# RTU AND MTU

# Elements of SCADA

Elements of a SCADA system

- Sensors and actuators
- RTUs and PLCs
- Communication
- MTU

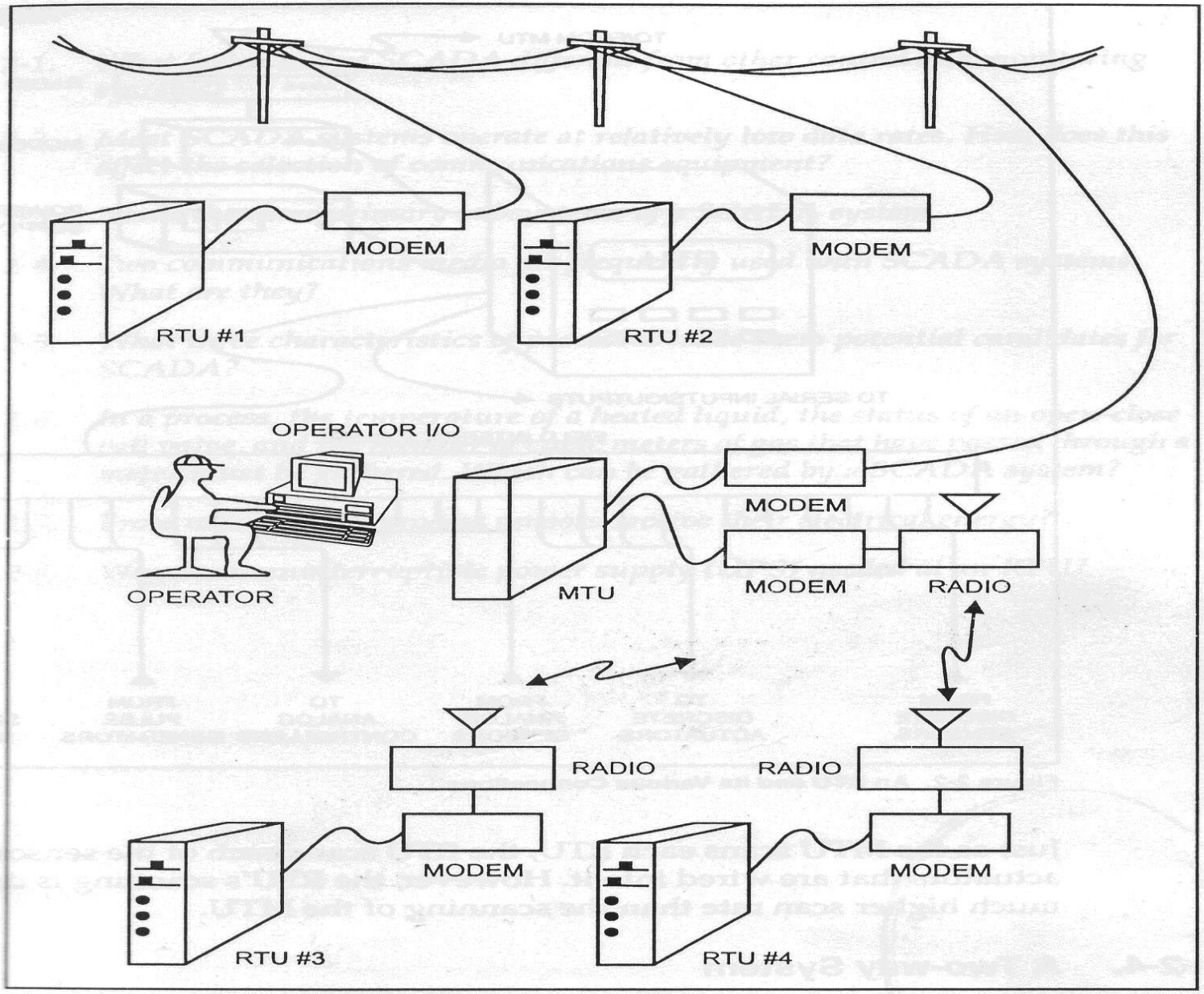



Figure 2-1. Major Components of a SCADA System

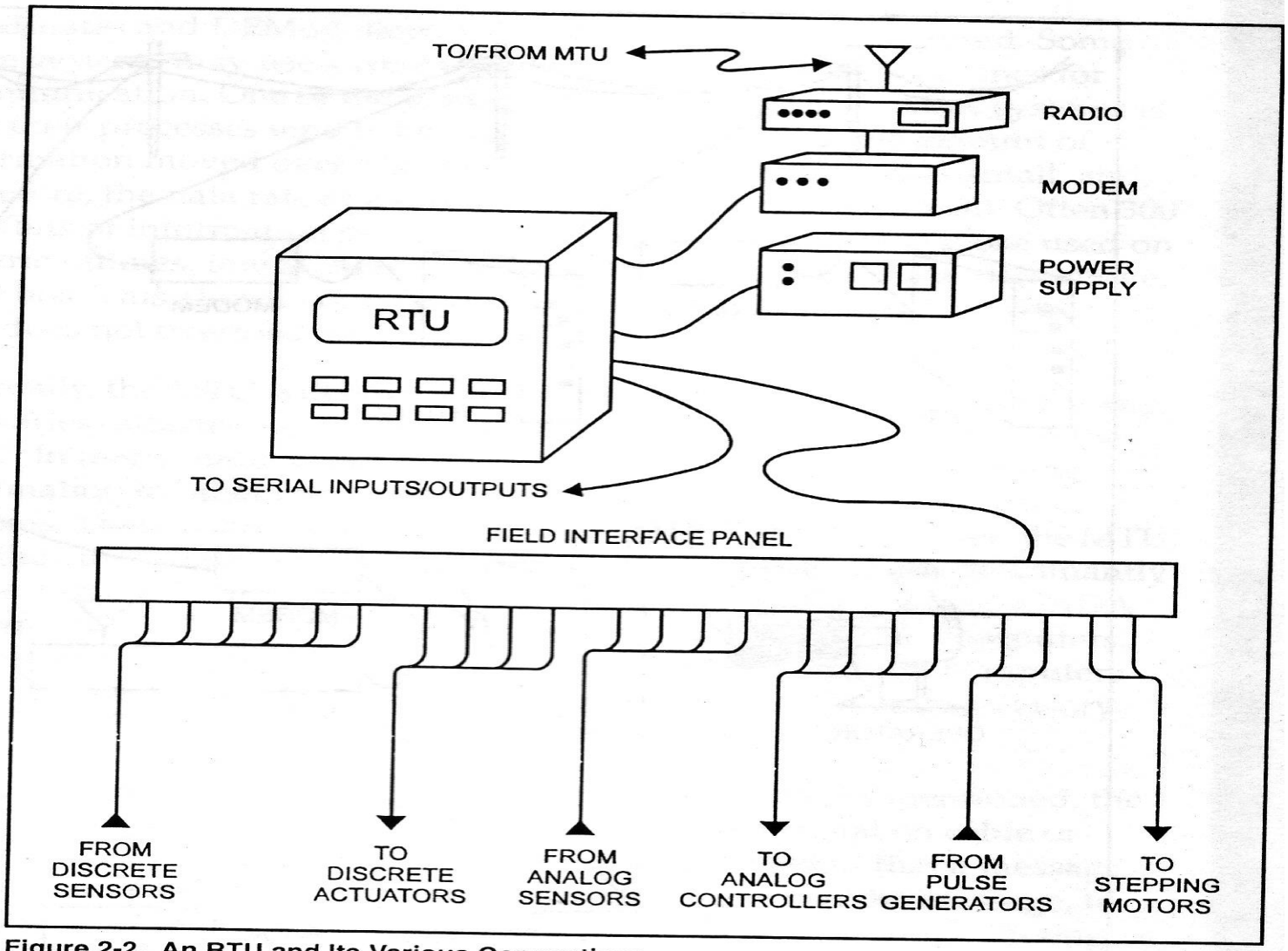



**Figure 2-2. An RTU and Its Various Connections**

# RTUs

RTU – Remote Terminal Unit

- Intelligent to control a process and multiple processes
- Data logging and alarm handling
- Expandable
- Asks the field devices for information
- Can control IEDs (Intelligent Electronic Device)
- Slave/Master device

# WHAT DOES AN RTU DO?

- The connections between the RTU and field devices are most often made with electrical conductors-i.e wires. Usually RTU supplies the electrical power for both sensors and low-power actuators.

- RTU scans each of the sensors and actuators that are wired into it.

- RTU gathers information from the field devices about analog values, alarms and status points, and metered amounts.

- It keeps this information available in memory until the MTU asks for it.

- When the RTU sees its specific address embedded in the protocol, data is interpreted and the CPU directs the specified action to take i.e it codes and transmits the information to the MTU.

- In addition, when the MTU instructs, the RTU opens and closes valves, turns switches on and off, outputs analog signals that may represent set points, and outputs pulse trains to move stepping motors.

- RTUs are now being offered that have the ability to receive and send messages to field devices in serial format, usually RS-232.

- In near future, we can expect that serial communications in the form of fieldbus will outnumber the 4-20mA analog signals used now.

- The protocol used can be open like Modbus, Transmission Control Protocol and Internet Protocol (TCP/IP).

- Some RTUs, called “smart PLCs” or Remote Access PLCs (RAPLC) provide remote programmable functionality while retaining the communications capability of an RTU.

# MTU

- Front End Processor
- SCADA server
- Historical/Redundant/Safety Server
- HMI computer
- HMI software

