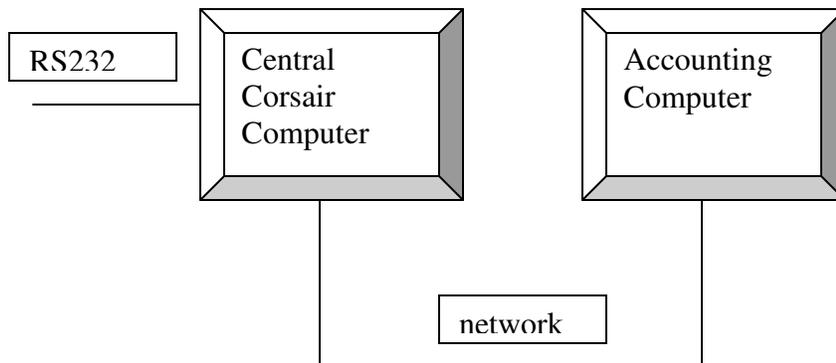**CORSAIR**   **~ Campus Power Monitoring ~**

Charlie is a maintenance man at a major university. The campus consists of three clusters of buildings: 8 in the north, 6 in the center, and 11 in the south. Charlie was given orders to monitor and log power usage on each of the buildings in the central cluster. He found metering equipment that could be hooked together using 2-wire RS-485 Modbus RTU communications. He purchased 6 meters and a computer.
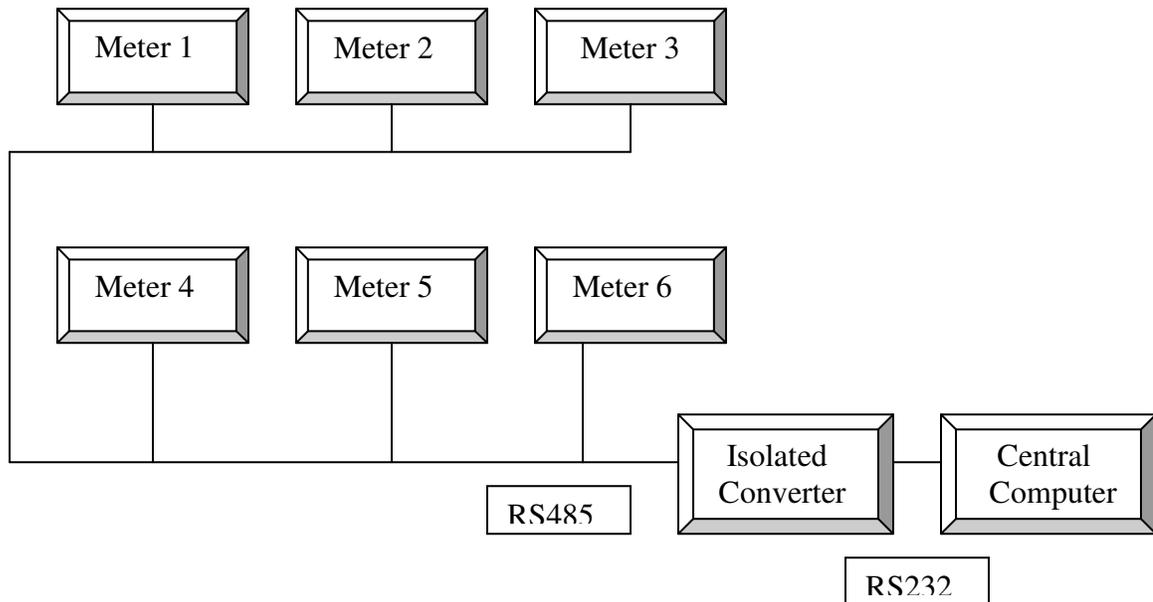
Charlie needed a data converter to match the RS-232 port on his computer to the 2-wire RS-485 wiring required by the meters. He spent a little extra money to get an isolated converter that would keep electrical noise from the meters out of his computer. Each meter had to be set up with a unique Modbus ID number. A meter fresh from the factory used ID one. Charlie used ID numbers two through seven for his six meters so if anyone hooked up an additional meter or if a meter was sent out for repair he would have less troubles with address conflicts. He used the meter's default 9600 baud data rate with no parity. The Modbus RTU protocol requires 8 data bits.

