



# 9210 & XPERT DATALOGGERS

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## GPRS Manual

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## Table of Contents

Introduction.....	5
Installation.....	6
Installation.....	6
Features.....	7
Configuration.....	8
“GPRS” Entry on Setup Tab.....	8
Enabled.....	9
Comm Port.....	9
Modem APN.....	9
Modem User Name and Modem Password.....	9
Modem PIN.....	10
Modem Type.....	10
Custom Modem Settings.....	10
Use Modem Settings.....	10
AT&T Support.....	10
Network.....	11
Auto Band.....	11
2G Band (GSM, GERAN, Edge, GPRS).....	11
3G Band (UMTS, UTRAN, HSPA and HSDPA).....	11
Operator.....	11
GPRS Power Settings.....	12
Power-on Interval, Time, and Duration.....	12
Power-on Action.....	12
Control.....	13
Warm Up.....	13
GPRS Transmission Settings.....	13
Interval.....	13
Time.....	14
Format.....	14
Num Values.....	15
Alarm Data.....	15
Retransmit.....	15
Content.....	15
Transmit Servers.....	16
GPRS SMS Settings.....	17
Transmit Mode.....	18
Transmit List.....	18
Alarms.....	19
Notify.....	19
Notify List.....	20
Setup Password and Data Password.....	20
Setup User List and Data User List.....	20
SMS Command Processing.....	20
GPRS Connect (SSP/CL) Settings.....	21

Primary IP and Secondary IP .....	21
Password .....	21
CSD Shoulder-Tap.....	21
GPRS Blocks in Graphical Setup and EzSetup .....	22
Alarm Block Properties.....	22
GPRS Block Properties.....	23
Tagging Data with EzSetup .....	24
Basic Entry on Setup Tab .....	25
Testing GPRS Operations.....	27
The GPRS Diagnostics Tab .....	27
Modem status .....	27
Tests... ..	29
Next task .....	29
Next task time .....	29
Time .....	29
Last SMS.....	29
More... ..	30
Signal Quality .....	30
Update.....	30
ON.....	30
OFF .....	30
Selftimed Statistics... ..	30
Alarm Statistics:.....	30
GPRS Test Dialog.....	30
Hydromet Cloud Test Transmission .....	30
SMS Test Transmission .....	31
SSP Test Transmission .....	32
Other Test Transmission .....	32
Troubleshooting .....	33
Appendix A – Telemetry Formats .....	34
ASCII Column Format.....	34
Handar Format .....	34
NFDRS and NIFC Formats.....	34
Pseudobinary Formats.....	36
Pseudobinary B (Interleaved and Non-Interleaved) .....	36
Pseudobinary-C Format .....	37
Pseudobinary-D Format .....	39
Six-Bit Binary Encoded Format.....	40
Pseudobinary over SMS Format .....	41
SHEF and SHEFFIX Formats.....	41
SSP Format .....	42
Text Format.....	42
BUFR .....	43
Name .....	43
Tx Content, Data Interval, Data Time, and Num Values.....	44
Sequence .....	45

BUFR Content Options.....	46
Originating Center .....	46
Data Category .....	46
Data Sub-category.....	46
Hydromet Cloud Protocol (“Session Type 0/1”) .....	46
Course of Events .....	46
Session Type Code.....	47
Report Type Code.....	47
Command-line Session Details .....	48

## Table of Figures

Figure 1: The GPRS entry on Setup Tab .....	8
Figure 2: GPRS Properties Dialog.....	9
Figure 3: Custom Modem Settings Dialog .....	10
Figure 4: GPRS Power Settings Dialog .....	12
Figure 5: GPRS Transmission Settings dialog.....	13
Figure 6: Select Tags dialog .....	16
Figure 7: GPRS Transmit Servers.....	16
Figure 8: Transmit Server .....	17
Figure 9: SMS Settings .....	18
Figure 10: GPRS Connection Settings Dialog.....	21
Figure 11: GPRS block in Graphical Setup .....	22
Figure 12: Alarm Block Dialog .....	23
Figure 13: GPRS Edit Tag Dialog .....	23
Figure 14: EzSetup Configuration .....	25
Figure 15: GPRS Tag in EzSetup .....	25
Figure 16: GPRS Custom Formatting Entry.....	26
Figure 17: GPRS Diagnostics Tab.....	27
Figure 18: Hydromet Cloud Test Transmission.....	31
Figure 19: SMS Test Transmission.....	31
Figure 20: SSP Test Transmission.....	32
Figure 21: Other Test Transmission .....	32

## INTRODUCTION

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Sutron's Xpert family of DCPs (both the 9210 and the Xpert, hereafter referred to as the Xpert) have been designed to be easily expandable by adding additional software libraries, called Sutron Link Libraries (SLLs). One such library is GPRS.sll, which adds the ability for the Xpert to communicate using a Sutron GPRS/HSDPA modem connected to a serial port.

This document is the user manual for GPRS.sll. The following topics are discussed:

- How to install the library.
- How to configure the Xpert for GPRS and HSDPA communications.
- Diagnostics

# INSTALLATION

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This section describes the installation and configuration of the GPRS.sll library.

## Installation

To install the library, copy the GPRS.sll file to the “\Flash Disk” subdirectory of your Xpert using Xterm. For more information on performing this file transfer, please refer to chapter 6 of the Xpert or 9210 user manual.

Once the file has been transferred, reboot the Xpert. The library will load automatically after the Xpert reboots.

To uninstall the library, use Xterm to delete the file from the Flash Disk subdirectory. This can only be done when the Xpert application is not running (select “Exit App” from the Status tab).

In order for the library to load and operate correctly, the version of the file must be the same as the version of the application loaded into the Xpert. This is usually not a concern because the same version of the slls and application are typically packaged together.

Should the need arise to verify that the versions are the same; the version of a sll as it resides on the PC can be determined by looking at the file’s properties (right-click on the file and select the “Version” tab). The version of the Xpert application is given by the application itself, at the top of the About dialog, which is accessed from the Status tab.

## FEATURES

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This section discusses what features are supported related to GPRS communications.

- Self-timed (scheduled) telemetry of data using TCP/IP messaging and/or SMS text messages
- Alarm telemetry of data using TCP/IP or SMS
- Support for standard Xpert network services when used with a VPN or static IP such as Telnet, Web Server, XTerm.
- Scheduled and manually initiated processing of incoming command messages
- Diagnostic support, including:
  - Scheduling details
  - Next self-timed message content and size
  - Recent incoming messages
  - Signal strength
  - Total message and byte counting
  - Projected data usage

# CONFIGURATION

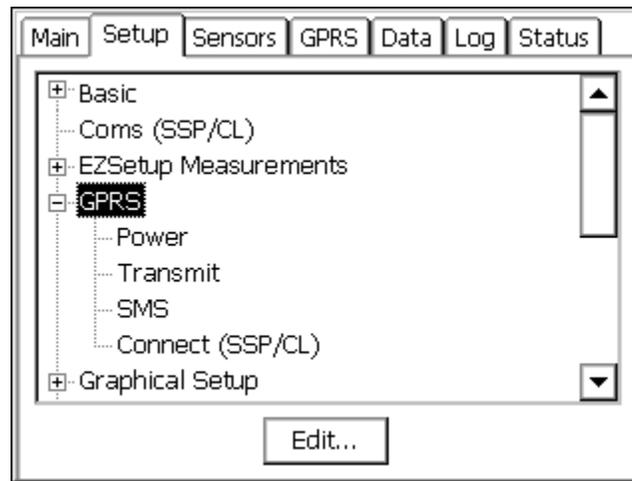
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This section discusses how to configure the GPRS features. There are three different places you'll go to use and configure the Xpert for GPRS communications:

- ["GPRS" Entry on Setup Tab](#)
- [GPRS Blocks in Graphical Setup and EzSetup](#)
- ["Basic" Entry on Setup Tab](#)

## "GPRS" Entry on Setup Tab

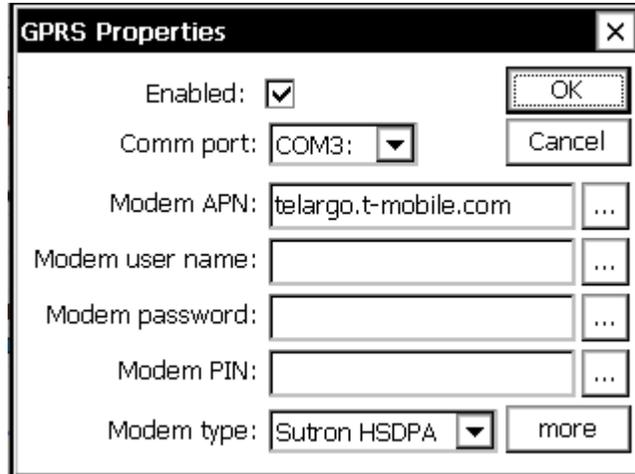
The "GPRS" entry and its sub-items on the Setup tab are used to configure the majority of GPRS operations.



**Figure 1: The GPRS entry on Setup Tab**

- The "GPRS" item contains settings related to the modem configuration.
- The "Power" sub-item contains settings to control when the modem should be powered to listen for incoming connections (or, alternatively, to connect direct to a server).
- The "Transmit" sub-item contains settings to control self-timed transmission schedules.
- The "SMS" sub-item contains settings to control all SMS-related communications.
- The "Connect" sub-item contains settings to control scheduled and on-demand SSP/CL connections to a server.

To access GPRS configuration settings, select the “GPRS” entry and press “Edit”. The following dialog appears:



**Figure 2: GPRS Properties Dialog**

The GPRS Properties dialog contains settings for configuring the GPRS modem hardware. Here are the options provided by this dialog:

### **Enabled**

This property must be checked to enable GPRS features, including self-timed and alarm transmissions via GPRS and/or SMS communication, and command processing.

