

# Device/User Interface Software Requirements For General Data Products 782 BPSK Subcarrier / Modulator

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## Table of Contents

Table of Contents .....	i
1.0 Introduction .....	1
2.0 Required Functionality.....	1
3.0 Parameter Ranges.....	1
4.0 Communications Protocol.....	1
5.0 GUI Functionality.....	1
6.0 Command Scripting.....	3
7.0 High-level Status.....	3
8.0 Replacement Algorithm.....	3
Appendix A: Graphical User Interface Requirements.....	4
Appendix B: Scripting Requirements.....	5

## 1.0 Introduction

This document provides device and user interface requirements for the General Data Products 782 Subcarrier Generator / Bi-Phase Shift Keyed (BPSK) Modulator

## 2.0 Required Functionality

The BPSK modulator is a device within the Data Handling Node. This device accepts TTL or RS-422 command data to feed the modulator section. It then uses this feed to “phase-shift keying” (PSK) modulate a selected frequency subcarrier. The resulting signal, which is then sent to the device output(s), can be in either square or sine wave form. The unit contains an integral frequency synthesizer to set the carrier frequency.

This device will be used as part of the telemetry data path from the Data Handling Node on into the Antenna Node. This device will be connected to other devices in the telemetry signal data path by way of its signal input/output ports. This device's input/output ports will be switched through an Analog Matrix Switch. Moreover, the command input port of this device will be connected to its node computer through a Digiboard switchable serial port controller. The full capabilities of this device will be used.

## 3.0 Parameter Ranges

The needs of ground station implementation will not require parameter limits that are different than those which are standard to the device.

The General Data Products 782 Subcarrier Generator / Bi-Phase Shift Keyed (BPSK) Modulator has the following range and parameter limits.

- Modulation Input Bitstream Rate DC up to 1Mbps
- Subcarrier Frequency / Internal Clock 1.0 Khz to 2.0 Mhz with 1.0 Hz resolution
- Maximum Frequency for Coherent Modulation 32.0 Khz
- Reference Clock Subcarrier divided by  $2^n$  where  $n = 1 - 7$

## 4.0 Communications Protocol

RS-232 Serial protocol will be used to communicate with this device. This device will be connected by way of a direct serial line. The port settings are as follows;

- Baud Rate 9600
- Stop Bits 1
- Data Bits 8
- Parity None

Other port settings are as follows.

- Data-Terminal-Ready control (DTR) Disabled
- Ready-To-Send control (RTS) Disabled
- Data-Set-Ready (DSR) Off

## 5.0 GUI Functionality

It should be noted that this device does not contain a simple remote reset. It is expected that users will want to reset the device to a known state. Default values for device start-up following a reset are noted.

The user will be able to set the following remote controllable features

- **Reset**
  - This feature will perform an immediate reset of the device to its default hardcoded values.
- **Apply Now**
  - This feature will cause the device to be set to the settings contained in the User Interface.
- **Command Input Stream Type**
  - Command code is "IN=~"
  - This item can be either TTL or RS-422
  - This item is defaulted to TTL
- **Input Code Selection and Conversion/Decoding**
  - Command code is "IC=~"
  - This item can be either of
    - BYPASS, i.e. no conversion/decoding
    - A type of Non Return to Zero: NRZ-Level, NRZ-Mark, NRZ-Space
    - A type of Bi-Phase Zero Degree: Bi-0-Level, Bi-0-Mark, Bi-0-Space
  - Requires a zero degree phase clock
  - This item is defaulted to NRZ-L
- **Internal Clock**
  - Command Code is "FR=~"
  - This item ranges from 10.0 Hz to 10,000,000 Hz
  - This item will be defaulted to 1,000,000 Hz
  - \*\*\* reference to this item on page(s) 4.2, 4.4 \*\*\*
- **Subcarrier Frequency**
  - \*\*\* Is this the same as the Internal Clock??? \*\*\*
  - \*\*\* have been unable to locate a command code for this item \*\*\*
  - \*\*\* reference to this item on manual page(s) 1.3, 1.4, 1.6, and 2.1 \*\*\*
  - This item ranges from 1.0 Khz to 2.0 Mhz
  - This item will be defaulted to 32.0 Khz upon device start up / reset
- **Reference Oscillator for Direct Digital Stream**
  - Command Code is "RE=~"
  - This item can be either Int (internal 5.0 Mhz oscillator), Ext5 (external 5.0 Mhz oscillator or Ext10 (external 10.0 Mhz oscillator)
  - This item will be defaulted to Int
- **Reference Clock Divide:** Divisor to generate subcarrier harmonic (multiple) which will be used as the Reference Clock Pulse
  - Command Code is "DV=~"
  - This item can be either of 2, 4, 8, 16, 32, 64, or 128
  - This item will be defaulted to 16
- **Output Waveform**
  - Command Code is "OW=~"
  - This item can be either of SIN (sine wave) or SQR (square wave)
  - This item will be defaulted to SIN
- **Output Modulation Code Selection and Conversion/Encoding**
  - Command Code is "OC=~"
  - This item can be either of:
    - BYPASS, i.e. no conversion / encoding
    - A type of Non Return To Zero: NRZ-Level, NRZ-Mark NRZ-Space
  - Modulation output jacks provide a zero degree phase clock
  - This item will be defaulted to NRZ-L

