

## Proton Plant - Tanjung Malim

# The Gateway for Intelligent Building Automation and SCADA System

### Design Concept

With the growing awareness in providing the best in automation technology, inCONTROL Tech Sdn. Bhd. (formerly known as VA TECH SAT Sdn. Bhd.) has once more proven itself to be a leader in automation technology. Having previously provided solutions to the top car manufacturers in Europe, this time attention has been focused on Malaysia's very own car industry, Proton, for its plant in Tanjung Malim, Perak.

iTEC has been entrusted with the task of providing an integrated Building Automation System (BAS) and Supervisory Control And Data Acquisition system (SCADA), implementing its best solution product. The scope of work comprises the design, supply, installation, testing and commissioning of both systems, or more precisely, one system with two views of the plant on a completely flat TCP/IP-based architecture. Amongst other things, these systems are comprised of process controllers with peripheral I/O modules, third party systems (integrated with BAS/SCADA) over higher-level communication interfaces and Man Machine Interface (MMI) systems.

The entire Proton plant is comprised of several areas as listed below:

- Energy Center
- Stamping Shop
- Body Shop
- Paint Shop
- Trim and Final
- Pilot Shop
- Waste Water Treatment Plant
- Outdoor Substation 2
- ETM Shop

The electrical- and plant processes of these areas will be monitored and controlled from a centralized control room in the Energy Center



Figure-1: Control Room

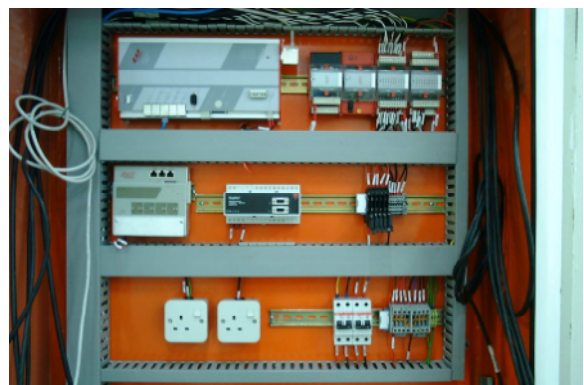


Figure-2: PLC remote panel

## ***Mechanical Systems***

The Building Automation System monitors and controls the different systems available through out the entire plant. These systems include the following:

- HVAC (Heating Ventilation Air-Conditioning)
- Water Supply
- Compressed Air
- Internal and External Lighting
- Sump Pumps
- Cooling Water
- Waste Water
- LPG, Etc...

Apart from direct control structure, the system should also allow scheduling of commands and PID Control for temperature and differential pressure parameters via modulating valves.

## ***Electrical System***

The electrical distribution system of the plant begins from a 33kV incomer Substation from the distribution network of TNB. This is then stepped down to an 11kV, 3.3kV and 415V networks to be distributed to the entire plant in a 'Ring' topology. Apart from the above, there is also an emergency supply network consisting of a generator set with an automatic switchover. Protection relays perform the control and monitoring functions for the individual switchgear, whereas, energy meters are utilized for metering functions.

The system iTEC has provided also has to integrate the system with local Programmable Logics Controller s (PLC) via open or proprietary protocols.

Automatic and user initiated generation of reports are implemented to keep track of the individual resource consumption for each building based on the number of vehicles produced.

The uniqueness of this project lies in the fact, that these two systems are constructed, and to be operated, independently from one another, but on a single platform, utilizing common hardware and the same MMI technology.

Since this SCADA system is the overall master of all the sub-systems, it was essential to have powerful open connectivity. With the use of OPC technology, it has been possible to integrate the third party systems to achieve overall system efficiently.

These systems have a **decentralized and independent philosophy** in their design and engineering process. This means that they have separate process controllers, I/O modules, MMIs and engineering philosophies. The net result is a **highly decentralized system** which is **completely interconnected**, providing on the one hand availability, and on the other, a complete view of the plant in one system.

Both the BAS and SCADA systems are subdivided into three levels:

- Field Level - Comprising I/O Modules, Digital Power Meters (DPM), 3rd party PLCs that acquire the field data and forward control commands on the bay equipment, and instruments.
- Process Controller (PLC) -Comprising Terminal Module (TM 1703) and Automation Component (AK 1703) systems. At this level the PLC acquires data from the first level equipment and forwards it to the MMI level.
- MMI Level - Presentation of acquired data in a graphical form, such as process images, alarm/events list, reports, archives etc.