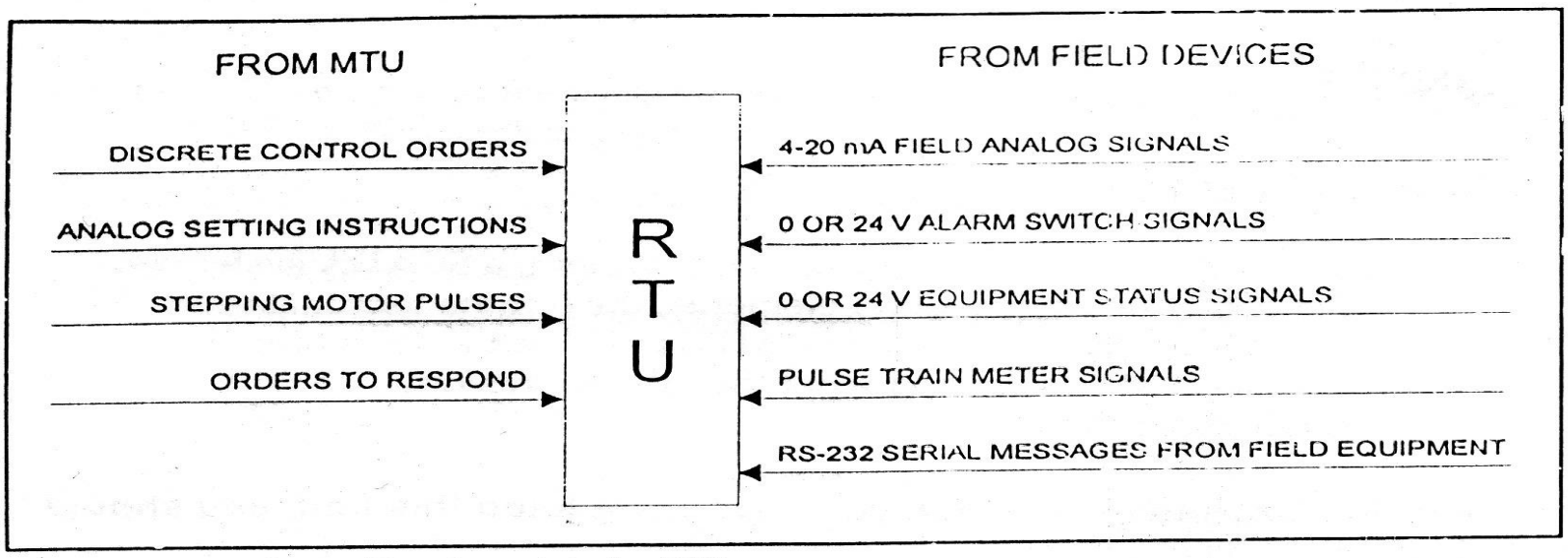



**Figure 8-1. The Signals That Come into the RTU**

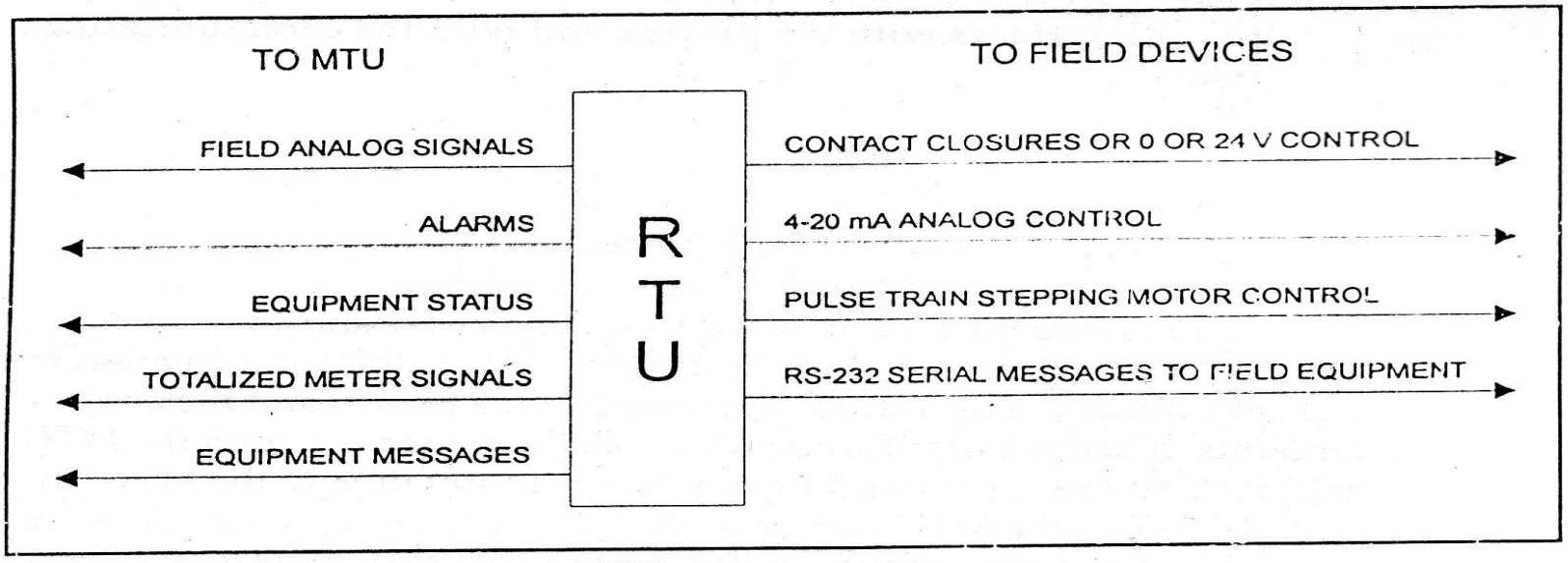



**Figure 8-2. The Signals That Leave the RTU**

# MTU

Front End Processor

- Gathers all communications and converts them into SCADA friendly communication
- Communication interface between several RTU channels and the host Master Station computer

# SCADA server

- It can be a Web server
- Data logging
- Analyzing data
- Serve the clients through a firewall
- Clients connected in the corporation or connected outside through internet
- Real-time decision maker
- Asks RTU for information

# Historical server

Historical/Safety/Redundant Server

- Logs the data from the SCADA server and stores it as a backup, in case of a disaster
- It is basically a safety server

# HMI Computer

Human Machine Interface Computer

- Access on the SCADA Server
- Control the system
- Operator Interface
- Software
  - User friendly
  - Programmable (C, C++)

# COMMUNICATION INTERFACE

- MTU is always uses the same medium that RTU uses to send the data.
- MTU has the same communications interface capabilities and equipment that of RTU.
- The major difference is that, as a slave, the RTU cannot initiate a conversation; as a master, the MTU can.
- MTU can be triggered by manual instructions from the operator or by other programs within the MTU.
- More than 99% of all the messages from MTU to RTU are automatically initiated.
- The MTU must also communicate to the printers and CRTs that form the operator interface.
- Many MTUs are required to pass data upward to accounting computers, corporate business computers, or computer networks.
- At this level, peer-to-peer communication is more common than master-slave communications. Nearly all of this communication is handled by LANs.

- The operator interfaces with the MTU, which is the system controller.
- A MTU in modern SCADA is always based on a computer.It can monitor and control the field even when the operator is not present.
- It does this by means of a built-in scheduler that can be programmed to repeat instructions at set intervals.
- MTUs must communicate with RTUs that are located from the central location.
- A SCADA s/m may have as one RTU or as many several hundred.
- There are two common media of communication,landline, which takes the form of optical fiber cable or electrical cable.In either case, a MODEM is required. Some large s/ms may use a combination of both.
- The screen must be described (VGA,EGA,color,etc.), and the report printer must be described (protocol,layout,etc.)
- Similarly the printer must also be described (portrait, parallel).

