KANTRONICS

KAM *XL*

Getting Started
And
Reference Manuals

Kantronics Co., Inc.
1202 E. 23rd Street
Lawrence, Kansas 66046
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Table of Contents

Contact Information....6
Sales/ Inquiries....6
Technical Support....6
Disclaimer Notice....7
Kantronics Warranty Registration....7
Warranty Registration....7
Last Name: _____....7
City: _____ Telephone: _____....7
Date of Purchase: _____ Dealer: _____....8
License Agreement....8
Limited Warranty....10
Applicable Warranty Period: One (1) year from date of purchase....11
Return/Repair Procedures....12
Check-List for Possible Problems....12
Return Procedures....12
Repair Service Charges....13
International Returns....14
Radio Frequency Interference Statement....15
RFI Suppression....15
Introduction....17
APRS digipeater:....17
Large PBBS:....18
E-mail:....18
Software control:....18
Configurations:....18
Users Guide....20
Installation....20
Package Contents....20
Additional Parts Required for a Multi-Mode Radio Station....21
The Major Components of the Station....22
The Front panel of the KAM *XL*....22
The rear panel of the KAM *XL*....23
CONNECTING THE KAM *XL* TO A POWER SOURCE....23
CONNECTING THE KAM *XL* TO A COMPUTER....23
The Computer....24
The Serial Port of the Computer....24
The Serial Cable....24
Installing the RS-232 Cable....26
The Terminal Program....27
CONNECTING THE KAM *XL* TO TRANSCEIVERS....28
KAM *XL* Radio ports....28
The Transceiver(s)....28
Parts for connecting the Transceiver....29
THE AUX PORT....30
CONNECTING A GPS DEVICE....30
Interface Communication modes of the KAM *XL*....31
Terminal Mode....31
Kantronics Host Mode....31
Exiting Host mode....31
KISS Mode....32
Exiting KISS mode....32
References on KISS Mode....33
XKISS (Extended KISS) Mode....33
COMMUNICATION MODES IN THE KAM *XL*....34
Packet Mode....34
Protocol for Amateur Packet Radio: AX.25....34
Connected vs. Unproto....34
Monitoring and Calling CQ....34

A Simple Connect....35
Digipeating....36
Gateways....36
Multi-Connects....37
Round Table Discussions....37
Selective Monitoring....37
Timing....37
TXDELAY....38
FRACK (Frame Acknowledgment Time)....38
FRACK * ((2 * n) + 1) seconds....38
Retries in AX.25 Level 2, Version 1 vs. Version 2....39
Convers Mode vs. Transparent Mode....39
Exiting Transparent Mode....39
Flow Control....40
Software Flow Control....40
Hardware Flow Control....40
Remote Access....40
Other Packet Modes of Operation....41
PBBS (Personal Mailbox)....41
Using the PBBS....42
Entering Messages....42
PBBS Commands....43
Sending Messages....45
Listing Messages....46
Editing Message Headers....47
Reverse Forwarding Messages from the Mailbox....48
Hierarchical Addresses....48
Advanced Configuration of the PBBS....50
Remote SYSOP Access to the PBBS....51
Routing Lines....51
KA-NODE....52
Configuring The KA-Node....52
Using a KA-Node....53
Using the XCONNECT Command....53
Determining Which Port You Have Connected To....53
Determining Which Port You Have Connected To....54
KA-Node Commands for Remote Use....54
K-NET....56
K-Net Configuration....56
Networking terms....57
K-Net SYSOP commands....58
K-Net USER commands:....62
GPS NMEA Interfacing....65
GPS Equipment Requirements....65
Cabling a GPS Unit to the KAM-*XL*....65
Configuring the GPS Commands....66
Other GPS Features....67
GPS Command Summary....70
GPS Device Manufactures and vendors....70
Advanced GPS/APRS Digipeating....71
Improving Efficiencies of Advanced Digipeating....71
Overview of UI Digipeating Commands....71
Configuring Digis for HF/VHF Gateway Operations....72
Bibliography....72
General Information....72
Technical Information....73
OTHER FUNCTIONS....74
TELEMETRY....74
Remote Control....74
Copying NWS EMWIN Weather Broadcasts....74
DAMA....75

Bibliography 76
HF Modes (Non-Packet) 77
Tuning in to received signals 77
Exiting non-packet modes 77
CW 77
Receiving CW 77
Tuning in a received signal 77
Transmitting CW 78
CW Directives 79
RTTY 80
Receiving RTTY 80
Tuning RTTY signals 80
Transmitting RTTY 80
RTTY Directives 81
MARS Feature 81
ASCII 83
Receiving ASCII 83
Tuning ASCII signals 83
Transmitting ASCII 83
ASCII Directives 84
AMTOR (includes LAMTOR, FEC, SELFEC, NAVTEX) 85
AMTOR Operation 85
Calling CQ 85
Answering a CQ 86
Mode B (FEC) Operation 87
Mode B (SELFEC) Operation 87
Receiving Mode B SELFEC 87
Transmitting Mode B SELFEC 87
Listen AMTOR operation 88
Notes on AMTOR operation 88
AMTOR directives 88
NAVTEX directives 91
Pactor Operation 92
Tuning Pactor signals 92
Monitoring Pactor FEC 92
Calling CQ or Transmitting FEC 92
Linking to another station 92
PTLISTEN Mode 93
G-TOR (and GMON) 95
Tuning G-TOR 96
Monitoring G-TOR 96
Linking to another station in G-TOR 96
Speed changes 96
G-TOR mailbox 97
Formatting Data 97
Hints for G-TOR Operation 97
Binary Files and G-TOR 98
Summary of GTOR Directives 98
PSK31 100
Tuning PSK31 Signals 100
Transmitting PSK31 100
Exiting PSK mode 100
PSK31 Directives 101
Kantronics KAM *XL* Command Set 102
Appendix A: Installation 182
Connecting to Radios 182
Interfacing Hand-Held Radios 183
Port 1: HF and Packet 184
Transmit level 185
Appendix B: Advanced Information 186
Disassembly and Assembly 186

Hard Reset 186
Updating/Uploading new Firmware 187
Calibration 188
Port 1: 189
Port 2: 189
PTT (Push-to-Talk) Watchdog Timer 190
Jumpers 190
Jumper Descriptions: 191
Appendix C: 193
Replacing the Lithium Battery 193
Appendix D: In Case of Difficulty 194
Appendix E: Additional Information 196

Contact Information

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1202 E. 23rd Street,
Lawrence, Kansas 66046

Sales/ Inquiries
Phone: 785-842-7745 8 am to 5 pm, Central Standard Time, M-F
Fax: 785-842-2031
Email: sales@kantronics.com
www.kantronics.com

Technical Support
Phone: 785-842-4476 1-4 pm Central Standard Time, M-F
Fax: 785-842-2031
Email: service@kantronics.com

The Kantronics KAM *XL* is manufactured in the U.S.A.

All brands and product names are trademarks of the respective companies.

The KAM *XL* is a Kantronics hardware and software design incorporating the AX.25 Packet protocol as adopted by the American Radio Relay League.

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NET/ROM is a registered trademark of SOFTWARE 2000.

APRS is a registered trademark of Bob Bruninga, WB4APR.

PSK31 is a design of Peter Martinez, G3PLX

A SPECIAL THANKS TO:
Peter Martinez G3PLX, for his consultation, and direction of implementation of the PSK31 in the KAM *XL* TNC.

Kantronics Beta Testers for the KAM *XL*:
Bert Amero, VE1AMA
Harvey Niday, K4TUE
Rick Ruhl, W4PC

Disclaimer Notice

We have attempted to make this manual technically and typographically correct as of the date of the current printing. Production changes to the KAM *XL* may add changes to the manual at a later date.

Send comments or suggest corrections to Kantronics Co. Inc., 1202 E. 23rd Street, Lawrence, KS 66046, or e-mail sales@kantronics.com.

Information in this document is subject to change without notice.

Contents of this publication or the firmware within the KAM *XL* may not be reproduced in any form without the written permission of the copyright owner.

Printed in the United States of America.

Kantronics Warranty Registration

Please take the time to fill out the warranty registration form (or a copy of the form) and mail it to Kantronics, including a copy of your sales receipt, to register your purchase. Kantronics must receive warranty registration within 60 days of purchase of the Kantronics KAM *XL* to be valid. Both must be on file at Kantronics in order for you to receive warranty service. Refer to the warranty policy in this manual for further information.

Mail form and sales receipt to:

Kantronics
1202 E. 23rd Street
Lawrence, KS 66046

Warranty Registration

Last Name: _____

First Name: _____ Call Sign: _____

Mailing Address

City: _____ Telephone: _____

State: _____ E-Mail: _____

Zip/Postal Code: _____

Country: _____

Product: Kam *XL* Serial #: _____

Date of Purchase: _____ Dealer: _____

IMPORTANT: READ THIS PAGE BEFORE INSTALLING THIS KANTRONICS PRODUCT

This product contains SOFTWARE on Programmable Memory (ROM) and/or diskette, which is protected by both United States copyright law and international treaty provisions.

If you install or use this product, you will be deemed to be bound by the terms of the SOFTWARE license shown below. If you do not wish to be bound by such license, return the (unused) complete product package to your supplier for refund. The supplier may deduct restocking/re-packaging costs.

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Limited Warranty

KANTRONICS CO., INC.
Effective November 1, 2001

To receive notice of future updates, or free copy of this manual, please go to www.kantronics.com.

NOTE: Return of the Warranty Registration card and proof of purchase is a pre-condition to warranty coverage.

1. WARRANTY. Kantronics Co., Inc. ("Kantronics") warrants to the first consumer purchaser ("you"), for the Applicable Warranty Period (as described below), that the Applicable Product (as described below) will be free from defects in material and workmanship.

2. REMEDY. Kantronics agrees that, for any Applicable Product found by Kantronics to be in violation of the warranty of Section 1 hereof within the Applicable Warranty Period, it will, at its option, repair or replace the defective Applicable Product at no charge to you, excluding in-bound shipping charges.