The next step was to purchase Corsair software for the computer. The Corsair dealer helped Charlie to develop a data template that matched the Modbus register map of the meter. He used the Corsair Modbus RTU serial driver and began reading values.

The next week Charlie was told that Linda in accounting needed to see information from the power meters on her computer. She needed read-only access since she wouldn't be changing any data. Her computer was already on the campus Ethernet network so Charlie added the Corsair computer to that network.

```
┌─────────┐   ┌───────────┐      ┌───────────┐
│  RS232  │───│  Central  │      │ Accounting│
└─────────┘   │  Corsair  │      │ Computer  │
          ────│  Computer │      │           │
              └─────┬─────┘      └─────┬─────┘
                    │                  │
                    │   ┌─────────┐    │
                    └───│ network │────┘
                        └─────────┘
```

Charlie bought some remote-control software for the Corsair computer. Linda could now take control of the computer any time that she wanted to from her office. This worked, but it was clumsy. It seemed that she always wanted to take control at the same time that Charlie wanted to see something. He had to work through a few issues with setting up printer drivers. The real problem hit when the guys in the campus MIS department found out that Charlie had installed the remote control software without checking with them. Their security policies prohibited any use of this type of program. Charlie had to find another solution. He called his Corsair dealer.

After a little study, Charlie configured his Corsair computer to act as an MB host. He bought an inexpensive MB remote-only version of the Corsair software to run on the accounting computer. Now she could see everything that Charlie could see on the central computer anytime that she wanted to.
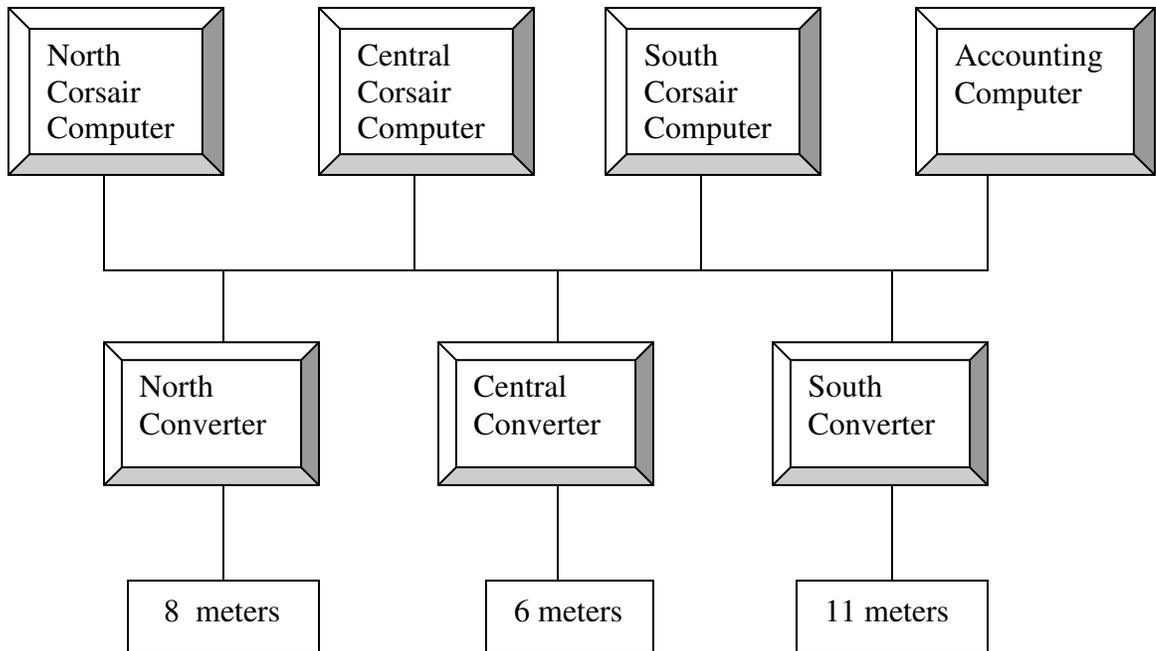
The next request was to put meters on the 8 north campus and 11 south campus buildings. Charlie did the north first. He purchased an inexpensive Modbus serial to Ethernet converter.

