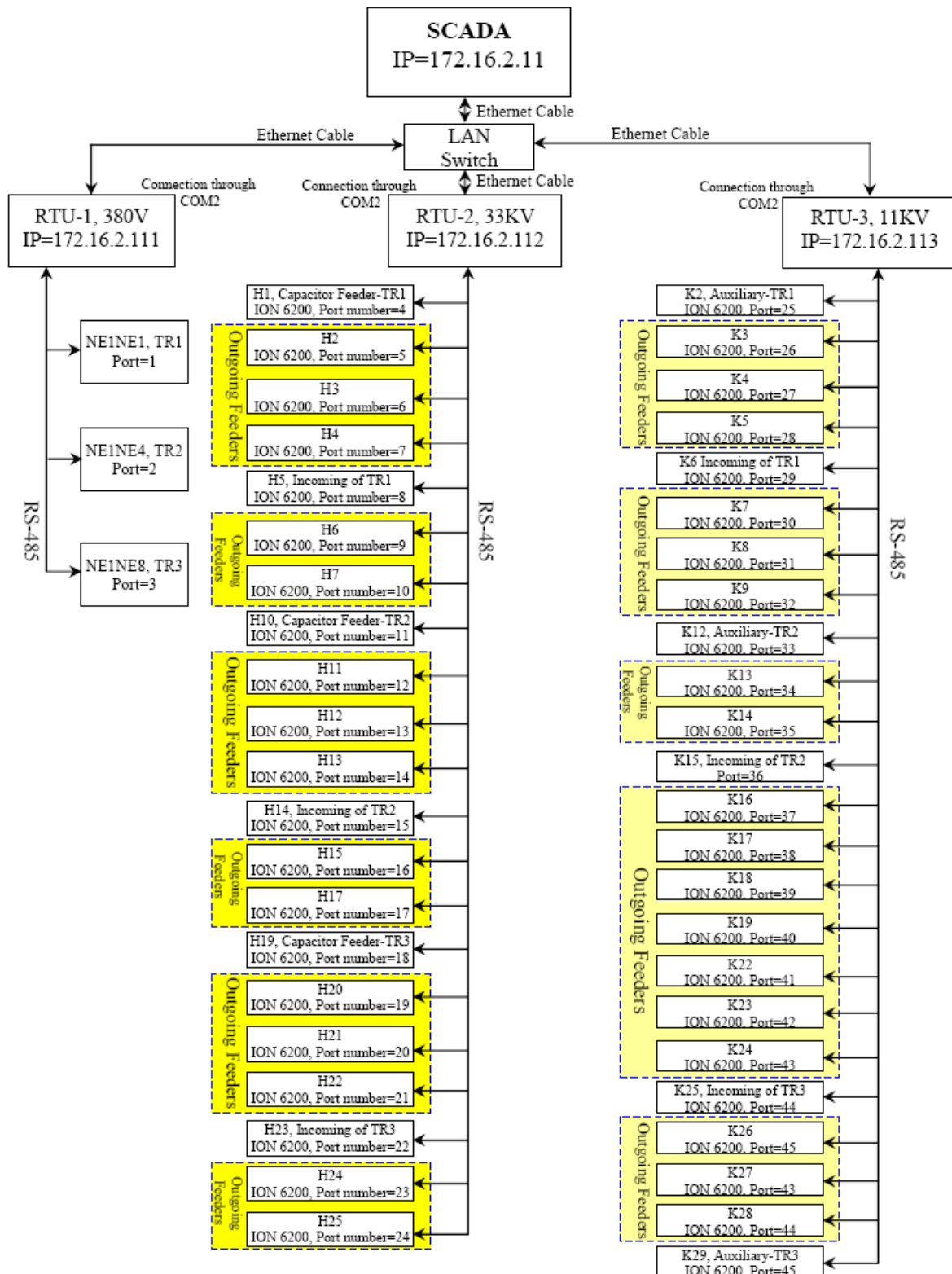


Fig. (8): The details practical network configuration for Falluja substation

H05



Fig. (9): Setting parameters to the ION 6200 meter (H5, incoming 33KV)