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5. APPLICABLE PRODUCTS AND PERIODS. Kantronics products are of two types - (1) hardware units and (2) firmware and software for operation of these units, whether incorporated into the units themselves or separate from the units as adjuncts or accessories to the units. Hardware units and the media containing firmware, software and documentation are sold to the consumer purchaser and become property of the purchaser. Firmware and software are licensed for use by the consumer purchaser in return for a fee included in the purchase price of the units and do not become the property of the consumer. (See separate License Agreement provided with these products). The product to which this warranty of Section 1 hereof applies (herein "Applicable Products") and the period during which the warranty shall apply (herein, "Applicable Warranty Period") are as follows:

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7. REMEDY PROCEDURE. Should you need to make a warranty claim, first contact the dealer from whom you purchased the product. If the dealer is unable to assist you, contact Kantronics Co., Inc., by mail at 1202 East 23rd Street, Lawrence, Kansas 66046 USA; by fax at 785-842-2031; or by phone at our Customer Support number 785-842-4476 (Hours: 1 pm to 4 pm CST). Contact us prior to returning an Applicable Product to receive a Return Authorization Number. (As a practical matter, problems can often be solved in such a manner without the product having to be returned to Kantronics for repair or replacement.) Return of any Applicable Product for the enforcement of rights under this Limited Warranty shall be at your expense. Any product returned for warranty service, which Kantronics determines to be without defect or not covered by this Limited Warranty, shall be subject to a minimum labor charge and the product will be returned to you at your sole expense. Please note, no warranty service will be provided until Kantronics has been furnished with your Warranty Registration card and copy of proof of purchase establishing purchase date.

8. NON-ASSIGNMENT. This Limited Warranty is not assignable by you. Any attempt to assign or transfer any of the rights, duties, or obligations hereof is void.

9. OTHER RIGHTS. This Limited Warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

Return/Repair Procedures

Important: Our repair statistics show that a large percentage of units returned for service, do not, in fact, require any service. Therefore, we advise you to please double-check the following list of common, user-solvable, sources of difficulty before contacting Kantronics about returning your unit for service. A RMA (Return Merchandise Authorization) number must be requested and received, and included with the unit returned for repair. If a unit is received without an RMA number, the shipment will be denied.

Check-List for Possible Problems

If encountering difficulty in getting this equipment to "talk" to your computer, please perform at least the following limited checks before calling or writing:

Carefully check the wiring connections between the computer serial (RS-232) port, and the KAM *XL*.

If the cables were purchased from a third-party source, double-check to be sure that they conform to the wiring instructions in this manual.

Verify the serial baud rate setting in the terminal programs.

It may be useful to perform a "Hard Reset". (See Hard Reset section.)

If service or repairs still appear necessary after checking the items listed above, it may be wise to call, fax, email, or write Kantronics to determine if the problem can be solved without returning the unit.

The Kantronics web page also includes a FAQ section, with a list of common problems and solutions.

Return Procedures

When calling the service department, have the following information available:

The unit name and serial number (the serial number is found on the bottom of the unit),

The firmware version number (the version number is displayed in response to the VERSION command),

The steps that have been taken to determine that the problem is with the KAM *XL*,

And, if possible, have the KAM *XL* and computer available to perform troubleshooting operations.

The Service Department telephone hours are 1 pm - 4 pm Central Time, Monday through Friday. Telephone access to the service department is not available outside the stated hours.

Service department contact information:

Kantronics Co., Inc.
1202 E. 23rd Street
Lawrence, KS 66046

Phone: 785-842-4476 (1 to 4 pm, central time)
Fax: 785-842-2031
email address: service@kantronics.com
web site: http://www.kantronics.com

When writing, faxing, or sending email to Kantronics, include a clear description of the problem, unit name, firmware version, computer type, communication software used and if possible, a list of current parameter settings in the unit (as shown in response to a DISPLAY command).

Be sure to include a return fax number, mailing address, and/or email address.

Returns direct to the factory for refund or exchange, are strictly regulated. The sales department must approve any return for refund or exchange.

If the unit was recently purchased from one of our authorized dealers, contact that dealer, first.

Repair Service Charges

Consult the limited warranty policy in this manual for the service provisions offered by Kantronics at no charge. This warranty is considered to be in force only when the customer has submitted a completed warranty registration within 10 days of purchase, and when the stipulations of the warranty have been met.

Violations of warranty clauses will automatically void the warranty, and cost of service or repairs will be charged to the owner. Service outside the warranty period will be charged at the cost of parts, labor, and return shipping, at the time of the repair or service. Units sent for service or repair, without prior Return Authorization, will be subject to the minimum charge for labor plus cost of return shipping and handling.

Repair or DAMAGE to a unit, whether accidental or otherwise, is not covered by any warranty provided by Kantronics, in which case, normal repair charges will apply.

Contact the Service Department at 785-842-4476 (Hours: 1 pm – 4 pm CST) to obtain a Return Authorization number. Repaired units will be returned via UPS (or Fed-EX) C.O.D., if other payment arrangements have not already been arranged. C.O.D. charges can be avoided by providing payment information (VISA, MasterCard, or Discover) either at the time of the return authorization request, or included with the unit, when it is sent to be repaired.

International Returns

This section applies to international returns only, not to domestic returns.
In case of unit problems, first contact the dealer from whom the product was purchased. If a Kantronics product must be returned, please observe the steps outlined below. This will prevent unnecessary difficulties and expense for both the shipper, and Kantronics.

All returns must be shipped to the factory at 1202 East 23rd Street, Lawrence, KS 66046 U.S.A.

All expenses of returning items to Kantronics, must be paid by the shipper. This includes any duty/entry fees, whether the return is for warranty or non-warranty repair. Usually, the best way to return items to us is by mail. However, if using a courier service such as DHL, UPS Expedited, Federal Express, etc., be sure to use DOOR-TO-DOOR service. When using one of these services, a commercial invoice may be required. Please check with the carrier before shipping.

Include in the description of the items on the paperwork (whether postal or courier) the words: "U.S. GOODS RETURNED FOR REPAIR/REPLACEMENT." An additional description of "Amateur radio peripheral equipment", or "Data communications equipment", would be helpful. It would also be helpful (but not required) to include the code number 9801.00.1035 which tells U.S. Customs agents that the package contains "U.S. goods returned without improvement/enhancement". However, if the words "U.S. goods returned for repair/replacement" are on the paperwork, the number is not really necessary.

Provide a value for customs purposes. This is usually the value of the item(s) in their current condition. A $0 value is not acceptable for U.S. Customs.

Inside the package, with the item(s), include:

A fax number, daytime telephone number, mailing address, and/or e-mail address if available, in case we need to contact you,

A correct and full shipping address for return,

Method of payment to be used for any charges (if VISA, MasterCard, or Discover, include expiration date),

A brief description of the problem,

A reference to any conversations with the technical/sales staff about the problem,

Return Authorization number.

For warranty repairs, we will pay the shipping charges to return the item(s) via air parcel post. If you wish return by courier service, include your account number. To be eligible for repair under warranty, we must have a record that you sent your Warranty Registration card and proof of purchase to Kantronics, and the item(s) must still be within the applicable warranty period at the time the return is authorized.

For non-warranty repairs, you must pay the return shipping charges, in addition to applicable repair charges.

Radio Frequency Interference Statement

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that the interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and receiver.

Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced Radio/TV technician for help.

The user is cautioned that any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. The user is also cautioned that any peripheral device installed with this equipment must be connected with a high-quality shielded cable to insure compliance with FCC limits.

RFI Suppression

In moving to the world of digital communications via computers, a new dimension of RFI may be encountered. In spite of the equipment manufacturers' diligence, each new piece of electronic equipment will react differently in each separate environment. Every amateur station will have its own unique layout, equipment variation, and antenna installations. Experience has shown that these differences are related to the total RF environment, and may be causative factors in RFI induced problems. The suggestions given here may assist in resolving RFI problems.

Use shielded cable for all connections between equipment.

Make all interconnecting cables as short as practical.

A balance should be maintained between cable length and equipment proximity. At times simply routing interface cables away from the video monitor or other devices, will solve a "screen hash" or electrical noise problem.

Feed-lines to antennas should be kept away from equipment control lines and/or interconnecting cables. If it is necessary for such lines to cross each other, they should do so at 90 degree angles.

Ground leads should be as short as possible and go to an EARTH GROUND.

FCC Declaration of Conformity:

NOTE: This equipment, Kantronics' KAM *XL*, has been tested and found to comply with the essential emission and immunity requirements of the EMC Directive FCC Title 47, Part 15, Subpart B. The test results are on file at the corporate offices of Kantronics.

Type of Equipment: Information Technology Equipment
Class of Equipment: Class B

Introduction

The Kantronics KAM *XL* is a dual-port multi-mode controller for wireless (RF) digital communication, with connectors for GPS and other data functions, a telemetry connector for remote sensing and control, and 2 radio port connectors.

The KAM *XL* advances the state of the art beyond the pioneering Kantronics' KAM, KAM Plus, and KAM *XL* products in a number of ways, including increased processing power, larger amount of RAM, more available operating modes, and DSP modems.

KAM *XL* features include:

Commonly used HF modes, such as CW, RTTY, ASCII, AMTOR, PACTOR, G-TOR, PSK31, 300 baud packet, and receive WEFAX,

300, 1200, or 9600 baud packet with a VHF or UHF transceiver,

Capture and beacon of information from a GPS receiver, weather station, or other similar type devices with NMEA or compatible data output format.

As a DIGIPEATER, a packet repeater, can re-transmit packets from other stations, and can be configured as an advanced APRS digipeater station.

Operation as a network node (compatible with NET-ROM or THE-NET) using the Kantronics K-NET node.

Gathering of telemetry data from multi-channel analog inputs and beaconing packets containing that data.

Packet communication is described briefly in this chapter and covered in detail in the chapter on packet modes of operation. Commands for packet mode are documented in the Commands chapter.

GPS compatibility:

A GPS (or other) data-reporting device with NMEA-0183 (or compatible) data output format can be connected to collect and beacon information reports at specific intervals, using the packet mode. A storage buffer can also be configured to store the reports internally, and be accessed through the PBBS.

APRS digipeater:

APRS UI digipeater functions are included, with advanced features such as UIDWAIT, UIFLOOD, and UITRACE.