RS485 to
8 north
meters

RS232 | Central Corsair Computer

Ethernet to Serial

Accounting Computer

network
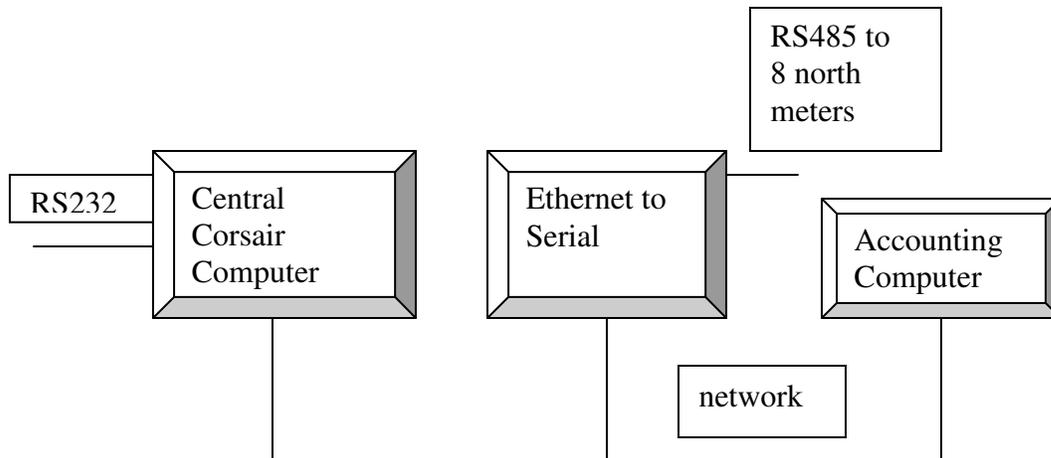
Charlie set up a second driver in his Corsair database to use the Modbus over Ethernet (Modbus Application) protocol. He had to contact Joe from MIS to get an IP address for the converter. Joe reluctantly assigned it. The data communications worked as expected. Charlie updated the Corsair database on the accounting computer to include the north campus buildings.
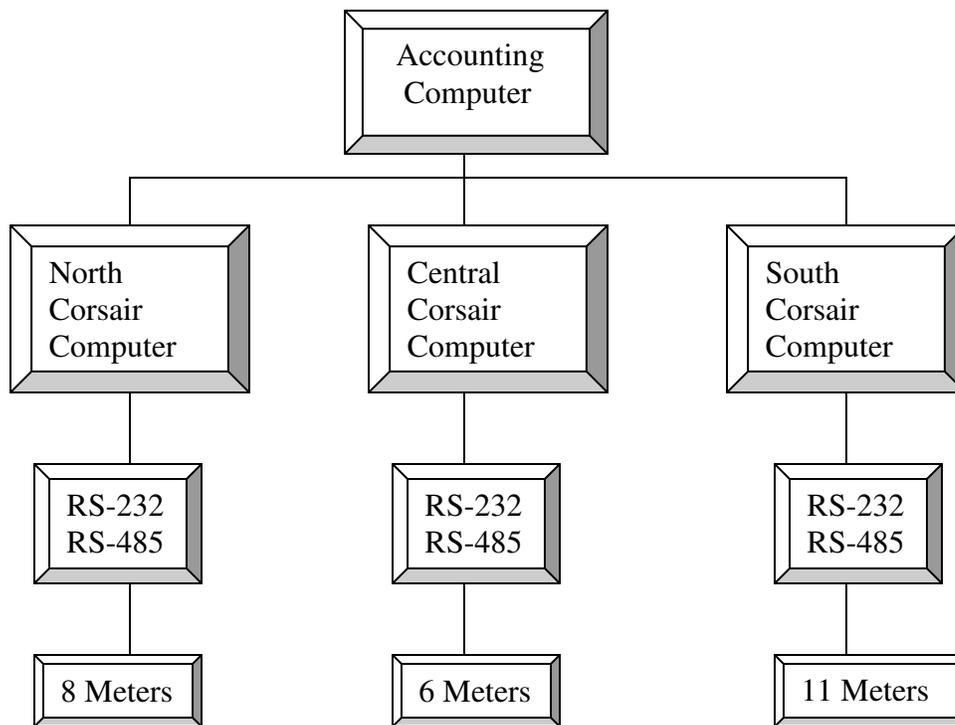
Next Charlie went to work installing the 11 meters on the south campus. He hooked them to another serial to Ethernet converter. MIS gave him another IP address. When it was powered up Charlie couldn't get good communications even though he did exactly what he had done on the north. He called his Corsair dealer and they reviewed the system architecture. At the dealer's suggestion Charlie checked how many TCP/IP connections his converters could support at one time. The answer was 10. He was about to buy another converter to split up the meters when he talked to the distributor again. The distributor told Charlie how the Corsair single-socket Ethernet multi-drop driver works. This driver is specially written to use with this type of converter. Charlie changed the driver type in the Corsair database and the south campus worked.