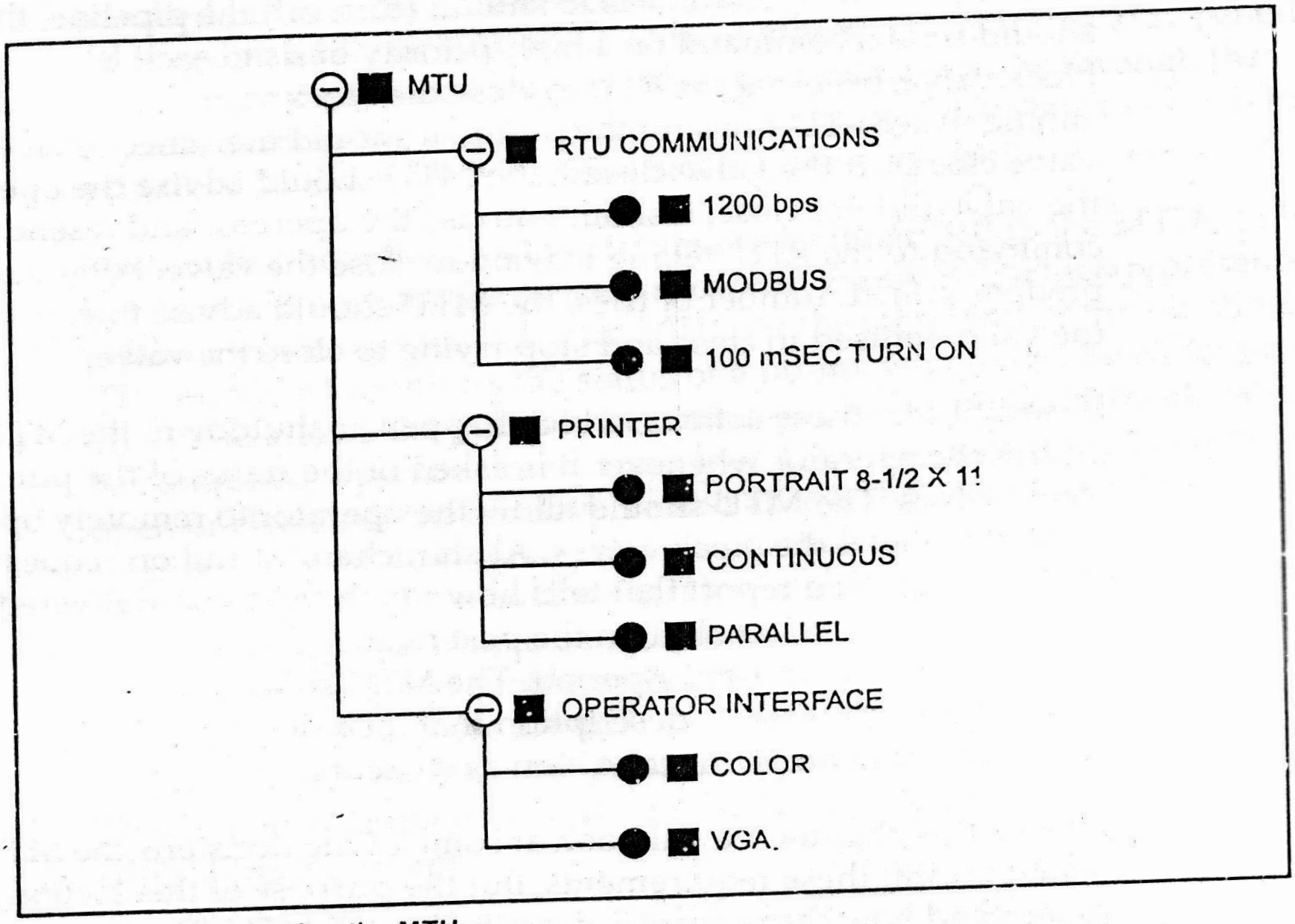



**Figure 9-2. Configuring the MTU**

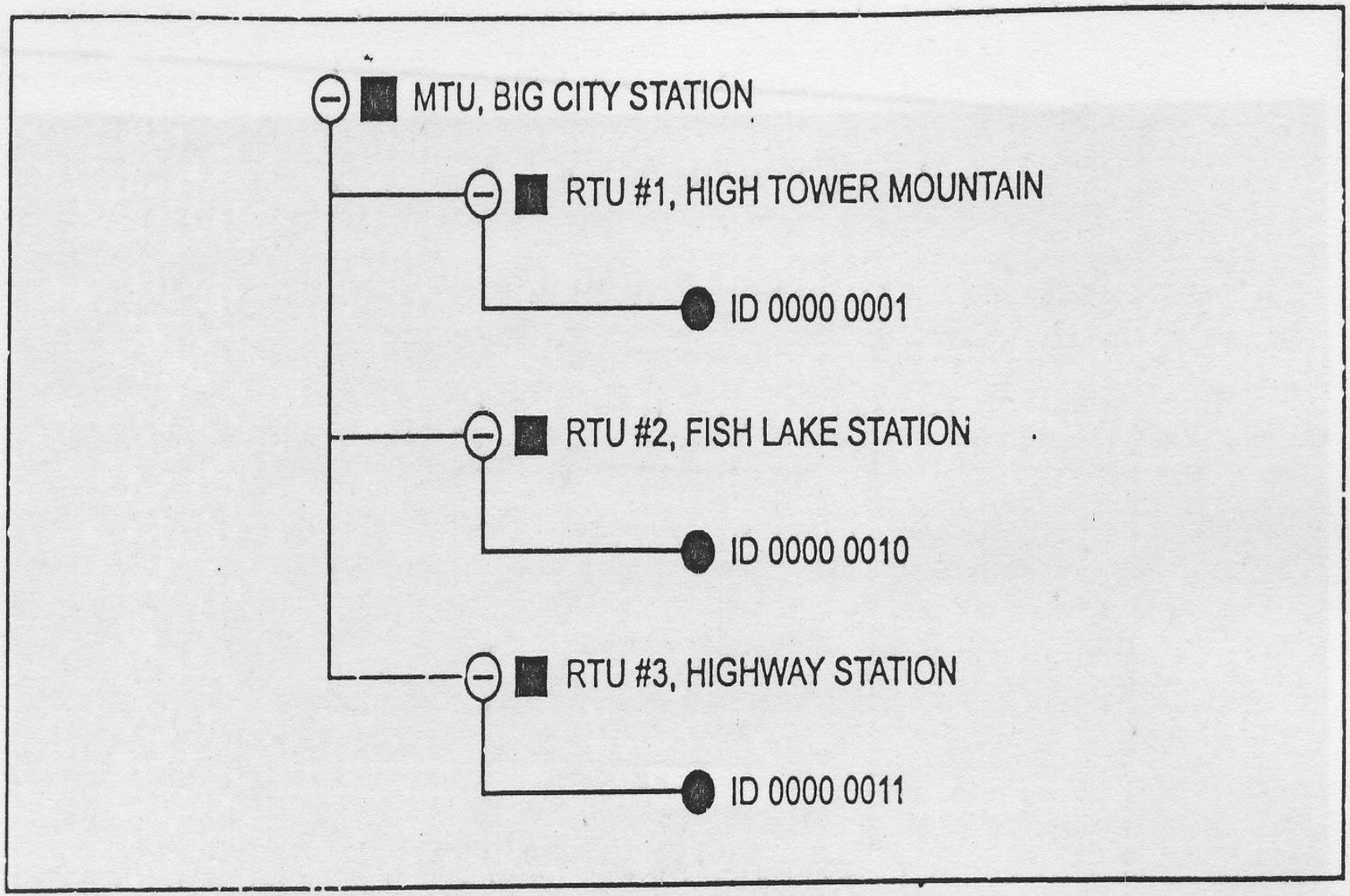



