Standard TNC Settings for
the Santa Clara County Packet Network

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This paper documents the standard values for several key TNC parameters which should be used to optimize your performance when accessing the Santa Clara County packet radio network. Each user of the Santa Clara County network should set their TNC to these parameters so that performance is optimized for all users.

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Introduction

Most TNCs have dozens of configurable parameters. For many of these parameters, picking a value is non-trivial since many of them interact with each other. Changing one parameter without a corresponding change to the others can severely degrade performance. In addition, a packet radio channel operates most efficiently if all TNCs use a common set of values for several important parameters. Yet each TNC manufacturer has chosen different defaults values. Without a common standard, the channel is virtually guaranteed to be less than optimal.

The parameters defined in this document have been tested and are known to work well, even in heavy traffic situations. All Santa Clara County network users are expected to implement these parameters.

Two lists of parameters are given:

Standard TNC Settings for Outpost Users: defines the complete set of parameters to optimize performance with Outpost. These can be saved in a command file so that the proper values are always set each time Outpost is used. Implementing these parameters reduces packet traffic by as much as 80%!

Standard TNC Settings for Non-Outpost Users: defines a subset of the commands that apply for users interacting with the TNC via a terminal or terminal emulator. These commands optimize access to the network without impacting keyboard operations.

A brief description of each parameter is given at the end of the document.

Standard TNC Settings for Outpost Users

Outpost provides a convenient mechanism to ensure that the TNC is properly set up with all applicable parameters each time it transmits a message. This section explains how to use Outpost to set all standard TNC parameters. The details of each parameter, as well as the procedures for set them manually, are covered in later sections.

In Outpost:

- Setup > TNC > (select TNC) > TNC Commands > Create/Update File
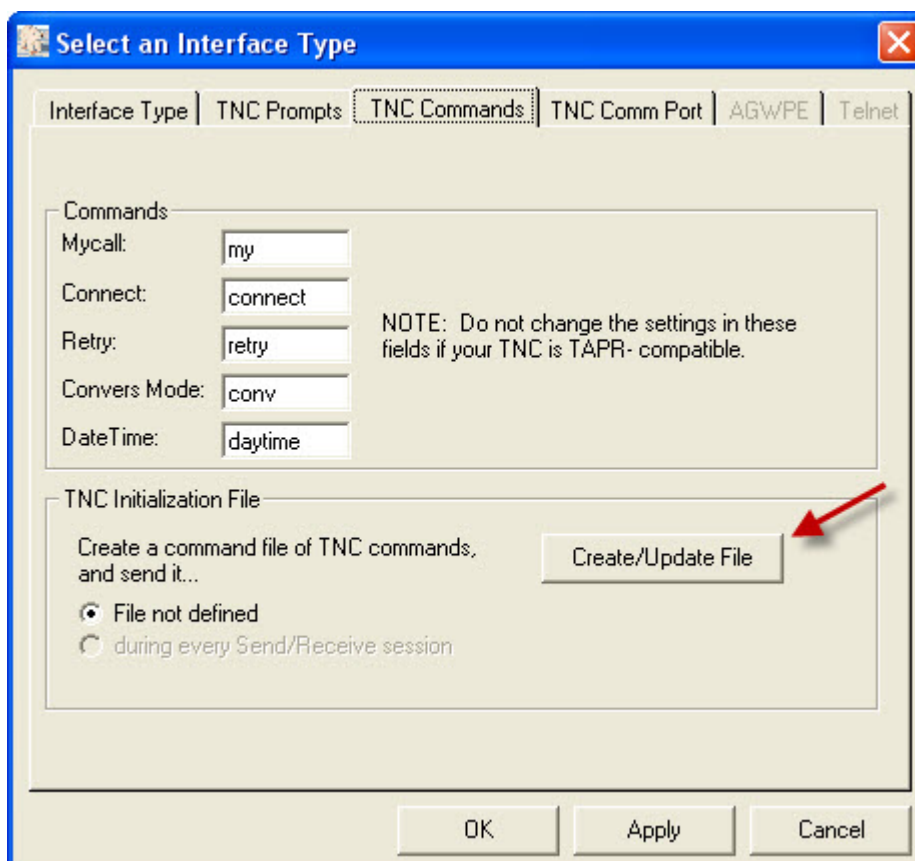
- Use the following table to enter the commands appropriate for your TNC type. Note that some TNCs do not have certain features while others us a different command for the same feature.
    - We recommend that you use copy-and-paste to avoid making typographical errors