Everybody was happy until the holiday weekend then the central Corsair computer failed and they lost all the logging data for three days. Charlie was told that each building needed to log all of its' data and also all of the data from the other buildings. He purchased two more computers and another serial to Ethernet converter.

```
┌──────────┐   ┌──────────┐   ┌──────────┐   ┌──────────┐
│  North   │   │ Central  │   │  South   │   │Accounting│
│ Corsair  │   │ Corsair  │   │ Corsair  │   │ Computer │
│ Computer │   │ Computer │   │ Computer │   │          │
└────┬─────┘   └────┬─────┘   └────┬─────┘   └────┬─────┘
     │              │              │              │
     │              │              │              │
┌────┴─────┐   ┌────┴─────┐   ┌────┴─────┐
│  North   │   │ Central  │   │  South   │
│Converter │   │Converter │   │Converter │
└────┬─────┘   └────┬─────┘   └────┬─────┘
     │              │              │
┌────┴─────┐   ┌────┴─────┐   ┌────┴─────┐
│ 8 meters │   │ 6 meters │   │11 meters │
└──────────┘   └──────────┘   └──────────┘
```

This approach turned out to be a disaster. Each serial to Ethernet converter now had to keep 3 computers happy instead of 1. The 9600 baud serial data rate was too slow to get a usable refresh rate on the Corsair computers. Charlie began to panic. He called his Corsair dealer again.