Large PBBS:

An extensive set of commands for configuring and controlling the mailbox are included. Its default size is 100K, but can be set to any smaller size or even disabled if memory is needed for other functions, or set to a larger size if memory is available. It includes advanced features such as message forwarding to a full-service BBS or other mailbox.

E-mail:

With special purpose computer software, commercial or amateur e-mail messages can be relayed via radio telex (AMTOR) or PACTOR, to another station for transfer to the internet.

Control and Sensing:

A telemetry port is available for sensing voltages (0 to +5 volts). Reports of samples of these inputs are available on command, or can be transmitted in a packet at specified intervals.

Control outputs are available, and are switched on or off by command.

Remote access:

The KAM *XL* can be accessed and controlled from a remote location via packet mode, with password control. Most commands and parameters can be sent from a remote station connected in this way. Control outputs can be switched, and telemetry sensing operations can also be done remotely.

Other operations:

Reception of HF WEFAX signals, with 2 gray levels possible.

Reception and display of 1200 baud EMWIN signals.

Standard TERMINAL, HOST, and KISS (and NET-ROM), serial port interface modes.

Software control:

The KAM *XL* can be controlled with terminal communication programs, including Kantronics' DOS-based Pacterm 2.0 (which is included), terminal programs included with Windows 3.1 (TERMINAL) and Windows 95/98/NT/ME (HYPERTERM), and programs from 3rd parties (written specifically for Kantronics TNCs).

Configurations:

The KAM *XL* is easy and flexible to configure to operate in selected modes, with a wide range of external devices, including remote TNCs, GPS devices, external modems, and remote sensing and control devices. Configuration is done by command entry from a terminal program, external port selection, and internal jumper settings.

The internal operating program (firmware) in the KAM *XL* is stored in FLASH ROM. Update or Upgrade firmware can be loaded from a file, with a simple ASCII file transfer from a terminal program.

Full details of the KAM *XL*'s internal jumpers, and other technical specifications are located later in the manual. Additional documentation and supporting material is available at the Kantronics website (www.kantronics.com).

Installation,
Modes of Operation,
Command Reference, and
Hardware Specifications

Installation

This chapter covers the hardware side of setting up a packet radio station.

The KAM *XL* is a multi-port device. Radio Port 1 is for low speed packet and HF non-packet modes, and Port 2 is a packet port, with each port connected to different transceivers. Unless otherwise noted, the steps involved for installing the two radio-to-transceiver connections are the same.

The major steps involved in installing (i.e., connecting the parts) a packet radio station are as follows:

Connect the KAM *XL* to a power source and confirm that the unit powers on when it should,

Connect the "Computer" port of the KAM *XL* to a serial port on a computer,

Install and/or configure terminal communication software in the computer to access the serial port on the computer,

Connect "Radio" port 1 on your KAM *XL* to a transceiver and adjust the volume of the transceiver, so the KAM *XL* can receive/transmit packet signals from/to the transceiver.

After learning how to connect radio port 1 to a transceiver, the same steps can be used to connect radio port 2 to another transceiver.

Package Contents

Verify that the items listed below have been included:

The KAM *XL* unit

Parts to use in assembling cables (2 male DB-9 connectors and shells, two mini-plug cables for receive audio from a radio, two 3-foot pieces of 5-conductor shielded cable),

2.1 mm power connector

CD which will include:
- KAM *XL* Manual
- PACTERM 2.0 – DOS based PC terminal program (copyright Kantronics, Inc)
- KAM *XL* Schematic
- BIOS Wizard for Kantronics KAM *XL* flash download
- DEMO version, Pacterm for Windows
- (To order full operating copy of Pacterm for Windows, contact CSS Inc. at sales@cssincorp.com.)

Note: The Kantronics supplied PACTERM 2.0 program (for DOS), is NOT the same program as PacTerm98 for Windows systems, supplied by CSS Inc.

Additional Parts Required for a Multi-Mode Radio Station

In addition to the KAM *XL* unit, the following parts are needed to set up a multi-mode digital communications radio station:

HF and/or VHF transceivers, with microphone (Mic) and external speaker or accessory jack connectors,

A computer and terminal program (or other RS-232 terminal device),

An RS-232 serial cable, used to connect the KAM *XL* to a computer,

A 12 Vdc power supply or power adapter.

The Front panel of the KAM *XL*

The KAM XL has several LED indicators, and a power switch.

A row of closely spaced green leds, located in the upper left part of the panel, is the tuning indicator "BARGRAPH". It will indicate when the receiver is tuned properly, for decoding a received signal.

Starting at the left, the lower row of leds functions are:

PORT 1 Transmit (RED), PORT 1 Receive (GREEN), Lock/Connect (tri-color), Valid/STA (GREEN), Speed (tri-color), Mail (YELLOW), PORT 2 Transmit (RED), PORT 2 Receive (GREEN), Connect (GREEN), STA (GREEN), POWER (GREEN).

The Power switch is located near the right end of the front panel.

The rear panel of the KAM *XL*

The KAM XL rear panel has six connectors, which are:

Power jack (2.1 mm): for external power supplied from a DC power source (+9 to +18 volts DC), center positive.

Radio Port 2 (DB-9 female): accepts the cable from a radio, for 1200 baud packet operation.

Radio Port 1 (DB-9 female): accepts the cable from a radio, for HF or packet operation.

Telemetry (DB-15 female): an analog input port for connection to external sensing devices, which provide voltages (from 0 to +5 volts). Two control line outputs are also available on this port.

AUX (DB-9 male): an RS-232 DTE-type port, for DATA input from a GPS receiver (or similar device), or for RS-232 communication to another device.

COMPUTER (DB-9 female): RS-232 (DCE) for connection to a computer serial port, for control of and communication with the KAM *XL*.

CONNECTING THE KAM *XL* TO A POWER SOURCE

A suitable power supply, such as a regulated DC power supply, an AC to DC power adapter, or a battery, should provide +9 to +18 volts DC at 100 ma (or more).

The power jack accepts a coaxial type plug, with a 2.1mm center. The center of the plug is the positive power connection.

Caution:
Exceeding the maximum input voltage or applying power with reversed polarity, can cause problems operating the KAM *XL* or may cause damage to the unit or the power supply. When using a fused power lead, do not use a fuse larger than 250 ma.

CONNECTING THE KAM *XL* TO A COMPUTER

To operate the KAM *XL*, the following is required:

A terminal device, or computer with an RS-232 (or compatible) serial port that is available (not in use by any other devices).

A terminal communication program that will load and run in the computers operating system, and can be configured to communicate through a serial port on that computer.

Note: If unsure about how to determine what serial (COM) ports the computer has, or how to make a serial port available, consult the computer documentation and/or computer dealer.

The KAM *XL* does not require any specific computer program, and many different communication programs will work.

A simple (DOS) terminal program called PACTERM is available from the Kantronics web pages. It is best used in DOS-only (by exiting windows to DOS), and can be used with standard COM-1 or COM-2 serial ports.

Users of computers with Windows operating systems have other alternatives, such as TERMINAL in Windows 3.1, HYPERTERM in Windows 95/98/Me, and Windows NT/2000/XP systems.

The Computer

Any computer that has an available (not used by any other device) RS-232 serial port, and a terminal program that can access that serial port, can be used.

Technical note: make sure the serial cable is wired as shown in the installation section below. Standard type serial cables, such as those used to connect an external telephone modem to the computer serial port, are correctly wired. If necessary, a cable can be assembled (wired as indicated using shielded cable).

The Serial Port of the Computer

On current models of PC-type computers, the serial port is usually a MALE DB style connector, with 9 or 25 pins. **A FEMALE connector is needed on the computer-end of the serial cable, to connect to the computer's serial port.**

To use the KAM *XL* with a non-PC type of computer, use a serial communication program and a serial modem cable normally used to connect a “HAYES” type high-speed telephone modem, to that computer.

If the computer does not have an RS-232 serial port available (or does not have one installed) but does have USB ports, adapter devices can be found that will add an RS-232 port through the USB connection. However, this requires Windows 95 OSR2 with USB support, Windows 98/ME, Windows 2000/XP or Macintosh systems.

When requesting help from computer dealers or others who may not be familiar with a packet radio modem, refer to your KAM *XL* as an "external modem device," not as a "TNC," a less familiar term.

The Serial Cable

Use a standard RS-232C serial cable, the same cable that would be used to connect an external-type telephone modem to the computer serial port, or make a cable with the same wiring to connect the KAM *XL* to a serial (COM) port on the computer.

When purchasing a cable, you should specify that:

The serial cable (RS-232C) should be shielded, with at least 5 wires connected and not longer than 25 feet.
The modem end of the cable should have a male DB-9 connector (to connect to the KAM *XL*) and the computer end of the cable should be a female DB-9 or DB-25 connector (depending upon whether the computers serial (COM) port has a male DB-9 or DB-25 connector).

25 pin to 9 pin adapters are also commonly available, if a cable with the proper ends is not found.

When making a serial cable, these parts are needed:

A male DB-9 connector assembly (connector plug and shell),

A length of shielded cable (less than 25 feet) containing at least five wires,

Either a female DB-9 or DB-25 connector assembly depends on the connector on your computer's serial (COM) port.

Serial Cable wiring:

If the computer serial port has a 9-pin connector, make these pin-to-pin connections:

Computer end	Modem end	Function
1 <	1	DCD
2 <	2	RXD
3 >	3	TXD
4 >	4	DTR
6 <	6	DSR
7 >	7	RTS
8 <	8	CTS
5	5	SG (signal ground)

If the computer serial port has a 25-pin connector, make these pin-to-pin connections:

Computer end	Modem end	Function
2 >	3	TXD
3 <	2	RXD
4 >	7	RTS
5 <	8	CTS
6 <	6	DSR
7	5	SG (signal ground)
8 <	1	DCD
20 >	4	DTR

TXD is data from the computer to the modem,
RXD is data from the modem to the computer,
RTS is a flow control signal from computer to modem,
CTS is a flow control signal from modem to computer,
DSR is a control signal from modem to computer,
DCD is a control signal from modem to computer,
DTR is a control signal from computer to modem,
SG is signal ground.