TNC Type	Send before Send/Receive	Send after Send/Receive
AGWPE	AGWPE parameters must be set in a dialog box in the AGWPE application. Use the table in the "Standard TNC Settings for Non-Outpost Users" section to set the proper values.	
Kantronics KPC-3 (non-"+" version)	INTFACE TERMINAL BEACON EVERY 0 SLOTTIME 10 PERSIST 63 PACLEN 128 MAXFRAME 2 FRACK 6 RETRY 10 RESPTIME 5 CHECK 30 TXDELAY 30 XFLOW OFF SENDPAC $05 CR OFF PACTIME AFTER 1 CPACTIME ON	SENDPAC $0D CR ON PACTIME AFTER 10 CPACTIME OFF
Kantronics KPC-3+	INTFACE TERMINAL BEACON EVERY 0 SLOTTIME 10 PERSIST 63 PACLEN 128 MAXFRAME 2 FRACK 6 RETRY 10 CHECK 30 TXDELAY 30 XFLOW OFF SENDPAC $05 CR OFF PACTIME AFTER 1 CPACTIME ON	SENDPAC $0D CR ON PACTIME AFTER 10 CPACTIME OFF

| Kenwood	BEACON EVERY 0 SLOTTIME 10 PERSIST 63 PACLEN 128 MAXFRAME 2 FRACK 6 RETRY 10 RESPTIME 5 CHECK 30 TXDELAY 30 XFLOW OFF SENDPAC $05 CR OFF PACTIME AFTER 1 CPACTIME ON	SENDPAC $0D CR ON PACTIME AFTER 10 CPACTIME OFF
Timewave	EXPERT ON BEACON EVERY 0 SLOTTIME 10 PERSIST 63 PACLEN 128 MAXFRAME 2 FRACK 6 RETRY 10 RESPTIME 5 CHECK 30 TXDELAY 30 XFLOW OFF SENDPAC $05 ACRPACK OFF PACTIME AFTER 1 CPACTIME ON	SENDPAC $0D ACRPACK ON PACTIME AFTER 10 CPACTIME OFF
KAM V 7 and 8	INTFACE TERMINAL STREAMEV OFF STREAMSW 0 MCON OFF BEACON EVERY 0/EVERY 0 SLOTTIME 5/10 PERSIST 192/63 PACLEN 64/128 MAXFRAME 1/2 FRACK 4/6 RETRY 10/10 RESPTIME 5/5 CHECK 0/30 TXDELAY 30/30 XFLOW OFF SENDPAC $05 CR OFF PACTIME AFTER 1 CPACTIME ON	SENDPAC $0D CR ON PACTIME AFTER 10 CPACTIME OFF BEACON EVERY 0/EVERY 60

Notes:

1) The above lists of commands to not set MYCALL (your call sign) because this is already set by Outpost.

2) The personal mailbox name (MYPBBS, MYMCALL, MYMAIL, etc.) is also not set here since this parameter is not needed by Outpost when sending messages.   If you wish to set up your TNC as a mailbox/PBBS so that others may connect to it and leave messages for you, then you need to use the appropriate command for your TNC. Consult the "Explanation of TNC Parameters" section for more information.

