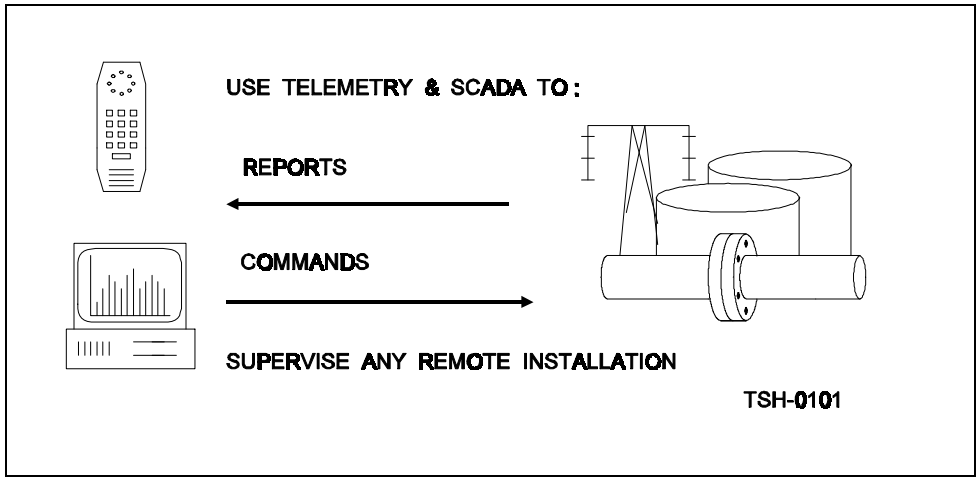
CHAPTER 1, WHAT IS TELEMETRY?

1.A THE FIRST TELEMETRY SYSTEMS:

The earliest use of telemetry in the US was probably when the native Americans exchanged smoke signals from hilltop to hilltop, for example: "The buffalo herd is now 30 miles from the river".

'30 miles' was a measurement they had made and then transmitted. There have been refinements over the years, of course, but the telemetering principle is still the same today. 'Tele' is distance, 'meter' is to measure. In other words, you transmit measurements over some distance. In additions to measurements, you can also transmit commands, such as: "Get me three fat bulls".



To take a modern example: Say you have a water tank on a hill and a pump at a water well below the hill. Without telemetry, you will have to send your man Charlie out to the tank. He measures the level and comes back and reports. If the tank is not full, you send Charlie out to the pump with instructions to run it for as long as you think it will take to fill the tank.

This method is very inefficient and costly. If the tank overflows you may face lawsuits from the property owners below the tank and if the tank runs dry you will loose revenue and irritate the homeowners. And you can't really afford to send Charlie out there either, day and night.

Sending smoke signals from the tank and from the pump is not a valid alternative. Modern telemetry to the rescue! You simply install an RTU (Remote Telemetry Unit) at the tank, another RTU at the pump and an RTU (or a computer) in your office and your problems are over. You can now relax and read the tank level and start and stop the pump from the comfort of your office and Charlie is free to do more productive work (and free to go home at night).

Telemetry and SCADA systems using a variety of RTUs are used for industrial control and supervision all over the world. These systems drastically cut operating costs and allow the automatic supervision and reporting needed in today's regulatory environments.

1.B WHAT KIND OF SIGNALS ARE TELEMETERED?

Virtually anything that can be measured or counted can be sent over Telemetry and SCADA systems. Here are some typical signals:

- **Water tank levels**
- **Liquid flow totals through a pipe**
- **High or low level alarms**
- **Computed gas flow totals**
- **Pipeline pressures & temperatures**
- **Voltages and currents on a transmission system**
- **Switch and alarm positions**

What about communications?

The world started serious communication with the first railroads. They had to, to avoid disasters. The railroad stations had to tell each other when the trains arrived and left. The first communication lines were therefore wires strung along the railroad on poles.