The dealer suggested that Charlie find his old RS-232 to 485 isolated converter and buy two more like it.

```
                    ┌─────────────┐
                    │  Accounting │
                    │   Computer  │
                    └──────┬──────┘
         ┌─────────────────┼─────────────────┐
  ┌──────┴──────┐   ┌──────┴──────┐   ┌──────┴──────┐
  │   North     │   │   Central   │   │   South     │
  │   Corsair   │   │   Corsair   │   │   Corsair   │
  │   Computer  │   │   Computer  │   │   Computer  │
  └──────┬──────┘   └──────┬──────┘   └──────┬──────┘
  ┌──────┴──────┐   ┌──────┴──────┐   ┌──────┴──────┐
  │   RS-232    │   │   RS-232    │   │   RS-232    │
  │   RS-485    │   │   RS-485    │   │   RS-485    │
  └──────┬──────┘   └──────┬──────┘   └──────┬──────┘
  ┌──────┴──────┐   ┌──────┴──────┐   ┌──────┴──────┐
  │  8 Meters   │   │  6 Meters   │   │  11 Meters  │
  └─────────────┘   └─────────────┘   └─────────────┘
```
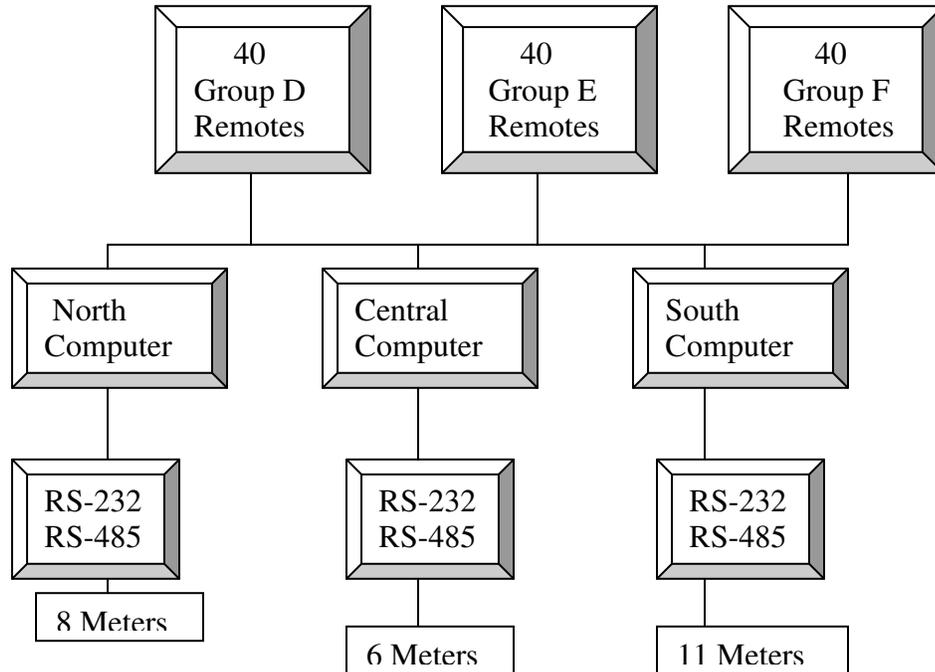
  Each Corsair computer was configured as an MB host. A little switching around of
drivers and database addresses allowed each computer to read its meters over the serial
line and the other meters over the network. The speed was restored and data was logged
for all three buildings on all three computers. MIS was happy to not have strange
converters on their network. Accounting still used the central Corsair computer as its
primary host. Charlie added the north computer as its backup host. He figured that the
project was finally done. It was for about two weeks.

The university management team was so proud of their power monitoring system that
they wanted everyone on the network to be able to view the meter data. This totaled 120
computers, including the one in accounting. Charlie contacted his Corsair dealer again
and asked for volume pricing on the MB remote-only version of the Corsair software.

PART 2

CONFIGURATION OF THE CAMPUS POWER MONITORING DATABASE

Charlie developed his Corsair database in several steps as his system evolved. This document details a possible way to do it starting from an empty database.

```
 ┌──────────┐      ┌──────────┐      ┌──────────┐
 │    40    │      │    40    │      │    40    │
 │ Group D  │      │ Group E  │      │ Group F  │
 │ Remotes  │      │ Remotes  │      │ Remotes  │
 └────┬─────┘      └────┬─────┘      └────┬─────┘
      │                 │                 │
 ┌────┴─────┐      ┌────┴─────┐      ┌────┴─────┐
 │  North   │      │ Central  │      │  South   │
 │ Computer │      │ Computer │      │ Computer │
 └────┬─────┘      └────┬─────┘      └────┬─────┘
      │                 │                 │
 ┌────┴─────┐      ┌────┴─────┐      ┌────┴─────┐
 │ RS-232   │      │ RS-232   │      │ RS-232   │
 │ RS-485   │      │ RS-485   │      │ RS-485   │
 └────┬─────┘      └────┬─────┘      └────┬─────┘
      │                 │                 │
 ┌────┴─────┐      ┌────┴─────┐      ┌────┴─────┐
 │ 8 Meters │      │ 6 Meters │      │11 Meters │
 └──────────┘      └──────────┘      └──────────┘
```