Figure 9-3. Three RTUs and Their Identification Numbers

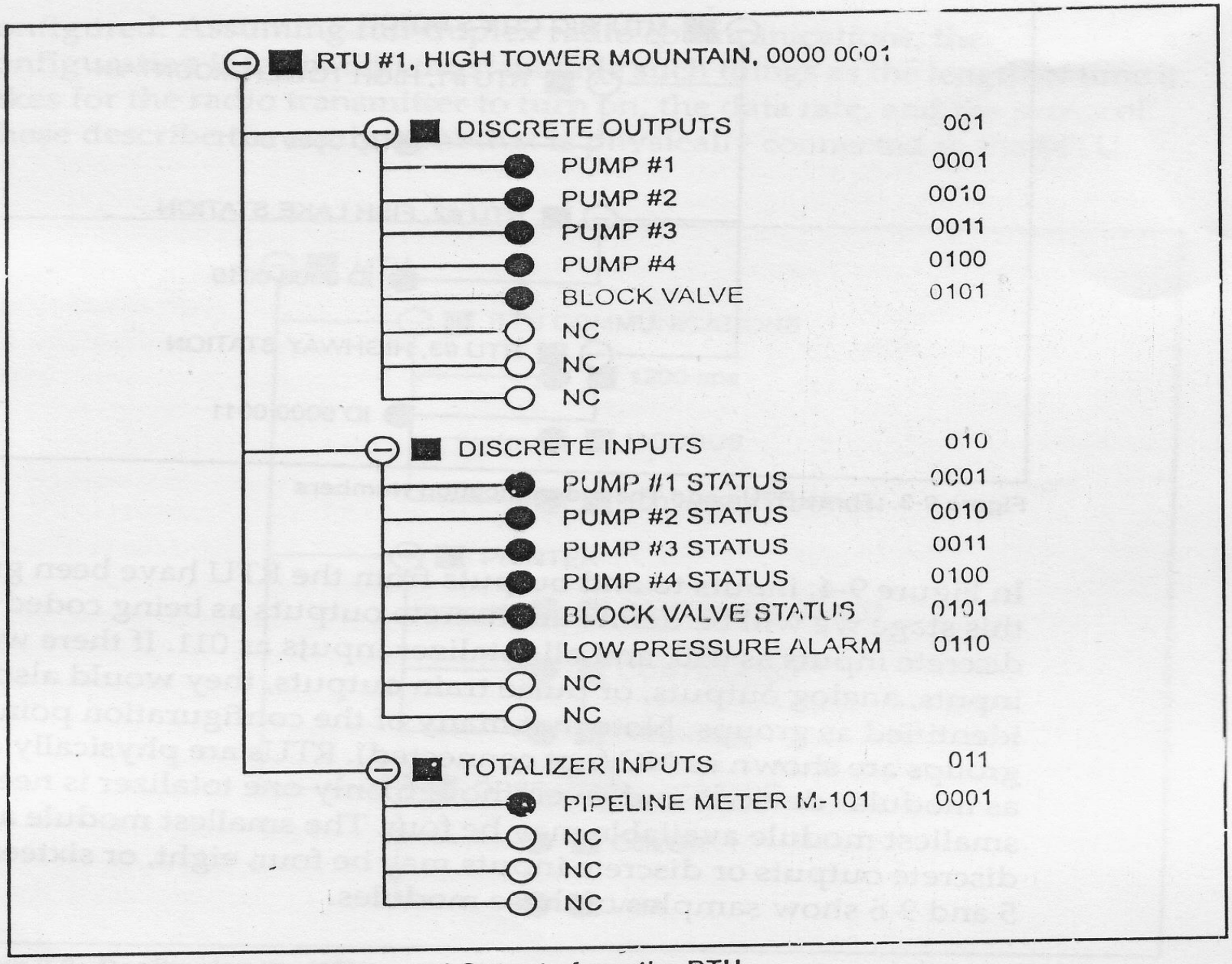