- When you have finished entering the commands in both columns, your screen should look something like the following (this example is for a Kantronics KPC-3+):
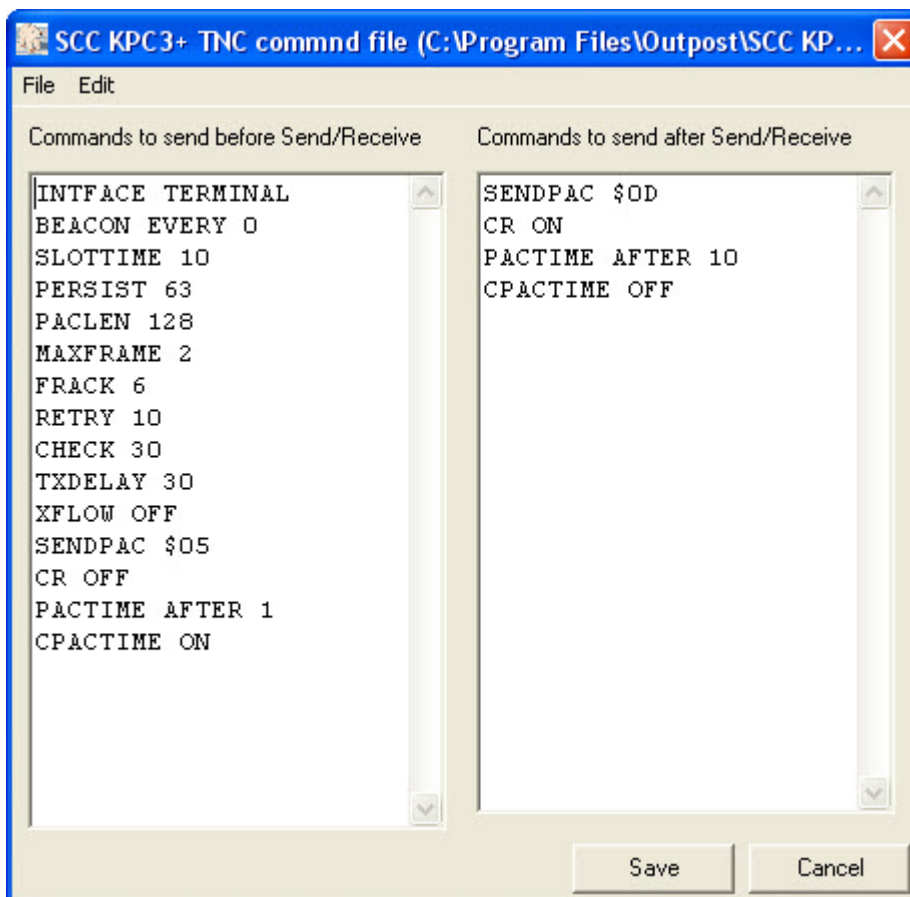
- Click Save.

- Then select "during every Send/Receive session" (see example below)
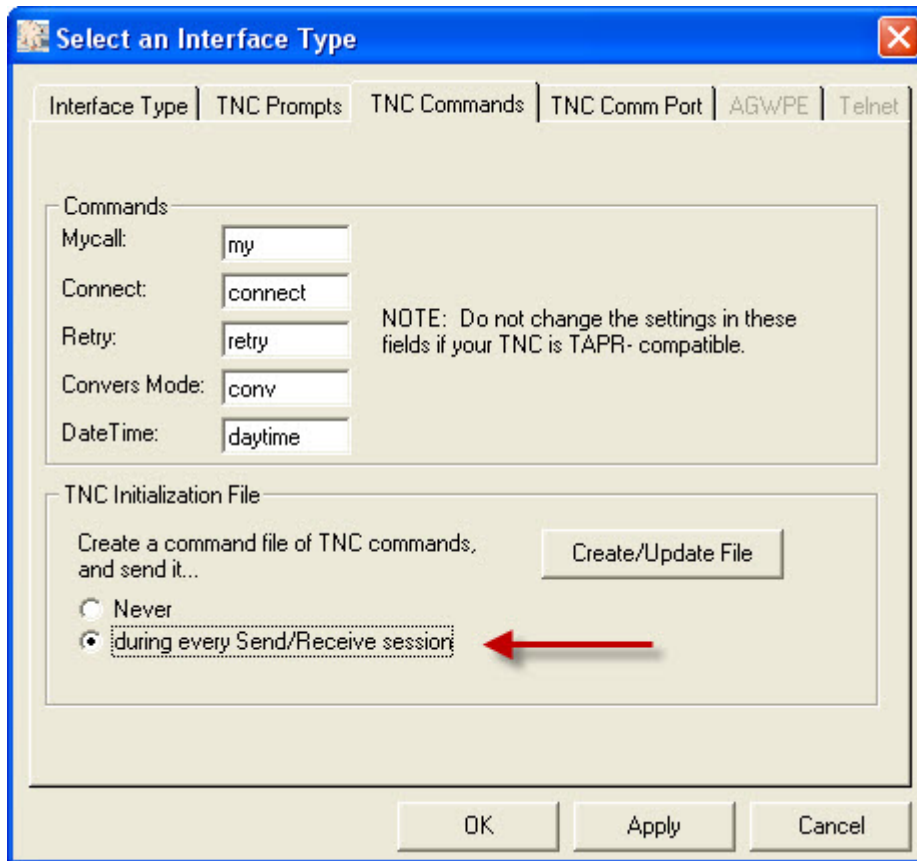
- Click OK

Each time Outpost talks to the TNC, it will send the commands in the "Send Before …" column, then connect to the BBS, send and receive messages, disconnect from the BBS, and then send the commands in the "Send After …" column.