### **Comm Port**

Specifies the serial port to which the GPRS modem is connected. Specifying “<None>” disables GPRS support. Make sure the selected port is not already in use for something else (e.g., make sure the port under Coms Setup tab entry is set to None). The port settings are fixed at 115200,n,8,1, with RTS/CTS hardware handshaking enabled.

### **Modem APN**

The APN name is used to connect the modem to the internet. It varies based on the provider of the cell service. For T-Mobile, a typical value is “telargo.t-mobile.com”

### **Modem User Name and Modem Password**

These are used to login to the cell service provider. For some providers they can be blank, but otherwise use the value assigned by the provider or by Sutron.

## Modem PIN

The SIM PIN unlock code. This must be specified if the SIM being used is locked. The GPRS Diagnostics Tab will warn if a SIM PIN is needed and hasn't been entered. Entering the wrong PIN can cause the modem to become blocked, so be carefully especially when swapping SIMs.

## Modem Type

Select from Sutron HSDPA (default), Sutron GPRS, or Janus T2. Sutron HSDPA selects the latest model of the Sutron GPRS-1 modem with support for 3G HSDPA and HSDPA bands as well as GPRS and GSM. The original version of the GPRS-1 modem only supports GPRS and GSM. Clicking the more button will display the Custom Modem Settings Dialog.

## Custom Modem Settings

This dialog allows settings to be adjusted to accommodate the cell provider.

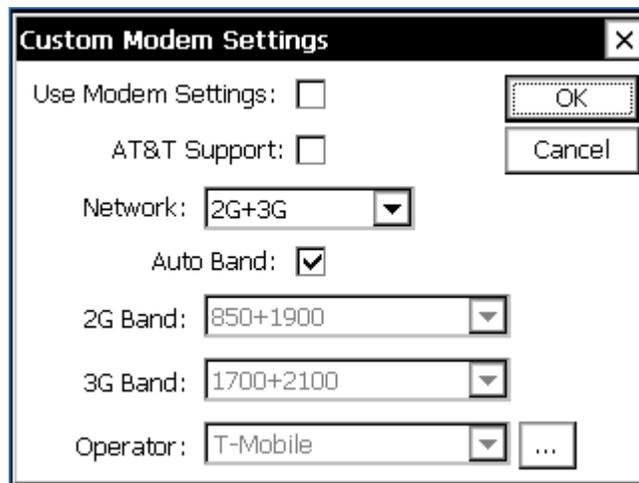


Figure 3: Custom Modem Settings Dialog

## Use Modem Settings

Check this option to use the settings that have been pre-configured in the modem, this permits the most flexibility, but requires connecting to the modem and issuing AT commands by hand to make any changes. In most cases, deselect this box, and the software will initialize the modem according to the selections made in the dialog.

## AT&T Support

The modem supports a feature called Enhanced Network Services (ENS) that allows it to freely connect to AT&T and Cingular towers. This setting is unique to the AT&T network, and enables support for ENS.

## **Network**

This setting allows the selection of 2G, 3G, or 2G+3G. Selecting the expected network technology can help the modem lock in the correct tower correctly and quickly. For instance some providers like AT&T do not support 2G anymore – in that case selecting 3G would tell the modem to not even try 2G. Or if 3G is not supported or is of low quality, the 2G setting would tell the modem to not try connecting to a 3G tower. When using the Sutron GPRS modem, this option is grayed out as it only supports 2G.

## **Auto Band**

This check box tells the modem to try to automatically detect the correct 2G and 3G radio band and cell operator to use, hence, when it's checked those other options are grayed out. Automatic selection may not work well in all cases, and then it's best to manually select the bands and/or operator.

## **2G Band (GSM, GERAN, Edge, GPRS)**

The following 2G bands are supported: 900+1800, 900+1900, 850+1800, and 850+1900. For instance T-Mobile uses the 1900 MHz band in the US for 2G, so either 900+1900 or 850+1900 may be selected. However, in Germany T-Mobile uses 900 MHz and 1800 MHz bands, so select 900+1800.

## **3G Band (UMTS, UTRAN, HSPA and HSDPA)**

The following 3G bands are supported: 1900+2100, 1900, 850, 850+1900+2100, 850+1900, 900, 900+2100, and 1700+2100. For instance T-Mobile uses the 1900 MHz, in the US and 2100 MHz in Germany for 3G, so the 1900+2100 selection should work for both. T-Mobile USA may still operate with 1700+2100 in some areas, but these AWS bands are being re-farmed for LTE. AT&T uses 850+1900.

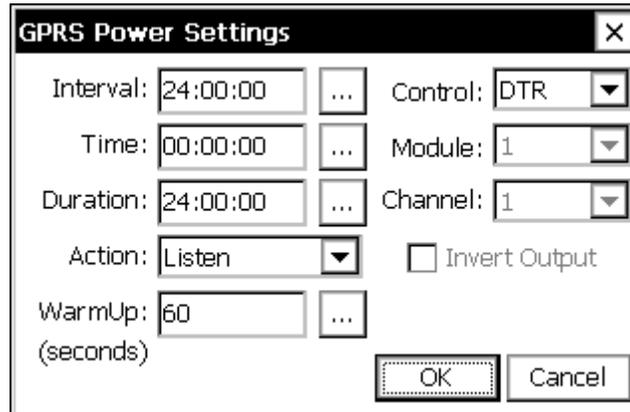
The Sutron GPRS modem supports multiple bands. In the United States, "Quad Mode" can typically be used, but internationally you may need to select the specific band to prevent frequency hopping and/or roaming. Normally, when a modem is connected to the Xpert for the first time, it is factory reset and programmed to work with pre-configured settings. The "Use Modem Setting" may be used to bypass this initialization and use the settings that were pre-programmed in to the modem. This allows many of the modem settings to be customized in the modem.

## **Operator**

This field may be used to specify which operator to connect. When set to blank the modem will search for the operator automatically. In some cases, this may not work well, and in order to establish a connection efficiently it may necessary to specify the operator. Unfortunately even the same ISP may have multiple operator codes, although in the US, "T-Mobile" and "AT&T" are correct for those ISP's. The selection displays a small subset of common operator codes. By communicating to the modem either directly with a PC, or using the PASSTHRU command, the "AT+COPS=?" may be issued to display a list of operators which the modem can currently detect.

## GPRS Power Settings

The GPRS power settings are accessed by selecting the “Power” item under GPRS in the Setup tab and clicking Edit. This dialog contains settings that determine when the GPRS modem should be powered on, how it should be powered on, and what it should do when powered on.



**Figure 4: GPRS Power Settings Dialog**

### Power-on Interval, Time, and Duration

Interval, Time, and Duration are used to specify when the modem is powered. Interval specifies how often to power on, Time specifies an offset to the interval, and Duration specifies how long to stay powered.

For example, with Interval = 01:00:00, Time = 00:30:00, and Duration = 00:15:00, the modem will be powered on every hour at half-past the hour, and will stay powered for 15 minutes.

When the modem is powered, the Xpert accepts incoming TCP/IP connections (e.g., telnet, Xterm, etc.), and processes incoming SMS messages. The primary reasons to turn off the modem are to reduce power consumption, and to limit time connected to the Cell network.

Note, if the LAN is powered on at the same time that the GPRS is powered on, the LAN will serve as the preferred TCP/IP transport, and may cause a conflict. This is similar to how enabling Wi-Fi on a cell phone causes communications to be routed using the Wi-Fi interface and not the 3G.

### Power-on Action

When Action is set to “Listen” (the default setting), the modem accepts incoming connections during the powered-on period. When set to “Connect”, the Xpert attempts to establish an SSP/CL connection to the Primary IP address and IP port specified in the GPRS Connect settings dialog, for the duration of the powered-on period. Note, SSP/CL connections support both Xterm (SSP) and command-line (CL) connections.

An Action type of “Connect” can be useful when the IP address of the GPRS modem is unknown. Enabling “Connect” is a way to have the modem “phone home” periodically.

### Control

Power to Sutron's GPRS modem is typically supplied via pin 9 of the Xpert RS232 port. Set Power Control to DTR, and Warm Up to 60 seconds, when this is the case. Note, you may need to configure the RS232 port to provide 12V DC on pin 9 using a hardware selectable jumper. See the Xpert user manual for more information.

It's sometimes desirable to control power to the modem via external relay. Set Control to Dig I/O in order to specify a Digital I/O module and output channel used to control the relay. The output will be turned “on” before a GPRS connection is attempted. The output is assumed to be an open-collector, hence “on” means 0V is output. If the output instead uses positive logic, select “Invert Output”.

### Warm Up

Warm Up is the number of seconds to allow the modem to warm up after asserting power, before trying to establish a connection. It applies to both the Dig I/O and DTR settings.

## GPRS Transmission Settings

The GPRS transmission settings are accessed by selecting the “Transmit” item under GPRS in the Setup tab and clicking Edit. This dialog contains settings that determine when the GPRS modem transmits data to TCP/IP based internet servers.

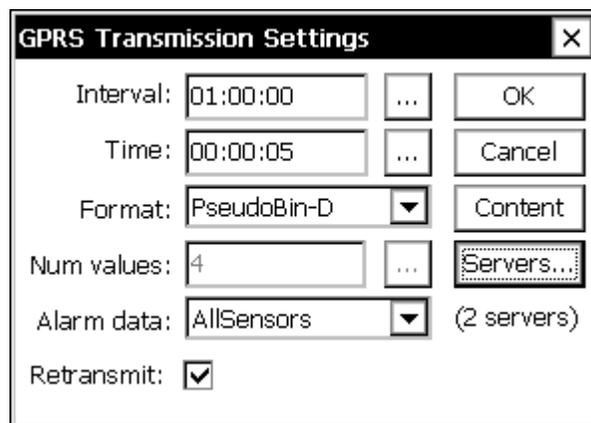


Figure 5: GPRS Transmission Settings dialog

### Interval

Interval defines how often to transmit self-timed messages. The format of the string is, “hh:mm:ss”, where “hh” = hours, “mm” = minutes, and “ss” = seconds. For example,

“01:00:00” means “every hour”, while “00:30:00” means every half hour. Typical rates are 01:00:00 for hourly transmissions and 04:00:00 for transmissions every 4 hours.