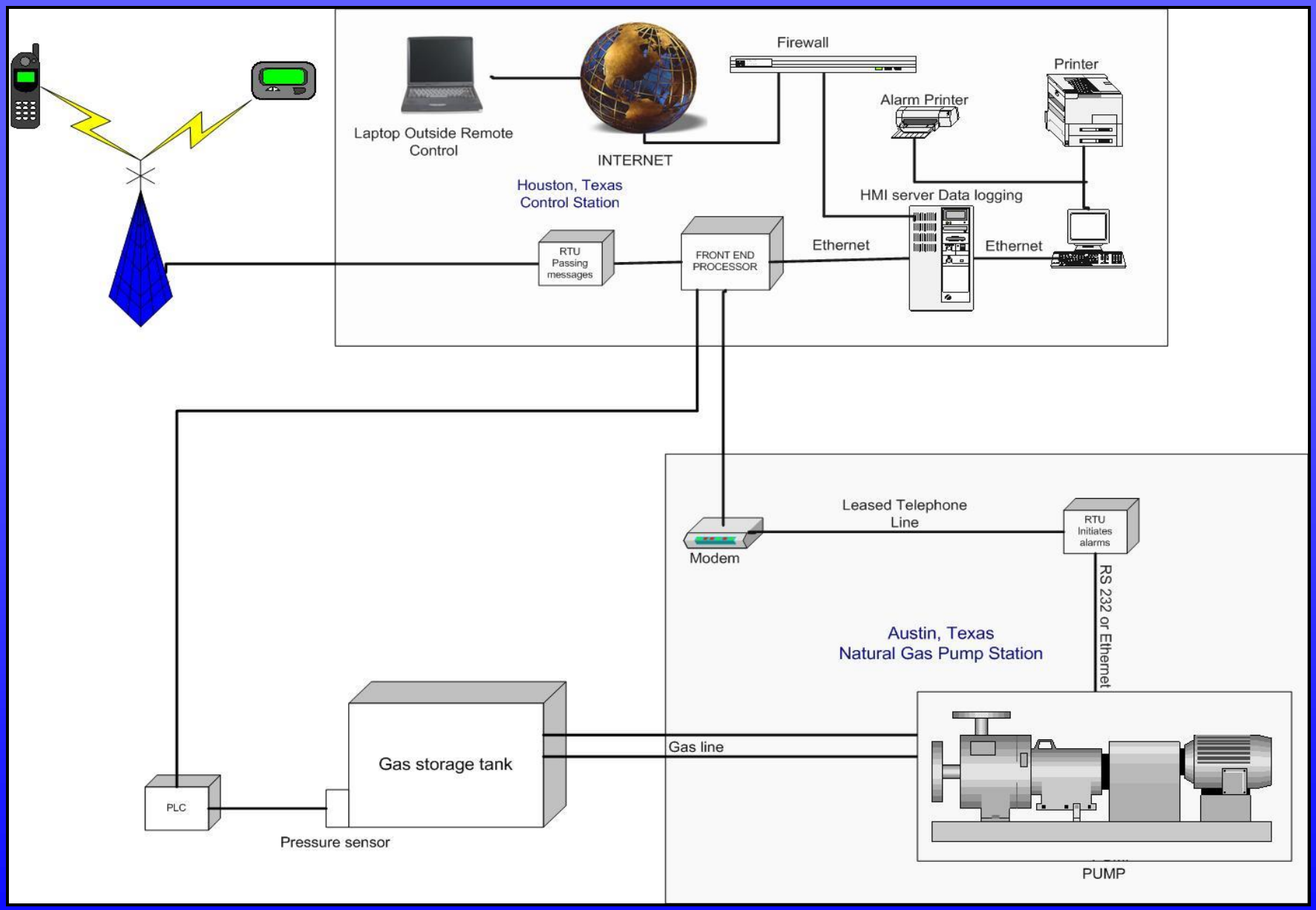
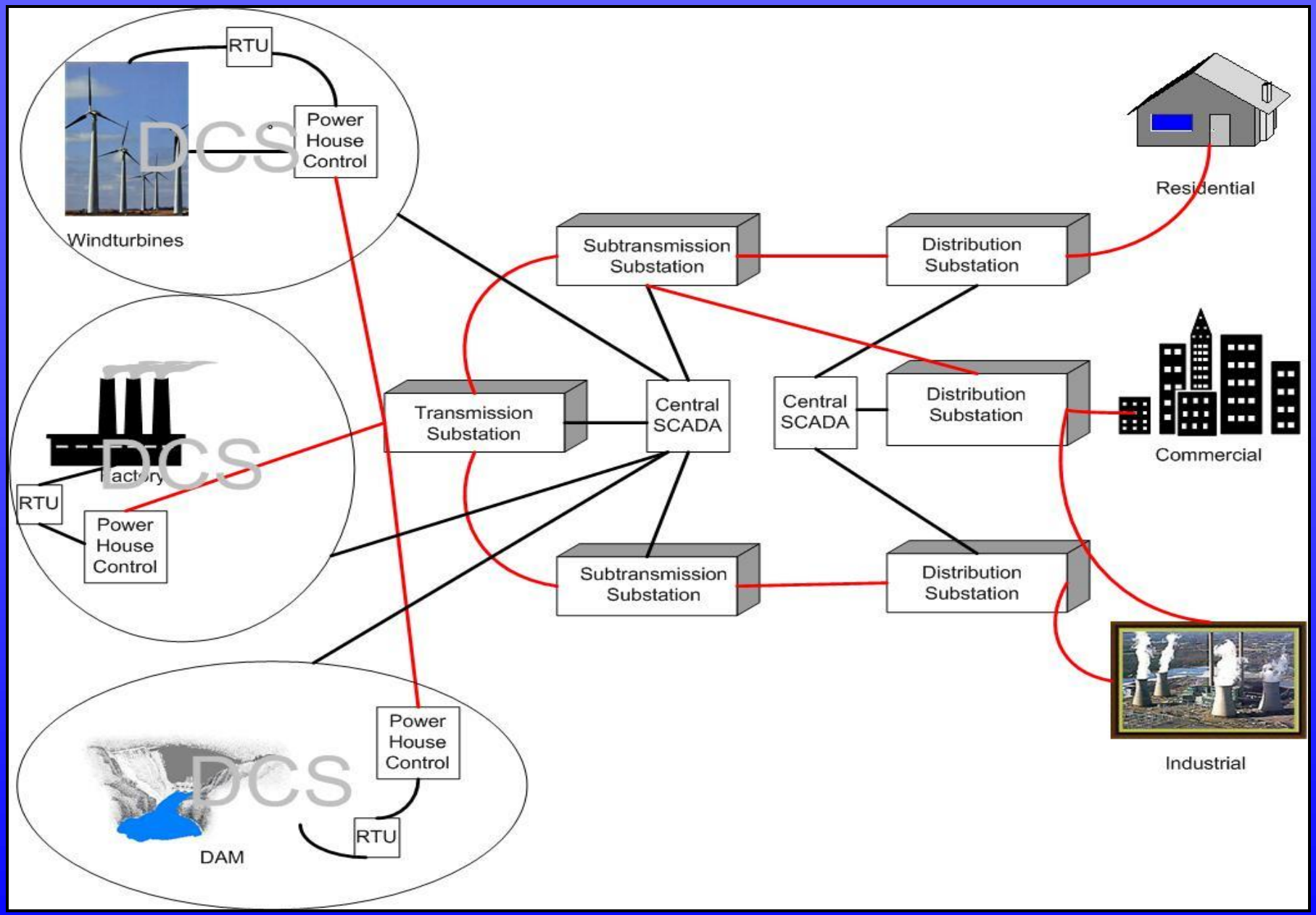