The purposes of the pins (by name)

FG - FRAME GROUND: This pin is attached to the chassis of the equipment as a safety ground.

TXD - TRANSMIT DATA: This line carries data output from the computer, to the KAM *XL*.

RXD - RECEIVE DATA: This line carries data input to the computer, from the KAM *XL*.

RTS - REQUEST TO SEND: This hardware flow control line is controlled by the terminal program in the computer, and is used to signal when it can or can not accept serial data from the KAM *XL*.

CTS - CLEAR TO SEND: This hardware flow control line is controlled by the KAM *XL*, to signal when it can or can not accept serial data from the computer.

DSR - DATA SET READY: This line is set high by the KAM *XL* to indicate that it is powered ON.

DCD - DATA CARRIER DETECT: This line is used by the KAM *XL* to signal the status of the current I/O stream to the computer. If a connection to another packet station exists on the current I/O stream, this line will be active (positive voltage). If the current I/O stream is not connected (to another station), the line will be inactive (negative).

DTR - DATA TERMINAL READY: Although interconnected via a buffer IC to the processor, this line is currently ignored.

Some terminal programs use or can be configured to use software flow control, and only three of the connections are used, TXD, RXD, and SG (signal ground). However, all terminal programs, whether using software flow control (using XON and XOFF) or hardware flow control (using RTS and CTS lines in the cable), should work with the five wire connection in the cable as described above.

The computer or terminal is usually referred to as DTE (data terminal equipment). At this end of a serial cable, TXD and RTS are output lines, and RXD and CTS are input lines.

The modem is referred to as DCE (data communication equipment). At this end of the serial cable, TXD and RTS are input lines, RXD and CTS are output lines.

For data to flow from one device to another (DTE to DCE), output lines of one device are connected to input lines on the other and vise-versa.

Installing the RS-232 Cable

With an appropriate serial cable, connect as follows:

Step 1. Make sure that both the computer and KAM *XL* are powered OFF.

Step 2. Plug the male DB-9 end of the serial cable into the "Computer" port of the KAM *XL*.

Step 3. Plug the female DB-9 or DB-25 connector end of the serial cable into a serial port on the computer. The connectors can then be locked in place with their mounting screws.

Caution: Do not connect the serial cable from the KAM-*XL* to the computers parallel port. A parallel port (i.e., printer, or LPT port) usually has female DB-25 connectors. The KAM *XL* cannot communicate through a parallel port.

Once the cables have been connected and secured, the equipment can be powered back on.

To verify that the serial cable is correctly wired and connected, use a terminal program or other communication software in the computer, and configure it to communicate through the appropriate serial port to establish communication with the KAM *XL*.

The Terminal Program

The serial port configuration in the terminal program should be set for 8 data bits, no parity, and one stop bit. Terminal interface baud rates supported by the KAM *XL* are 300, 600, 1200, 2400, 4800, 9600, 19200 and 38400. In general, use the fastest baud rate that the terminal program, the computer serial port, and KAM *XL* will support. The terminal program should be set for "full-duplex" communication.

For operation with terminal programs using “half-duplex” communication, set the TNC command called ECHO to OFF.

Most current model PC-type computers come with high-speed serial ports already installed. In older type computers, a serial port card with high-speed buffered UARTS should be installed to use baud rates above 9600 baud. Serial port cards with high-speed buffered UARTS are available through many parts suppliers and will improve the reliability of high-speed communications. Request a serial port card with "high-speed buffered UARTS" (identified as 16550, or equivalent), when ordering from a supplier.

CONNECTING THE KAM *XL* TO TRANSCEIVERS

To communicate with other stations, the radio ports of the KAM *XL* must be connected to an HF or VHF radio (or both), depending on the type of communication desired. Radio Port 1 is for HF packet and the other non-packet modes, and is normally connected to an HF SSB transceiver. Port 2 on is for Packet only mode, and is normally used with an FM transceiver (VHF, UHF, or HF 10 meter).

KAM *XL* Radio ports

Port 1:

Port 1 will typically be connected to an HF (SSB, CW, or FM) transceiver, but could be used with a VHF FM transceiver.

In a cable between Port 1 and a radio, at least four pins must be connected; transmit audio, receive audio, PTT, and ground.

Transmit audio output should be connected to the microphone input (or transmit data input) on the microphone jack of the radio.

Receive audio input should be connected to the external speaker output (or receive data output) from the radio.

PTT should be connected to the transmitter keying line on the microphone jack.

Ground should be connected to a chassis ground of the radio.

If CW will be transmitted from the KAM *XL*, its CW key output line (pin 4) should be connected to the CW key input on the radio (the same connection where a hand operated key would be connected.)

Port 2:

Port 2 will usually be connected to a VHF or UHF FM transceiver.

In a cable from Port 2 to a VHF radio, the same connections apply as from Port 1; transmit audio, receive audio, PTT, and ground. Note that CW output is only available on port 1.

Detailed descriptions of the radio ports on the KAM *XL* are located in the appendix sections.

The Transceiver(s)

There are hundreds of models of FM transceivers, with many different wiring configurations and connections. Refer to the documentation for the transceiver to determine how it can be connected to other devices, or TNCs such as the KAM *XL*.

Specifically, determine what type of microphone connector or data plug to use, and which pins should be connected in a cable between the radio and other devices.

Parts for connecting the Transceiver

For the construction of a cable assembly from the KAM *XL* to a radio, 2 cable kits are included, containing a male DB-9 connector plug and shell, a length of shielded multi-conductor cable, and an external speaker cable with a mini-plug installed.

Connectors for the radio end of the cable are not included with the KAM *XL*.

THE AUX PORT

The AUX port is an RS-232 serial port, for connection from the KAM *XL* to other devices. It is configured as a DTE port, the same as a computers serial port.

It can be used for input from a GPS device, for interconnection to another TNC communicating in NET/ROM mode in a node stack, or for communicating with other devices with RS-232 serial ports.

If the command GPSPORT is set to a baud rate greater than zero, the AUX port acts as input for NMEA type data from a GPS receiver, or other device.

If the command NBAUD is set to a baud rate greater than zero, the AUX port is used to interconnect with other TNCs in NET/ROM mode, at the specified baud rate.

CONNECTING A GPS DEVICE

To capture data from a GPS device, connect its DATA output to the AUX port on the back of the KAM *XL*.

If the GPS receiver has a cable that can be connected to a computer serial port to report its position data, the same serial cable can be connected directly to the AUX serial port of the KAM *XL*, without changes.

Since cabling may vary from one GPS vendor to another, that cable is not supplied with the KAM *XL*.

To make a cable for connecting a GPS device to the KAM *XL*, at least 2 connections are required, GPS data output and signal ground.

Connect GPS data output to pin 2 on the KAM *XL* AUX connector.
Connect GPS data ground to pin 5 on the KAM *XL* AUX connector.

The GPS data input to the AUX port on the KAM *XL* is enabled with its GPSPORT command.

Interface Communication modes of the KAM *XL*

Terminal Mode

Terminal mode is the text-based command interface that allows operation of and communication with the KAM *XL* from a terminal program or "dumb" terminal unit. In this mode, only one communication mode can be used at any time, which could be Packet mode on either or both radio ports or one of the non-packet HF modes instead.

However, when a non-packet mode is being used on the HF port, the VHF port can still be accessed by other stations to use any of the active functions, such as the APRS digipeater, GPS data beacon, PBBS, KA-Node, or K-Net node.

Kantronics Host Mode

Host mode provides a way of having more control of KAM *XL*, from a program that makes operation easier and with more functionality than when using a simple terminal program. This allows sending commands and receiving command responses, communicating over the radio ports in two modes at once (connected and monitored 1200 baud packets and a non-packet HF mode.)

Communication between a program and the KAM *XL* in HOST mode uses frames of data. Each data frame has a header which indicates the frame type (command, data, etc.), the radio port that data is intended for or from, and sent or received data. The KAM *XL* retains all of its commands and functions in Host mode.

Host mode uses Hardware flow control only, and requires that the serial cable that connects the KAM *XL* to the computer include the RTS and CTS lines (as well as TXD, RXD, and signal ground).

Exiting Host mode

If a Host mode program has been used to operate the KAM *XL*, it may leave the KAM in Host mode when it exits. If a standard terminal program is then used (set to the same interface baud rate) to communicate with the KAM *XL*, instead of a "sign-on" message, some characters and SØØ will be displayed. This is the Host mode current-status message.

The Host mode program should have an option to return the TNC to COMMAND or TERMINAL mode, when that program exits. If the program is set to do this, other "standard" terminal programs can then be used.

If the terminal program allows entry of high-numbered ASCII characters, a sequence of characters can be sent to exit Host mode so the terminal program can then be used. First, send a FEND (frame-end) character (ASCII code 192), then the letter q (upper or lower case is ok), and finally another FEND character. A FEND character can be entered manually, by pressing and holding the ALT key, entering 192 from the number key pad on the right side of the keyboard (or in Hyperterm under Windows, holding the ALT key and entering 0192), and then releasing the ALT key. The KAM *XL* will exit Host Mode, will return to TERMINAL interface mode, and will display the usual Kantronics "sign-on" message.

KISS Mode

Amateur packet radio communications can use the TCP/IP suite of protocols instead of AX.25 by switching to TNC to KISS interface mode and running software that supports the KISS code designed by Phil Karn (see references at end of this section). The KISS protocol specifies the communication between a TNC and a host (e.g., computer).

KISS Mode allows the TNC to act as a modem and packet assembler/disassembler (PAD). In KISS Mode, data processing is shifted from the TNC to a computer running special software supporting the KISS code designed by Phil Karn. Very few of the KAM *XL*'s commands (and none of its other functions), are available when it is in KISS mode. The operating functions that are available depend solely on the computer program used.

KISS code supports higher-level protocols (i.e. TCP/IP) for sharing computer resources in a network fashion. Examples of TCP/IP programs are NET, NOS, and JNOS. Also, some networking software (G8BPQ) requires the KISS Mode of operation.