Standard TNC Settings for Non-Outpost Users

The parameters listed in this section are for use by all Santa Clara County packet network users. They are a subset of the parameters used by Outpost users. All of these parameters should be set on any TNC used in the Santa Clara County network. Doing so will optimize performance, regardless of how the TNC is used.

Use the following table to enter the commands appropriate for your TNC type. Note that some TNCs do not have certain features while others use a different command for the same feature.

For AGWPE: Use the AGWPE user interface to set the parameters listed in the table below.

For other TNCs: Use the TNC command line ("cmd:") to enter the commands listed in the table below.

Note: In the table below, W6XRL4 is the fictitious call sign of Herman Munster from the TV show "The Munsters" in the 1960s. Replace "W6XRL4" with your actual call sign.

TNC Type	TNC Parameter and Value
AGWPE	PERSIST 63 SLOTTIME 10 MAXFRAME 2 RETRIES 10 FRACK 6 RESPTIME 5 CHECK 300
Kantronics KPC-3 (non-"+" version)	INTFACE TERMINAL MYCALL W6XRL4 MYPBBS W6XRL4-1 BEACON EVERY 0 SLOTTIME 10 PERSIST 63 PACLEN 128 MAXFRAME 2 FRACK 6 RETRY 10 RESPTIME 5 CHECK 30 TXDELAY 30 XFLOW OFF