**Figure 9-4. Grouped Inputs to and Outputs from the RTU**

# Gas SCADA


Laptop Outside Remote Control
INTERNET
Firewall
Printer
Alarm Printer
Houston, Texas
Control Station
HMI server Data logging
RTU
Passing
messages
FRONT END
PROCESSOR
Ethernet
Ethernet
Modem
Leased Telephone
Line
RTU
Initiates
alarms
RS 232 or Ethernet
Austin, Texas
Natural Gas Pump Station
Gas storage tank
Gas line
PLC
Pressure sensor
PUMP

# Power SCADA

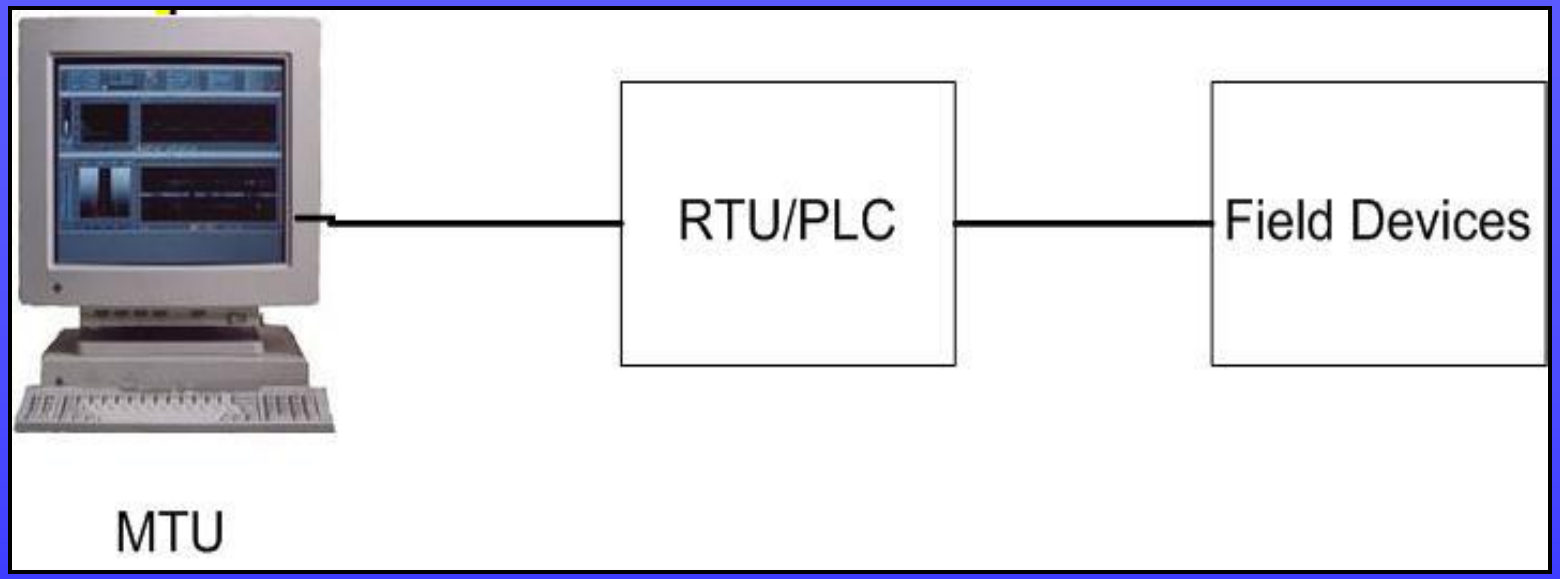

RTU
Power House Control
DCS
Windturbines
Residential
Subtransmission Substation
Distribution Substation
Transmission Substation
Central SCADA
Central SCADA
Distribution Substation
Commercial
RTU
Power House Control
DCS
Subtransmission Substation
Distribution Substation
Industrial
Power House Control
RTU
DCS
DAM

# SCADA system types

Three types of basic SCADA systems:

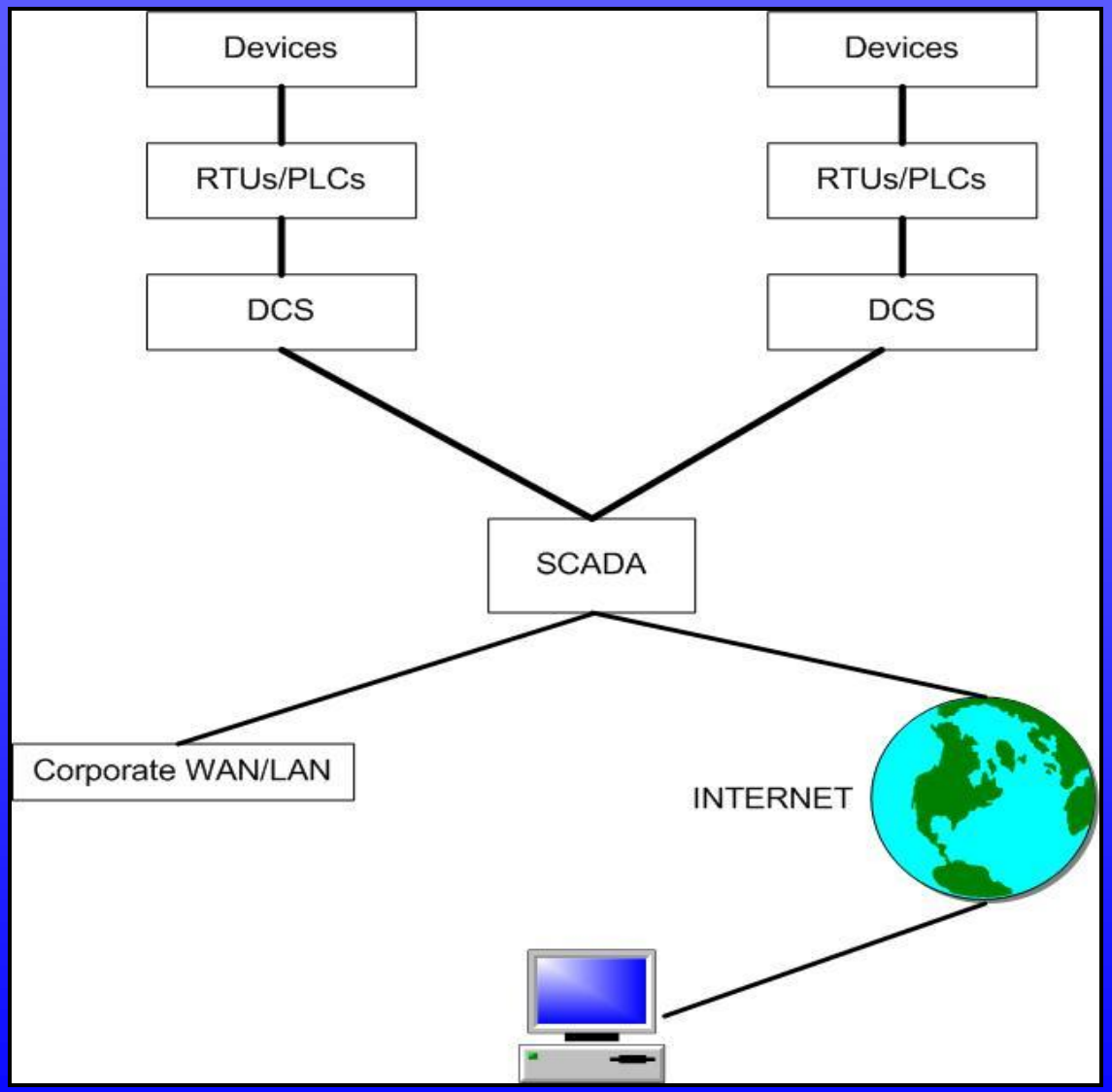
- Basic SCADA
  - One machine process
  - One RTU and MTU
- Integrated SCADA
  - Multiple RTUs
  - DCS
- Networked SCADA
  - Multiple SCADA