Manually initiated control actions originate from the MMI level and are forwarded to the PLC level. Automatic control actions such as PID are performed at PLC level and appropriate actions to be taken are forwarded to the first level analog output modules for the regulation of the position of the adjustment valves. By having 'process intelligence' in the form of control logic at PLC level, a

decentralized control system has evolved. The advantage of this is improved reliability, performance, faster response times and greater availability.

**System Configuration**

The communication backbone for the plant is a **high-speed fiber optics network**. A virtual LAN was configured to enable communication between the PLC units in each building with the control room, which is located in the Energy Center. These are important factors when the end client demands an uninterrupted and high-speed communication for the control network. The operators in the control room perform the monitoring and control functions using four (4) separate workstations.

Two workstations act as the BAS server and the electrical server. The other two (2) workstations are the clients for its respective servers. However, with the right authorization, both functions can be accessed at any one workstation.

With a distributed control function in mind, two PLC units are placed in each main building. The first PLC unit serves as the controller for the mechanical functions and the second PLC unit is placed in the substation room to provide the electrical SCADA functions.

There is a **seamless integration** of equipment over different sets of protocol being implemented by the PLC without a need for third party protocol converters. The numerical protection relays for the electrical network are communicating over its own proprietary protocol. Most of the other subsystems such as the lighting system and wastewater management system are integrated into the system communicates over MODBUS. See Figure-3.

Extended remote I/O Modules are located through out each building. The remote I/O Modules extend the reach of the PLC unit. Each PLC is able to support up to 16 extended remote I/O Modules with each module handling up to 150 hardwired signals (digital input/output, analog input/output). This configuration allows the **reduction of hardware** necessary for each building.