**Time**

This property defines an offset to Interval. It has the same format as Interval. A Time of “00:15:00” means, “15 minutes after the hour”. Some examples of transmission schedules are shown in the table, below:

TxInterval	TxTime	Transmission Schedule
01:00:00	00:00:00	12AM, 1AM, 2AM, ..., 12PM, 1PM, 2PM, ...
02:00:00	00:00:00	12AM, 2AM, 4AM, ..., 12PM, 2PM, 4PM, ...
01:00:00	00:30:00	12:30AM, 1:30AM, 2:30AM, ..., 12:30PM, 1:30PM, ...
04:00:00	00:15:00	12:15AM, 4:15AM, 8:15AM, 12:15PM, 4:15PM, ...

**Format**

This property defines the format of the data sent in self-timed transmissions, as well as alarm transmissions when Alarm Data = “AllSensors”). The following formats are supported:

ASCII Column	ASCII human readable format with sensor values in columns. Each row represents data from a previous measurement interval
BUFR	Binary format per WMO BUFR specification for transmission and storage
PseudoBin-B	6-bit “binary” format, interleaved
PseudoBin-B Non-Int	6-bit “binary” format, non-interleaved
PseudoBin-C	6-bit “binary” format, non-interleaved, with additional meta data
SHEF	ASCII human readable format using SHEF codes
SHEFFIX	ASCII human readable format using SHEF codes, where data appears in fixed width format of 7 chars
NIFC	ASCII human readable format based on NIFC requirements
NFRDS	ASCII human readable format based on NFRDS requirements
Handar	ASCII human readable format
SSP	Sutron Standard Protocol, binary format
Text	ASCII human readable text format, with alarm flags

See [Appendix A – Telemetry Formats](#), for detailed definitions of each of the formats.

## **Num Values**

When the selected format is interleaved (e.g., ASCII Column or PseudoBin-B), the number of data values to include for each selected data item must be the same for all selected items, and so is entered in this dialog, rather than in the GPRS block dialog.

Example: If Num Values is 4, and two GPRS blocks are defined for “HG” and “HF”, then the last 4 values of HG and HF appear in the transmit message.

## **Alarm Data**

Alarm Data can be either “SensorsInAlarm” or “AllSensors”. When set to the latter, alarm transmissions contain the same data as is found in self-timed transmissions, i.e., all data tagged with an GPRS block in the Graphical Setup (as well any data points tagged in EzSetup). However, when Alarm Data is “SensorsInAlarm”, only the data *triggering the alarm* is included in the transmission.

## **Retransmit**

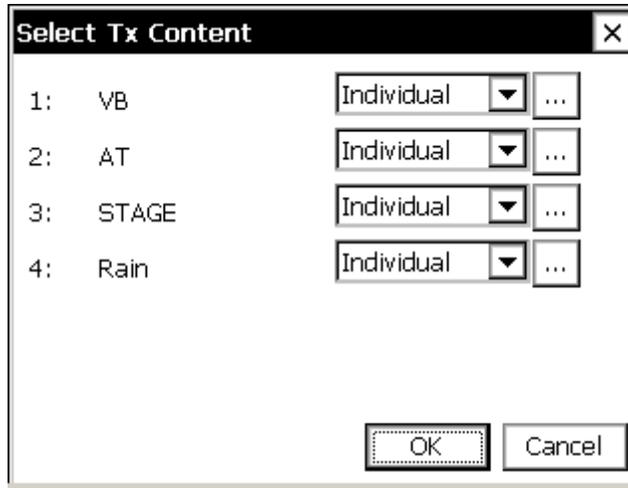
When checked, data from failed self-timed transmissions (due to a network outage, for example), are retransmitted on the next successful self-timed connection. Note that the most recent data is always transmitted first on the first successful reconnect, followed by the oldest to newest data from any previous failed transmissions. Up to 7 days of missed data will be retransmitted.

Note: A system reboot prevents retransmission of data logged by LogField blocks and EzSetup. For complete retransmission support, log data using the standard Log blocks in Graphical Setup.

In “All Servers” transmission mode, retransmissions are tracked for each server defined. In “Fallback” mode, a retransmission completes once any server is reached.

## **Content**

When you press the Content button on the GPRS Transmission Settings dialog, the “Select Tx Content” dialog opens showing a list of all GPRS blocks in the Graphical Setup (as well as any data points tagged in EzSetup).



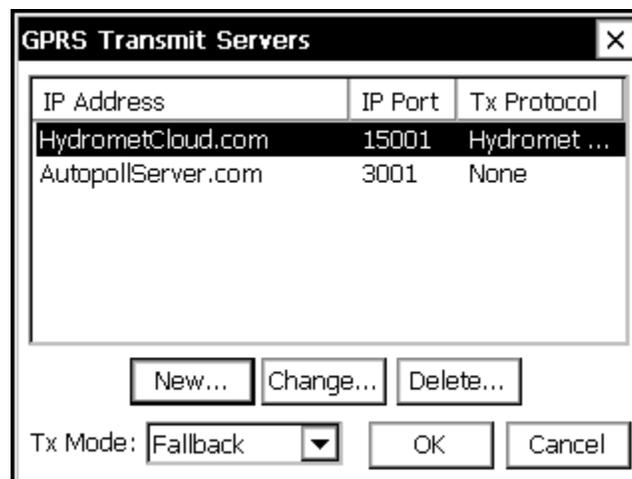
**Figure 6: Select Tags dialog**

When more entries exist than can be shown in the dialog, scroll bars appear, allowing you to scroll to other entries.

From this dialog, you can change the value of the “Tx Content” property for each data item in the list. You can also press the “...” button to access and change other properties in the block’s properties dialog.

### Transmit Servers

Press the “Servers...” button to open a new dialog used to configure destination servers for self-timed and alarm transmissions.

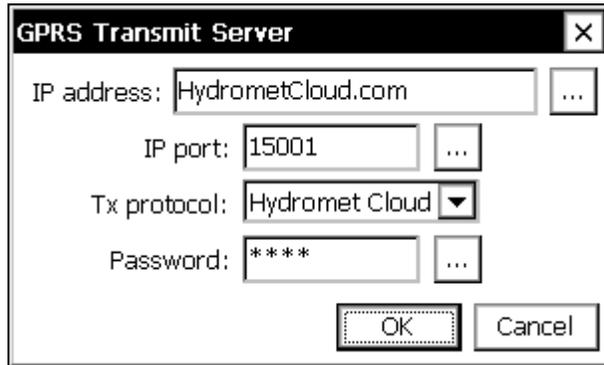


**Figure 7: GPRS Transmit Servers**

Multiple servers may be defined. When Tx Mode is set to “Fallback”, each server is tried in succession until the first successful transmission. When Tx Mode is set to “All Servers”, each server receives the transmission.

Multiple server types are supported. To add a new server, press the “New...” button. To change an existing server, press the “Change...” button. To delete an existing server, select the server and press “Delete...”.

The following dialog is used to add or change the settings of a server targeted to receive transmissions:



**Figure 8: Transmit Server**

To define a server, enter the server’s internet address and port into the IP Address and IP Port properties, respectively.

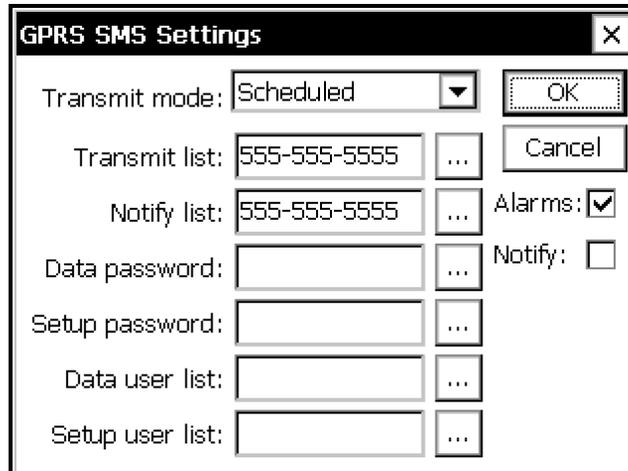
Tx Protocol may be set to either “Hydromet Cloud” or “None”. When “Hydromet Cloud” is selected, transmissions may be made to Sutron’s Hydromet Cloud service (formerly, “SutronWin”), or to AutoPoll using an AutoPoll task type of “Capture” with the “Hydromet Cloud compatible” option selected.

When Tx Protocol is set to “None”, the Hydromet Cloud compatible protocol is bypassed, and the data is simply dumped to the destination server. Transmissions may be made to AutoPoll in this case using an AutoPoll task type of “Capture” with the “Hydromet Cloud compatible” option deselected.

The Password property applies only to the Hydromet Cloud protocol, and must match the password entered in the server.

## GPRS SMS Settings

The GPRS SMS settings are accessed by selecting the “SMS” item under GPRS in the Setup tab and clicking Edit. This dialog contains settings that determine how the GPRS modem transmits manages sending and receiving SMS text messages.



**Figure 9: SMS Settings**

### **Transmit Mode**

Transmit Mode enables the user to receive self-timed transmissions using SMS communication, for example, through your phone.

When Transmit Mode is set to “Scheduled”, and Transmit List has at least one phone number defined, the user will receive text messages with self-timed transmissions every time a self-timed transmission is supposed to occur based on the transmit Interval and Time in the GPRS Transmit settings. Note, an SMS self-timed transmission may be delayed due to retries to transmit servers, when problems reaching one or more transmit servers occur.

When Transmit Mode is set to “Fallback” and Transmit List has at least one phone number defined, the user will receive a text message with the self-timed transmission content whenever a self-timed transmission fails to reach the destination server.

The format of the SMS self-timed transmission follows the Transmit Format setting in GPRS Transmit settings, unless the selected format is “SSP”. When “SSP” is the selected format for the transmission to server, the data is reformatted to “Text” when sent via SMS.