The system consists of a total of 123 Corsair computers. The North, Central, and South computers run a full featured version of the Corsair software. Each is hooked to a group of meters through a serial line. 120 of them run less expensive MB Remote-only versions of the software. They are divided into 3 groups of 40. These groups are labeled group D, group E, and group F. For this example the remote computers are named D1 through D40, E1 through E40 and F1 through F40.

The remote computer database is developed first. It must then be slightly modified for each of the 3 host computers. There will be a total of 4 different Corsair .CAP files. All computers will be able to see the data from all the meters.

The first step is to determine IP addresses for the North, Central and South host computers. They must use fixed IP addresses that do not change. Assume that they are to be 192.168.141.1 through 3 for this example. There addresses must be assigned to the network adaptor under the Windows Control Panel network configuration. They also must be entered as MIS addresses onto computer records in the Corsair database. The

120 remote computers may have server-assigned IP addresses. Six records must be
entered into the Corsair computer database:

Record 1:
Computer Name :   North Campus
MIS IP Address: 192.168.141.1
MB Host?:   Yes
MB Remote?:   No
Can Write? :   No
Primary Host: ??
Backup Host: ??
Extended Protocol: No

Record 2:
Computer Name: Central Campus
MIS IP Address: 192.168.141.2
MB Host?:   Yes
MB Remote?:   No
Can Write?:   No
Primary Host: ??
Backup Host: ??
Extended Protocol: No

Record 3:
Computer Name: South Campus
MIS IP Address: 192.168.141.3
MB Host?:   Yes
MB Remote?:   No
Can Write?:   No
Primary Host: ??
Backup Host: ??
Extended Protocol: No

Record 4
Computer Name: Group D Remote

MIS IP Address: 0.0.0.0
MB Host?:   No
MB Remote?:   Yes
Can Write?:   No
Primary Host: North Campus
Secondary Host: Central Campus
Extended Protocol: Yes

Record 5
Computer Name: Group F Remote
MIS IP Address: 0.0.0.0
MB Host?:   No
MB Remote?:   Yes
Can Write?:   No
Primary Host: Central Campus
Secondary Host: South Campus
Extended Protocol: Yes

Record 6
Computer Name: Group I Remote
MIS IP Address: 0.0.0.0
MB Host?:   No
MB Remote?:   Yes
Can Write?:   No
Primary Host: South Campus
Secondary Host: North Campus
Extended Protocol: Yes

This database arrangement distributes the 120 remotes evenly across the 3 hosts. (40 each) A host can support up to 100 remotes. If one of the N, C, or S hosts fails each remote will still find a host to connect with.

The next step is to create a single driver record in the Corsair database. It gets the Modbus RTU serial driver type. Zooming on it allows the creation of multiple device tags on the PLC. The addresses and type of these devices depend upon the Modbus register map of the meter. Every device tag that is needed should be created before any cloning is done. It's less work to delete extras later than it is to add them in after cloning is done. When all the device tags are finished the PLC record needs to be cloned 10 times to create a total of 11 PLCs. They get node ID numbers from 2 through 12. Partial renaming on PLC and device tags can occur now.