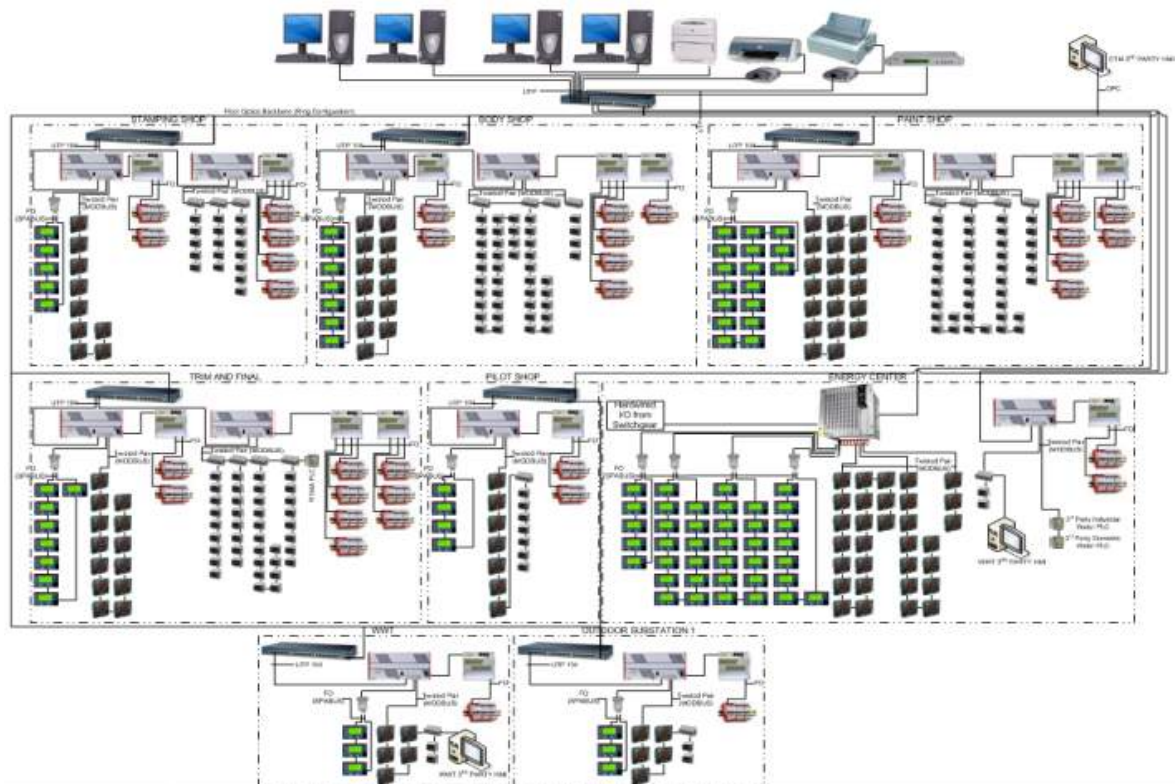


Figure-3: System Topology

**Process Control & Visualization**

The overall look and feel of the MMI for the Proton Plant has been based on the ZENON system from COPADATA. It provides a transparent, open interface between operator and process. Among its key features are realistic representations of process data, multi-window, multi-screen technology and freely customizable display hierarchies in order to enable the presentation of process information tailored to the user's requirements.

Take for example the Proton Plant. The processes flowing from both the cooling tower and expansion tank are represented in ZENON as they are in the real processing plant. See Figure-5.

ZENON also supports filter functions that allow selective access to online and archived information. Communication servers for the PLC systems. Numerous PLC interfaces are available for linking the system with the real process, which can be operated in parallel. The PC-based process control system family makes use of the features provided by Windows 2000; the result is a high level of availability, optimum multitasking features and excellent integration options. Windows 2000 provides a basis for both multiple and remote workplaces.

ZENON provides a user-friendly interface for the benefit of users of the system at all levels. With a familiar and proven user interface, which runs on a Windows 2000 platform, it simplifies the transfer of data between programs and ensures trouble-free integration of new peripheral devices.

Any new developments to the system can be carried out easily, and costs kept to a minimum, thanks to the marvels of the extensive software libraries included with ZENON.

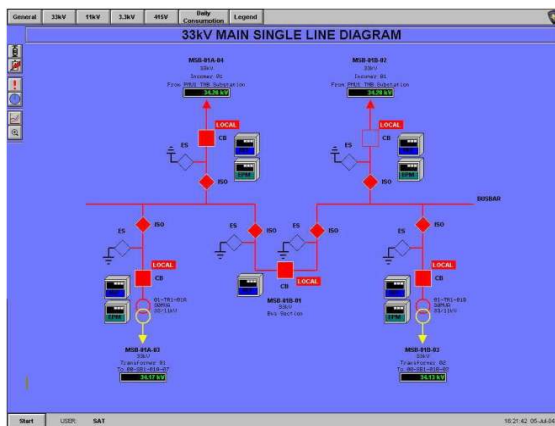


Figure-4: MMI electrical process

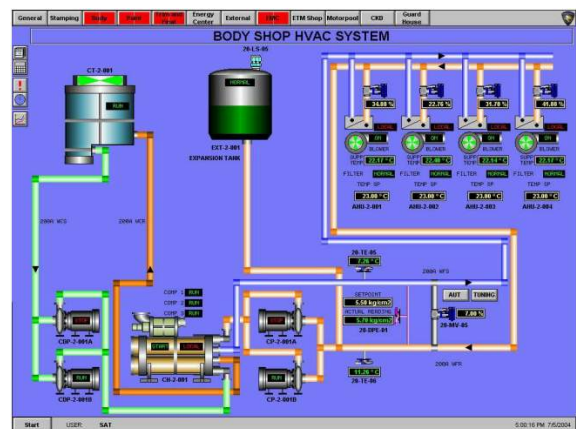


Figure-5: MMI mechanical process

**Special Functions**

**Report Function**

The supplied system includes a thorough reporting function for the analysis of energy consumption for the plant. The facility has decided to implement an internal billing system for the consumption of energy such as electricity, compressed air, domestic as well as industrial water supply.

The values are obtained from the digital power meters for the electrical consumption. On the other hand, the compressed air and water consumption are calculated from the flow meter values.

The operator is able to ascertain the energy consumption for each building in the facility from the HMI (Human Machine Interface). This report is configured to display the daily consumption in addition to the monthly consumption.

Moreover, the client is able to cross check the utility bills from external providers with the plants actual consumption.