Technical Note: In the KISS Mode, the TNC simply passes all received data to the computer, and the computer program is responsible for all processing of that data, including decisions concerning routing, digipeating, and other control decisions.

The TNC converts the packets of synchronous data being received from the radio link into packets of asynchronous data to be passed to the computer over the serial port, and converts the packets of asynchronous data from the computer into the synchronous format suitable for radio transmission. The TNC retains the responsibility of determining proper timing for channel access.

To place the KAM *XL* in KISS Mode, at the command prompt (cmd:), type INTFACE KISS and press return. Then, send a RESET command, or cycle power (off/on) to the KAM.

The KAM *XL* will remain in KISS interface mode, until it receives the KISS exit code, or it has been hard reset.

Exiting KISS mode

The TCP/IP program should include the command to EXIT KISS mode in the TNC. See that programs documentation for the proper command.

To enter the EXIT KISS command manually (from a regular terminal program), send a three character sequence which includes a FEND (frame-end) character (ASCII code 192), FF (ASCII code 255), then another FEND character. A FEND character can be entered manually, by pressing and holding the ALT key, entering 192 from the number key pad on the right side of the keyboard, and then releasing the ALT key. The ASCII code 255 can be entered by pressing and holding the ALT key, entering 255 from the number key pad on the right side of the keyboard, and then releasing the ALT key.

The KAM *XL* will exit KISS Mode, will return to TERMINAL interface mode, and will display the usual Kantronics "sign-on" message.

Otherwise, perform a HARD RESET. This will reset all commands to their factory default settings, and allow the KAM *XL* to be re-initialized as a new unit.

References on KISS Mode

Karn, P.: "TCP/IP: A Proposal for Amateur Packet Radio Levels 3 and 4", pp. 4.62-4.68 ARRL Amateur Radio Computer Networking Conferences 1-4. Newington, CT: ARRL, 1985.

Chepponis, M. and Karn, P.: "The KISS TNC: A Simple Host-to-TNC Communications Protocol", pp. 38-42, 6th Computer Networking Conference, Newington, CT: ARRL, 1987.

XKISS (Extended KISS) Mode

The KAM *XL* also supports the G8BPQ multi-drop KISS Mode, called extended KISS (XKISS). With this mode, the TNC can be connected to a G8BPQ node along with other TNCs on the same serial port, to provide multiple radio ports to the node. Otherwise, XKISS works the same as KISS. For information on this mode of operation, see the documentation for the XKISS software used.

Packet Mode

The KAM *XL* is a Terminal Node Controller (TNC)

Packet radio modems, or packet modems, are generally referred to as TNCs. This "label" or "moniker" was adopted when the Tucson Area Packet Radio Group (TAPR) developed their first "TNC-1" packet radio modem kit in the early 1980s. The TNC is the workhorse of packet radio. As a listening device it hears an audio signal from the radio, changes the data to digital form, determines if the data is a good packet and sends it to whatever device is attached, usually a computer. As a relay device it also checks the packets it receives and determines if the packets need to be resent, then does so if appropriate. As a sending device it receives digital data from the computer, packetizes the data, and converts it into audio tones, which are sent out to the radio. The set of rules that all packet TNCs follow is called the AX.25 protocol.

Protocol for Amateur Packet Radio: AX.25

The most commonly used protocol in amateur packet radio is AX.25. The details of its inner workings can be found in a book titled "AX.25 Amateur Packet-Radio Link-Layer Protocol", which is available from the ARRL.

Connected vs. Unproto

There are two ways to send data in packet radio, connected or unproto (unconnected).

In the Connected Mode, a “connection” is established to another station. Packets are sent to that specific station, and acknowledgments are expected in return that the packets were received correctly. If an acknowledgment is not received, the TNC will re-send the data (depending on the setting of AX25L2V2, it may send a poll first). The RETRY parameter will determine how many times this is done before the connection is aborted due to bad conditions.

When acknowledgment is received, the TNC can then send more data. Therefore the Connected Mode, barring impossible conditions, assures that the other station will receive all characters correctly and in the proper order.

When the TNC sends a packet in the Unproto Mode, no acknowledgment is expected or required, and no retries are attempted. This mode is often used for calling CQ, for transmitting beacons, and for informal roundtable chats.

Monitoring and Calling CQ

When the MONITOR command is ON, packets heard from other stations can be displayed. The display of monitored packets includes “header” and “data” parts. At the beginning of the header, two callsigns are displayed separated by a ">". The first callsign is the station that transmitted the packet, and the second callsign is the destination station that the packet is intended for. Unproto packets may have any destination, but typically use CQ.

When transmitting UNPROTO packets, the UNPROTO command sets the destination or “to” address of those packets. Its default setting is CQ. Enter the Convers Mode to send a CQ message, by entering the command CONV<CR> or K<CR>. Then, typed and entered characters will be packetized and transmitted as data, and not be interpreted as commands.

To exit Convers mode and return to Command Mode, enter a <Ctrl+C>, by holding down the Control key and pressing the "C" key.

A Simple Connect

To connect to another station, start from command prompt and enter a connect request. For example:

CONNECT callsign<CR>

Where CONNECT is the TNC command to establish a packet link with and another station, and callsign is the callsign of the other station. If the connect request fails, the TNC will display the following messages:

*** RETRY COUNT EXCEEDED
*** DISCONNECTED

When the TNC does receive an acknowledgment for a connect request packet, it will display the message:

*** CONNECTED TO callsign

and will then change to the Convers Mode, or the communication mode defined by the settings of the NOMODE and CONMODE commands.

Two commands determine when entered data will be packetized and transmitted. The command SENDPAC defines the key or character that causes a packet to be transmitted. Its default setting is the ENTER or RETURN key. Whenever that key is pressed, a new packet will be transmitted.

A second command called PACLEN, determines the maximum number of characters to include in a transmitted packet. When the number of typed characters is equal to the number defined by PACLEN, a packet will be made and transmitted even if the ENTER key has not yet been pressed.

When the conversation with the other station has ended, the packet link to the station can be “disconnected”. To disconnect, return to Command Mode with <Ctrl+C> and type a "D" for Disconnect. Press the return or enter key after any command to the TNC. A Disconnect request packet will be sent to the other station, and when an acknowledgement has been received back, the TNC will display this message:

*** DISCONNECTED

and will return to command mode.

Either station can issue the disconnect command, no matter which station originated the connect.

While connected to another station, the display of monitored packets will stop. To continue the display of monitored packets, while connected to other stations, set the command MCON to ON.

Digipeating

TNCs can digitally-repeat or “digipeat” packets, to help other stations reach a destination station that they can not hear direct. In Kantronics TNCs, the command that controls this function is called DIGIPEAT, and its default setting is ON. In many areas, a dedicated “DIGI”, consisting of a properly configured TNC, a radio and antenna, are installed in a high location to provide digipeater capabilities for many local stations.

When the command MRPT is set to ON, packets heard from digipeater stations will include callsigns of the sending station and the intended recipient of the packet, and the callsigns of any digis used to relay those packets. The list of digis used, is often called the “path”.

The command called MYALIAS, defines an alternate callsign or alias name of the digipeater. It is typically set to a name that indicates a location or area of coverage of the digi, which is often easier to remember than a callsign.

A station that needs to send a packet to another station it can not hear direct, would address that packet “VIA” a digi stations callsign or alias. Up to 8 digis can be used to relay packets to reach a desired station.

To connect to another station VIA a digipeater, a command would be entered such as:

CONNECT KCØKON VIA LRNCE

or if several digis are required,

CONNECT KCØKON VIA LRNCE,LVN,KCI

To send unconnected type packets like CQ messages or BEACONs VIA a digi, the UNPROTO command is used to set the path,

UNPROTO CQ VIA LWRNCE

When digipeating, a packet is transmitted by the originating station, is re-transmitted by all relay stations specified, to reach the destination station. That station would then respond that it received the packet, by returning an acknowledgement packet by the same path to the original station. This is often called end-to-end acknowledgment.

A special type of digipeater function for UI packets used by APRS stations is also available, configured by its own set of commands. It is described in another section, called "Advanced GPS/APRS digipeating.

Gateways

A Gateway Digi is a dual-port TNC, which allows packets heard on one of its radio ports, to be relayed out from its other radio port. The radios attached to the ports of the TNC are usually on different frequencies, or bands such as VHF/UHF or VHF/HF.

Using a gateway digi is nearly the same as using a regular type digi. Transmitted packets VIA a Gateway, are heard on one port of that TNC, and are re-transmitted out from the TNCs other port.

Multi-Connects

The KAM *XL* allows packet “connect” links (or streams) to as many as 26 other stations, on each of its radio ports, at the same time.

The command MAXUSERS determines how many streams per port may be used at one time, and the command USERS determines how many connect links from other stations will be accepted. Each incoming connect is assigned to the next available stream. If the number of streams allowed by USERS is full, a busy message will be returned to the next station attempting to connect, instead of a connect acknowledgement.

By setting the USERS command to a lower number than MAXUSERS, the number of streams between them will not be assigned to connect requests from other stations, and are reserved for outgoing connects.

To determine which port and stream are the current “I/O”, to which keyboard input will be directed, use the STATUS command. The report indicates which streams are currently active, and the current “I/O” stream and buffer status.

To change streams, to make another connect or to direct data to another connected station on a different stream, type the STREAMSW character, the number of the port (if different than the current “I/O” port), and the letter designation of the desired stream. No return or enter key is necessary.

The setting of STREAMEV will then determine how often the stream designator is displayed with received data. Setting it to ON will make the stream designators show on every connected packet received. Setting STREAMCA also to ON, will add the callsign of the "from" station beside the stream designator.

Round Table Discussions

Several stations talking together, presents a difficult situation for packet radio since the protocol requires two stations to connect to each other in order to make sure they receive each others packets. To be absolutely sure that each station receives all transmitted data, a connect link would have to be established to each station, and that data sent to each station in turn.

Selective Monitoring

With MONITOR ON, the BUDLIST command can be used to limit the display of monitored packets from other stations, to only those packets FROM (or TO, or both) a specific station or any of to 10 callsigns listed.

