DN 6000334

PROGRAMMING MANUAL FOR THE MODEL 520V ANALOG SYNCHRONIZER

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FOR THE
MODEL 520V ANALOG SYNCHRONIZER

CHAPTER 1
INTRODUCTION

This manual describes the commands you can use to set up and control the Acroamatics Model 520V Analog Synchronizer (ASYN) with the TDP Compiler. *Programming Manual for the VMEbus Telemetry Data Processors Portable Compiler*, Acroamatics Document Number 6000266, describes the syntactical conventions of the TDP Compiler, and how to use it.

Information about installation, operation, and maintenance of the card can be found in *Technical Manual - Model 520V Analog Synchronizer*, Acroamatics Document Number 6000301.

Types of Commands

The TDP Compiler supports two classes of commands for the ASYN. The first class of commands are those you use to program the device to process a Pulse Amplitude Modulated (PAM) telemetry stream. The setup programming language is described in Section 2. The other class of commands are Single Line Commands. You use Single Line Commands for direct control of certain ASYN functions. Single Line Commands are described in Section 3. Single Line Commands are executed without stopping the ASYN and then restarting it, whereas a setup program always automatically stops the ASYN momentarily, and then restarts it to ensure that the hardware has been initialized and the new setup is in effect.

Abbreviating Commands

In this manual, all command names are shown in their long, mnemonic form. It should be noted that most command names may be abbreviated after three characters to the minimum number of characters necessary to uniquely identify the command. In cases where a command name contains two words and the second word is not necessary to uniquely identify the command, the second word may be omitted. Also, for command names that contain a hyphen, the hyphen may be replaced with a space.

Entering Integer Parameters

Parameters which take an integer value may be specified either in hexadecimal, or by default, in decimal format. To specify hexadecimal number, the number should be preceded by a "/". For example, the number 1023 could be specified as **1023** or **/3ff**.

CHAPTER 2
SETUP PROGRAM SYNTAX

The TDP Compiler supports two forms of ASYN programming. One of these is completely compatible with programs written for Acroamatics Model 2410 Programmable Analog Synchronizer, which was a separate, stand-alone device. Setting up the Model 2410 was treated as a completely separate function, which only described the PAM stream characteristics. Programming the Distribution System for processing data extracted from the PAM stream was described in a different program section. It referred to the “Digital Port" that received the data from the 2410. The general form of a stand-alone ASYN setup program is

```
PAM [n]
   .
   .
commands
   .
   .
END
```

where *n* must be **1** or **2**, referring to one of two possible ASYN cards. If the number is omitted, its default value is taken to be **1**. The **END** statement finishes the programming by checking the setup for errors, and if there are none, downloading the setup to the addressed card. Appendix A contains an example of a stand-alone setup program

The second form of an ASYN setup program is a more integrated structure, similar to the form of a PCM program. When you use this form, you first described the characteristics of the PAM stream you are processing, then you describe what you want to do with the data (the Distribution System programming). The general form of an integrated ASYN setup program is

```
PAMn [offset]
   .
   .
commands
   .
   .
ENDFORMAT
   .
   .
processing
   .
   .
END PAMn
```

Here, the *n* in the **PAM** “port" declaration identifies this as an “integrated" setup. Again, *n* refers to the ASYN card being addressed (**1** or **2**), but in this case it is not optional. The optional *offset* parameter sets the base ID for the PAM channels. It replaces the “Channel ID Offset" command, **OFFSET**, described later in this Section, and follows the same rules. If *offset* is omitted from the declaration, the ID Offset is set to zero. Except for the **OFFSET**, command, all the

setup commands and their parameters are the same for either an “integrated" setup or for a “stand-alone" setup, and they are described in this Section.

As an additional feature of an integrated setup, symbolic names are automatically generated for the PAM channels, and these may be used in processing section of the program. The names are “**PAMCH***n*", where *n* is the PAM Channel number, which can range from **1** through the number of channels specified in the **LENGTH** command (see below). If, for example, your PAM format had 64 channels of data, you could refer to **PAMCH1** through **PAMCH64**. Appendix B contains an example of an integrated setup program

Selecting the Input Source

The data signal to be processed may be selected from either of the two input connectors located on the rear panel. The command to select the input source is

INPUT *src*

where *src* can be **1** or **2**.

Setting the Data Format

To set the data format, use the following command

FORMAT *code*

where *code* may be **PAMNRZ**, **PAMRZ**, **PDM1**, or **PDM2**.

Setting the Input Polarity

The Input Polarity is set with the command

POLARITY *mode*

where *mode* can be **NORMAL** or **INVERT**.