**CAUTION:** SMS transmissions are limited to 160 bytes of data, and so won’t contain any portion of a transmission beyond that limit. Some transmission formats are more compact than others. You may need to experiment with different formats, and/or different “Num Values”, in order to receive all data via SMS.

### **Transmit List**

Enter into Transmit List the set of phone numbers you’d like to receive self-timed and alarm transmissions. Phone numbers should be separated by a comma “,”.

## Alarms

When Alarms is checked and Transmit List has at least one phone number defined, the station sends alarm messages via SMS. The SMS message includes the station name and time.

The format of the alarm transmission depends on whether Alarm Data is “All Sensors” or “Sensors in Alarm”.

An example of the Text format used for SMS alarm messages:

```
RTU01 12:22<cr><lf>
STAGE 4.55 G H+R+<cr><lf>
RAIN 2.0 G OK<cr><lf>
```

The message begins with the station’s name (“RTU01”) and the current time in HH:MM (12:22) format followed by a list of sensor readings containing the name of the sensor (“STAGE”), the value (“4.55”), the quality (“G”), and the alarm status (“H+R+”).

In the above example, “H+R+” indicates that STAGE is experiencing a high limit and high rate of change alarm, while the “OK” status for RAIN indicates that it is within expected limits.

Quality codes:

G: Good quality  
B: Bad quality  
U: Undefined quality

Alarm codes:

H: High limit exceeded  
L: Low limit exceeded  
R: High Rate of change  
OK: Normal

A “+” after a code indicates that the sensor has just entered that state, while a “-“ after a code indicates that the sensor has just exited that state.

## Notify

When Notify is selected, the station reports the following events via SMS to the list of phone numbers in the Notify List:

- Station Rebooted – Indicates the station has rebooted
- Recording on/off – Indicates the station has turned recording on or off
- GPRS connect failure – Indicates GPRS services may not currently be available (e.g., a cell tower may support GSM/SMS services but not GPRS). This message may also mean there’s something wrong with the APN settings, account settings, or the provider service.

- Shoulder tap failure – Indicates GPRS was unable to perform a shoulder tap request. The request may have come by SMS, the command line, or by ringing the cell modem (CSDShoulderTap = Yes).

### **Notify List**

Enter into Notify List the set of phone numbers you'd like to receive notifications. Phone numbers should be separated by a comma “,”.

### **Setup Password and Data Password**

These two properties specify authorization codes used to validate incoming command messages. Setup Password specifies the authorization code for “setup-level” access, while Data Password specifies the authorization code for “data-level” access.

Incoming command messages have setup-level access by default. When the Setup Password property contains an authorization string, any and all incoming messages that normally require setup-level access to be processed must prefix the command with the authorization code. For example, the “REBOOT” command requires setup-level access to execute. Hence, to command the station to reboot given an authorization code of “MyAuthCode”, send the message, “MyAuthCode REBOOT”.

### **Setup User List and Data User List**

These two properties limit SMS access to the phone numbers defined in the corresponding list. A blank list means any phone number is allowed, although it is still subject to Setup Password or Data Password rules, defined above.

### **SMS Command Processing**

The following commands are supported via SMS:

- Call home (shoulder tap). Initiate an SSP/CL connection to Primary IP and IP Port defined in Connect Settings, or url and port, if specified.  
STAP [url[:port]]
- To set (or show if url or port isn't provided) the Primary IP, Secondary IP, or IP Port values defined in Connect Settings:  
SETPIP [url]  
SETSIP [url]  
SETTCP [port]
- Check power status, or turn power temporarily on or off until the next power cycle:  
POWER [ON|OFF]
- Command-line commands  
e.g., REBOOT, TIME, DATE, MEASURE, SHOW, RECORDING, etc.  
Any responses that are generated as a result of the command are sent via SMS to the original sender. The responses are limited in length by the maximum SMS message length of 160 characters.

## GPRS Connect (SSP/CL) Settings

Cellular modem IP addresses are often not publicly routable (you can't connect to them), so it's sometimes useful to have the station "call home". The GPRS Connect (SSP/CL) Settings" dialog is used to specify the connection details used when the station is told to call home. A station is told to "call home" in the following circumstances:

- STAP command, received via SMS
- SMS STAP command, issued by command line
- CSD shoulder-tap (when phone number of GPRS modem is dialed with "CSD shoulder-tap" option enabled)
- Power-on Action set to "Connect" (see GPRS Power Settings dialog)

An SSP/CL connection is made when calling the target server. Sutron's XConnect software supports this kind of connection, as does Sutron's TCP Party Line utility, which can be used to connect a Telnet or Xterm session running on your PC to the calling station. Contact Sutron Customer Service for more information about obtaining and using the TCP Party Line utility.

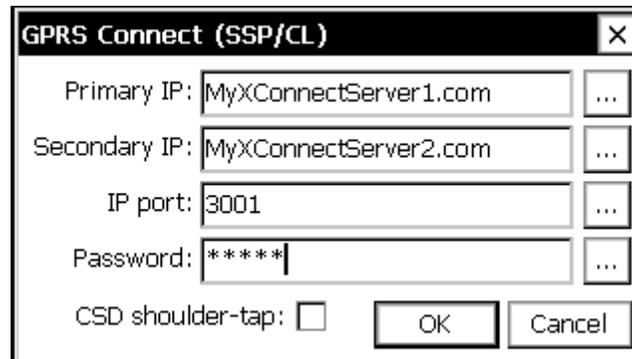


Figure 10: GPRS Connection Settings Dialog

### Primary IP and Secondary IP

When connecting, the station first tries the Primary IP and port a few times. If this fails, the station then tries the Secondary IP and port a few times. This repeats until a successful connection is made.

### Password

When initiating a connection, the station name and this Password are transmitted to the server. The server has the option of then accepting or rejecting the connection, based on these login credentials.

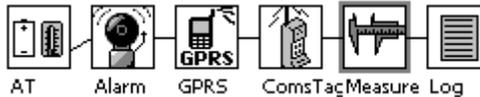
### CSD Shoulder-Tap

When this option is enabled, a phone call placed to the phone number associated with the SIM card installed in the modem, will trigger the station to "call home".

## GPRS Blocks in Graphical Setup and EzSetup

Sensor data can be tagged for transmission in two ways using either the Graphical Setup, or the EzSetup. The properties are the same, whether you are working in the Graphical Setup or EzSetup.

Using the Graphical Setup, you need to attach a GPRS block (found under the Telemetry category) to an output you'd like to have transmitted, and then configure the block. Here's an example of the order we suggest that the blocks be created and connected together:



**Figure 11: GPRS block in Graphical Setup**

In the setup depicted above, the GPRS block tags a measured data point, that of, Air Temp (AT). Here are some important notes about the setup:

- The GPRS block appears after Alarm block. This ensures the GPRS block “sees” the result of the alarm evaluation, triggering alarm transmissions, if needed. Of course, the Alarm block is only required if your system will evaluate data for Alarm and/or alarm transmissions.
- The GPRS block appears before the ComsTag block. This ensures the ComsTag “sees” the alarm transmission status generated by the Alarm and GPRS blocks.
- The ComsTag block is required for SSP telemetry, but even when not using the SSP format it allows the value to be displayed on the Data tab and/or accessed via the command prompt and SMS commands.

### **Alarm Block Properties**

The Alarm block is a standard block used to define high limits, low limits, and rate of change. The block is discussed in detail in the Xpert manual, but one interesting feature to note is that Alarm blocks may be strung together to handle multiple conditions.

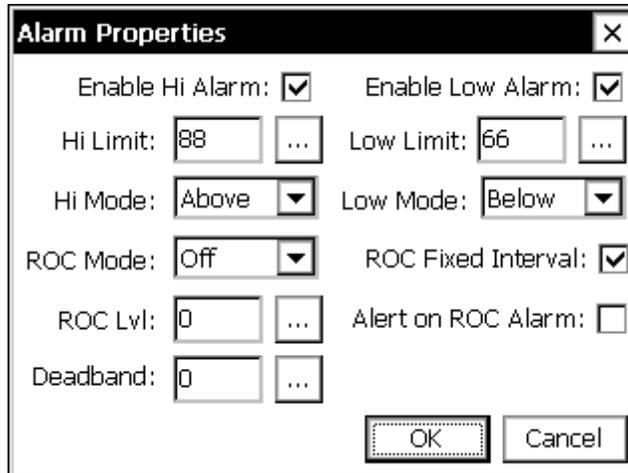


Figure 12: Alarm Block Dialog

### GPRS Block Properties

To view and edit the properties of the GPRS block, tap the block and select “Edit Properties” in the pop-up menu that results (in EzSetup, simply press the GPRS button). The following dialog is shown:

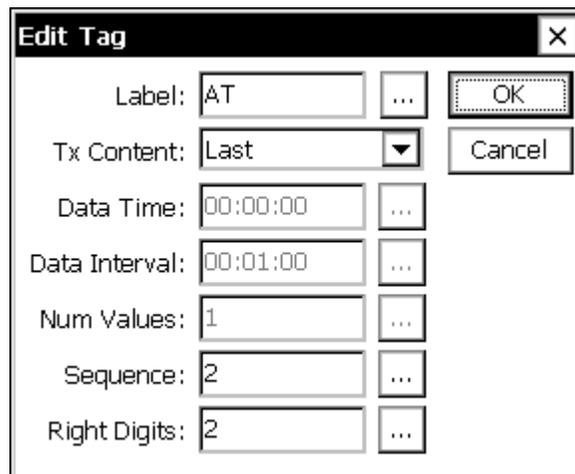


Figure 13: GPRS Edit Tag Dialog

The GPRS Edit Tag dialog is used to edit the properties of the GPRS block that “tags” the data point for transmission.

### Label

Label defines the “name” of the data. Some formats (e.g., SHEF) include this Label in the transmission.