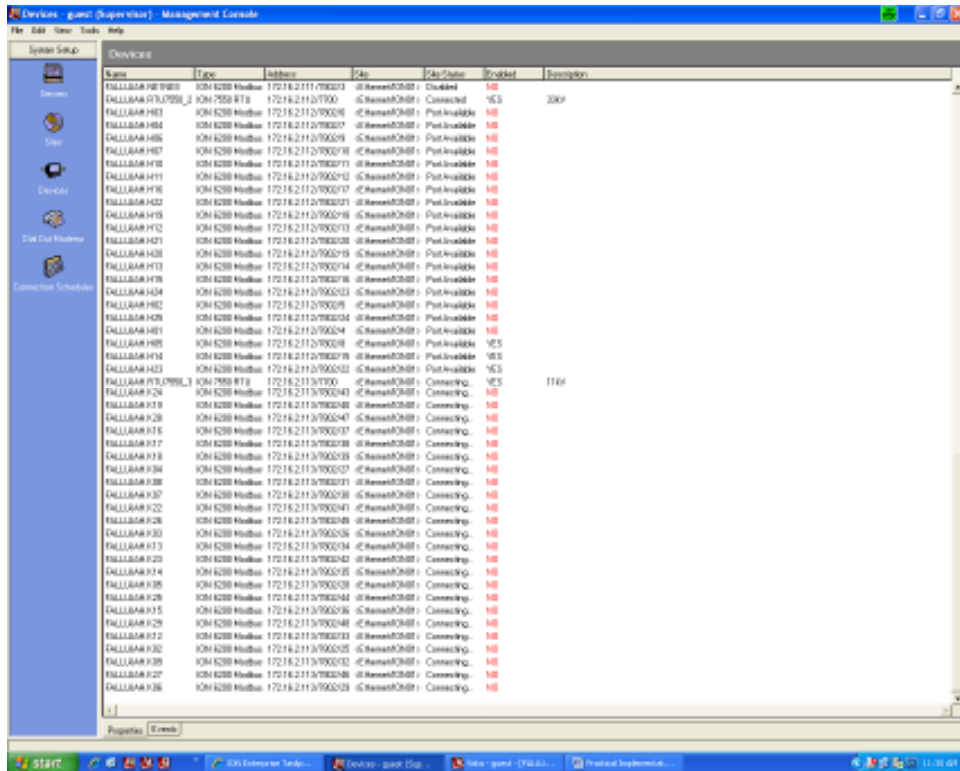


Fig. (10): Available devices of substation accessed from the Management Console

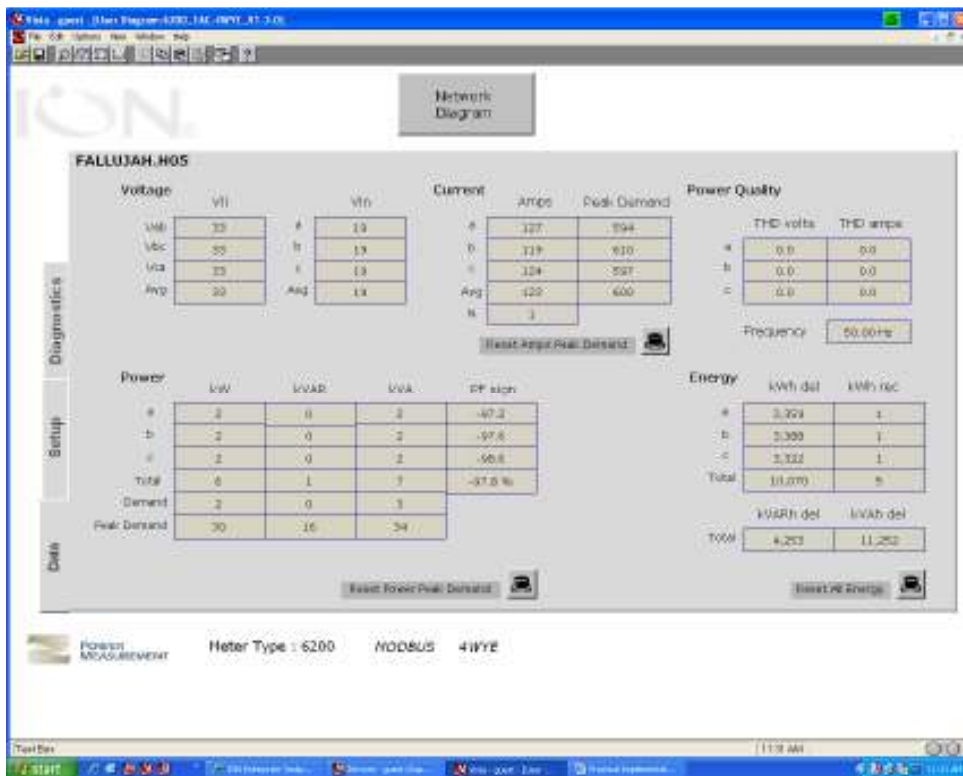


Fig. (11): Real time data of H5, incoming 33KV (TR1)