- **Output jack RF signal to antenna**
  - Command Code is “MD=”
  - This item can be either of Coherent, Non-Coherent, or No Modulation
  - Coherent modulation is permitted with a subcarrier  $\leq 32.0$  KHz
  - This item will be defaulted to Coherent

## 6.0 Command Scripting

See Appendix B: Scripting Requirements

## 7.0 High-level Status

It should be noted that this device does not feature parameter monitoring. It will need to be understood that the GUI will initiate communication / command with the device and will reflect the value(s) embedded in the device command string(s). The device will acknowledge that a command string was received, i.e. 'heard'. However, there is no way to confirm or otherwise verify that the command values were set.

Note that remote control users of this device only have control/access to those items available from the keypad. The amplitude vernier and offset vernier are analog concepts which are used to fine tune the output signal. They are unavailable to remote users.

There are two indications of device responsiveness: 1) return from the device of the “last message accepted” message, and 2) return from the device of the “last message rejected” message following issue of commands. Last message accepted is denoted with the '>' character. Last message rejected is denoted with the '?' character.

## 8.0 Replacement Algorithm

Note that when power is first applied or following a power interruption the device will default to the operating parameters as defined in non-volatile memory. Particularly note too, that the device will revert to local mode. Operator intervention will be required to place the device back into remote mode. The operator will have to manually select remote mode from the device's front panel keypad.

Operator intervention will be required to recover from loss of the device at the master console. Loss of the device will be indicated by a loss of responsiveness to commands. This device loss will be reflected on the Master Node control screen. At this time the Master device configuration table will have to be updated.

## **Appendix A: Graphical User Interface Requirements**

The user will be able to access the following remote controllable features.

**Appendix B: Scripting Requirements**

<b>Master</b>	<b>Node</b>	<b>Comments/Error Handling</b>
Resource Request Specific Parameter: unit number	Start  Check allocation table for unit number  If available then Mark unit as assigned to this Master Reply "Unit # assigned" Open log file Retrieve configuration file from this Master Else Reply "Unit # not available" End  Stop	>> Insure that Remote is selected on the device's front panel display  >> Issue an 'Alive' and listen for a response to indicate that unit is responding and available.
Resource Request General	Start  Check allocation table for an available unit using the least recently used method  If available then Mark unit as assigned to this Master Reply "Unit # assigned" Open log file Retrieve configuration file from this Master Else Reply "No units available" End  Stop	>> Insure that Remote is selected on the device's front panel display  >> Issue an 'Alive' and listen for a response to indicate that unit is responding and available.
Setup Parameter: unit number	Start  Verify possession of unit by this Master	

Master	Node	Comments/Error Handling
	If not assigned to this Master then Inform this Master Stop End  Load and Verify configuration file  If configuration file error then Inform this Master Stop End  Stop	>> Operator intervention required          >> Operator intervention required
Start Support Parameter: unit number	Start  Verify possession of unit by this Master  If not assigned to this Master then Inform this Master Stop End  Stop	>> Operator intervention required
Stop Support Parameter: unit number	Start  Verify possession of unit by this Master  If not assigned to this Master then Inform this Master Stop End  Stop	>> Operator intervention required
Takedown Parameter: unit number	Start  Verify possession of unit by this Master	

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<b>Master</b>	<b>Node</b>	<b>Comments/Error Handling</b>
	If not assigned to this Master then Inform this Master Stop End  Mark unit as not assigned Close log file Send log file to this Master  Stop	>> Operator intervention required