## Tx Content, Data Interval, Data Time, Num Values

These properties define what data to include in the transmission. See the following table for details:

<b>Tx Content</b>		<b>Description of data to transmit</b>
All		All the data measured since the last transmission (up to Num Values, if enabled in global transmission settings), will be transmitted
Individual		Individual values measured since the last transmission will be transmitted.
	Data Interval	The time interval between readings. For example, "01:00:00" means "hourly data"
	Data Time	The time, or offset into the interval, of the data to include. For example, "00:15:00" means "include data measured on a 15 minute offset"
	Num Values	Number of values for each data item to include in the transmission. Enabled only for non-interleaved transmission formats
Last		Only the last measured value will be transmitted (or the last "Num Values", if enabled in global transmission settings)
Exclude		Do not transmit this output

## Sequence

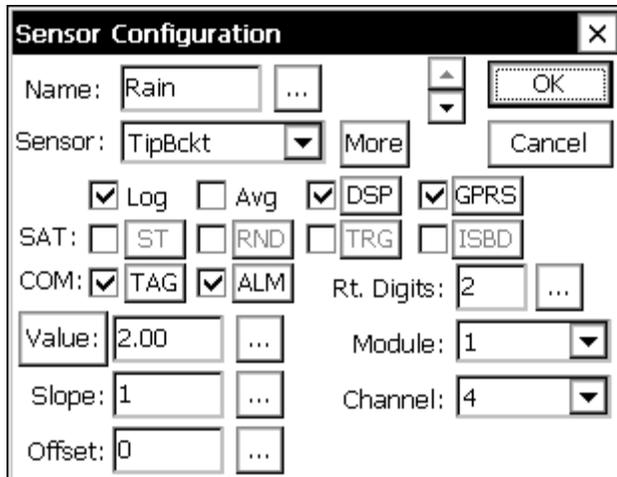
This property determines the order of the data item within the transmission.

## Right Digits

This property determines the number of right digits to include in the transmission.

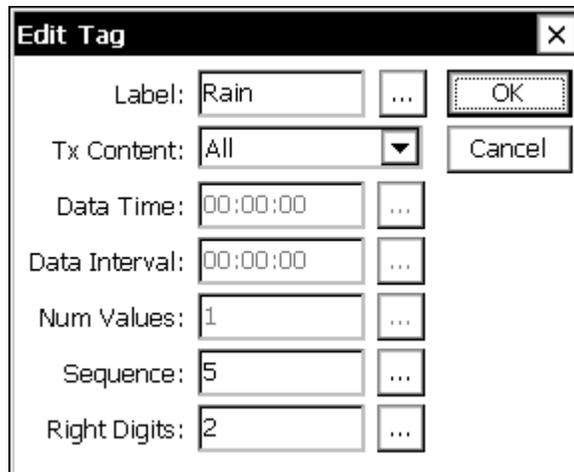
## Tagging Data with EzSetup

Tagging data for GPRS transmission in EzSetup requires placing a check next to the GPRS button and then pressing the GPRS button to select the properties.



**Figure 14: EzSetup Configuration**

Pressing the GPRS button will bring up the same [GPRS Block Properties Dialog](#) as described above:



**Figure 15: GPRS Tag in EzSetup**

## Basic Entry on Setup Tab

A Basic program can format custom GPRS messages. Any of the Basic string functions can be used to format the buffer as required, but the Bin and Bin6 functions exist specifically to help forming 8-bit and 6-bit binary encoded data.

To create a self-timed formatting routine, create a function with a "SELFTIMED\_" prefix. The return value of the function becomes the buffer. For example:

```
Public Function SELFTIMED_STFormatter
    Selftimed_STFormatter = "Test Selftimed Message"
End Function
```

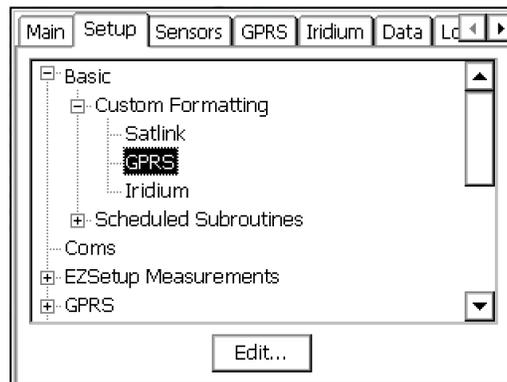
To create an alarm formatting routine, create a function with an “ALARM\_” prefix and a single parameter in which the group number will be passed. The return value of the function becomes the buffer. For example:

```
Public Function ALARM_Formatter(Group)
    ALARM_Formatter = "Test Alarm Reporting Message: " +
    Str(Group)
End Function
```

It's possible to append to the buffer, as opposed to simply overwriting it, by taking advantage of string concatenation. The following example appends its message to the current buffer:

```
Public Function SELFTIMED_STFormatter
    SELFTIMED_STFormatter = SELFTIMED_STFormatter + "Test
    Selftimed Message"
End Function
```

More than one formatting function can exist in your program, but only one self-timed and one alarm function may be active at one time. The active routine is selected in the Iridium Custom Formatting entry under Basic, on the Setup tab:



**Figure 16: GPRS Custom Formatting Entry**

# TESTING GPRS OPERATIONS

This section describes how the GPRS Diagnostics Tab may be used to test out GPRS communications.

## The GPRS Diagnostics Tab

The GPRS Diagnostics Tab may be used to test communications over GPRS, and examine the communication status.

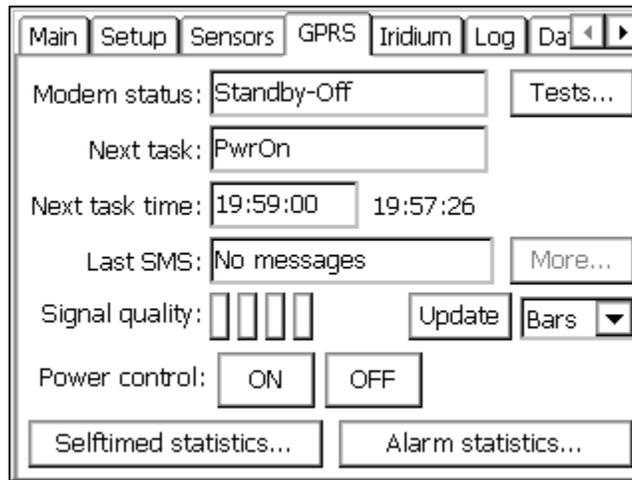


Figure 17: GPRS Diagnostics Tab

### Modem status

Modem status describes the current state of GPRS processing, and may be any one of the values in the following table:

Status	Description
Alarm Tx	Alarm transmission in progress
App Stop	System is being shutdown
Comm Error!	An error has occurred talking to modem (check connection to modem)
DailyMaint	System is storing and resetting daily counts
Disabled-Off	GPRS is disabled and off
Disabled-On	GPRS is disabled, but power is still on
Force Power Off	The "OFF" button was pressed in the GPRS Diagnostics Dialog
Force Power On	The "ON" button was pressed in the GPRS Diagnostics Dialog
GPRS Denied	A connection to the GPRS network could not be made
GPRS Ignore	A GPRS connection could not be established, and the Xpert is moving

	forward with GSM support, but will still try to establish a GPRS connection as needed
GPRS Ready	GPRS is registered
GPRS Roaming	GPRS could not establish a connection to the home network and is currently roaming on a partner network.
GPRS Search	GPRS is still trying to establish a connection to a tower
GSM Denied	A connection to the GSM network could not be made
GSM Ready	GSM is registered
GSM Roaming	GSM could not establish a connection to the home network, and is currently roaming on a partner network.
GSM Search	GSM is still trying to establish a connection to a tower
Modem Chg	A change to the modem settings has been made and is being applied
Power Off	Modem is powering off
Power On	Modem is powering on
Property Chg	A setup change is taking effect
Reconnect	A GPRS connection unexpectedly dropped and is being reconnected
Reschedule	A setup change requires events to be rescheduled
SelfTimed Tx	Self-timed transmission in progress
Send Alarm	An alarm tx is being scheduled
SMS Notify	An SMS notification message is being sent
SSP/CL Chg	A change to the SSP/CL and/or Transmission settings has been made and is being applied
Standby-Off	Modem is not powered, and is ready for next task
Standby-On	Modem is powered up due to the power settings, and is ready for next task.
Standby-On*	Modem is powered up to handle a temporary condition such as transmission outside the normal power-up cycle, an alarm transmission, or a call back operation.
Starting	System is starting up
Stopped	GPRS processing has stopped (no transmissions will occur)
Stopping	System is stopping

In addition while a GPRS network connection is being established there are additional status messages that may be display during the process as follows:

<b>Network Connection Status</b>	<b>Description</b>
All Devices Connected	A network link has been established
Authenticated	The network link has been authenticated
Authentication Acknowledged	A request for authentication is being acknowledged
Authentication Notify	Authentication is needed
Authentication Retry	Authentication with different credentials has been requested
Connected	Network connection has been established
Connecting Device	A connection is about to be started
Device Connected	A connection has been made to the modem (not the network)
Device Setup	The modem port is being configured
Disconnected	The connection has been terminated or failed
Opening Port	The modem port is being opened
Password Expired	Password has expired
Retry Authentication	Retrying authentication
Starting Authentication	Authentication is being performed

### **Tests...**

Pressing this button will bring up the [GPRS Test Dialog](#).

### **Next task**

The next task that's scheduled to occur and may be: Nothing, DailyMaint, PwrOff, PwrOn, Reschedule, SMSNotify, SelfTimed, Alarm, Reconnect, or AppStop.

### **Next task time**

Contains the time that the next task is scheduled to start

### **Time**

The current time is displayed as a reference

### **Last SMS**

Displays the last SMS text message received

### **More...**

If multiple text messages have been received, pushing this button will display the last 5.

### **Signal Quality**

Displays the last measured cell signal strength in terms of bars, or in dBm with % bit error rate. The dBm value can range from -51 (strong) to -113 (weak). For reference -75 is considered “5 bars”, and -105 is considered “2 bars”. The bit error rate will vary from 0.2% (best) to 12.8% (worst). Often the bit error rate is a better indicator of quality than signal strength.