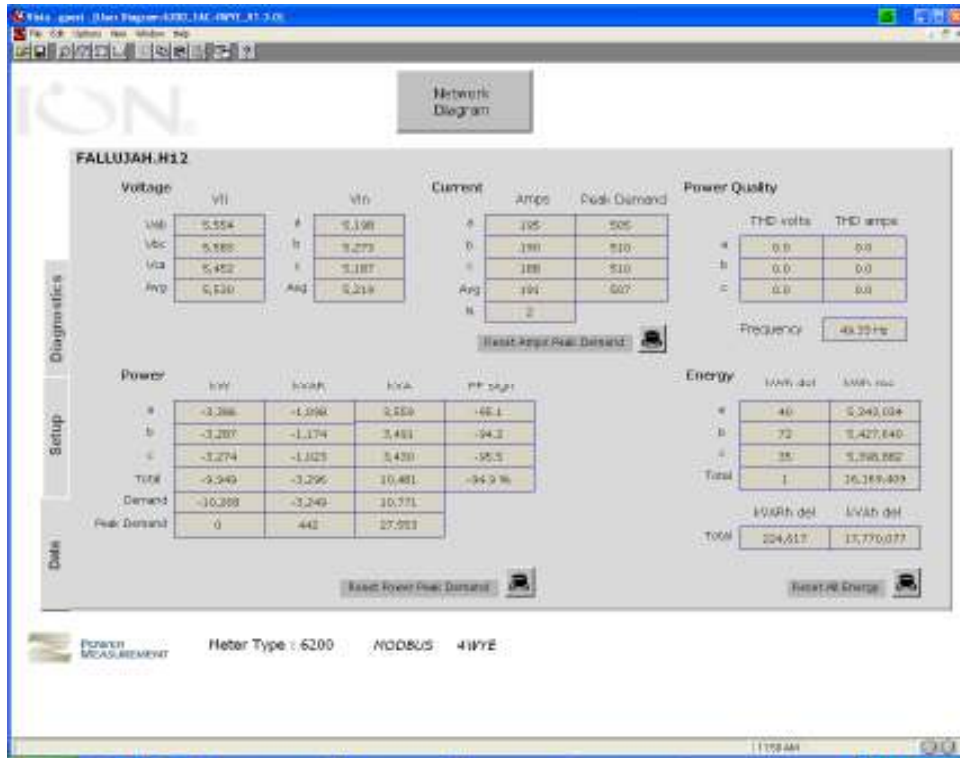


Fig. (12): Real time data of H12, outgoing 33KV (TR2)

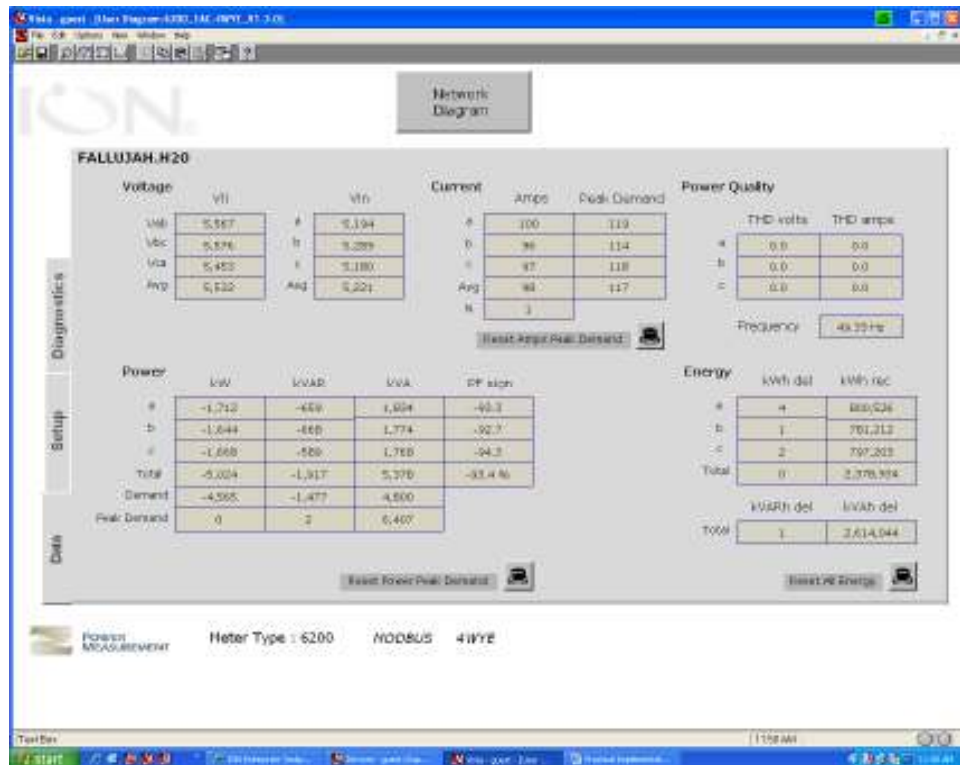


Fig. (13): Real time data of H20, outgoing 33KV feeder (TR3).



