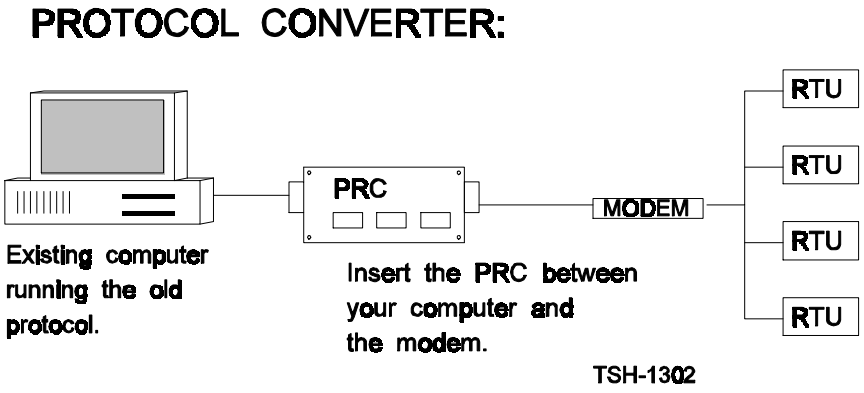
CHAPTER 13, PROTOCOL CONVERTERS AND DATA CONCENTRATORS

13.A SUMMARY:

Protocol (language) converters are used between different components in Telemetry or SCADA systems where different protocols or languages are used. It is very common, for instance, to have an expensive central station control installation that may have been bought several years ago at great cost. No matter that modern PC computers and control software are a fraction of the price paid for this old, expensive system. Management cannot allow the old system to be scrapped.

The company that originally delivered the RTUs for this system may no longer be in business or their RTUs may be very expensive. New, cost effective RTUs cannot communicate in the old system's protocol. It is also too expensive to re-write the old software to talk to newer RTUs and PLCs.

Protocol converters to the rescue! These devices can talk the old system's protocol at one end and modern RTU language at the other.



Data concentrators are used to talk to several RTUs in a cluster and to appear to the central station as one large RTU.

Often the functions of both a protocol converter and of a data concentrator are combined in one unit. This is a very cost effective way to add a cluster of new RTUs to an existing older system.

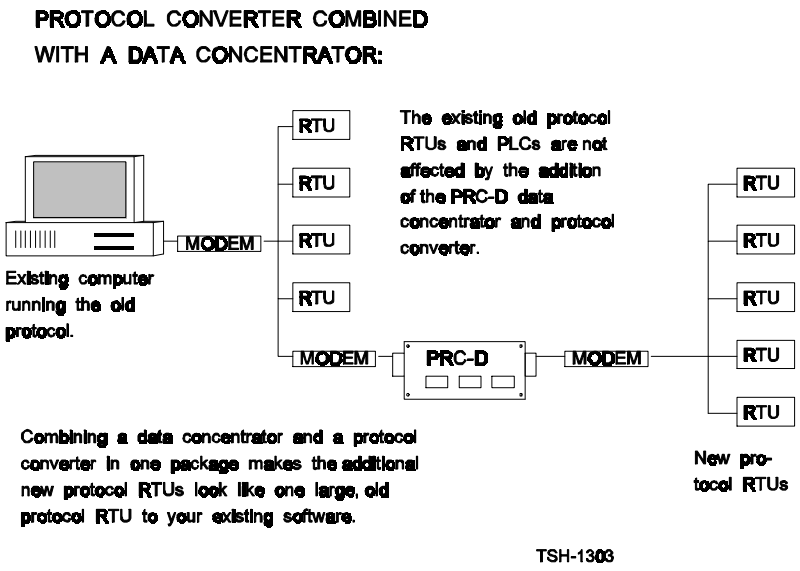
13.B ANOTHER WAY OF LOOKING AT PROTOCOL CONVERTERS AND DATA CONCENTRATORS:

Why protocol converters? They are used because there are many different protocols or languages in the Telemetry and SCADA world.

Compare these devices to a translator, at an airport, say. Many languages are spoken here. A newly arrived visitor, for example, speaks only Norwegian and the customs man speaks only English. A translator (protocol converter) is called in. He hears English and speaks Norwegian, in one direction. In the other direction he hears Norwegian and speaks English. So the customs man and the visitor can now communicate.

