

Some radio modems are half-duplex modems. This means they cannot receive and transmit at the same time. We need to add a delay between the reception of a packet and a reply, since there will be some latency when the modem changes from a receptive to a transmittive state.

```

|                                     Net D      |Provide a 50 msec delay between
|                                     D52        |packet receive and packet
5|-----[50]-----|transmit.

```

The PLC is now setup for our network and radio modem communications. Let's start the control portion of the program. Let's calculate the level of the tank in inches. The level sensor is calibrated to generate a signal of 0-5V for the range of 0-100". The sensor is linear within this range and the following rung will calculate a level from the raw analog value.

```

|                                     Level      |
|                                     C0         |Compute the current level.
6|-----[A24*10/102]----|1" = 10.2

```

The pump station has an overflow sensor, which will trigger when the level is above 105". When an overflow occurs, we want both pumps to turn on, until the level drops blow 50". The following RLL performs this,

```

|OVFL                                OVFL      |If we have overflow then
| X0      R101                       R1        |generate alarm.
7|-| |---|^|------(S)-----| R1 will cause PUMP1 and
|                                     |          | PUMP2 to be turned ON.
|                                     C31       |
8|-----[C0-50]----|
|Overf OVFL                          OVFL      |We had an overflow alarm, but
| R31   R1                             R1        |the level has dropped, so
9|-| |---| |------(R)-----|shutoff the alarm.

```

R1 will turn both pumps on, later in the program. Next, we will determine if a pump should be turned on or off depending on the level.

```

|                                     C31       |Is level > 90"
10|-----[C0-90]----|
|Overf                                PUMP      |
| R31                                  R10       |Yes, so turn on a pump.
11|-| |------(S)-----|
|                                     C31       |Is level < 10"
12|-----[10-C0]----|
|Overf                                PUMP      |
| R31                                  R10       |Yes, so shut-off the pump.
13|-|/|------(R)-----|

```

When a pump is turned on, start a 0.5 second timer, to delay the checking of the pump status.

```

|PUMP                                  |
| R10                                  T1        |
14|-| |------(50)-----|

```

Since we have two pumps, we may lengthen their life spans by rotating their operations. This flip-flop operation is achieved by the following rungs,

```

|PUMP      PUMP1                       |
| R10     R100  R0                     R50     |Toggle pumps
15|-| |---|^|+---| |------( )-----|
|                                     PUMP1    |
|                                     R50       |R0 OFF, pump 2
16|          `---| |------(R)-----|
|                                     PUMP1    |
|                                     R50       |R0 ON, pump 1
17|          `---|/|------(S)-----|

```

R0 is used to determine which pump will be turned on. If R0 is on then use pump 1, else use pump 2. Next, we will turn on or off the appropriate pump. R10 will control the on/off status of the pumps and R0 indicates which pump to turn on.

```

| PUMP1 PUMP          PUMP1          |
| R0    R10          Y6              |Turn ON both pumps if there is
18|-| |---| |---+----- ( )-----|an overflow alarm (R1).
| OVFLA            |
| R1              |
19|-| |-----'
| PUMP1 PUMP          PUMP2          |
| R0    R10          Y7              |
20|-|/|---| |---+----- ( )-----|
| OVFLA            |
| R1              |
21|-| |-----'

```

R1 indicates there was an overflow condition and both pumps should be on. Next we should check to see if any alarm conditions have occurred and if so, turn on an appropriate error light.

```

| PUMP1 P1STA          |Pump 1 on and no status
| Y6    X8    T1      Y0      |then error.
22|-| |---|/|---| |----- ( )-----|
| PUMP2 P2STA          |P2Fai
| Y7    X9    T1      Y1      |Pump 2 on and no status
23|-| |---|/|---| |----- ( )-----|then error.
| OVFL          OFALA
| R1            Y2      |Overflow alarm.
24|-| |----- ( )-----|

```