



TECHNICAL NOTE TNOI21

Title: Working with Modems

Product(s): G3 HMI Series

This Tech Note explains how to configure your G3 panel to work either with modems, or with direct serial connections to computers running the Microsoft Windows operating system. Note that Crimson's modem support is fundamentally different from that provided by earlier Red Lion operator panels, in that it is entirely based upon the Point-To-Point Protocol, otherwise known as PPP. While protocols such as Modbus allow a single conversation to occur between any two devices, PPP is more akin to an Ethernet connection in that it allows an unlimited number of logical connections to exist on a single physical link. A single PPP connection can thus allow simultaneous access to the panel's TCP/IP download facility, its web server, its shared serial ports, and to any TCP/IP based protocols that have been selected via the Communications window.

SOME TYPICAL APPLICATIONS

The sections below list some typical applications of modem technology...

You want an operator panel in a remote location to send an email to a service engineer to inform him of a fault condition. By configuring an on-demand connection to an Internet Service Provider, the panel is instructed to automatically connect when an email is to be sent, and then to hang-up when the message has been transferred.

You want an operator panel in a remote location to send messages directly to the cell phones of a group of service engineers to inform them of a fault condition. By configuring a GSM modem with SMS support, the panel is instructed to notify the engineers of the fault by means of short text messages. Further, when a given engineer replies to the message to indicate that he will deal with the problem, the G3 can optionally forward the reply to all the other engineers, letting them know that someone has taken ownership of the issue.

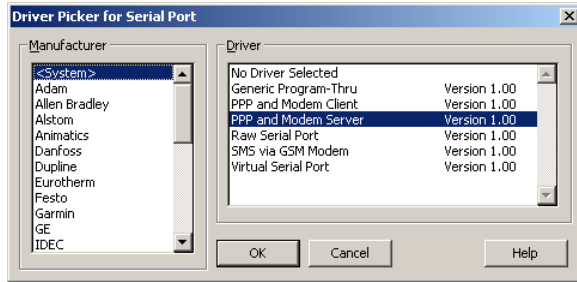
An operator panel in a remote location is configured to accept incoming connections from a PC based at a central office. Once the connection is made, the panel's database can be remotely upgraded by instructing the Crimson configuration to download via the TCP/IP link. If so configured, the panel's web server can be accessed so as to provide remote control facilities. Best of all, by installing virtual serial port software on the PC and by enabling port sharing on the G3, a PLC programming package can be used to download to the programmable controller connected to the operator panel—with the software 'thinking' it is talking over a standard COM port!

An operator panel in a remote location is configured to accept incoming connections from a SCADA system located in a central office. The SCADA package can use Modbus TCP/IP to access gateway blocks within the panel, thereby reading and writing data collected from devices connected to the G3's serial ports. The SCADA package can also make direct contact with devices connected to the panel's Ethernet port by means of the G3's IP routing capability.

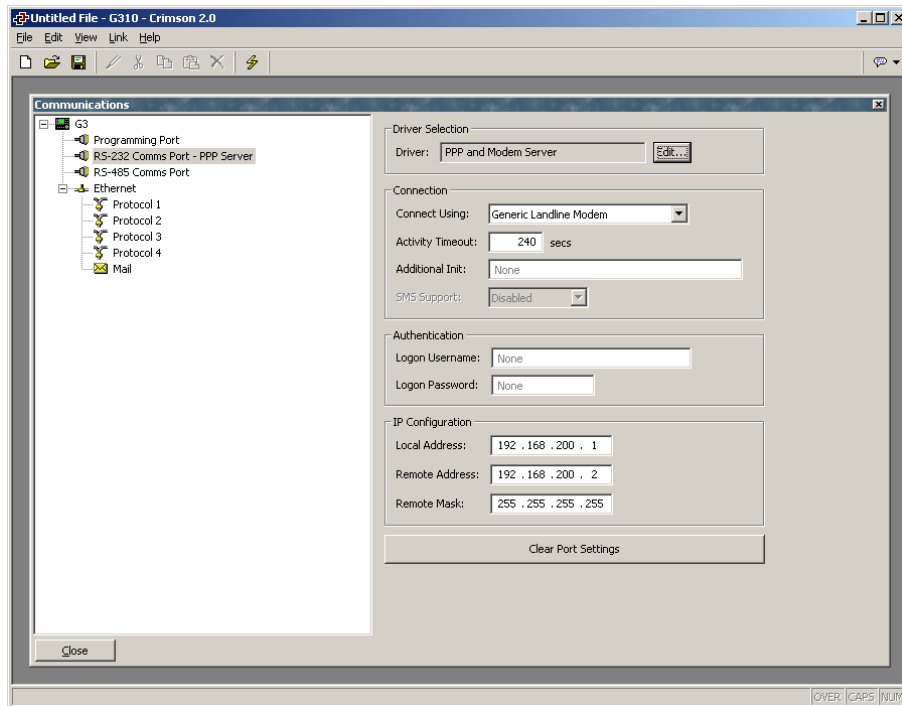
There are obviously many other applications beyond these few examples.