The protocol converter does the same thing, except that it probably speaks ASCII or some bit oriented language. It hears the RTUs in their protocol and speaks to the central station in its protocol, and vice versa.

Now, say that ten Norwegian speaking visitors arrive at our airport. It would not be cost effective to call in ten translators. One translator will do. Once you have an interpreter speaking and understanding Norwegian it does not matter if he speaks to one or ten visitors. He now has two functions. One is to translate (convert) and the other is to gather information from all ten visitors and give it to the customs man. He also gets information from the customs man and gives it to all ten visitors.



The data concentrator works like the translator at the airport. It automatically gathers information from several RTUs and looks like one RTU to the master station. And it uses the protocol the master station understands. Messages and commands from the master station is also distributed to the RTUs in the protocol they understand.

13.C A LITTLE HISTORY:

The first practical communication protocol in wide use was Morse Code. It is still used, but not for telemetry. When telemetry came into wider use most manufacturers preferred to have their own protocol. One of the reasons for this was that there was no standardization and another was that the manufacturer wanted to lock the customer in on his product.

This latter effort to lock the customer in is still practiced, unbelievable as it seems. Even more unbelievable is the practice of secret protocols which persist to this day.

Today, a number of open protocols have emerged, the most common being CAP (Compact ASCII Protocol) and MODBUS. These protocols are well documented in freely available publications. They are easy to deal with. There is no real difficulty in writing software to handle these protocols. These two protocols are rapidly becoming the world's de-facto protocol standard.

Meanwhile, there are lots of old protocols out there and plenty of work for the protocol converter.

13.D THE SCANDATA PRC PROTOCOL CONVERTER

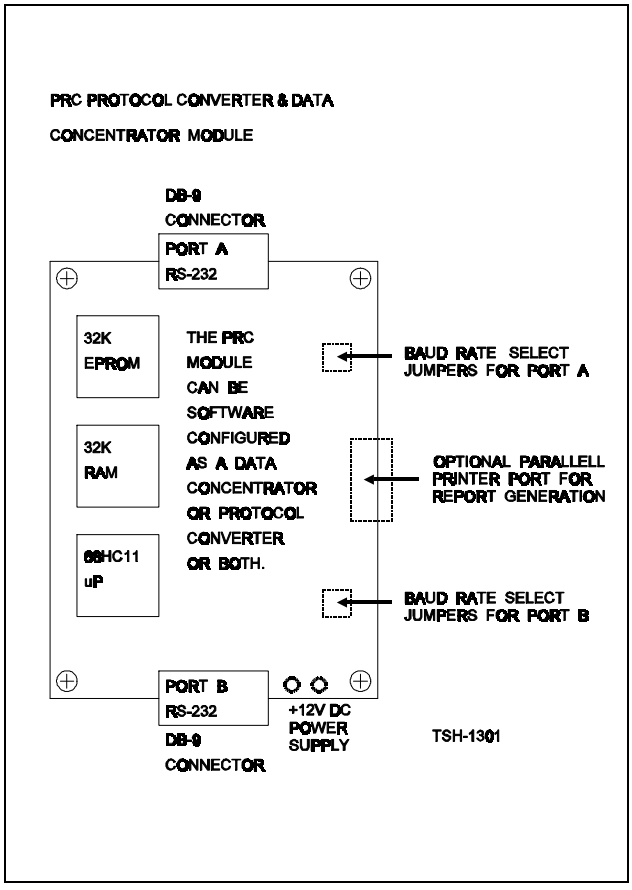
Older protocols sometimes offer a challenge to the programmer. These protocols were often bit oriented and shrouded in secrecy and complexity in an effort to retain the customer captive with the original vendor.

Protocol conversion software can always be written as long as a 'dictionary' can be established. This dictionary should state what incoming messages the protocol converter will see and what outgoing messages the protocol converter will send in answer to these incoming messages.

ScanData will quote protocol conversion software based on a well defined incoming and outgoing message dictionary.

13.D.1 PRC PROTOCOL CONVERTER DESCRIPTION

The PRC module is mounted on a 6" x 6" PC board, equipped with four threaded 1/4" spacers in each corner. It is designed for operation in harsh industrial environments and has a HardCoat(tm) moisture barrier coating with automatic color change fault detection. A variety of enclosures are available.



The PRC module contains one 68HC11 microprocessor, 32K of program ROM and 32K of memory RAM. It contains two baud rate generators, independently selectable over jumpers. Two RS-232 serial ports connect between the existing equipment and the new RTUs or PLCs.