### **Update**

Pressing the Update button will cause the signal strength to update for 2 minutes or until the button is pressed again. As it updates, a tone is output by the Xpert that’s proportional to the signal strength. The higher in frequency, the better the signal. This can be used to aid in aiming the antenna.

### **ON**

Pressing “ON” turns the GPRS radio on until the next scheduled off time.

### **OFF**

Pressing “OFF” turns the GPRS radio off until the next scheduled on time. GPRS will still turn on as needed for transmissions.

### **Selftimed Statistics...**

Displays the following information about self-timed transmissions:

Last Tx, #Tx Today, Next Tx Time, Next Tx msg, Next Tx size, Est #Tx bytes/day, and #Tx bytes today.

The estimate #Tx bytes/day can be used to help estimate the data budget for a station, but as it doesn’t include overhead it will be significantly low.

### **Alarm Statistics:**

Displays the following information about alarm transmissions:

Last Tx, #Tx today, #Tx bytes today.

### **GPRS Test Dialog**

The GPRS Test Dialog is used to send SMS, self-timed, SSP, or other kinds of test transmissions. Select the type of transmission using the Transmission Type drop-list, enter a test message (and other related information), and press Send.

### **Hydromet Cloud Test Transmission**

The Hydromet Cloud test sends the message using a Hydromet Cloud compatible protocol. This test could also be used to send to AutoPoll, when using an AutoPoll task type of Capture, with Raw deselected (or “Hydromet Cloud compatible” selected).

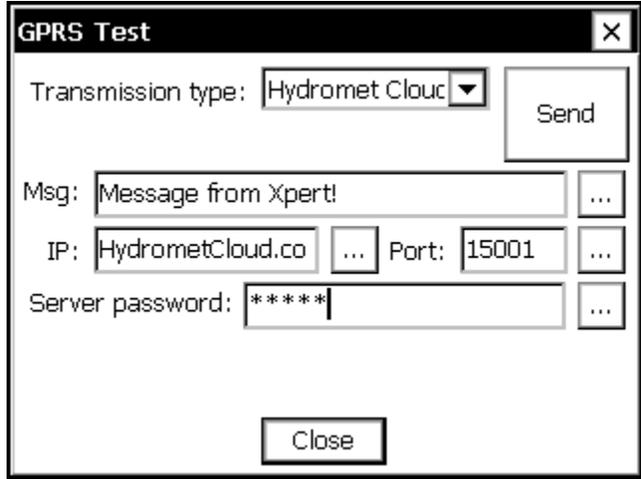


Figure 18: Hydromet Cloud Test Transmission

### SMS Test Transmission

The SMS test sends an SMS message to the specified phone number. SMS messaging requires GSM services, which may operate in areas where GPRS service is not available.

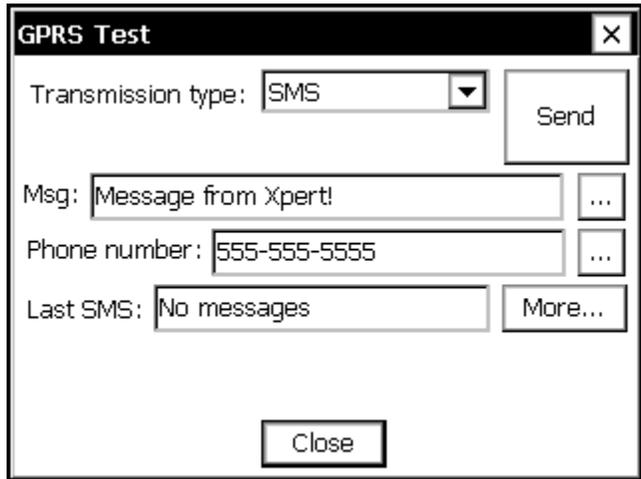
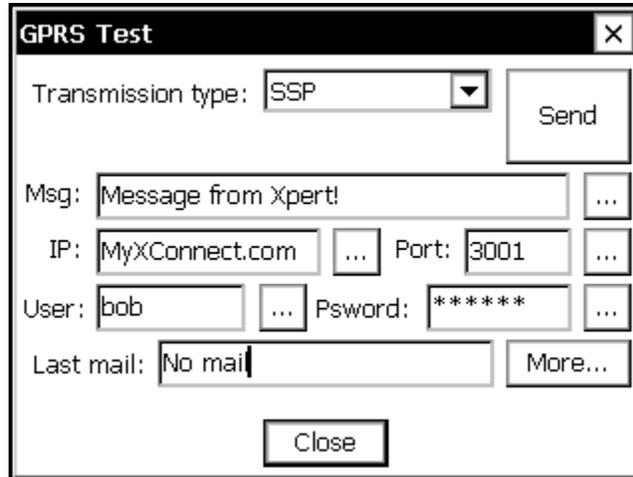


Figure 19: SMS Test Transmission

The Last SMS field displays the last SMS message received by the station. To see up to the last 5 received SMS messages, select the “More...” button.

### SSP Test Transmission

The SSP test transmits an SSP mail message to the specified server (or station/RTU), and verifies whether the message was acknowledged.

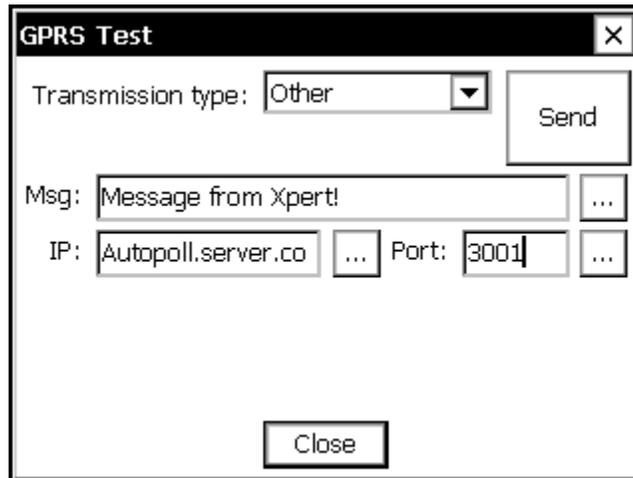


The screenshot shows a dialog box titled "GPRS Test" with a close button (X) in the top right corner. The "Transmission type" is set to "SSP" in a dropdown menu, with a "Send" button to its right. Below this, the "Msg:" field contains "Message from Xpert!". The "IP:" field contains "MyXConnect.com" and the "Port:" field contains "3001". The "User:" field contains "bob" and the "Psword:" field contains "\*\*\*\*\*". The "Last mail:" field contains "No mail" and has a "More..." button to its right. A "Close" button is located at the bottom center of the dialog box.

Figure 20: SSP Test Transmission

### Other Test Transmission

The Other transmission test type transmits a message to the specified server. No response is expected or checked.



The screenshot shows a dialog box titled "GPRS Test" with a close button (X) in the top right corner. The "Transmission type" is set to "Other" in a dropdown menu, with a "Send" button to its right. Below this, the "Msg:" field contains "Message from Xpert!". The "IP:" field contains "Autopoll.server.co" and the "Port:" field contains "3001". A "Close" button is located at the bottom center of the dialog box.

Figure 21: Other Test Transmission

## TROUBLESHOOTING

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1. Did you check to make sure that Remote, Coms, Basic, or any other part of the system isn't trying to use the com port you wish to use for GPRS? Issuing "status" at the command prompt will list all ports that Remote has been configured to support.
2. Did you check to make sure the LAN device is turned off?
3. If you just configured a serial port for the first time, have you tried rebooting the unit?
4. Observe the GPRS Diagnostics Tab while a connection is attempted and verify that connections are being scheduled, and watch for an issue during the connection negotiation.
5. Verify that the GPRS device is being powered up correctly by pressing ON in the GPRS Diagnostics Tab.
6. Issuing "report high" or even "report debug" at the command prompt is a good way to get real time diagnostic information about the performance of the GPRS SLL and the system in general. You can monitor SSP messaging by issuing "report ssp". SSP over TCP/IP messages may be viewed by issuing "report ssp0", or the options may even be combined by issuing "report ssp ssp0".
7. The system status page will show information about the most recent diagnostic messages and the current state of the GPRS device. This can also be displayed on demand at the command prompt with the "info" command.
8. The system.log can be examined to look for status messages, connection errors, and transmission errors.
9. Use the GPRS Diagnostic page to send test mail messages.
10. If you need to reach your station for maintenance, but it's configured to turn on only when transmitting, you may try sending the SMS command "POWER ON" to the station. The SMS command won't be able to go through while the modem is powered off, but it may get through on a retry or if you happen to time it for when the station is transmitting.
11. Contact Sutron Customer Support at 703-406-2800.

# APPENDIX A – TELEMETRY FORMATS

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This appendix contains descriptions for each of the supported telemetry formats.

## ASCII Column Format

The ASCII Column format is an ASCII, human readable format placing sensor values in columns, with each row containing data from earlier measurement intervals (newest data appears in top row).

The following example contains the last 3 measured values for 4 different sensors. Note how “//” is used to indicate “missing” data.

```
-4.422 35.00 136.16 37.00
-4.397 34.00 135.23 36.00
-4.324 33.00 134.88 //
```

The “right digits” property, defined by the GPRS data tag block, determines the number of right digits that appear in the transmission.

The number of rows in the transmission is determined by the “Num Values” property in the “GPRS Transmission Settings” dialog (select “Transmit” entry under the GPRS node on the Setup tab).

## Handar Format

The Handar format is an ASCII, human readable format where sensors are separated by <CRLF>, sensor data is separated with a space, and missing data is reported as “M”.

For example:

```
010034380517419:21:30G42+0NN155E9200070"
1.3 1.3 1.3 1.3
2.4 2.4 2.4 2.4
M 12.2 12.2 12.2 12.2 12.3 12.3 12.3
```

## NFDRS and NIFC Formats

The NFDRS (National Fire Danger Rating System) and NIFC (National Interagency Fire Center) formats produce reports of human readable ASCII values using SHEF codes as labels for data.

