3

Serial Port Communication Service

This chapter describes serial communications and describes how to define settings for three different serial connections: hardwired, radio (RTS/CTS), and dial-up.

Introduction to Driver Objects

Certain object classes represent and communicate with external physical devices such as PLCs, RTUs, and controllers. A few examples include Modbus, Tiway, AB_PLC5, and Optomux. We use the generic term *driver* to refer to these types of object classes. The functionality built into driver objects enables them to communicate with the physical devices that they represent. Lookout*Direct* communicates with the outside world primarily through driver objects.

In traditional systems, drivers are separate applications that run independently of the operator interface. Driver programs compete for CPU time with applications such as database managers, HMIs, and historical data loggers, necessitating multitasking and increased CPU power. In contrast, Lookout*Direct* drivers are not separate applications. Lookout*Direct* driver objects work as any other object in the Lookout*Direct* event-driven environment, except that they communicate with external devices.

With traditional systems, you assign a particular driver to a specific serial port. In such configurations, multiple drivers cannot share a single serial port. Lookout*Direct* does not associate baud rate, data bits, parity, or stop bits with a particular serial port. In this way, drivers that implement different protocols and baud rates can use the same port and the same modem or radio frequency.

This capability allows you to mix and match RTUs, PLCs, and other devices over a single radio frequency without communication conflicts or special hardware. For example, you can use a single two-way radio connected to a serial port to communicate with several different brands of RTUs out in the field, each one using a different protocol. You can have seventy-five remote PLCs share a set of five dial-up modems.

All this is possible because of the Lookout*Direct* port communication service. Objects use the communication service, an environment service, to gain access to serial ports in an orderly and timely fashion.

Note Some Lookout*Direct* driver objects communicate with physical devices through dedicated hardware. These driver objects do not use serial ports but instead rely on their own proprietary network cards to communicate with the outside world. A few examples include Modbus Plus (SA85 card), Data Highway (KT card), and DeltaTau (PMAC card). You do not need to configure serial ports for these objects classes. Refer to the appropriate object class documentation in you online help or in the PDF Lookout*Direct Object Reference Manual* to verify if a particular object class uses a serial port.

Understanding the Communication Service

The Lookout*Direct* serial communication service allocates serial port usage between driver objects. At the frequency of the object **Poll Rate,** a driver object notifies the communication service that it needs to use a specific serial port to poll a device. If the requested serial port is not in use, Lookout*Direct* allocates the serial port to the driver object. When the driver object takes control of the serial port, it defines port communication parameters such as baud rate and protocol and polls its device. When polling is complete, the driver object releases the port so the communication service can allocate it to other driver objects.

You can uniquely configure each serial port for hardwired, radio, or dial-up communications through the **Serial Port Settings** dialog box. Refer to the *Defining Serial Port Settings* section for more detailed information.

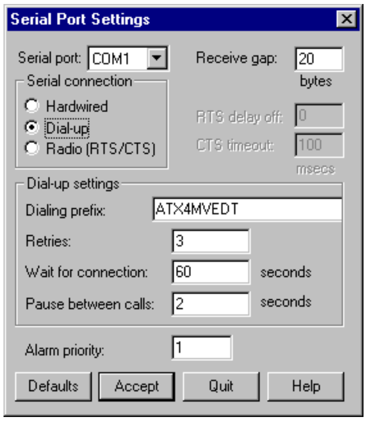
Note You must define serial port communication settings on every copy of Lookout*Direct*. If you have more than one instance of Lookout*Direct* running on the same computer, each instance must use a different serial port.

Because multiple Lookout*Direct* applications cannot share the same serial port, if it is necessary for two processes to access the same serial port, they need to be run in the same Lookout*Direct* application. If you are designing a system with multiple server process files, and those server files all access the same serial port on a single computer, they need to be run in the same Lookout*Direct* application.

Defining Serial Port Settings

This section walks you through the steps to configure serial port settings for hardwired, radio, and dial-up communications.