Setting the Frame Length

The Frame Length is set with the command

LENGTH *nchannels*

where *nchannels* is the number of channels per frame. The frame length can be **10-999** channels.

Setting the Channel Rate

The channel rate is set with the command

RATE *frequency*

The allowed rate for *frequency* depends on the setting of the Data Format. The following table summarizes the allowed frequencies for each of the Data Formats.

Data Format	*frequency* (channels/sec)
PAMNRZ	**10-250,000**
PAMRZ	**10-125,000**
PDM1	**10-10,000**
PDM2	**10-10,000**

You can express the *frequency* in a variety of ways. For example, if you want to set the **RATE** to 110 kHz, any of these commands can be used:

```
RATE    110000
RATE    110k
RATE    .11M
RATE    1.1e5
```

Setting the Zero Scale Reference Channel

The location of the zero scale reference channel is set with the command

ZERO CHL *position*

where *position* can be **1-999**, but must be less than the Frame Length.

Setting the Full Scale Reference Channel

The location of the full scale reference channel is set with the command

FULL CHL *position*

where *position* can be **1-999**, but must be less than the Frame Length.

Setting the Search Loop Width

The PLL bandwidth determines the capture/recapture of rate synchronization. The PLL bandwidth for when the ASYN is in Search mode is set by the command

SRCH WIDTH *aperture*

where *aperture* may have values **1-5**, with **1** representing widest possible capture range (10%), and **5** representing the narrowest (0.625%). A wide *aperture* is recommended for the Search Width in order to allow the PLL to adjust to rapid changes in the input rate for a shorter capture time.

Setting the Lock Loop Width

The PLL bandwidth determines the capture/recapture of rate synchronization. The PLL bandwidth for when the ASYN is in Lock mode is set by the command

LOCK WIDTH *aperture*

where *aperture* may have values **1-5**, with **1** representing widest possible capture range (10%), and **5** describing the narrowest (0.625%). A narrow *aperture* is recommended for the Lock Width in order to prevent the PLL from responding to noise perturbations on the input signal once frame synchronization has been achieved.

Setting the Check-To-Search Count

The Check-To-Search count specifies the number of sync patterns that must be missed before the frame synchronization mode changes from Check to Search. The Check-To-Search count is set by the command

CHECK-SRCH *count*

where you may set the *count* to values from **1-15** frames.

Setting the Check-To-Lock Count

The Check-To-Lock count specifies the number of sync patterns that must be seen before the frame synchronization mode changes from Check to Lock. The Check-To-Lock count is set by the command

CHECK-LOCK *count*

where *count* may be set to values of **1-15** frames.

Setting the Lock-To-Search Count

The Lock-To-Search count specifies the number of sync patterns that must be missed before the frame synchronization mode changes from “Lock" to “Search". The Lock-To-Search count is set by the command

LOCK-SEARCH *count*

where you may set *count* to **1-15** frames.

Automatic Ranging Servo

The Automatic Ranging Servo provides coarse adjustments to the gain and offset scaling of the input signal while the frame synchronization strategy is in “Search" mode. On very stable data, the servo may introduce small errors, so the Automatic Ranging Servo may be turned on or off with the command

AUTO-RANGE *state*

where *state* may be set **ON** or **OFF**.

Data Ranging Servo

The Data Ranging Servo uses the full and zero scale reference channels to provide fine adjustments to the gain and offset scaling of the input signal. These fine adjustments reduce the data errors to less than ± 0.1% of full scale. The Data Ranging servo can be active while the frame synchronization strategy is in “Lock" mode. On very stable data, the servo may introduce small errors, so the Data Ranging Servo may be turned on or off with the command

DATA SERVO *state*

where you may set *state* to **ON** or **OFF**.

Channel Rate Servo

The Channel Rate Servo adjusts the center frequency of the PLL to maintain rate synchronization with the input signal. The rate servo is usually left on, but there may be occasions when you want to turn it off (for instance, to check the rate stability of the incoming data). The Channel Rate Servo may be turned on or off with the command

RATE SERVO *state*

You can set the Servo *state* to **ON** or **OFF**.

Automatic Slip Correction

Automatic Slip Correction is provided to detect master sync pulses that occur one channel early or one channel late. This helps to maintain frame synchronization in the presence of noise bursts and dropouts. It also allows data ID tagging to be corrected immediately instead of being off by one for as many frames as the Lock-To-Search count calls for. To turn Automatic Slip Correction on or off, use the command

SLIP *state*

The Slip Correction *state* may be set **ON** or **OFF**.