| Kantronics KPC-3+ | ```
INTFACE TERMINAL
MYCALL W6XRL4
MYPBBS W6XRL4-1
BEACON EVERY 0
SLOTTIME 10
PERSIST 63
PACLEN 128
MAXFRAME 2
FRACK 6
RETRY 10
CHECK 30
TXDELAY 30
XFLOW OFF
``` |
|---|---|
| Kenwood | ```
MYCALL W6XRL4
MYMCALL W6XRL4-1
BEACON EVERY 0
SLOTTIME 10
PERSIST 63
PACLEN 128
MAXFRAME 2
FRACK 6
RETRY 10
RESPTIME 5
CHECK 30
TXDELAY 30
XFLOW OFF
``` |
| Timewave | ```
EXPERT ON
MYCALL W6XRL4
MYMAIL W6XRL4-1
BEACON EVERY 0
SLOTTIME 10
PERSIST 63
PACLEN 128
MAXFRAME 2
FRACK 6
RETRY 10
RESPTIME 5
CHECK 30
TXDELAY 30
XFLOW OFF
``` |

NOTE: If your TNC brand is not listed in the above table, then we do not have any specific information about it. You should be able to use the examples in the above table, along with your TNC documentation, to figure out the appropriate commands for your TNC. Also, let us know which TNC you're using on the scc-packet Yahoo group. We'll make an effort to add the most common TNC types to this document.

How to Set TNC Parameters Manually

To set the TNC parameters manually, connect to the TNC using a terminal emulator.   You can use any terminal emulator you want. Outpost includes one called "Ipserial."

Open your terminal emulator and set the proper serial port settings. Be sure you set RTS/CTS (i.e. "hardware") flow control.

For example, in Outpost:

- Go to: Tools > Interactive Packet > Serial/Comm Port
    - This opens the Ipserial window
- Click on: File > Comm Port Settings
- Select the proper settings for your serial port.
    - 9600 baud, 8 data bits, no parity, 1 stop bit is common
    - Select RTS/CTS flow control.
    - Click OK
- Click on: Connect

You should see a command prompt "cmd:" in the terminal window. If not, type the "*" (asterisk) character one or more times. Several TNC manufacturers use the "*" character for auto baud detection.

Use the table of "Standard TNC Parameters for Non-Outpost Users" to enter the commands, one at a time.

Explanation of TNC Parameters

Full Command Set Mode

Many TNCs ship from the factory with only a few commands enabled. In theory, this is supposed to be helpful to the novice user. In practice, it means we have one more command to issue before we can issue the commands we need to use. Set the mode of the TNC to allow you to enter more than novice commands

AGWPE, Kenwood	N/A
Kantronics	`INTFACE TERMINAL`
Timewave	`EXPERT ON`

Station Identification

The following parameters identify your station. The examples use the fictitious call sign of Herman Munster, W6XRL4, from the TV Show "The Munsters" in the 1960s. This call sign does not have the proper format for a U.S. call sign so it will never conflict with or be confused with a real call sign.

Call Sign

The call sign set in your TNC should be set to your personal or club call sign. (Replace "W6XRL4" with your real call sign.)

AGWPE	N/A
Kantronics, Kenwood, Timewave	`MYCALL W6XRL4`

Mailbox ID

If you're running a mailbox on your TNC, you will identify it with a CallSign-SSID value. (Replace "W6XRL4" in the example below with your real call sign.) An SSID of 1 is most commonly used to identify PBBSs (Personal BBSs or mailboxes) such as found in TNCs.

AGWPE	N/A
Kantronics	`MYPBBS W6XRL4-1`
Kenwood	`MYMCALL W6XRL4-1`
Timewave	`MYMAIL W6XRL4-1`

Beacon Interval

The BEACON parameter controls how often the TNC sends out an ID packet. Do NOT enable beaconing unless you are running a mailbox or other function on your TNC to which others will connect.

To turn off beaconing:

AGWPE	N/A
Kantronics, Kenwood, Timewave	BEACON EVERY 0

If you are running a BBS, mailbox, digipeater or node, you may want to beacon so that your users know that your station is up and available for them to use. But beaconing on busy frequencies is frowned upon. A good compromise is to set your beacon timer to 30 minutes or longer. Be aware that different manufacturers use different increments of time. Kantronics uses minutes. Timewave and Kenwood use increments of 10 secs. The following commands all set the beacon interval to 30 minutes.

AGWPE	N/A
Kantronics	BEACON EVERY 30
Kenwood, Timewave	BEACON EVERY 180

Beacon Text

The BTEXT parameter controls text in your beacons. If you have beaconing turned off, then the beacon text does not matter. If you must beacon, then keep your beacon text as short as possible, but provide enough information so that people know how to reach you. Some people include their callsign-ssid and city to tell users how/where to connect.

AGWPE	N/A
Kantronics, Kenwood, Timewave	BTEXT W6XRL4-1 Your-City ARES/RACES

Channel Access
Slot Time

The SLOTTIME parameter specifies how often the TNC runs an algorithm to see if it can transmit. For best performance, all devices should use the same slot time. The interval is 10 ms.

All TNCs	SLOTTIME 10

Persist

The PERSIST value specifies the threshold for a random attempt to transmit. Too low a value and you will not receive your fair share of access. Too high and you prevent others from transmitting, including

those you are communicating with. This can cause timeouts and retries which slow down the channel for everyone. For best performance, all devices should use the same persist value.

All TNCs	PERSIST 63

Transport and Session Control

Packet Length

The PACLEN value sets the maximum number of bytes to be sent in each packet. Larger packets can increase throughput if the channel is clear. But larger packets can also decrease throughput if the channel is congested. A value of 128 results in good performance in both busy and non-busy conditions. For best performance, all devices should use the same PACLEN value.

All TNCs	PACLEN 128

Maximum Frames

The MAXFRAME value controls how many frames can be sent before requiring an acknowledgement. Higher values can increase throughput. But as the channel gets busier or the channel conditions degrade, higher values can cause tremendous performance degradation due to needless retries. For best performance, all devices should use the same MAXFRAME value.

All TNCs	MAXFRAME 2

Frame Acknowledgement Time

The FRACK value controls how long the TNC waits for an acknowledgement before assuming that the frame was lost and performing a retry. For best performance, all devices should use the same frack value. The increment is in seconds. If the channel is exceptionally busy and you experience timeouts or "BBS busy" conditions, you might increase this value by one or two. The increment is in 1 sec.