ADDING A DIAL-IN CONNECTION

To add a dial-in connection to your database, open the Communications window and select the serial port to which the connection will be made. Click on the Edit button of Driver field in the right-hand pane, and select the *PPP and Modem Server* driver from the System section of the selection dialog...



The right-hand pane will now show the modem configuration...



The modem has the following configuration options...

The *Connect Using* property is used to select the physical device to be used to make the connection. The devices support at this time are direct serial connections to computers running Microsoft Windows, generic landline modems which implement the Hayes command set, and the Telit GM-862 GSM mode. For dial-in connections, the Telit device must be configured in Circuit Switched Data mode.

The *Activity Timeout* property is used to define how long a period must pass without the G3 sending a packet over the PPP link in order for the connection to be terminated. For dial-in connections, it is assumed that the connecting device is friendly, so no effort will be made to filter out optional packets that might result in the link staying active for long periods. Note that even if you want a permanent connection, you must enter a suitable timeout so as to allow the detection of dead links. This implies that so-called permanent connections may still drop on occasions, but since the client will immediately reestablish the link, this is not an issue.

The *Additional Init* string is used with non-direct links, and provides a series of AT commands to be used to initialize the modem. The initial AT prefix is not required. Several commands may be combined by simply placing one after the other. The exact string that will be required for your modem is dependent upon its internal software, so if you contact Technical Support for assistance, be sure to have exact make and model information available.

The *SMS Support* property is used to enable Short Message Service messaging when using a GSM modem. In order for SMS messaging to operate properly, you will also have to enable the SMS Transport using the Mail icon in the Communications window.

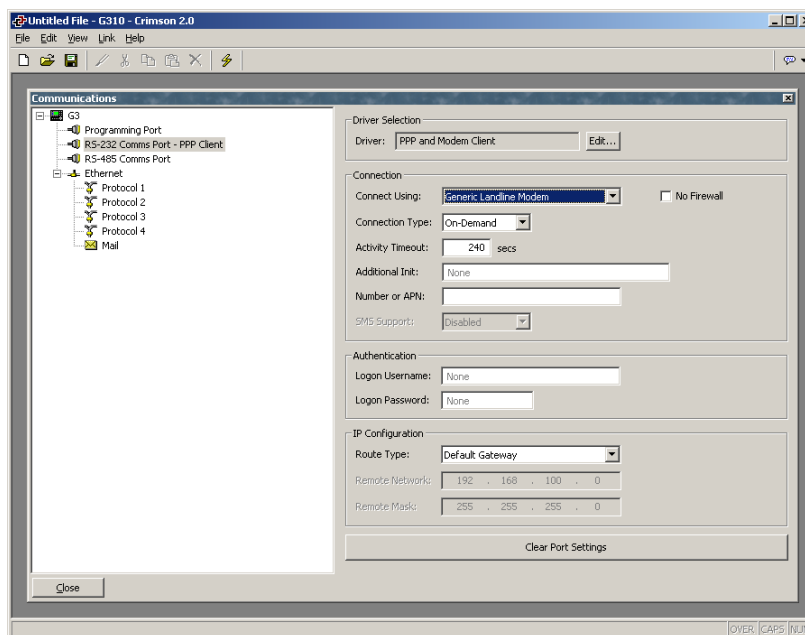
The *Logon Username* and *Logon Password* properties are used to define the credentials that the remote client must provide in order to be allowed to connect to this device. The username is not case sensitive, while the password is. Crimson's PPP implementation will ask its peer to use CHAP authentication to avoid transmitting or receiving plaintext password, but will fallback to using PAP if the remote client does not support CHAP.

The *Local Address* property is used to define the IP address to be allocated to the local end of the connection. This will thus be the IP address of the G3 for this link. Please note that this must not be the same as the IP address of the G3's Ethernet port, as every physical IP interface must have a distinct IP address. The default value will work in most situations, unless your network design demands that you use a different setting.

The *Remote Address* property is used to define the IP address to be allocated to the remote end of the connection. It is used together with the *Remote Mask* property to determine what packets will be routed to this connection. For most applications, a mask of 255.255.255.255 will be used, thereby instructing Crimson to send via this interface only those packets directly bound for the remote client. A mask of 0.0.0.0, by contrast, will allow all packets that do not specifically match another interface to be forwarded to the remote client, presumably for further forwarding to the intended host. Intermediate masks may be used to control exactly which packets are sent.