The labels applied to measurement outputs are used to identify the data to include in the report. The following table shows what labels are recognized by the NIFC and NFDRS formatter. An “x” means the sensor label must appear in the setup for the formatter to succeed. The items with no “x” are recognized and will be formatted, but are not required.

Sensor	Label	NIFC	NFDRS
Rainfall	PCH	x	x
10-Min Avg Wind Spd	USH	x	x
10-Min Avg Wind Dir	UDH	x	x
Air Temperature	TAH	x	x
Fuel Temperature	MTH	x	
10-Min Avg Rel Hum.	XRH	x	x
Battery Voltage	VBH	x	x
Barometric Pressure	PAH		
Peak Wind Direction	UGX		
Peak Wind Speed	UPH		
Fuel Moisture	MMH		
Solar Radiation	RDH		x

Here's an example NIFC telemetry report:

00.00  
000  
270  
328  
110  
100  
14.0  
000  
000  
020  
0486

Here's an example NFDRS telemetry report:

00.00  
000  
270



Name	Bytes	Description
Block ID	1	BLOCK-IDENTIFIER is always sent as "B" to indicate that this is the pseudobinary B format.
Group ID	1	GROUP-ID can be "1" to indicate a scheduled transmission, "2" meaning an alarm transmission, and "3" indicating a forced transmission.
Delta Time	1	Age in minutes of the most recent data
Data	3x num sensors	Data in either interleaved, or non-interleaved format. The example above shows the data interleaved (most recent of all sensors followed by next oldest, and so on). See the section below, "Six-Bit Binary Encoded Format" for details on how these values are encoded.
Battery Voltage	1	Logger battery voltage measured just prior to transmission

### Pseudobinary-C Format

The Pseudobinary-C format also produces an ASCII report of 6-bit pseudo-binary formatted values, but with additional fields to describe label and time information. Just as the "B" version of the format, this format is "pseudo"-binary, because each sensor value and descriptor is expressed in the range of ASCII characters, but not in such a way that is readily human-readable.

#### Pseudobinary-C Format

Name	Bytes	Description
Block ID	1	BLOCK-IDENTIFIER is always sent as "C" to indicate that this is the pseudobinary C format.
Group ID	1	GROUP-ID can be "1" to indicate a scheduled transmission, "2" meaning an alarm transmission, and "3" indicating a forced transmission.
Measurement Delimiter	1	This byte is always a "+" and it is used to denote the start of measurement data.
Measurement Index (Sequence)	1	The Sequence number assigned by user in the output telemetry settings. This value is encoded 6 bit binary. Typically, the sequence number assigned is unique, allowing you to uniquely identify the data point.
Day	2	This 2 byte encoded 6 bit binary encoded number represents the Julian day of the year. The day tells when the most recent (first) sensor reading of this

		measurement was made.
Time	2	This 2 byte encoded 6 bit binary encoded number is a number of minutes into the day. It tells when the most recent (first) sensor reading of this measurement was made.
Interval	2	This 2 byte encoded 6 bit binary encoded number tells the measurement interval in minutes, or the amount of time between readings of this measurement.
Measurement Data	3 for each sensor reading	Sensor data encoded 6 bit binary.
Additional Measurements	Variable	If more than one measurement was setup for transmission, more data will follow. Each measurement setup will have data starting with the Measurement Delimiter and ending with Measurement Data.
Final Delimiter	1	This byte is always "." and it is used to denote the end of all measurement data.
Battery voltage	1	This is the battery voltage measured prior to making the transmission. The range of the number will be -32 to +31 and can be converted to volts by multiplying by 0.234 and adding 10.6 allowing a range of 3.1 to 18.1 volts.

Example Pseudobinary-C message:

```

C3+ADGTU?///+BDGTU?@UI+CDGTU??~v///.L
Group          3 format C
Sequence       A    1
Julian Day     DG   263
Time           TU   21:41
Interval       ?    00:-1
Data:          ///  missing
Sequence       B    2
Julian Day     DG   263
Time           TU   21:41
Interval       ?    00:-1
Data:          @UI  1353
Sequence       C    3
Julian Day     DG   263
Time           TU   21:41
Interval       ?    00:-1
Data:          ?~v  -74
              ///  missing

```

### Pseudobinary-D Format

This is another compact data format. It differs from Pseudobinary B in that it has a timestamp at the start of the message. The timestamp indicates when the transmission should have taken place and helps decode when the data was collected. Pseudobinary D is 4 bytes larger than format B.

The timestamp is similar to the one in Pseudobinary C. Pseudobinary D is smaller than Pseudobinary C and it lacks detailed timestamps that would allow one to completely reconstruct the time the data was collected from the message itself. To correctly use Pseudobinary D, the decoder needs to know the measurement setup used.

The benefit of using Pseudobinary D is being able to correctly decode data regardless of when it was sent or received. This allows stations to re-transmit old data and have it correctly interpreted by the decoder while keeping the message size at a minimum.

Name	Bytes	Description
Block ID	1	BLOCK-IDENTIFIER is always sent as "D" to indicate that this is the pseudobinary D format.
Group ID	1	GROUP-ID can be "1" to indicate a scheduled transmission, "2" meaning an alarm transmission, and "3" indicating a forced transmission, or "4" indicating a retransmission
Day	2	This 2 byte encoded 6 bit binary encoded number represents the Julian day of the year. The day tells when the transmission was originally scheduled to take place
Time	2	This 2 byte encoded 6 bit binary encoded number is a number of minutes into the day. It tells when the transmission was originally scheduled to take place
Measurement Data	3 for each sensor reading	Sensor data encoded 6 bit binary. The value transmitted will be value * 10 <sup>RightDigits</sup> . The string /// will be sent if the data was never measured or had bad quality
Battery voltage	1	This is the battery voltage measured prior to making the transmission. The range of the number will be -32 to +31 and can be converted to volts by multiplying by 0.234 and adding 10.6 allowing a range of 3.1 to 18.1 volts.

## Six-Bit Binary Encoded Format

The six bit binary format is used to encode numbers into displayable ASCII characters. Notice that fractional numbers cannot be represented, so for instance a battery voltage of 13.04 volts set up with 2 right digits will be sent as 1304.

- A 1 byte encoded number can range from -32 to +31.
- A 2 byte encoded number can range from -2048 to +2047
- A 3 byte encoded number can range from -131072 to +131071

Binary encoded numbers are always sent most significant bytes first. The number itself is broken down into 6-bit digits, and each digit is placed in one byte of data. The number 64 (ASCII "@") is added to each digit to make it fall within the range of displayable ASCII characters. The only exception is that 127 (ASCII <DEL>) is sent as 63 (ASCII "?")

**Example 1.** Encoding the number 10 in 1 byte:

Since 10 will fit in 6-bits we only have to add 64 which would yield 74. So the number 10 would appear as ASCII 74 or the letter "J".

**Example 2.** Encoding the number 12345 in 3 bytes:

First we have to convert 12345 into binary in 6-bit pieces:

$$12345 \text{ (base 10)} = 11\ 000000\ 111001 \text{ (base 2)}$$

Now we can convert each piece back to base 10:

$$11\ 000000\ 111001 \text{ (base 2)} = 3, 0, 57$$

Finally, we add 64 to each piece and convert to ASCII:

$$67, 64, 121 = \text{ASCII "C@y"}$$

**Example 3.** Encoding the number -12345 in 3 bytes:

First we have to convert -12345 into two's complement 18-bit binary:  $-12345 \text{ (base 10)} = 111100\ 111111\ 000111 \text{ (base 2)}$

Now we can convert each piece back to base 10:  $111100\ 111111\ 000111 \text{ (base 2)} = 60, 63, 7$

Finally, we add 64 to each piece and convert to ASCII (since the second piece is 63 we leave it alone):

$$124, 63, 71 = \text{ASCII "|?G"}$$

**Example 4.** Decoding the 3 byte string "@SW":

This is just like encoding except we follow the steps backward.

First we convert all the characters to ASCII decimal codes:

$$\text{ASCII "@SW"} = 64, 83, 87$$

Now we subtract 64 from each piece and convert to 6-bit binary:

$$0, 19, 23 = 000000\ 010011\ 010111$$

Finally, we combine all the bits to form one 18-bit two's complement number and convert to base 10:

$$000000010011010111 = 1239$$

### Pseudobinary over SMS Format

The Pseudobinary formats contain 8 characters which cannot be sent over SMS using the standard GSM 7-bit character set without inserting additional characters. This is undesirable as it would reduce the number of bytes that can be sent over SMS from 160 to 80 (in the worst case). To work around this limitation, SMS messages that contain a Pseudobinary message will automatically be translated to replace non-supported characters with supported characters. Please note that this requires that the characters be translated back upon reception and before they can be passed to a decoder.

The following table describes the character translation that's performed:

ORIGINAL		REPLACEMENT	
HEX	CHAR	HEX	CHAR
5B	[	31	1
5C	\	32	2
5D	]	33	3
5E	^	34	4
60	`	35	5
7B	{	36	6
7C		37	7
7D	}	38	8
7E	~	39	9

### SHEF and SHEFFIX Formats

“SHEF” format conforms to NESDIS Standard Decimal format specifications. The format is ASCII and readable by persons without the aid of a computer.

The standard decimal format is human readable while binary formats require some processing before the values can be read. The standard decimal format is generally twice as long as the binary transmission. This means that less data can be sent in the same amount of time using the standard decimal format.

An example of a standard decimal format message is shown below. This message comes from a station with three sensors in the self-timed group. The sensors have been named HG, PC and TA. The battery voltage is the voltage of the battery just prior to transmission.