Later, these same kind of wires were strung around cities on poles and people could communicate with each other over telephones. (Tele = distance, Phone = talk).

These pole lines were then strung between cities and called long distance or trunk lines.

Technology improved. Radio links and coaxial cables came along. Now we have satellites and fiber optics and data highways and we are communicating more than ever before.

Communication between people and computers and telemetry RTUs is still basically the same. Whether you get a phone jack or a leased cable from the phone company or string your own cable or erect your own radio system, you still use what is called voice grade communication from site to site.

Computers and telemetry RTUs all communicate over these voice grade circuits, originally designed to carry human voice only. To do this, they need send and receive tones over these circuits, tones sounding (sort of) like human voices. At least these tones have to fit in the voice band, 300 to 3,000 Hz. If you hear them, they sound like a fast chirping of demented birds.

1.C WHAT KIND OF SYSTEMS ARE THERE?

There are three main groups of telemetry and SCADA systems, depending on their mode of operation:

1.C.1 Mode-A, DIALING SYSTEMS:

Systems that use the public dialing telephone system are called Mode-A systems. These systems can communicate in voice or in computer compatible languages.

The advantages of Mode-A systems are:

- Low communication costs. Just the cost of each call and the cost of installing a phone jack at the site.

- You can access any remote site, anywhere in the world, from anywhere else in the world that has a telephone.

Voice telemetry RTUs like the VBX-7 need no extra equipment. Just call the unit and it will compose a voice report, using the phrases you recorded when you installed it.

RTUs that communicate in ASCII in Mode-A, like the SLR, LMX, the SMR and the M-system, communicate in computer compatible languages and can be accessed with any computer and modem combination.

1.C.2 Mode-B, CONTINUOUS TRANSMISSION SYSTEMS:

Systems that continuously communicate with a central station are called Mode-B systems. The central station is most often a computer. These systems communicate in computer compatible languages.

The advantage of Mode-B systems are:

- Continuous supervision of all remote sites in the system from a central location.
- Rapid update of incoming information.
- Rapid action on outgoing commands.

1.C.3 Mode-C, SIGNAL MULTIPLEXING SYSTEMS:

Systems that transfer signals from one point to another are called Signal Multiplexers or Mode-C systems. These systems consist of two or more RTUs or MUX modules communicating with each other in computer compatible languages over cable or radio. Analog and digital signals are transferred from any point in the system to any other point or to multiple points.

The advantages of Mode-C, Signal Multiplexer systems are:

- Lowered cable or radio transmission costs as multiple analog and digital signals can be transmitted and received over one cable circuit or over one radio link.

1.D WHERE ARE THESE SYSTEMS USED?

Today, telemetry systems are used all over the world. Signals are telemetered from Jupiter and from the moon. Wild animals carry telemetering collars and their doings are tracked.

Telemetering and SCADA systems described in this Handbook are mainly used by:

- **Water & Waste Water industries**
- **Pollution supervision systems**
- **Petrochemical industries**
- **Natural gas transmission & distribution**
- **Chemical and food companies**
- **Mines, dams and elsewhere for remote supervision**

1.E. WHAT IS THE COST?

A complete remote flow metering single point RTU unit like the ScanData SLR is available for about three hundred dollars in quantities. You can access this unit with your existing computer and modem and get an accurate report from on the accumulated flow from a flow meter at the site. (A single point RTU is one that handles only one input or output.) Per point cost: $300.00.

What's the payback time?

Say you have to send Charlie out to check your remote water tank twice a day. Say each trip takes him an hour. With his salary, overhead, cost of the truck, etc., calculate $30.00/hour, twice a day = $60.00/day plus Saturday and Sunday $90.00/day (overtime).

You are looking at 5 x $60.00 plus 2 x $90.00, $480.00 per week or close to $25.000 per year.