ADDING A DIAL-OUT CONNECTION

Dial-out connections are added exactly as above, except that the *PPP and Modem Client* driver should be selected for the required port. The configuration options for this modem are shown below...



The modem has the following properties that are distinct from those for dial-in connections...

The *Connect Using* property is as for dial-in connections, with the addition of support for GPRS connections via a GSM modem. These connections differ from CSD connections in that they achieve much higher speeds, and are typically charged on the basis of how much data is transferred rather than how long the connection is maintained. GPRS connections may thus be configured for permanent connection, unless there is a need to provide downtime to allow SMS messages to be transferred.

The *No Firewall* property is used to turn off the protection that is normally provided for dial-out connections. This protection prevents incoming connections from being made to this interface, and prevents the G3 from sending certain diagnostic packets that might either provide a hacker with information about the system, or might be used by an attacker to keep a connection active in the absence of actual data transfer. If you are connecting directly to the Internet by means of this connection, you should not normally turn off the firewall. The firewall should be disabled only for connections to corporate networks or to other controlled environments.

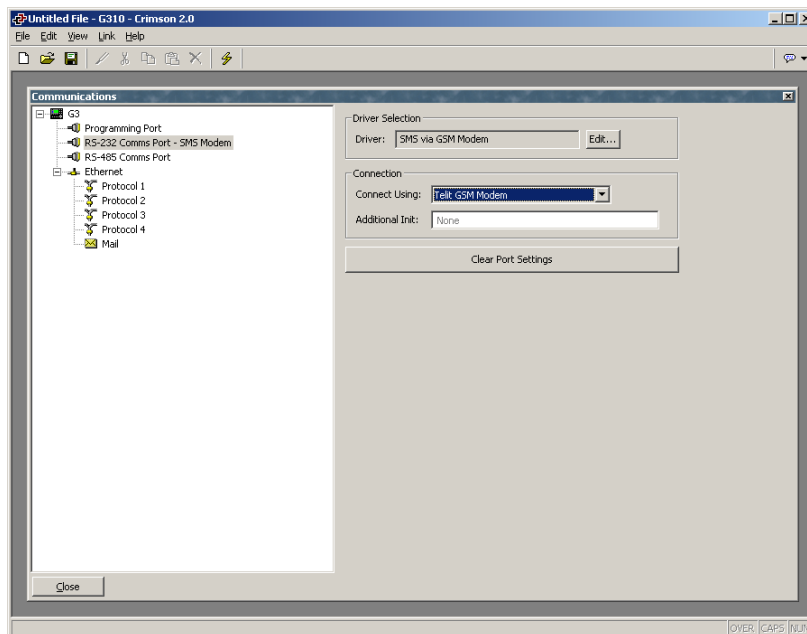
The *Connection Type* property is used to indicate whether you want this connection to be permanently maintained, or whether you want it to be established automatically when an attempt is made to transfer data to hosts that are reachable via this interface. If you select an on-demand connection, you must specify the timeout after which the link will be terminated if no packets have been transmitted by the G3.

The *Logon Username* and *Logon Password* properties are used to define the credentials that will be passed to the remote server when attempting to initialize this connection. The username is not case sensitive, while the password is. Crimson's PPP implementation will ask its peer to use CHAP authentication to avoid transmitting or receiving plaintext password, but will fallback to using PAP if the remote client does not support CHAP.

The *Route Type* property is used to define the data that will be transferred via this interface. For on-demand connections, this effectively defines when the connection will be activated. If *Default Gateway* is selected, any packets, which do not match the address and netmask of the Ethernet connection, will be sent to this interface. Note that in this mode, the Ethernet port must have a gateway setting of 0.0.0.0, or it will take all the packets and leave none to activate the modem! If *Specific Network* is selected, you must provide the address and netmask that defines the network to which packets will be routed.

ADDING AN SMS CONNECTION

SMS connections are used when text messaging functionality is required, but where neither dial-in nor dial-out PPP connections will be established. They are configured as described above, except that the *SMS via GSM Modem* device should be selected for the required port. The configuration options for this modem are shown below...



The device properties are a subset of those provided for dial-in connections. SMS support is always enabled with this driver, but once again, note that in order for SMS messaging to operate properly, you will also have to enable the SMS Transport using the Mail icon in the Communications window.

SMS MESSAGE PROCESSING

When SMS messaging is enabled, the G3 will instruct the GSM modem to check for new incoming or outgoing messages every five seconds. Incoming messages are forwarded to the mail manager, which will optionally forward them to other users according to its configuration. Note that it is not possible to check for messages while the modem is connected to a CSD or GPRS session, so you will want to avoid using permanent connections when working with SMS. Note also that if more than one GSM modem is configured, all will be able to receive messages, but only the second modem will be used for sending.