- G: Good quality
- B: Bad quality
- U: Undefined quality

Alarm codes:

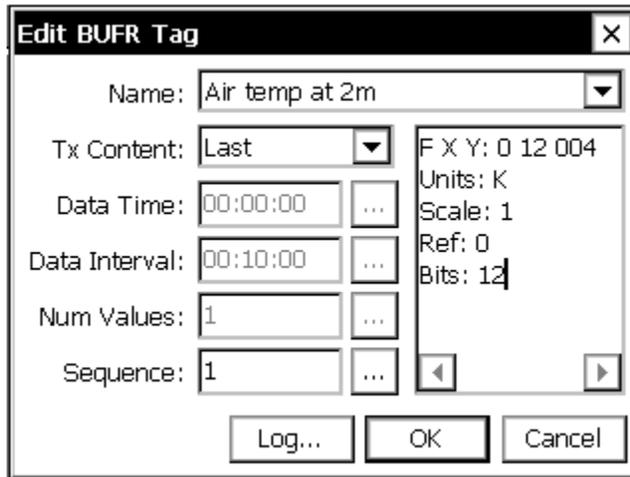
- H: High limit exceeded
- L: Low limit exceeded
- R: High Rate of change
- OK: Normal

A “+” after a code indicates that the sensor has just entered that state, while a “-“ after a code indicates that the sensor has just exited that state.

## BUFR

“BUFR” format is a binary message, conforming to WMO BUFR requirements for data transmissions and storage.

When BUFR is the selected format, the telemetry block used to “tag” the data for transmission has the following properties:



### Name

The Name field describes the data to be transmitted. The Name corresponds to the Name (or sometimes called, “Description”), found in the WMO BUFR Table B. The read-only text pane to the right, updates as Name is changed, to show the following details from Table B:

Descriptor (F X Y)	The F X Y descriptor that uniquely identifies the data from Table B, e.g., 0 12
--------------------	---

	004 for “Air Temp at 2m”
Units	The units of the transmitted data
Scale	The scale applied to the data prior to transmission. Note, scale is applied as follows: transmitted data = measured value times 10 raised to the power of scale.
Ref	Reference Value subtracted from measured value after scaling, prior to transmission.
Bits	Data width in bits allowed for the transmitted value

### Expanding Table B

The logger has an internal version of the WMO Table B that includes a handful of commonly transmitted values. If the internal table does not contain the values you need to transmit, create a text file called “BUFRTABLEB.txt”, add the desired items in the format described below, and copy the text file to the logger’s Flash Disk. Here is the format of the text file:

F, X, Y, Name, Units, Scale, Reference, Bits

For example:

```
0,1,1,WMO block number,Numeric,0,0,7
0,1,2,WMO station number,Numeric,0,0,10
0,5,2,Latitude (coarse accuracy),deg,2,-9000,15
0,6,2,Longitude (coarse accuracy),deg,2,-18000,16
0,7,4,Pressure,Pa,-1,0,14
0,11,1,Wind direction,degree true,0,0,9
0,11,2,Wind speed,m/s,1,0,12
0,11,35,Vertical gust acceleration,m s-2,2,-8192,14
0,12,1,Temperature/air temperature,K,1,0,12
0,12,4,Air temp at 2m,K,1,0,12
0,13,3,Relative humidity,%,0,0,7
0,13,23,Total precip past 24 hours,kg m-2,1,-1,14
0,13,55,Intensity of precipitation,kg m-2 s-1,4,0,8
0,14,30,Direct sol rad/period (high accuracy),J m-2,-2,0,20
0,14,32,Total sunshine,h,0,0,10
0,25,25,Battery voltage,V,1,0,9
```

### Tx Content, Data Interval, Data Time, and Num Values

These properties define what data to include in the transmission. See the following table for details:

Tx Content	Description of data to transmit
All	All the data measured since the last transmission

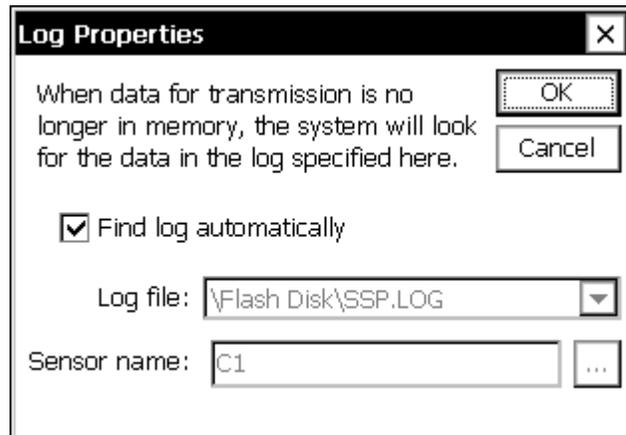
		(or up to Num Values for interleaved formats), will be transmitted
Individual		Individual values are selected for transmission based on timestamp
	Data Interval	The time interval between readings. For example, “01:00:00” means “hourly data”
	Data Time	The time, or offset into the interval, of the data to include. For example, “00:15:00” means “include data measured on a 15 minute offset”
	Num Values	Number of values for each data item to include in the transmission. Enabled only for non-interleaved transmission formats
Last		Only the last measured value will be transmitted (or the last “Num Values”, if enabled in global transmission settings)
Exclude		Exclude this item from transmission

### Sequence

This property determines the order of the data item within the transmission.

### The “Log...” Button

The “Log...” button opens a dialog used to select the backing log containing the data for transmission.

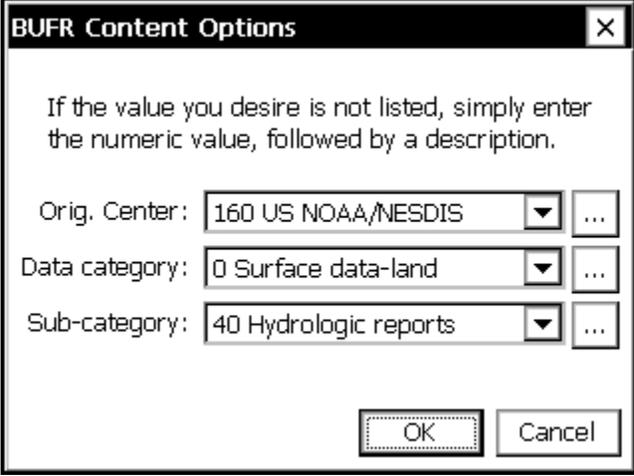


The system normally stores transmission data in memory, and only resorts to searching the log when the data is not found there (e.g., due to power-loss). The system normally selects the backing log automatically. If the automatic selection is incorrect, uncheck “Find log automatically” and specify the log manually.

Note: The system is unable to use log records as a backing log for transmission data (i.e., data logged using the LogRec and LogField blocks).

## BUFR Content Options

When the selected format is “BUFR”, the telemetry device settings (e.g., Satlink, LANTx, GPRS, or Iridium), offer the following BUFR content option settings for edit (accessed by pressing the “BUFR” button on the telemetry device settings dialog):



The image shows a dialog box titled "BUFR Content Options" with a close button (X) in the top right corner. Inside the dialog, there is a text instruction: "If the value you desire is not listed, simply enter the numeric value, followed by a description." Below this instruction are three rows of input fields, each with a dropdown menu and a button with three dots (...):

- Orig. Center: 160 US NOAA/NESDIS
- Data category: 0 Surface data-land
- Sub-category: 40 Hydrologic reports

At the bottom of the dialog are two buttons: "OK" and "Cancel".

### Originating Center

Select the originating to use in the BUFR message. If the desired center is not listed in the dialog drop-down, simply enter the desired value, with its numeric component, first (e.g., “34 - My originating center”). If the field is left blank, 0 is used.

### Data Category

Select the data category to use in the BUFR message. If the desired category is not listed in the dialog drop-down, simply enter the desired value, with its numeric component, first. If the field is left blank, 0 is used.

### Data Sub-category

Select the data subcategory to use in the BUFR message. If the desired subcategory is not listed in the dialog drop-down, simply enter the desired value, with its numeric component, first. If the field is left blank, 0 is used.

## Hydromet Cloud Protocol (“Session Type 0/1”)

GPRS transmissions use the “Hydromet Cloud” protocol that permits the server to issue commands to the station. The protocol helps support communications to a device which has a non-routable IP address, as many IP cell modems provide. This protocol does not apply to SSP transmissions.

### Course of Events

1. Logger connects to server

2. Logger sends Session Type Code<cr> (see below)
3. Logger sends Station Name<cr>
4. Logger sends Report Type Code<cr> to indicate purpose of connection (see below)
5. Logger sends transmission data (if any)
6. Logger sends ETX (0x03) to mark end of data
7. Logger sends a 3 byte pseudobinary encoded CRC16 of previous data and a shared secret
8. Server sends either an acknowledgement character <cr> (0x0D) to acknowledge receipt of data. Alternatively, if server has commands for logger pending, server sends login string “!login=username,password<cr>” instead of <cr>
9. If logger fails to receive the acknowledgement or login string within 15 seconds, the logger disconnects and marks the attempt as failed
10. If server sent login string and logger accepts login credentials, logger enters command-line session, the server issues pending commands, and the logger processes and responds accordingly. Server sends “exit<cr>” to signify all commands have been sent.
11. Logger disconnects

### **Session Type Code**

"Session type" defines the processing that occurs on connection. The most recent session type is defined by the Course of Events above, and details that follow. New session types will define new/different courses of action, as needed.

"1" = defined by Course of Events, above

"0" = similar to session type 0, but without the requirement for the server to acknowledge receipt of the data, and without the requirement for the logger to impose a time-out on login before entering a command session.

### **Report Type Code**

“Report Type code” describes the purpose of the transmission:

"0" = self-timed

"2" = entering alarm

"4" = exiting alarm

"6" = no data, command session only

"8" = forced tx (test tx initiated by user)

"10" = self-timed retransmission

## **Command-line Session Details**

The server may precede each command with a "!" to signal machine mode

When processing a command in machine mode, the logger:

- Suppresses the command echo
- Uses ETX (0x03) as the command prompt (i.e., follows the command response with ETX, rather than the normal command prompt)
- Inhibits pagination (doesn't pause to wait for user input after outputting a full "page" of data)