A VBX-7 will read two tank levels, 16 alarm conditions, turn two pumps or valves on and off and report on one pulsing flow meter, all for a purchase cost of less than $1,600.00. All you need, in addition, is the telephone in your office. Oh yes, you will also have to pay for each phone call.

The VBX-7 is never sick and takes no paid vacations. It works 24 hours a day at no extra charge. It will call you or five other phone numbers when it finds any one of 20 alarm conditions and give you a complete voice report.

The payback is obvious. The VBX-7 may pay for itself with a few pump stoppage or tank overflow alarms. It certainly will pay for itself in a few months of operation.

The same holds true for most Telemetry and SCADA installations. Most companies are finding, in fact, that they have to install automatic supervision of some kind simply to stay competitive.

A complete 21 point voice telemetry RTU unit, the VBX-7, is available for $1,590.00 (see sidebar, What's the payback?). It need no additional equipment for its operation (other than the sensors at the site). Per point cost: $76.00.

Larger RTUs become proportionally less expensive, looking at the per point cost. The M-system, for example, can very cost effectively handle up to 4,000 points.

1.F WHAT ELSE DO I NEED?

An RTU needs these four things to operate:

1. A power supply (except the SLR which has a built in battery).
2. A communications line; telephone line, cable or radio.
3. Sensors and actuators.
4. A central station, which can be a simple phone, a computer or another RTU.

This Handbook describes these requirements in detail.

Placing Scan-Data RTUs on the WEB.

The UDS Device Servers allows connecting serial devices such as Scan-Data RTUs, PLCs and SCADA master station PCs to IP based Ethernet networks, quickly and easily. Using a method called serial tunneling, the UDS encapsulates serial data into packets and transports it over Ethernet. Using two UDS units, connected by a network, virtual serial connections can be extended across a facility or around the world.

There is no need to develop special software to take advantage of Ethernet networking. With virtual COM ports, mapped to remote Device Servers o the network, you can replace direct serial connections.

In modem emulation mode, the UDS is used to replace dial-up modems. The unit accepts modem AT commands on the serial port, then establishes a network connection to the end RTU or PLC, leveraging network infrastructure and bandwith to eliminate dedicated modems and phone lines.

The UDS Device Server includes a built-in WEB server, which can be used for configuration or to display operating and troubleshooting information on the attached device. When attached to the Internet, it provides links to online support.

Flash memory provides for maintenance-free non-volatile storage of WEB pages, and allows future system software upgrades.

1.G WHERE DO I GO FROM HERE?

This Telemetry and SCADA handbook has been written to answer the most commonly asked questions on Telemetry and SCADA. It has chapters on all the aspects of these systems and also chapters on Upgrading, Designing and Testing.

Any complex subject is made easier by dividing it into smaller sections. This Handbook has divided SCADA and Telemetry into 20 chapters, each complete:

Each of these chapters is in turn is divided into sections. Sidebars contain detailed information on related subjects.

The Handbook can be used as a Tutorial as each succeeding chapter goes into more and more detail. It can also be used as a reference manual as each subject is referenced in the CONTENTS listing at the beginning and in the ALPHABETICAL INDEX at the end of the Handbook.

WHERE CAN I GET MORE INFORMATION?

The following descriptions, pertinent to this chapter, are included in the DESCRIPT directory on the SCADAtech(TM) CD:

pri-0901.pdf Design Guide and Price List.

gui-0980.pdf How to design SCADA and Telemetry systems.

cus-1185.pdf Customer reference list.

lokc1242.pdf Lookout SCADA software for Windows.

vbxc0929.pdf Voicebox Supervisor RTU.

lmrc0890.pdf LMR low cost RTU.

msyc0870.pdf M-system modular RTU.

app-1319.pdf Distributing SCADA data over the WEB.

You will find these and many more constantly upgraded application notes and technical descriptions on our WEB site:

www.scan-data.com

When you are there, click on the blue button near the bottom of the WEB page that says **Technical Information.** Then click on the description # you need.