All TNCs	FRACK 6

Retry

The RETRY value controls how many times the TNC will retry before giving up and aborting the session. For best performance, all devices should use the same retry value. If the channel is exceptionally busy and you experience timeouts or "BBS busy" conditions, you might increase this value to 15.

All TNCs	RETRY 10

Response Time

The RESPTIME value determines the minimum delay to wait after a clear channel before sending an acknowledgement. This helps to ensure all the sending station's frames have been sent and avoids collisions between data packets and acknowledgement packets. For best performance, all devices should use the same retry value. The increment is in 100 msec.

AGWPE, Kenwood, Timewave	RESPTIME 5
Kantronics KPC-3	RESPTIME 5
Kantronics KPC-3+	N/A

Check

The CHECK value sets a time-out value for a packet connection if the distant station hasn't been heard from. AGWPE uses an increment of seconds. Kantronics, Kenwood and Timewave use an increment of 10 secs.

AGWPE	CHECK 300
Kantronics, Kenwood, Timewave	CHECK 30

Radio Timing
Transmit Delay

The TXDELAY value controls how long the TNC waits after asserting PTT before sending data. Flags are sent during this interval to help the remote device synchronize. This allows the transmitter time to come up to full power. It also allows the receiver at the remote end time to open squelch and synchronize to the flags. Most equipment works fine with a delay or 25-30. Some newer radios can work with even smaller delays, but bear in mind that the receiver on the other end may not handle a shorter delay. Tube-type transceivers and amplifiers can require longer time to switch and may require a longer delay. The increment is in 10 msec.

All TNCs	TXDELAY 30

Flow Control
Hardware Flow Control

Flow control occurs between the application program, such as Outpost or your terminal emulator, and the TNC. Both the TNC and the application have to use the same type of flow control. Otherwise, one may overrun the other. Hardware flow control has been found to be very reliable and is the only type of flow control used by Outpost. XFLOW ON sets software flow control; XFLOW OFF sets hardware flow control.

AGWPE	N/A
Kantronics, Kenwood, Timewave	XFLOW OFF

NOTE: Be sure to also set Outpost (or your other application) to hardware flow control

In Outpost: Setup > TNC > (Select TNC) > TNC Comm Port > Flow Control = RTS/CTS

Packetization Control

When PacFORMS converts a form into a text message, the resulting message contains many short lines of text. Most TNCs are set to send a packet after each line of text, since this is convenient for converse mode (chat and other keyboard activity). But this behavior results in about five (5) times more packets than necessary for PacFORMS messages. This creates excess delay for the sender of the message and slows down the entire channel for everyone.

In order to pack more information into fewer packets, the TNC must be instructed to NOT send a packet after each carriage return. When Outpost is used, the easy way to work around that problem is to let Outpost set the proper parameters before each Send/Receive operation and then restore them after each Send/Receive operation.

Note that these commands will impact Converse mode (chat) operations outside of Outpost. So, for situations where the TNC is used manually (without Outpost), it is best to NOT use the following commands.

ALL Santa Clara County Outpost users should set these options in Outpost. This will reduce the number of packets sent by up to 80%!

Packetization Character

The SENDPAC character instructs the TNC to send out a packet. When the TNC receives a SENDPAC character, it packetizes the characters it has received and sends them out. The default is $0D (carriage return), which causes a packet to be generated after each line of text in a PacFORMS message. So we set SENDPAC to $05 (enquiry), which is simply a character that is unlikely to be seen in PacFORMS or other message text. When the session is finished, we set it back to the default.

TNC Type	Send before Send/Receive	Send after Send/Receive
AGWPE	N/A	N/A
Kantronics, Kenwood, Timewave	SENDPAC $05	SENDPAC $0D

Append Packetization Character

This CR or ACRPACK parameter controls whether the SENDPAC character is added as the last character in the packet. The default is on, which works well for keyboard chat. But we don't want that behavior because we will be sending packets based on time and we don't want the extra SENDPAC characters in the output. So we turn it off at the beginning of the session and restore it at the end of the session.

TNC Type	Send before Send/Receive	Send after Send/Receive
AGWPE	N/A	N/A
Kantronics, Kenwood	`CR OFF`	`CR ON`
Timewave	`ACRPACK OFF`	`ACRPACK ON`

Packetization Wait Time

The PACTIME AFTER parameter controls the amount of time that the TNC waits for a character before sending what it already has as a packet. A longer value is good for chat mode. But Outpost is sending characters to the TNC much faster than we type, so we don't want the TNC to sit and wait after each command. We set the value to 1 (the minimum) at the start of the session and restore it to the default at the end of the session.

TNC Type	Send before Send/Receive	Send after Send/Receive
AGWPE	N/A	N/A
Kantronics, Kenwood, Timewave	`PACTIME AFTER 1`	`PACTIME AFTER 10`

Packetization CharacterTimer Enable/Disable

The CPACTIME parameter controls whether or not PACTIME is used. Since we are no longer sending carriage returns after commands (because we changed SENDPAC), this causes the TNC to go ahead and send a packet after PACTIME. We turn this on at the start of the session and turn it off at the end of the session.

TNC Type	Send before Send/Receive	Send after Send/Receive
AGWPE	N/A	N/A
Kantronics, Kenwood, Timewave	`CPACTIME ON`	`CPACTIME OFF`

Revision History

27-Apr-2010	N6MEF	Updated to recommend setting all parameters via Outpost TNC command file. Added summary tables. Reorganized into Outpost vs. Non-Outpost parameter lists to simplify user directions.
04-Feb-2010	N6MEF	First version
12-Dec-2011	KN6PE	Added KAM V7 and 8 Outpost settings, page 5; Bob Howard VE3YX