The next step is to clone the driver record twice for a total of 3 drivers. This will result in a total of 33 PLCs in the database. Extra PLC records need to be deleted from the north and center drivers. Suggested addresses would be:

Driver Record: North Meters
PLC: North Meter 1   Node:2   MBHR ID: 2
PLC: North Meter 2   Node:3   MBHR ID: 3
PLC: North Meter 3   Node:4   MBHR ID: 4
PLC: North Meter 4   Node:5   MBHR ID: 5
PLC: North Meter 5   Node:6   MBHR ID: 6
PLC: North Meter 6   Node:7   MBHR ID: 7
PLC: North Meter 7   Node:8   MBHR ID: 8
PLC: North Meter 8   Node:9   MBHR ID: 9

Driver Record: Center Meters
PLC: Center Meter 1   Node:2   MBHR ID: 22
PLC: Center Meter 2   Node:3   MBHR ID: 23
PLC: Center Meter 3   Node:4   MBHR ID: 24
PLC: Center Meter 4   Node:5   MBHR ID: 25
PLC: Center Meter 5   Node:6   MBHR ID: 26
PLC: Center Meter 6   Node:7   MBHR ID: 27

Driver Record: South Meters
PLC: South Meter 1   Node: 2   MBHR ID: 42
PLC: South Meter 2   Node: 3   MBHR ID: 43
PLC: South Meter 3   Node: 4   MBHR ID: 44
PLC: South Meter 4   Node: 5   MBHR ID: 45
PLC: South Meter 5   Node: 6   MBHR ID: 46
PLC: South Meter 6   Node: 7   MBHR ID: 47
PLC: South Meter 7   Node: 8   MBHR ID: 48
PLC: South Meter 8   Node: 9   MBHR ID: 49
PLC: South Meter 9   Node:10   MBHR ID: 50
PLC: South Meter 10   Node:11   MBHR ID: 51
PLC: South Meter 11   Node:12   MBHR ID: 52

At this point the database contains a large number of duplicate tag errors on device records. It's time to finish renaming all tags to clear up duplication. The Corsair tree printout may assist in checking the database at this point.

The next step is development of all the operator screens and sheets that are required for the project. Each record should be as complete and correct as possible before cloning and retagging.

It is now recommended to print the complete project tree. If each meter is developed identically the usage counts on each device record should match the corresponding counts on other PLCs.

PART 3   CREATING THE DATA LOGS

The campus system requires that log data be kept on each of the North, Central, and South host computers. The 120 remote computer will not be running the Corsair program continuously so they each need to get their log data from a host. The group D remotes will get their log data from the North host, group E from the Central and group F from the South.

PART 4   MODIFYING THE DATABASE FOR EACH OF THE HOST
              COMPUTERS

At this point the database is ready to be installed on each of the 120 Corsair remote computers. The Corsair.cfg configuration file must be properly set up depending on whether each computer is a group D, E, or F remote. This is done under the computer properties menu selection.

The remotes communicate to the hosts via Ethernet so the serial port settings on the remotes are not important. Port 1 on each of the three hosts should be set to 9600 baud with 8 data bits, one stop bit, and parity as required by the metering equipment.

Each of the 3 driver records in the Corsair database now has the Modbus RTU serial type. Each host can only access one group of meters through a serial port. It must access the other two groups of meters through Ethernet. This is doe by changing some driver types to Modbus Multi-Drop Extended protocol. This is done as follows:

North Computer
        Driver #1 - North meters - RTU Serial
                        Set port to #1
        Driver#2 - Central meters - Multi-Drop Extended
                        Set all PLC IP addresses to 192.168.141.2
        Driver#3 - South meters - Multi-Drop Extended
                        Set all PLC IP addresses to 192.168.141.3

Central Computer
        Driver#1 - North meters - Multi-Drop Extended
                        Set al l PLC IP addresses to 192.168.141.1
        Driver#2 - Central meters - RTU Serial
                        Set Port to #1
        Driver#3 - South meters - Multi-Drop Extended
                        Set all PLC IP addresses to 192.168.141.3

South Computer
        Driver#1 - North meters - Multi-Drop Extended
                        Set all PLC IP addresses to 192.168.141.1
        Driver#2 - Central meters - Multi-Drop Extended
                        Set all PLC addresses to 192.168.141.2
        Driver#3 - South meters - RTU Serial
                        Set port to #1

Each host will appear as an MB remote to the other two hosts. When everything is running each host will show a total of 42 connected remotes – 40 remotes and the two other hosts.