Timing

Dwait vs. Persistence and Slottime

When the TNC acts as a digipeater, received packets that need to be relayed are retransmitted as soon as the frequency is clear. Other TNCs on frequency (should) hold off or wait their turn, using a PERSISTENCE/SLOTTIME algorithm or DWAIT method to determine when to transmit. This practice has been adopted to reduce collisions with packets being digipeated, since these packets must (by the AX.25 protocol) be acknowledged end-to-end. The use of the PERSIST/SLOTTIME algorithm to gain channel access is standard in Kantronics' TNCs. The default value for DWAIT is set to zero. If the DWAIT method is used, the TNC sending non-digipeat packets will wait for DWAIT (times 10 milliseconds) time of clear channel before beginning to key-up the radio to transmit.

The algorithm used with the settings of the PERSIST and SLOTTIME parameters, helps avoid packet collisions by randomizing the wait time before transmitting. By using this random timing, it is less likely that any two TNCs will transmit at the same time, and causing a packet collision. When a TNC has a packet to transmit and detects that the channel is clear, it will wait SLOTTIME (times 10 milliseconds), and generate a random number. If resulting number is smaller than the number specified by the setting of PERSIST, the TNC will transmit. If the number is larger, it will wait another SLOTTIME and then generate another random number and again decide whether to transmit or not.

When using PERSIST/SLOTTIME, DWAIT should be set to 0, since both will be used if specified.

As an example, assume that PERSIST is set to 63, and SLOTTIME is set to 10. This value of SLOTTIME results in a random number being generated every 100 milliseconds. When the TNC sees that the channel is clear, it waits 100 ms, then generates a random number between 0 and 255 (inclusive). If, in this example, the number was 83, then the TNC would not start the key-up of the transmitter since 83 is greater than the 63 PERSIST value. Instead, it would wait an additional 100 ms, and if the channel is still clear, generate a new random number. This time, let's say it comes up with the number 27. Since this is less than the PERSIST value, the key-up of the transmitter to send the packet will begin.

TXDELAY

TXDELAY should be adjusted to allow sufficient time for the radio to switch from receive to transmit and develop full power output. If the TNC starts sending packet data before the transmitter has reached full power, the beginning of the packet won't be heard by other stations, and the packet will be lost. TXDELAY also allows sufficient time for other stations receiver and TNC to become active and detect a received packet signal.

The TNC sends only flags during the TXDELAY period. Flags are not part of a packet or data to be decoded. When TXDELAY is set extra long, the flags preceding a packet can be heard.

FRACK (Frame Acknowledgment Time)

If the TNC expects an acknowledgment of a packet it has sent, it will wait FRACK seconds for the acknowledgment. If the acknowledgment is not received it will either send a poll or retransmit the packet, depending on the setting of AX25L2V2. When digis are used, extra time is allowed for each transmission using the following equation:

FRACK * ((2 * n) + 1) seconds
where n is the number of digipeaters. The lower the baud rate (HBAUD) the higher this parameter should be set, because everything is slower. The length of the transmission (determined by PACLEN

and MAXFRAME) also needs to be taken into account when deciding how to set FRACK. Longer packets (and more of them) require more time to be transmitted, more time to be repeated by the digipeater, and so on down the line. The FRACK timer begins when PTT is released (the packet has been sent) and is suspended when data carrier from the radio is present, or when your station is transmitting.

Retries in AX.25 Level 2, Version 1 vs. Version 2

The way retries are accomplished depends on AX25L2V2 being OFF or ON. If a packet is transmitted to a connected station, and an acknowledgement is not received back, the entire packet is retransmitted (with the same frame number) up to the number of tries specified by the RETRIES command, until an acknowledgement is received. If acknowledgement is still not received, a disconnect sequence is started, up to the number of RETRIES again. If there is still no response from the other station, the un-acknowledged packet is discarded. In level 1 type responses, single pairs of angle brackets are used (such as <rr0>).

Under version 2 (AX25L2V2 ON), when an acknowledgement has not been returned, a POLL only is sent (not the entire packet), up to the number of times specified by RETRIES. In level 2 type responses, two pairs of angle brackets are use (such as <<rr0>>).

Convers Mode vs. Transparent Mode

In the Convers Mode special characters are recognized by the TNC. They are used to edit typed data before transmitting it, to pass through special characters as data to another station, or to cause a packet to be transmitted.

Transparent Mode was designed for sending files, whether ASCII data files or program files. Special characters (other than TRFLOW and TXFLOW when ON) have no meaning to the TNC in transparent mode, they are just characters to be put in a packet and sent to the radio.

In Transparent Mode, the PACTIME command defines when packets are transmitted. There is no MONITOR function while in TRANSPARENT mode. Only data from a connected station can be received.

Exiting Transparent Mode

Since Transparent Mode allows the sending of all characters, only a special sequence of characters or a modem break will exit Transparent Mode. The command called CMDTIME sets a timing of character entry, that will allows the use of the COMMAND character in the special character sequence. Three COMMAND (<Ctrl+C>) characters must be entered within CMDTIME of each other, with at least one CMDTIME before and after the special sequence.

Some terminal programs can send a MODEM BREAK signal, which toggles the TXD line for a specific period of time that is longer than a standard character bit time. This will also cause the TNC to exit TRANSPARENT mode, as long as its command BREAK has not been set to OFF.

Flow Control

Both the computer and the TNC have fixed amounts of input (and output) buffer space. Flow control prevents the loss of data in communication between the computer and a TNC. If one of the devices has a nearly full input buffer, it can signal the other device to stop sending data until it has been able to process the data it has already received.

Software Flow Control

Software flow control uses special characters, as defined by the commands XOFF, XON, STOP, and START, which are inserted into data on the TXD and RXD lines between the computer and TNC. One of the devices will send a <Ctrl+S> to signal the other device to stop sending data, and a <Ctrl+Q> to signal that it can resume sending data. Software flow control can be disabled, by setting the command XFLOW to OFF. The commands TRFLOW and TXFLOW are used to enable software flow control in TRANSPARENT mode.

Hardware Flow Control

Hardware flow control uses the RTS and CTS lines in the RS-232 cable. The TNC will de-activate the CTS line to the computer, to signal it to stop sending data. The computer will de-activate the RTS line to signal the TNC to stop sending data.

Remote Access

The commands of the KAM *XL* can be accessed remotely from another TNC, as long as its commands MYREMOTE and RTEXT have been set. MYREMOTE defines the callsign or name for the remote access feature, and RTEXT is a password character string.

In a local TNC, command it to connect to the MYREMOTE callsign in the remote KAM *XL*. It will respond to the connect request, with three lines of six numbers per line. Pick one of the lines, and enter the characters at the positions indicated in the line, as entered in RTEXT.

As a simple example, enter the command RTEXT aBcD. Since there are only 4 characters in the line, the numbers returned in the three lines of six numbers, in response to a connect request to the MYREMOTE, will only be 1 to 4, such as:

1 1 3 2 4 2
2 1 4 4 3 1
4 3 1 2 4 1

Selecting the first line, the return entry would be:

aacBDB

Upper and lower case characters must be entered exactly the same as they were in RTEXT, numbers and spaces also count as a character.

When remote command access has been granted, a prompt: (instead of cmd:) will be returned, and commands to the remote TNC can then be sent. Any command that causes a reset to occur, will lose

the connection in the remote TNC, the same as when cycling its power off and back on, leaving the local TNC still thinking it is connected to that remote station.

Proper care should be used when changing commands remotely, as some commands can cause that remote TNC, or any TNC for that matter, to stop communicating completely.

If three password attempts are made and failed when linked to the MYREMOTE callsign, it will disconnect and will not respond to connect requests for 15 minutes.

There is a limitation on the amount of data that can be returned from the remote TNC while using its remote access. Responses are limited to 300 characters or less, so some commands will not fully display their response. In response to the command DISPLAY, only the first 300 characters of the full display listing will be returned. But the setting of any single command can be displayed in its entirety.

When finishing a remote access session, send the command to the remote TNC:

DISC MYREMOTE

The remote TNC will then send a disconnect packet back to the local TNC. The local TNC can also be commanded to disconnect from the remote TNC, by returning it to its command prompt and entering the DISC command.

The same password entry sequence is also presented when connecting and requesting SYSOP access to the PBBS or K-NET node from another station.

Other Packet Modes of Operation

PBBS (Personal Mailbox)

The KAM *XL* includes a Personal Bulletin Board System (PBBS or mailbox), which is capable of storing messages for local display, and/or forwarding messages to another PBBS or BBS for other users. This PBBS provides many of the same message handling functions as a computer based packet radio full-service BBS, including the forwarding of Bulletins, Private mail, and NTS traffic (for more information on the national network of full-service PC-based packet BBS systems, see a current ARRL operations manual).

The personal mailbox is compatible with the large community bulletin board systems (RLI, MBL, etc) and will allow them to forward messages directly into your TNC. Messages to other stations can be placed messages in the mailbox, and if the local Community BBS system allows, will be picked up (reverse forwarded) from the personal mailbox into the BBS system on request.

The PBBS can also be configured to automatically connect to the community BBS (again, if that system allows) and forward any messages to or through that system.

Using the PBBS

In order to use any Kantronics TNC PBBS (even your own), first get the cmd: prompt, and then connect to the callsign of the PBBS. For instance, if the MYPBBS is set to use the callsign NØKN-1, connect to it by typing "CONNECT NØKN-1". In this example, the PBBS is in this TNC, and will respond to the local terminal the same way it would respond to any other station connecting to it over the radio.

The TNC will display a message indicating that a connection has been made to the callsign of the PBBS;

*** CONNECTED to NØKN-1

The PBBS will then display its SID and initial sign-on message. The SID is enclosed in square brackets and consists of the unit name, firmware version, and the supported features (i.e. HM$). The supported features in the PBBS of the KAM *XL* are Hierarchical forwarding, Message ID, and BID. These identifiers are the SID definitions published by Hank Oredson (WØRLI) with his Community BBS system.

If a PTEXT has been defined, the TNC will send it as the next line, and then send the PBBS command prompt. For example, the PBBS in the KAM *XL* will respond with the following:

[KAM-XL-1.0-HM$]
102400 BYTES AVAILABLE
(PTEXT would be here, if it has been entered)
ENTER COMMAND: B,J,K,L,R,S, or Help >

Connecting to any Kantronics TNC-based PBBS would result in a similar prompt sequence.