Setting the Reset Delay

The Reset Delay feature permits the control amplifiers to remain at their “Lock"ed settings for a programmable period of time after the frame synchronization state has changed from “Lock" to “Search". After the Delay time, the Auto Range and Data servos are reinitialized. The Reset Delay is set with the command

DELAY *time*

By default, *time* is assumed to be given in milliseconds. You may set the Delay *time* to **0-10230** milliseconds. The *time* is rounded to the nearest 10’s of milliseconds. For instance, the command **DELAY 1042** would set the delay to 1040 milliseconds.

The Delay *time* can also be specified in seconds. This is done by giving a *time* that contains a decimal point (“.") and/or ends with the letter “S". For instance, the commands **DELAY 1.** and **DELAY 1S** both set the delay to 1 second. In this

case, the range for *time* is **0-10.23**, and any given *time* will be rounded to the nearest .01 second.

Setting the Channel Transition Sensitivity

Channel Transition Sensitivity control is used to achieve or maintain rate synchronization of telemetry data with excessive filtering or noise. It is set with the command

CHL SENSE *sensitivity*

You can set the *sensitivity* to values from **0** to **3**. A *sensitivity* of **0** detects an edge of approximately 30% full scale (less sensitive), while a *sensitivity* of **3** detects an edge of approximately 8% full scale (more sensitive). When setting the Channel Transition Sensitivity, the objective is to find the setting which prevents detection of as many false edges as possible, yet permits enough leading edges to keep the PLL locked. Therefore, *sensitivity* should be increased for overfiltered data (**2** or **3**), and decreased for noisy data (**0** or **1**).

Setting the PCM Sync Pattern

The ASYN outputs a 10 bit NRZ-L representation of each channel received, along with a programmable 10-bit PCM sync pattern and a synchronous 0° clock. The specified sync pattern is inserted into the PCM stream at the last channel of the PAM master sync time. The sync pattern is set with the command

PCM SYNC *value*

where *value* may be **/000-/3ff**.

Setting the Guard Bands

Programmable Guard Bands are provided to allow data channels that exceed the reference channels to be scaled into meaningful data. The Guard Band is set with the command

GUARD BAND *size*

where *size* may be **0.0-20.0**%. *size* specifies the percentage of full scale that is to be occupied by the Guard Bands. For example, a *size* of 20 corresponds to mapping the full scale reference channel to be 90% of full scale, and the zero scale reference channel to be 10% of full scale. Hence, the Guard Bands occupy 20% of full scale.

Setting the ID Offset

Channel numbers need to be converted to unique ID tags that do not conflict with any other ID tags on the TDP's Distribution Bus. In the stand-alone form of ASYN setup, this is done with the command

OFFSET *value*

where *value* may be **/0000-/FF00**. It is required that *value* lie on a hexadecimal 100 boundary. The *value* /100 and /BA00, for example, are valid ID Offsets because they lie on hexadecimal 100 boundaries, while /101 or /BA01 are not. The **OFFSET** command is not valid in the integrated form of ASYN setup, because the optional "Port Offset" is used instead.

PAM channels are numbered with a ten bit identifier, starting with zero. When the ASYN card outputs data to the Distribution System, it delivers it with an ID tag which is simply the channel number and ID Offset, "ORed" together. **Note:** The "OR" function means that if the Frame Length is greater than 256 channels, one must be careful in choosing the ID Offset. For example, for a Frame Length of 512 channels, an ID Offset of /C00 would produce unique ID's for each channel, whereas /F00 would not. To be useful, you should choose an ID Offset such that each channel number receives an ID tag that is unique from every other channel number's ID tag, and that is also unique from all ID tags produced by other devices on the TDP's Distribution Bus.

Selecting the Distribution Bus Output Format

The Distribution Bus is accessed through the 60 pin connector on the card edge. The format used to output data to the Distribution Bus is selected with the command

OUTPUT *format [justification]*

where *format* may be **OBN** for offset binary or **2CM** for 2's compliment, and *justification* may be **LJ** for left justified or **RJ** for right justified. If *justification* is not specified, the default is to output left justified data.

Setting the Sync Channel Values

The values for the channels in the sync pattern are set using the command

SYN*n value*

where *n* is the sync channel number (**1-5**), and *value* may be **0.0-150.0**%. The sync *value*s are programmed as a percentage of full scale and resolved to within 0.1%.

Setting the Sync Channel Tolerances

The tolerances on the sync values are set using the command

TOL*n value*

where the sync channel number, *n*, is in the range **1-5** and *tolerance* may be **0.0-100.0**%. The sync *tolerance*s are programmed as a percentage of full scale and resolved to within 0.1%.