USING MULTIPLE INTERFACES

Each G3 panel can support up to two modem independent connections. When combined with the Ethernet port, this gives a total of up to three distinct IP interfaces, all of which will operate according to the configuration parameters defined for each connection. This section describes how these multiple interfaces will interact, and how the G3 will decide where to send each packet of data.

INTERFACE SELECTION

Each interface will have an IP address and a network mask, the combination of which is used to decide whether to forward packets to that interface. For example, if the Ethernet interface is configured with an IP address of 192.168.1.0 and a network mask of 255.255.255.0, any packets for IP addresses starting with 192.168.1 will be sent to this interface. Likewise, if an on-demand modem connection has a remote IP address of 192.168.2.2 and a netmask of 255.255.255.255, sending a packet to address 192.168.2.2 will result in the connection being established.

DEFAULT ROUTE

In addition, one single interface may also define a default route, which will be used to handle packets that do not specifically match any other interface. The method used to configure the route varies according to the interface type, as shown in the table below...

INTERFACE	TO DEFINE DEFAULT ROUTE
Ethernet	Enter a non-zero value for the <i>Gateway</i> property.
Dial-In	Enter 0.0.0.0 for the <i>Remote Mask</i> .
Dial-Out	Select Default Gateway for the <i>Route Type</i> property

Note again that only a single interface may define a default route. For example, a G3 panel may be connected to a number of Ethernet devices using an IP address of 192.168.1.0 and a netmask of 255.255.255.0, with no gateway defined. An on-demand modem connection may be configured to access an Internet Service Provider so as to send alarm emails. Its *Route Type* is set to Default Gateway, making it the route for any packets for IP addresses that do not match the network defined for the Ethernet gateway. The SMTP server is configured as 24.104.0.39, thereby resulting in a dial-out connection when an attempt is made to send a mail message.

IP ROUTING

The Ethernet icon in the Communications window contains a property called *IP Routing*. If this facility is enabled, incoming packets from non-firewalled modem interfaces will be compared against the IP address and netmask for the Ethernet interface, and will be forwarded to that interface should a match occur. This facility is most often used with dial-in connections, and allows IP access to all devices connected to the Ethernet port, provided a suitable route is defined by the client.

CHECKING THE MODEM STATUS

In order to help debug modem connections, Crimson provides the `GetInterfaceStatus` function. This function takes a single argument, which is the numeric index of the required interface. Interface zero is always the panel's loopback interface. Next comes the Ethernet interface, if it is enabled, such that PPP interfaces start at 1 when Ethernet is disabled and 2 when it is enabled. The function returns a string, which can be interpreted according to the following table...

STATUS	MEANING
CLOSED	The interface has not yet been initialized. This state will only occur for a short time during system start-up.
INIT	The modem is being initialized. If the connection remains in this state, there are probably errors in the init strings being sent to the modem.
IDLE	The link is idle. GSM modems will return a number at the end of the string to indicate signal strength. The next table explains how to interpret these values.
SMS	The modem is sending SMS messages, or polling the modem to see if new SMS message are available. If SMS messaging is enabled for a modem, you will see this state appear for a short period every five seconds.
CONNECTING	The modem is establishing a connection. In the case of a client connection, this state indicates that a call is being placed. In the case of a server connection, this indicates that the modem is waiting for a call. GSM modems will also return an IDLE state while waiting for a call in order to show signal strength.
CONNECTED	The modem has established a connection. This state will persist for only a short time, as the LCP negotiation process will begin after a small delay.
NEG LCP	The connection is negotiating LCP options. This process decides on a set of link protocol settings that are acceptable to both the client and the server.
AUTH	The connection is performing the authentication process to ensure that the appropriate user credentials are used.
NEG IPCP	The connection is negotiating IPCP options. This process decides on a set of network protocol settings that are acceptable to both the client and the server.
UP	The connection is active and IP data can be exchanged.
HANGING UP	The modem is disconnecting. This state will exist for only a short time before the modem returns to IDLE.

The signal strength values returned by GSM modems have the following meaning...

VALUE	SIGNAL STRENGTH
0	-113 dBm or less.
1	-111 dBm.
2-30	-109 dBm to -52 dBm in 2 dBm steps.
31	-51 dBm or greater.
99	Signal strength cannot be determined.

Cell phones typically interpret these values as follows when displaying signal strength...

VALUE	STRENGTH	NUMBER OF BARS
5 or less.	-103 dBm or less.	One
6 thru 9.	-101 dBm thru -95 dBm	Two
10 thru 14.	-93 dBm thru -85 dBm	Three
15 or greater.	-83 dBm or greater.	Four