At this point the PBBS is ready to display messages, accept messages to other users, allow editing of messages already entered, display help information, etc.

Entering Messages

To enter a message addressed specifically to another user, who can connect to the PBBS and read the message later, use the Send Private command:

SP KBØNYK

and the TNC responds with:

SUBJECT:

enter a short subject line:

Just a quick question…

The TNC responds with:

ENTER MESSAGE n-END WITH CTRL-Z OR /EX ON A SINGLE LINE

where "n" is the next available message number in the mailbox. Enter the text of the message. At the end of the message, press the return key to begin a new line, and type a <Ctrl+Z> or /EX to end and save the message. The <Ctrl+Z> or /EX must be on a line by itself. When the message has been ended properly, the PBBS responds with:

MESSAGE SAVED
ENTER COMMAND: B,J,K,L,R,S, or Help >

The PBBS is again ready to accept commands.

When the PBBS is connected to any station, the Mail LED on the front panel will be lighted. When the PBBS is not connected, and contains unread messages addressed to the MYCALL, MYPBBS, or any of the callsigns or names entered in the PBLIST command, the Mail LED will blink.

The PBLIST is also used with the PBPERSON command and the following PBBS commands: LMINE, KMINE, and RMINE.

PBBS Commands

The commands available to users connected to the PBBS are as follows:

B(ye)
Causes the PBBS to disconnect.

E(dit) n [BPTYNFH] [>tocall] [<fromcall] [@BBS] "old" "new"

Available only to the system operator (SYSOP) or to a user at the keyboard of a computer connected directly to the TNC (i.e., not to a remote connection, except for the SYSOP). For an explanation of this command, see the section below on "Editing Message Headers."

H(elp)
Displays a HELP menu.

J(heard)
Displays a list of stations recently heard by this TNC. The list will include a date and time stamp indicating when each station was heard.

J(heard) S(hort)
Displays only the callsigns of stations heard.

J(heard) L(ong)
Displays the callsigns of stations heard and any digipeaters used and the destination callsign.

L(ist) [x [y]] [;]
Lists all messages in the mailbox allowed to be read. This will include all BULLETIN and TRAFFIC messages, and any PRIVATE messages addressed TO the TNCs callsign or messages that were sent from this TNC. The SYSOP of the PBBS (keyboard or remote) can

list and read ALL messages. Optionally, the list can be started from a specific message number, and end with at another specific message number, i.e. x = START # and y = END #. Also, including the optional semi-colon (;) in any List command will also show the @BBS and BID (BULLETIN ID - see section on "Sending Messages") of the messages (if any).

L(ist) <|> call [;]

Lists only those messages in the mailbox which are addressed to a specific callsign (>), or which were sent by a specific callsign (<). To list only those bulletin messages addressed to AMSAT for instance, enter the command L >AMSAT.

LB [;]

Lists all BULLETINS in the mailbox.

LC [cat [;]]

The LC command by itself, will cause the PBBS to list only the TO field of all BULLETINS in the mailbox. If a category is specified (i.e. LC RACES) the PBBS will list the full message headers of all BULLETINS addressed TO that category.

LLn [;]

Lists the most recent n number of messages in the mailbox, that the current user is allowed to read.

LM (ine) [;]

Lists all messages in the mailbox which are addressed to the user currently connnected.

LO [+|-]

Sets the order in which messages are listed. When set to +, the messages are listed in ascending numerical order (oldest to newest). When set to "-", the messages will be listed starting with the highest message number (newest to oldest). The listing order can not be changed if the PBLO command is set to FIXED.

LT [;]

Lists all TRAFFIC messages.

K(ill) n

Deletes message number n from the mailbox. You may only delete TRAFFIC messages, PRIVATE messages addressed TO or FROM you, or BULLETINS you sent. The SYSOP may delete any message, including BULLETINS.

KM(ine)

Deletes any messages marked as READ addressed to the current user. Messages marked as NOT READ, will not be deleted.

R(ead) n

Reads a specific message by number. Only PRIVATE messages addressed TO or sent from the current user, and any BULLETIN or TRAFFIC messages, may be read. PRIVATE messages addressed to the current user, will have the STATUS flag set to Y, when read.

Using RH instead of R will include the message headers as well as the other information provided by the Read command. The message header contains the date/time the message was received at each forwarding BBS that forwarded the message.

RM(ine)
Displays all unread messages addressed to the current user.

S(end) call
Sends a PRIVATE message to the callsign specified. Using S(end) is the same as using the SP command.

SB cat
The SB (Send Bulletin) command is used to send a BULLETIN, addressed to the specified category.

SP call
The SP (Send Private) command is used to send a PRIVATE message to a specified callsign. Using this command is the same as using the S(end) command.

ST zip
The ST (Send Traffic) command is used to send NTS type traffic messages to the PBBS.

Some of these commands are described in more detail below.

Sending Messages

The SEND command (and its many forms) allows the following syntax:

S call [@ bbcall [.haddr]] [$ mid]
SP call [@ bbcall [.haddr]] [$ mid]
ST zip [@ location [.haddr]]
SB cat [@ location [.haddr]] [$ bid]

Where:
call is the callsign of the station the message is addressed to.
bbcall is the callsign of a full service BBSto deliver the message to.
haddr is the complete Hierarchical address designator for the BBS system or destination of the message (see the section below on "Hierarchical Addresses" for more detailed information). Contact a local community BBS SYSOP for complete information on local Hierarchical addressing.
location is the designator used for distribution of the message. For TRAFFIC, this should be NTSxx where xx is the two letter POSTAL code for the state.
mid is the MESSAGE ID assigned to the message by the originator.
bid is the BULLETIN ID assigned to the message by the originator.
zip is the 5 digit postal zip code (or postal code).
cat is the message category. For instance, a message requesting help on a subject may be sent to the category HELP, info sent to INFO, items for sale to SALE, etc.

Contact a local community BBS SYSOP for some other examples and suggestions.

When sending a message to the PBBS, it must include the @BBS (bbcall [.haddr]) field if the message is to be forwarded from the PBBS to a full-service BBS system. Any message entered into the PBBS over the radio will initially be marked with a status of H (held) and will not be allowed to be forwarded, until the SYSOP has edited the message header and changed the H flag. This gives the

SYSOP full control over the relayed messages from the PBBS. Messages entered from the local keyboard connected to the TNC do not require editing in order to be allowed to be forwarded, but must include at least an @BBS field to enable the reverse forwarding.

Listing Messages

When listing messages with any of the LIST commands, a display will be similar to the one shown below. If the optional semi-colon (;) is specified in the list command, the display will also include the @BBS field (if it exists) in square braces after each line.

```
MSG# ST    SIZE  TO     FROM       DATE              SUBJECT
6    B     45    KEPS   W3IWI      10/19/01 09:37:11 2 Line Element set
4    B     26    HELP   WB5BBW     10/19/01 09:34:05 Xerox 820
3    T     38    66044  WØOUU      10/19/01 09:33:42 QTC Lawrence 913/842
2    PN    14    NØAPJWØSC         10/19/01 09:33:27 AMTOR
1    B     30    ALL    KCØKON     10/19/01 09:32:49 Need help on AMTOR
102120 BYTES AVAILABLE
NEXT MESSAGE NUMBER 7
ENTER COMMAND: B,J,K,L,R,S, or Help
```

The message number (MSG#) is listed, followed by the STATUS of the message. This status includes the message type (B=Bulletin, T=NTS traffic, and P=Personal message). The second character in the ST column is the current status of the message.

A Bulletin status (type B) can be:

F -it has already been forwarded to another full-service BBS.

H -it is being held for review by the SYSOP because it was entered into the PBBS over the radio.

An NTS traffic message (type T) may have a status of:

H -indicating that it is being held for review by the SYSOP before it may be forwarded.

The Private message (type P) can have the following status characters in the second position:

H -This is a personal message that has an @BBS field but is being held for review by the SYSOP before it may be forwarded.

N -This message is a Personal message that has not been forwarded and has not been read by the station it is addressed to. If it is forwarded to a full-service BBS, it will be deleted if PBKILLFW is ON.

Y -This message has been read by the station it is addressed to, but has not been killed. It will not be forwarded even if it has an @BBS since it has already been read.

Editing Message Headers

The following command can be used to edit message headers:

E(dit) n [BPTYNFH] [>tocall] [<fromcall] [@BBS] "old" "new"

This command, available only to users with SYSOP access, allows the editing of headers and content of any message in the mailbox. Sysop access is automatic when connecting from a local terminal, or can be granted to remote users connecting to the PBBS over the radio, by password control. See the section titled "Remote Sysop Access to the PBBS" for more detail.

The **TYPE** of the message:

B - Bulletin
P - Private
T - Traffic

The **STATUS** of the message:

Y - Yes [it has been read]
N - No [it has not been read]
F - Forwarded [it has been forwarded]
H - Held [it is not available for reverse forwarding]

Note: F and **H** are toggles. Entering **F** switches the status of the message from **F** to **NOTF** or from **NOTF** to **F**. Similarly, entering **H** switches the status of the message from **H** to **NOTH** or from **NOTH** to **H**.

Who the message is to or from:

>tocall
<fromcall

The destination mailbox (@BBS):

@BBS [.haddr]

And the subject or text of the message:

In the message, replace the FIRST occurrence of the string "old" with the string "new". When a message is listed, the "tocall" and "fromcall" appear in the TO and FROM columns, respectively. If a message has been entered with an "@BBS" for forwarding, the complete hierarchical address is shown when the message is read:

MSG#2 02/10/92 10:30:58 FROM KBØNYK TO HELP @WA4EWV.#STX.TX.USA.NOAM

The @BBS is also listed when using the semi-colon (;) option with any of the list commands.

The Edit command can be accessed by connecting to the mailbox from the attached terminal, or by connecting over the radio. When connecting over the radio, SYSOP privilege must gained by giving the SYSOP command as the first command sent to the PBBS. When giving the SYSOP command, the PBBS will return a password verification string, to which the proper response must be given, in order to gain SYSOP access. This is explained in detail later.