1. From the Lookout*Direct* menu bar, select **Options»Serial Ports.** The **Serial Port Settings** dialog box appears.



Serial Port Settings

Serial port: COM1
Receive gap: 20 bytes

Serial connection
○ Hardwired
● Dial-up
○ Radio (RTS/CTS)

RTS delay off: 0
CTS timeout: 100 msecs

Dial-up settings
Dialing prefix: ATX4MVEDT
Retries: 3
Wait for connection: 60 seconds
Pause between calls: 2 seconds

Alarm priority: 1

2. In the **Serial port** data field, select the communication port you are defining.
3. Define the serial port parameters for the appropriate communication port. The rest of this section contains complete descriptions of the parameters.
4. Click on **Accept** to save the parameter changes for the serial port.
5. Click on **Quit** to exit the dialog box.

Selecting the Serial Port

Use the **Serial port** field to select the communication port you are defining. Microsoft Windows supports up to nine serial ports; however, most computers support only two serial ports without additional hardware.

Setting Receive Gap

The **Receive gap** setting is available for all serial connection types.
This number specifies the number of empty bytes (or amount of time) a driver receives from a controller before the driver recognizes the end of a message frame and asks for another message. Normally you should leave this at the default setting of 5. However, if you are experiencing garbled communication alarms, you might try increasing this number to allow more dead time before

Lookout*Direct* decides it has received a complete message. For example, with a slow baud rate of 1200, you might have to increase the **Receive gap** setting to approximately 30.

Selecting the Serial Connection

Hardwired Settings

Hardwired serial connections require no hardware handshaking for line control. Use this setting for all serial communication types except dial-up telephone and remote radio transceivers. You should also use this setting when directly connecting Lookout*Direct* to the master repeater on a radio system or through a leased-line modem. Because a master repeater is a full-duplex device that does not require keying and unkeying of the frequency, it acts much like a physically hardwired network. Other hardwired connection types include RS-232, RS-422, RS-485, and leased telephone lines.

RTS/CTS Handshaking Settings

RTS/CTS is a local hardware handshaking mechanism between the local computer and the local communication device. Use the **Radio (RTS/CTS)** serial connection when you connect the serial port to a device that requires RTS/CTS hardware handshaking, such as a radio transceiver that must be keyed up during data transmission and unkeyed during data reception. Other half-duplex communication media, such as RS-485, might require RTS/CTS hardware handshaking. Although the RTS/CTS scheme works identically for other RTS/CTS communication schemes, this example assumes that you are communicating through radio.

When you select RTS/CTS hardware handshaking, Lookout*Direct* controls the RTS, or request-to-send pin, and monitors the CTS, or clear-to-send pin, during data transmission (pins 4 and 5 on a 25-pin RS-232 connector). Therefore, you must have at least the RTS pin (pin 4) wired *straight through* on your RS-232 cable. The CTS pin (pin 5) is optional.

Lookout*Direct* initiates a serial transmission on an RTS/CTS port by first asserting RTS to key the radio. Lookout*Direct* then begins monitoring the state of the CTS pin. When the radio transmitter is fully keyed and ready to transmit, the radio asserts CTS and Lookout*Direct* immediately begins data transmission. If the radio does not assert CTS within the **CTS timeout** setting (default is 100 ms), Lookout*Direct* assumes the radio is ready to transmit and transmits anyway.

The **CTS timeout** setting is the maximum amount of time that Lookout*Direct* waits after asserting RTS for CTS before transmitting. Most radios typically take between 10 and 80 milliseconds to key up. Consult your radio specifications and DIP switch settings to determine the key-up delay on your radio.

If your radio can assert CTS when it is ready to transmit, add about 50 milliseconds to the radio key-up delay specification and use this total value for the **CTS timeout**. If your radio does not assert CTS, you should begin by adding about 20 milliseconds to your radio key-up time. Then, increase this value in 10 millisecond increments until the remote radio begins to correctly receive the first bytes of the message.

Some radios might assert CTS before they are actually ready to transmit. In this case, disconnect the CTS line (pin 5 on a 25-pin RS-232 connector) and set the **CTS timeout** to a value high enough to let the radio fully key before transmission.

After it transmits the last byte of data, Lookout*Direct* continues to assert RTS, keeping the radio keyed until the **RTS delay off** time period expires. You should set this value to the default of zero milliseconds so that Lookout*Direct* unkeys the radio as soon as possible to prepare to receive the response.

When unkeyed, most radios generate an audible squelch tail that the remote device might decode as unexpected garbage bytes. Some remote devices reject the entire message instead of just decoding the valid data and ignoring the extra garbage bytes. In this case, keep the radio keyed for several milliseconds using the **RTS delay off** setting. This time period delays the squelch tail long enough for the remote device to recognize the last data frame as valid before receiving garbage bytes caused by the squelch tail.