# Basic SCADA



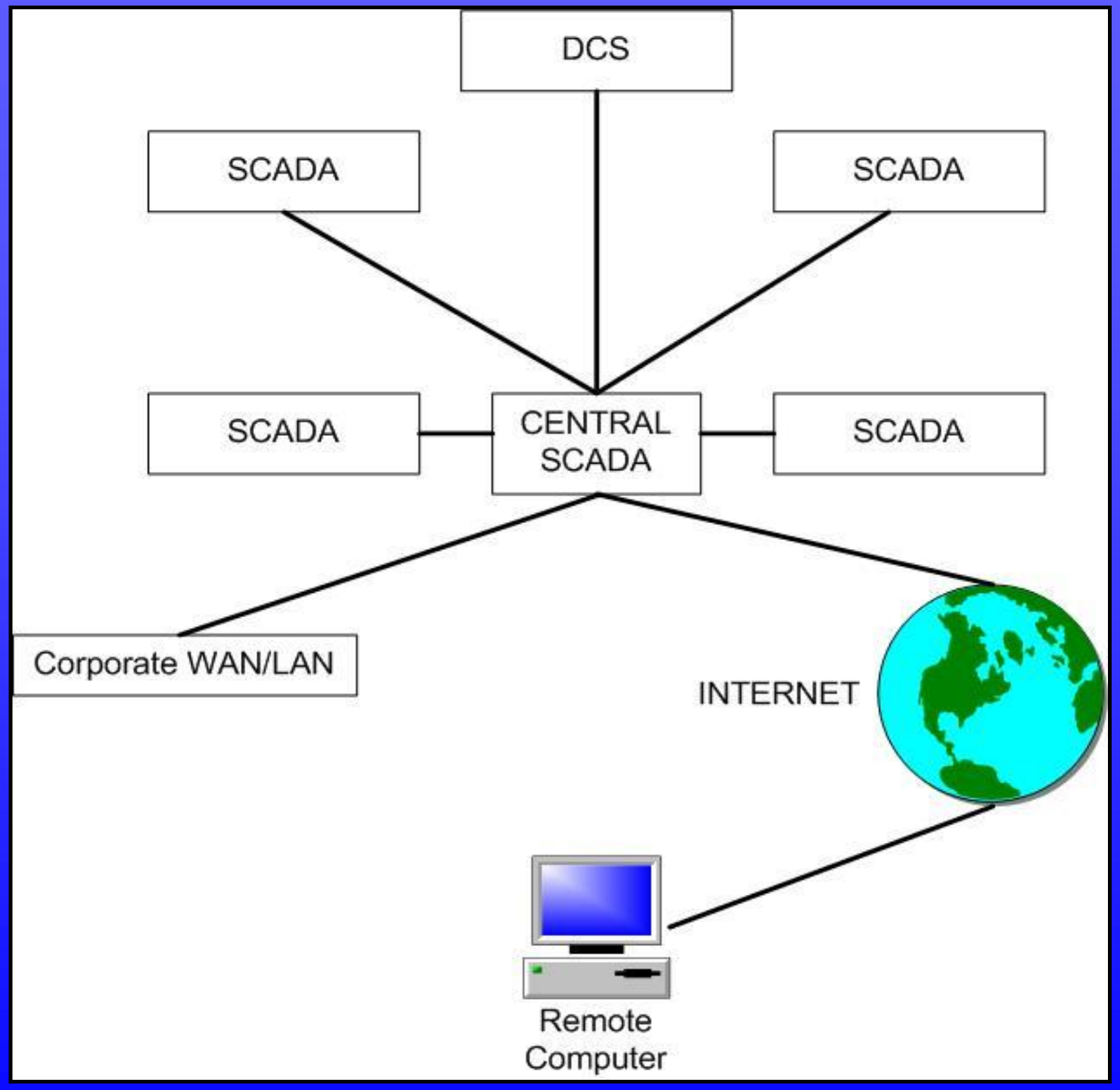

- Car manufacturing robot
- Room temperature control

# Integrated SCADA




- Water systems
- Subway systems
- Security systems

# Networked SCADA




- Power systems
- Communication systems