Setting the Filter Width

To set the filter width, use the following command

FILTER *width*

where *width* may be **OFF**, **WID**, **MED**, or **NAR**.

CHAPTER 3
SINGLE LINE COMMANDS

Single Line Commands are commands that either change the operating mode of the ASYN, or that can be executed without stopping and then restarting the ASYN. When you give a Single Line Command, an **END** statement is not required. A Single Line Command is executed immediately. The general form of an Single Line Command is

PAM *[n] command*

You can select the ASYN card number to receive the *command* by giving the optional parameter *n*, (**1** or **2**). If you do not specify *n*, ASYN card **1** is selected by default.

Set Idle Mode

The ASYN can be placed in Idle mode with the command

PAM *[n]* **IDLE**

or

PAM *[n]* **STOP**

Set Run Mode

The ASYN can be placed in Run mode with the command

PAM *[n]* **RUN**

Set Automatic Ranging Servo

The Automatic Ranging Servo can be turned on or off with the command

PAM *[n]* **AUTO-RANGE** *state*

This performs the same function as the similar setup program command (see Section 2). The *state* can be **ON** or **OFF**.

Set Data Ranging Servo

The Data Ranging Servo can be turned on or off with the command

PAM *[n]* **DATA SERVO** *state*

This performs the same function as the similar setup program command (see Section 2). The *state* can be **ON** or **OFF**.

Set Channel Rate Servo

The Channel Rate Servo can be turned on or off with the command

PAM *[n]* **RATE SERVO** *state*

This performs the same function as the similar setup program command (see Section 2). The *state* can be set **ON** or **OFF**.

Calibrate

You use the **CAL** command to perform the calibration procedure described in Acroamatics Document Number 1500520, *Card Test Procedure for the Model 520V Analog Synchronizer*. There are nineteen steps in the Test Procedure, and you select the setting for each test step with the command

PAM *[n]* **CAL** *step*

The *step* parameter is the test procedure step you are performing, (**1-19**).

APPENDIX A
EXAMPLE STAND-ALONE SETUP

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EXAMPLE STAND-ALONE SETUP

```
| SETUP PROGRAMMABLE ANALOG SYNCHRONIZERS
PAM 1
  INPUT 1
  FORMAT         PAMNRZ
  POLARITY       NORMAL
  LENGTH         64
  RATE           25000
  ZERO CHL       60
  FULL CHL       62
  SRCH WIDTH     1
  LOCK WIDTH     1
  CHECK-SRCH     1
  CHECK-LOCK     1
  LOCK-SRCH      1
  AUTO-RANGE     ON
  DATA SERVO     ON
  RATE SERVO     ON
  SLIP           ON
  DELAY          2000
  CHL SENSE      2
  PCM SYNC       0
  GUARD BAND     0.0
  OFFSET         /3100
  OUTPUT         OBN LJ
  SYN1           0.0
  TOL1           10.0
  SYN2           100.0
  TOL2           10.0
  SYN3           100.0
  TOL3           10.0
  SYN4           100.0
  TOL4           10.0
  SYN5           50.0
  TOL5           10.0
END
```

APPENDIX B
EXAMPLE INTEGRATED SETUP

APPENDIX B
EXAMPLE INTEGRATED SETUP

```
| SETUP PROGRAMMABLE ANALOG SYNCHRONIZERS
PAM1    /3100
  INPUT 1
  FORMAT         PAMNRZ
  POLARITY       NORMAL
  LENGTH         64
  RATE           25000
  ZERO CHL       60
  FULL CHL       62
  SRCH WIDTH     1
  LOCK WIDTH     1
  CHECK-SRCH     1
  CHECK-LOCK     1
  LOCK-SRCH      1
  AUTO-RANGE     ON
  DATA SERVO     ON
  RATE SERVO     ON
  SLIP           ON
  DELAY          2000
  CHL SENSE      2
  PCM SYNC       0
  GUARD BAND     0.0
  OUTPUT         OBN LJ
  SYN1           0.0
  TOL1           10.0
  SYN2           100.0
  TOL2           10.0
  SYN3           100.0
  TOL3           10.0
  SYN4           100.0
  TOL4           10.0
  SYN5           50.0
  TOL5           10.0
ENDFORMAT

OBN
PAMCH2:          ODBT    DAC2
                 PAS

PAMCH15:         SCDT    1.25 -10% DAC4
                 PAS

DEFAULT PAMCH1-PAMCH64: PAS
END PAM1
```