CHAPTER 8, DIALING THE RTU OVER THE PHONE LINE

8.A SUMMARY:

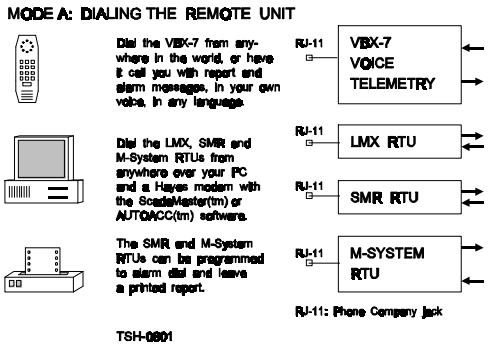
The public telephone system was originally designed for people talking to each other. The system now reaches all over the world and has been developed into an astounding level of technical perfection. You can now dial your cousin in Lapland from your home in Resume Speed, Iowa, reaching him immediately and talking to him without hearing any delays, distortions and echoes, just as you talk to someone across town.

8.B COMPUTERS USING DIALING PHONE LINES:

The computer world has not been slow in adapting to use this marvelous network. From the first feeble beginnings only a few years ago, with voice cup 300 baud modems, networks like Internet allow you to reach virtually anyone with a computer, instantly, anywhere in the world, at blindingly fast baud rates. This may rate as the most important development in recent years and is sure to change our world.

8.C RTUs USING DIALING PHONE LINES:

RTUs have been able to benefit from these developments. It is now entirely practical to install even complex RTUs such as gas flow computers and to control them remotely over the dialing phone network with a computer. Modern computer error correction techniques have made the communications virtually error free.



8.C.1 ADVANTAGES IN DIALING THE RTUs:

The main advantage with dialing the RTUs is that there is normally no installation cost; the telephone company installs the RJ-11 phone jack for you and all you have to do is to plug in the RTU. It is equally easy to check the communication lines. Just plug in any phone into the RJ-11 jack and dial someone you know. If this work, the RTU will work equally well.

8.C.2 HOW ABOUT ERRORS?

Modern computer error detecting techniques make the information transferred in Mode-A systems virtually error free. The LMR, SMR and M-system RTUs are all capable of operating in Mode A with internal modems. The -232 version of the LMR RTU can be programmed to operate in Mode-A with an external Hayes compatible modem.

HOW WELL DOES DIALING THE RTU WORK?

Some ten years ago ScanData installed a gas flow computing RTU in an important gas compressor station near a small town in Louisiana. The gas company's main computer in Omaha, Nebraska, automatically dials the RTU every morning, retrieving complex gas flow data and sending instructions to the RTU on desired gas flow, etc.

There was skepticism on how well this would work, especially since the compressor station was served by a small rural telephone company with a history of sketchy service.

The end result was that there was never an erroneous message or command recorded in years of operation. The RTU faithfully calculated gas flow and ramped the compressors up and down to reach the desired gas flow as demanded by the computer in Omaha, all completely automatically.

8.C.3 HOW DIFFICULT IS IT TO INSTALL ONE OF THESE RTUS?

The quickest and most cost effective way to start to monitor and control a remote site is to install one of the many different types of Mode-A (dialing) RTUs ScanData has available at your remote. Mode-A installations are very flexible; you can start with a single, low I/O count remote RTU and expand it later to several hundred RTUs.

All that's required when installing one of these RTUs is the RTU itself, a 12V or 110V power supply and an RJ-11 jack. Wire the sensors, actuators, alarm contacts, flow meters or what have you to the RTU, apply power and plug the RTU into the RJ-11 jack. Simply call the RTU from any phone to verify proper operation. If it answers with a tone (or, in the case of the VBX-7) with a voice message, you know that it is working.

8.C.4 HOW ABOUT INSTALLED COST?

You can purchase the SLR Super Low power RTU for about $300.00 in quantities. It is designed to report total accumulated gas flow at industrial installations but it will report on any flow meter, anywhere in the world where there is a phone line. It shares the line with other phone users and all you need to install it is the RJ-11 jack. It has its own battery, good for five years. Wire it to your flow meter, plug in the phone line and you are all set.

EXAMPLE OF MODE-A SYSTEM.

As an example of a complex Mode-A system, Kerr McGee in Nevada is using several M-system RTUs to control the flow of water from Lake Mead to several reservoirs and to Lake Las Vegas. It was impractical for them to lease cables or to install their own cables or radio.