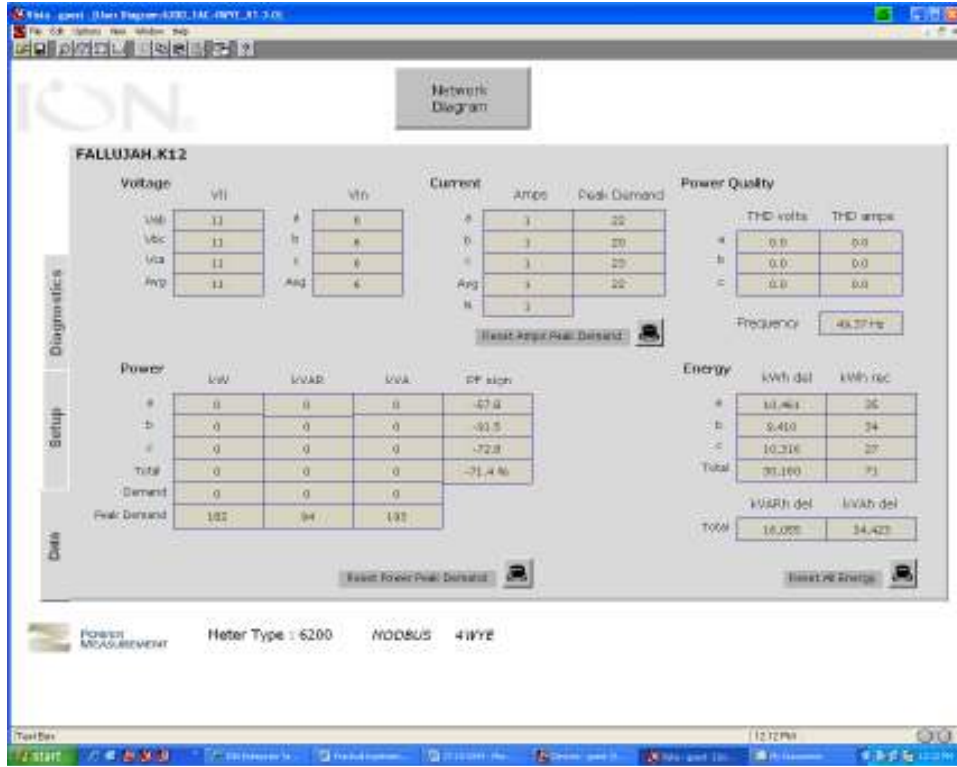


Fig. (16): Real time data of K12, auxiliary 11KV for TR2

## بناء منظومة السيطرة الاشرافية وجمع البيانات عملياً لمحطة توزيع الفلوجة الثانوية

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### الخلاصة:

أنظمة السيطرة الرقمية لمحطات التوزيع الثانوية رُكِبَتْ في مناطق مختلفة من العراق في السنوات الأخيرة. أغلب هذه التقنيات استعملت أنظمة سيطرة وجمع بيانات إشرافي (SCADA) بالوحدة الطرفية البعيدة (RTU) لمراقبة أجهزة القياس للوصول الى مغذيات الادخال والايخراج، بينما النظام الآخر استعمل أنظمة سيطرة منطق قابلة للبرمجة (PLC) للسيطرة ومراقبة النظام داخل المحطة الثانوية من قبل مهندسين محترفين. نظام مراقبة عملي بدأ من السيطرة وجمع البيانات الإشرافي بالوحدات الطرفية البعيدة قُدمت في هذه الورقة لمحطة الفلوجة الثانوية. هناك 3 من أدوات RTU يُستعمل لجمع البيانات من المقاييس ION 6200 رُكِبَتْ داخل صناديق فولتيات الادخال والايخراج للولطية المنخفضة (380V)، 33KV بالاضافة الى 11KV، ثم ان البيانات من كل وحدة طرفية بعيدة سُرسلت إلى حاسبة السيطرة وجمع البيانات الإشرافي (حاسوب رئيسي) عن طريق المسار الخاص للبيانات، استعملت السيطرة الإشرافية ونظام جمع البيانات برامج مشروع ION والمجهزة من قبل شركة AREVA بالاضافة إلى كل الصناديق التي جهزت من قبل نفس شركة. العديد من الصعوبات طُهرت أثناء العمل، مثل أخطاء IP، اختيار البارامترات، اختيار السياقات، وموائمة المقاييس تم حلها لحين الحصول على اشتغال طبيعي للمحطة.