## **Events and Alarms**

What is also interesting about ZENON, is that it also supports report generation and the Chronological Event List (CEL) function. Report generation allows the user to view the measured values stored by an archive function within ZENON itself. Here, the user can choose the name of the area or time and date of the specified measured values. As for the (CEL), this function provides a view of the total events that occurred on the particular day. It also supports a filtering function, so that the user can select on which particular date an event has occurred.

As for alarming, ZENON implements a unique function called Reaction Matrix (REMA) for linking a specific station with a class, which will be activated when an alarm occurs.

## **3rd Party Connectivity**

iTEC has successfully integrated a number of independent third party systems in the facility. This systems range from the Compressor Control System in Energy Center, Waste Water Management System in the Waste Water Treatment Plant to an earlier automation system being used in the ETM Shop. The open system concept makes the integration seamless and smooth.

## **PLC Component AK 1703**

The Automation Controller AK 1703 manages all I/O units and downstream communicable devices connected to it. It is responsible for data preprocessing and transfer to the master station system (MMI). In addition to its tasks in respect of network-capable communication, it also performs all automatic functions and data logic.

Based on this PLC system component, it provides all necessary performance characteristics, such as compact logging of values/binary information and full network capability.

Resulting from the overall sum of all systems concepts, the automation component AK is a modular, process controlled, parameterizable automation device, which, due to a uniform technology and architecture, fulfils all tasks of the integrated process control and telecontrol technology (local and widely distributed automation).



Figure-6: AK 1703

## **Special Features**

- Economical expansion of small stations with compact master control unit.
- Economical expansion of large stations with a large number of data points with the addition of up to 160 peripheral boards.
- Combined application of local automation with telecontrol functions.
- Flash technology for firmware and parameters (no batteries ensures non-volatile storage).
- Optical fiber technology for the parameterization tool connection and the detached automation periphery.

## **PLC Terminal Module TM 1703**

The TM 1703 PLC consists of the Master Control Element and the Peripheral Elements that can be expanded by adding modules, also situated in distributed locations.

The system concept creates the technological conditions necessary for highly complex and yet fully transparent automation solutions. The mechanical design is based on intelligent terminal modules that can be readily mounted on 35 mm DIN rails.

This PLC permits systematic reduction of hard-wired I/O interfaces through the direct connection of actuators and sensors with wire cross-sections of up to 2.5 mm<sup>2</sup>. Modules for binary input and output up to 220 VDC also open up streamlining potentials at the interposing level. For decentralized input/output, individual modules can be distributed as far away as 200 m.

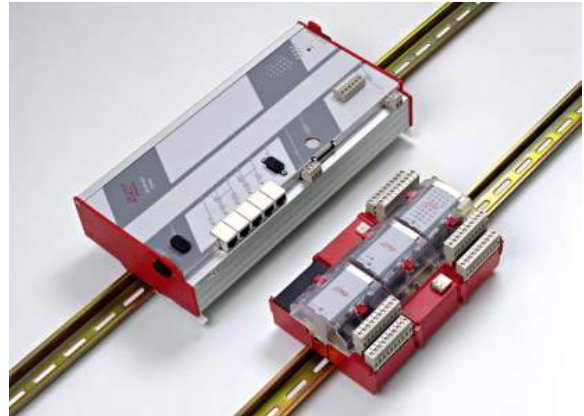


Figure-7: TM 1703

For the management of parameters, this PLC is based on Flash Card technology, as used in digital cameras. This ensures full Plug & Play capability for the component replacement procedure. Using the Flash Card, one can import the parameter configuration into the replacement part. This eliminates loading via a personal computer, since the parameters required are always available locally. Together with comprehensive remote diagnostics functions, this helps to reduce downtimes to a minimum.

This PLC permits the usage of a host of different media for local and remote communication. The universal implementation of the IEC 60870-5-101/103/104 standard guarantees consistent addressing from acquisition to output. The implementation of numerous third-party protocols also ensures the seamless integration into existing automation networks. As for the engineering database system, the software tool enables the utilization of the properties of similar types of primary units and equipment (e.g. pumps, circuit-breakers, feeders, etc.) also for the parameter configuration. The close interfacing with design tools such as ELCAD ensures the consistent, uniform documentation of the global system all the way down to circuit diagram level.

## Conclusion

With all the best in technology and processes automation, iTEC has once again proven itself to be a leader in automation technology, by engineering and commission a highly reliably system to empower operators and system owners for high performance process management and control.