If you set the **RTS delay off** setting too high, the remote device begins transmitting its response before the local radio is unkeyed, causing a communication alarm in Lookout*Direct*.

Dial-Up Modem Settings

Use the **Dial-up** serial connection when you use a modem in conjunction with a switched telephone line (not leased line). You can customize the dial-up settings for your particular modem and phone line.

The default **Dialing prefix** settings are based on the Hayes Corporation AT command set, which is an industry standard for data modems. The following table explains the Lookout*Direct* default settings. For additional commands, refer to your modem operation documentation.

Table 3-1. Dialing Prefix

`AT`	Attention code that must precede all commands
`D`	Dial phone number with these modifiers: `P` for pulse; `T` for tone
`En`	Local echo mode: `E` for no echo
`Mn`	Speaker on or off: `M` for speaker always off
`Vn`	Verbal or numeric result codes: `V` for numeric result codes
`Xn`	Result code and dialing options: `X4` waits for dial tone before dialing, and recognizes busy signal

When you use an external dial-up modem with Lookout*Direct*, the DTR line in your cable between the modem and the computer must be wired straight through. This line is pin 20 on a 25-pin RS-232 connector and pin 4 on a 9-pin connector. Lookout*Direct* uses the DTR line to command the modem to disconnect (hang up) and return to the command mode.

Some factory modems are not configured to respond to the DTR line. After Lookout*Direct* first successfully dials out to a remote modem and finishes the polling cycle, it drops the DTR line but the modem remains connected. If the modem does not respond after several seconds of Lookout*Direct* attempting to raise and drop the DTR line, Lookout*Direct* generates an alarm stating that the modem is not responding. If you receive this alarm message, your modem is not configured to monitor the DTR line.

The Hayes Corporation standard command for configuring the modem to hang up and enter command mode upon loss of DTR is `&D2`. You can use a terminal program to make this setting permanent on most modems by entering the modem command `AT&D2&W` to store the setting permanently in nonvolatile modem memory. Or you can just add `&D2` into the **Dialing prefix**. The default **Dialing prefix** is `ATX4MVEDT`, so you might change it to `AT&D2X4MVEDT`.

Retries specifies the number of times Lookout*Direct* dials the specified phone number and attempts to connect to the modem at the other end of the line. If Lookout*Direct* fails to connect after the specified **Retries**, it generates an alarm and moves on to the next phone number in the polling queue (if a queue has formed).

Wait for connection specifies the length of time Lookout*Direct* waits to receive a connect signal back from the modem it is calling. The time period begins when Lookout*Direct* first sends the local modem the dialing prefix command. The time should be long enough for the local modem to receive a dial tone, dial the phone number, allow the remote modem to pick up the line, and send back a connect message. If the specified time is too short, your system could be operating correctly but never make a connection.

Pause between calls is the length of time Lookout*Direct* waits after hanging up before it sends the local modem the next dialing prefix signal. If the specified time is too brief, your system might not hang up the existing call but still attempt to call the next number.

Note Your specific modems, radios, and local phone lines might operate faster or slower than the default settings. You might need to use a trial-and-error approach to find the best settings for your system.

Serial Port Hangup

You can configure your serial port to use +++ATH hangup as well as DTR hangup.

Every serial port you have configured will have a configuration section in the Lookout*Direct*`.INI` file under the port name, such as `[COM1]`. Add the following entry to the file to set your hangup mode:

```
DTR_Hangup=N
```

When *`N`*=1 (default), that port uses DTR hangup. When *`N`*=0, the port uses +++ATH hangup.

Serial Port Diagnostics

You can create serial port diagnostic files to help solve serial port problems. Open the LookoutDirect`.INI` file (located in your Lookout*Direct* directory) with a text processor. Every serial port you have configured has a configuration section in this file under the port name, such as [COM1]. Add the following entry to the file to create a diagnostic file

```
Diagnosticfile=N:\completepath\filename
```

where *`N`* is the drive letter, followed by the complete path to the file (including the file name) you want to hold your diagnostic information. After editing the `Lookout.INI` file, reload your Lookout*Direct* process file to force Lookout*Direct* to reread the `.INI` file.