They use the ScadaMaster(tm) program on several PC computers to access the RTUs to get full reports from the sites and to start and stop their main supply pumps.

A version of the ScadaMaster(tm) program runs continuously on a Kerr McGee office computer. It automatically dials each RTU three times per hour, checks the level in the reservoirs and automatically starts and stops the six main pumps by Lake Mead in a programmable sequence to keep the reservoirs full.

Another example of a Mode-A system is with the Degussa Corporation in Huntsville, Alabama. They have chemical tank installations in several hundred sites in the US and abroad. They installed LMX-103 RTUs at each site. The AutoAcc(tm) program runs nightly in a computer in their office. This program dials each RTU in turn and obtains a report from each remote tank installation. Each report is automatically printed out on a printer and recorded into a disk file.

Installing a VBX-7 Voice Telemetry RTU at the site is equally cost effective. You need no additional equipment. Just use your regular phone to receive reports and transmit commands to the site. You can dial the VBX-7 RTU from anywhere in the world and it will give you complete engineering and alarm reports, in your own voice. Use your phone keypad to start and stop pumps, open and close valves, etc. You need to enter a secret access code on your keypad before the VBX-7 will respond. The VBX-7 can also call you (and five additional telephone numbers) if any one of 20 alarm conditions occur.

Installing an LMX-103 RTU is also quite cost effective and you can now dial your installation with your computer and get complete written reports on what is happening at the site. Commands to the site are keyed in over your computer keyboard.

You can install high I/O count M-system RTUs at stations with many input signals and you can install SMR and M-system programmable RTUs at stations where you need to perform gas flow calculations, logging, gas chart replacement functions and other complex tasks. Check the price list in back of the Handbook for an idea of what these different systems cost.

8.C.5 WHAT SOFTWARE DO I USE?

You can communicate with all these RTUs (except the voice operated VBX) with any communication software package, such as Procom and others. As the messages to and from the RTUs are in plain, well documented ASCII, you will have no difficulty in formatting the strings the RTU needs nor in interpreting the strings from the RTU.

ScanData has excellent dialing software packages available such as AutoAcc(tm) and ScadaMaster(tm) to automatically access all SLR, LMX, SMR and M-system RTUs. These programs will perform automatic commands and automatically obtain full printed reports from the site(s).

8.D DO I USE VOICE OR ASCII RTUs?

You have two main choices in RTUs. One is to use a voice telemetry RTU, such as the ScanData VBX-7. This approach has a number of advantages. One is that you need no special equipment to communicate with the RTU; any telephone will do. Another is that the VBX-7 voices its messages from a number of pre-recorded phrases in a manner that anyone can understand.

The other choice is to use RTUs that communicate in ASCII (American Standard Code for Information Interchange). Here you use a computer and a modem to talk to the RTU. The great advantage with that is that all the information goes directly into your computer's data base. You can then store it, print reports with it and hand it over to other data bases.

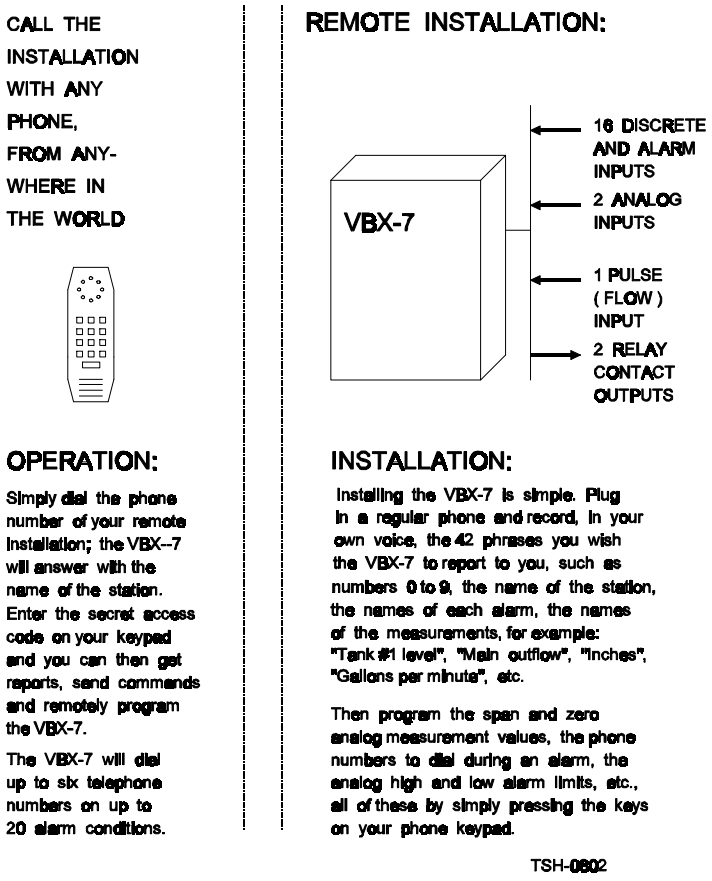
8.E HOW THE VOICE TELEMETRY RTU WORKS:

The VBX-7 waits for about 4-5 rings before it answers the phone during incoming calls. This is to give a person at the site a chance to pick up his phone (connected in parallel with the VTM- 7) and to answer the incoming call. The VTM-7 will not answer if the parallel phone was picked up.

When the VBX-7 answers, it answers with the pre-recorded identifying phrase **'Wild Rose Reservoir Pump Station'** or with whatever phrase was recorded in phrase position #1. You enter the secret access code by pressing the proper keys on the keypad of your phone. The VBX-7 will confirm that your access code was accepted. You can now request information from the VBX-7, send commands to the VBX-7, remotely program the VBX-7 and perform all the functions described in the manual.

The VBX-7 will automatically dial up to six different telephone numbers on up to 20 alarm conditions. The called parties will hear the alarm message(s). Pressing **'**'** on the keypad acknowledges the alarm message and inhibits re-dialing. Pressing **'##'** on the phone keypad inhibits further alarm dialing to other telephone numbers. The alarm outdialing starts again after the programmable intercall delay (normally

24 hours), should the cause of the alarm remain.



8.F HOW THE ASCII TELEMETRY RTUS WORK:

All ScanData ASCII telemetry RTUs conform to the Bell Telephone Bell-212 protocol. This means that they are compatible with all dialing (Hayes compatible) modems. This protocol has been in use for many years and is very tolerant to the noise and distortion that can occur on rural telephone systems and on badly maintained lines. Newer and faster protocols have been developed for super fast computer to computer communication, but their use in Telemetry and SCADA systems is limited as they require complex protocols at each end and with the typical short RTU messages (1- 3 seconds long at 1.200 baud) there is no real time savings.

When the RTU is dialed, it goes off hook (lifts the phone) and sends an answer tone of 2,025 Hz, telling the caller that he has reached a Bell-212 compatible modem. The calling modem then sends an originate tone, 1,070 Hz, telling the RTU that communication has been established.

After this handshake procedure the RTU and the calling modem can start sending messages to each other.

These two tones are frequency shift modulated to send the ASCII messages. The originate tone shifts between 1,070 and 1,270 Hz and the answer tone shifts between 2,025 and 2,225 Hz.

The RTU then sends a short ASCII string, such as **'READY'**. The calling device now has 30 seconds in which to send a request for information, a command or a programming instruction for RTUs so equipped.

All these messages are preceded by a line feed and terminated by a checksum and a carriage return, as described in the manual of each RTU.

The exception to this protocol procedure is the SLR, the Super Low power RTU. It sends the answer tone, then, after about 4 seconds, proceeds to send the accumulated flow count in ASCII digits, followed by 2 seconds of answer tone before hang up. All this in the interest of using as little power from the battery as possible.

When programmable ASCII RTUs such as the SMR and the M-system dial a number, the above Bell-103 handshake procedure is reversed. The RTU sends an originate tone and expects the calling number to respond with an answer tone. After that, the procedure is the same as described above.

8.G CONCLUSION:

Dialing RTUs installed at remote locations is a viable solution for Telemetry and SCADA systems where there is no other alternative or where installing cables or radios would be too expensive.

These systems have proven eminently reliable over the years. Transmission errors may occur, but with the safeguards built into the RTUs these errors are detected and the message rejected. The system re-polls until an error free message is obtained.

The cost per call is very predictable. Reduction in calling costs can be obtained by calling at night when the tariffs are lower and by having the RTU store data so that it does not have to be called that often.

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.

mdm-1315.pdf Bell-212 dialing modem.

vbxc0929.pdf Voice Box Supervisor RTU.

adl-1363.pdf Dimensioning alarm dialers.

cds-1368.pdf Analog and digital signal transfer by dialing.

An easy way to get the latest and most recently updated versions of these descriptions is to go 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.