An optional parallel printer port is available for local report printing.

The program starts automatically when power is applied.

Any string input in one format at one port is output at the other port in the converted format, and vice versa. Up to 20 strings can be held in buffer to facilitate buffering between slower and faster baud rates.

13.D.2 INSTALLING THE PRC PROTOCOL CONVERTER

Mount the converter with the 4/40 threaded spaces to a cabinet back panel, unless it is ordered with the optional enclosure in which case you can mount the enclosure on a wall or leave it on a table.

Connect one of the communication lines (RTU, modem or computer) to the correct port connector. Port 'A' (the line side) normally interfaces with the old protocol side and port 'B' (the RTU side) with the converted protocol side. Apply 12V DC power.

Check that strings are input at one side and output at the other. The easiest way to check for proper operation is to use the ScanData MYC Monitor Y Cable. Insert it between either port and the device it is connected to. You can see the strings on the laptop or other computer you connect to the MYC cable, provided they are in the ASCII format.

If your old protocol is not in ASCII but in an old bit oriented protocol, you will need to use one of the several communication analyzer software packages available for PC computers.

USING THE MYC MONITOR 'Y' CABLE

The ScanData MYC monitor cable is used to observe and verify the ASCII messages that pass to and from any R-232 connector. It can be used at central station computers, at RTUs and PLCs and at Protocol Converters and Data concentrators, wherever there is an R-232 connector sending and receiving ASCII messages.

The MYC has three 9-pin R-232 connectors. Unplug the connector to the device to be tested and insert the MYC cable. Connect a laptop or other DOS based PC to the third (monitor) connector. Use DB9 to DB25 adapters if needed.

Configure the supplied communication software for terminal mode with the proper baud rate and parity. You will see the incoming and outgoing messages scroll up on the screen.

13.E THE SCANDATA DATA CONCENTRATOR

The ScanData PRC-D Data Concentrator uses the same hardware as the PRC-D. Only the software is different. The purpose of the data concentrator is to talk to a cluster of RTUs on its RTU side and talk to a central computer or to another RTU on its line side.

The Data Concentrator is used in radio and cable systems where it is used to reach a cluster of RTUs. In a radio system it allows one repeater station to reach a number of RTUs in a cluster, forming a small multi-drop network of RTUs, as all radio systems are inherently multi-drop.

In a cable system it allows a number of RTUs to be cabled into one Data Concentrator, either in a star configuration or in a multidrop configuration. This can very often mean a considerable saving on cable costs as you do not have to run a cable from each of the RTUs back to the central station or to the master RTU.

The flexibility of the Data Concentrator approach also allows you to use a cable connected cluster of RTUs working into a radio repeater or a radio connected cluster of RTUs working into a cable network. The Data Concentrator automatically turns the RTS pin high before transmitting on the RTU side. The RTS pin is also used to turn the radio transmitter open collector driver transistor **'ON'** in all ScanData modems.

13.F THE SCANDATA PROTOCOL CONVERTER AND DATA CONCENTRATOR COMBINED.

With additional software, the PRC board will work both as a protocol converter and as a data concentrator (PRC-D).

This makes it possible to add one or more clusters of modern, high capacity and cost effective RTUs to existing older systems with older protocols. No changes need be made to the existing software as the Data Concentrator and Protocol Converter combination looks like a large old protocol RTU to the software.

13.G TALKING TO ONE OR MORE SMART TRANSMITTERS

4-20 mA analog sensors for pressure, flow, etc. can be delivered with 'Smarts'. In other words, they are able to communicate over an R-232 port. Many sensors communicate in the popular Hart protocol.

The PRC-D protocol converter and data concentrator is an ideal device to communicate with one or more smart transmitters. On the line side the PRC-D appears as an RTU or a PLC to the software, making for a painless interface.

This illustrates the main use for the PRC-D: to make interconnects between different devices painless and low cost.

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.

sdc-1321.pdf Data concentrators reduce cable runs and radio circuits.

spc-1001.pdf Protocol converters upgrade 'orphan' SCADA systems.

app-1498.pdf Adding inputs and outputs with master/slave RTUs.

app-1561.pdf RTU and PLC communication methods.

app-1319.pdf How to distribute SCADA data over the WEB.

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.