Reverse Forwarding Messages from the Mailbox

The TNC mailbox will allow entry of messages to be forwarded to a full-service BBS (RLI, MBL, etc). These messages have a special format, and can be entered in any personal mailbox.

Entering an @ BBS in the address of a message, will make that message available to be forwarded or reverse forwarded to a full service BBS. Including the HIERARCHICAL address of the destination BBS, will improve the chances of the message to be delivered properly.

Forwarding a message is when the TNC PBBS automatically connects to a full-service BBS and sends messages to be passed through the BBS system to another station.

Reverse forwarding happens when a full-service BBS connects and sends messages to a TNC PBBS, then asks for and receives any messages from the PBBS to be passed to another station via the BBS forwarding system.

If the command PBKILLFW has been set to ON, successfully forwarded messages will be deleted from the PBBS.

Bulletin type messages will be marked with a status of "F" and will remain in the PBBS.

Note: To enable forwarding or reverse forwarding from the PBBS, the Hierarchical address of the PBBS must be entered in the HTEXT command, which is required for complete return addressing capability in forwarded messages.

Hierarchical Addresses

Hierarchical addresses are used to accommodate the national packet traffic system, including messages processed by PC-based packet radio BBSs.

The HTEXT command sets the Hierarchical address of the TNCs PBBS. This is used whenever the PBBS forwards mail to another BBS to provide complete return addressing capability. A hierarchical address consists of state, country, and continent codes, separated by periods. Some areas, particularly in large states, may also use sub-state designators.

Complete information on Hierarchical forwarding can be obtained from a local BBS station or system operator. Basically, the first field after the @ symbol is the HOME BBS of the destination station, to which the message is being sent. The next several fields are the Hierarchical address. They include designators for (sub-state), state, country, and continent.

Other PBBS features include the ability to select whether or not to kill private and traffic messages after they have been forwarded, and whether or not to HOLD messages received over the radio.

The PHEARD command will show the callsigns of stations that recently connected to the mailbox along with their start and stop times.

Advanced Configuration of the PBBS

When the TNC is first initialized, and its callsign has been set, the PBBS will automatically be enabled and the PBBS is allocated 100K bytes of RAM. The MYPBBS callsign is set to be the same as the TNC callsign, but with a different SSID of -1.

The size of the PBBS may be changed using the PBBS command. The maximum amount of memory available to allocate to the PBBS will depend on the amount of free memory available. NUMNODES, MAXUSERS, and MYREMOTE, etc., will affect the amount of available memory.

Changing the size of the PBBS will not cause existing messages to be re-numbered. If the new PBBS size is still large enough to contain existing messages, none of them will be lost.

To renumber all existing messages in the PBBS, beginning at number 1, re-enter the PBBS size to the same as the current size. Enter the PBBS command alone first, to find its current size.

Most of the TNC functions remain active, even when the terminal is turned off or disconnected from the KAM *XL*. When this is the case, other stations connecting to the MYCALL of the KAM *XL* can be sent to the mailbox automatically, to leave a message or read messages addressed to them.

Before exiting the terminal program, set the command CMSG to PBBS. The CTEXT command can also be set to inform the connecting station that the user of the TNC is not available at this time, and the mailbox will answer instead.

A custom greeting message, as specified by the PTEXT command, can be included in the sign-on of the PBBS and sent to users connecting to the PBBS. The PTEXT message can contain a text string of up to 128 characters.

The TNC owner can send the DISCONNECT MYPBBS command, that will cause the PBBS to immediately disconnect from a connected station.

If a station has connected to the PBBS, but no activity occurs on the connection for 15 minutes, the PBBS time-out timer will automatically disconnect the user, to make the PBBS available to other stations.

If a community bulletin board forwards messages into the PBBS, it will include the routing headers which are the lines beginning with "**R:**". The routing headers show the complete path taken by the message. By default, these headers will be stored with each message. To conserve mailbox space, all but the last routing header can be thrown away, by setting the command PBHEADER to OFF.

To set the PBBS to accept only those messages addressed to the TNCs MYCALL (or MYPBBS, or calls or names in the PBLIST), set the PBPERSON command ON.

Finally, the PBLO command is used to determine the order in which messages are listed to a user. When set to OLD, listed messages will be sent in the order of oldest to newest. When set to NEW, the list will be newest to oldest. When the option of FIXED is added, the user cannot change the listing order, and when set to VARIABLE, the user may change the order by sending the LO command.

Remote SYSOP Access to the PBBS

Users of the PBBS through a radio connection can gain remote SYSOP access by entering the SYSOP command as the first command after connecting to the PBBS.

Upon receiving the SYSOP command from a remote user, the PBBS will return three lines of five numbers each. These numbers indicate the character positions in the RTEXT command. This is the same password access query, as when a remote user connects to the MYREMOTE callsign.

Routing Lines

Under current FCC requirements, BBS systems that can store and forward messages without an operator being present, must have the capability to provide a record of the path the message has taken from its origination. To accomplish this, BBSs include a routing line, beginning with "R:". This "R:" line includes the date and time the message was received, message number, BBS callsign and hierarchical routing information.

When reading messages using the RH command, the complete header of the message is displayed, including the routing lines. If the command PBHEADER has been set to OFF, only the last routing line is saved with forwarded messages.

KA-NODE

Overview

The KA-Node is a simple packet-networking node. When enabled, this station can be used by other stations, not only as a digipeater but also as a node, helping them to find pathways to other stations that they can not reach.

KA-Nodes, like other networking nodes such as NET/ROM, operate more efficiently than do digipeaters as a link between two stations. End-to-end acknowledgement of received packets is not required with the nodes; instead they handle errors between each other, rather than from end to end (which can cause extra traffic when errors or interference occurs). A KA-Node, however, is "silent" in that it does not automatically connect to and exchange routing data with adjacent nodes, as do fully-features nodes such as NET/ROM, X1J, or Kantronics K-Net.

Consequently, users cannot issue a connect to a distant station without knowing the path - as they sometimes can with a fully featured node. At the same time, KA-Nodes are useful in that they are more efficient than digipeaters in using channel time, while not requiring the effort and time required to maintain a full-function network node.

Configuring The KA-Node

The following commands are used to configure the KA-Node: NUMNODES, MYNODE, NDWILD, KNTIMER, and KNXCON.

The command NUMNODES, when set to a number greater than zero, enables the KA-Node. The number sets the number of circuits (channels) allowed through the KA-Node. Each circuit consists of a connect "IN" from a station to the node, and a connect "OUT" from the node to another station. Each KA-Node circuit allowed will require approximately 4.3K of memory.

If an attempt is made to set NUMNODES to a value requiring more memory than available, a message indicating that the value is out of range will be displayed. The total number of circuits that can be allocated will be affected by the amount of memory allocated to the Personal Mailbox and other TNC functions.

The callsign assigned to the KA-Node, by the MYNODE command, must be different from the callsigns used for the TNCs other functions, such as MYCALL, MYALIAS, MYPBBS, MYREMOTE. By default; the TNC sets the MYNODE to the callsign that was used to initialize the TNC, with an SSID of -7.

If the command NDWILD has been set to ON, the KA-Node will accept connect requests to any SSID of its callsign (MYNODE), except those already assigned to the TNCs other functions.

Packets passing through the KA-Node are monitored and displayed, unless the MYNODE callsign is included in the SUPLIST command.

If it becomes necessary to disconnect a station from the KA-Node, issue the command DISCONNECT MYNODE x, where x is the number of the channel to disconnect.

The command KNTIMER sets a timeout, to clear inactive connections. If no data passes through a circuit for n minutes, then that circuit (connect in and out) will be disconnected. The default time is 15 minutes. The timeout function can be disabled by setting n to 0.

The setting of the command KNXCON, when set to ON, allows connecting stations to connect out on the opposite port of the TNC.

Using a KA-Node

The KA-Node function is for use by other stations. When a station connects, the KA-Node will return its command line, which is similar to the command line of the PBBS. The commands available are B, C, J, N, or Help?. X will be included if the KNXCON command is ON. Preceding the command line, will the text specified in the command NTEXT, if entered.

The command B is for BYE. When it is received, the KA-Node will disconnect.

The command C is for CONNECT. It is entered with the callsign of a destination station, to which the node is to connect. If the optional S (for STAY) is included after the callsign, the KA-Node will remain connected to the station that connected IN, after the destination station has been disconnected.

The command J is for JHEARD (stations heard). When received, a list of callsigns of stations from which packets were recently heard by the TNC which contains the KA-Node will be returned. If the optional L (for LONG) is included with the J command, the list will include dates and times the packets from those stations were heard, the destination callsigns in the packets they sent, and any digipeaters used. The format of the date and times in the list, will be as specified by the TNCs DAYSTRING command.

The command N is for NODES heard. When the TNC hears ID packets from other stations, that include a callsign with a /N, that callsign is included in the Nodes heard list. If no /N callsigns have been heard in any ID packets, the response will be NO KNOWN NODES. As with the J command, the optional L will return more information about those stations heard.

Using the XCONNECT Command

The X command, for cross-connect, is a unique feature of the KA-Node. It allows cross-linking between two frequencies through the node in much the same manner as the Kantronics unique gateway, but with local acknowledgment of packets.

Determining Which Port You Have Connected To

When connected to a multi-port node, the JHEARD command can be used to determine which port of the node you have connected to. A typical node response to the JHEARD command may be displayed as shown (a KAM Plus would use /H and /V instead of /1 and /2):

N66046/2* 11/01/2001 14:32:69
NØKN-1/1 11/01/2001 16:25:01
WØXI/2 11/02/2001 16:28:05
KCØKON/1 11/02/2001 16:32:09

In this illustration the number following the slash (/) indicates the port the station was heard on. Your callsign will usually be the last one in this list.

You can now see that by comparing the port on which your call appears in the JHEARD list to the port indicated for other stations, you can determine whether to CONNECT or XCONNECT to the station of your choice.

The X command, for cross-connect, is a unique feature of the KA-Node. It allows cross-linking between two frequencies through the node in much the same manner as the Kantronics unique gateway, but with local acknowledgment of packets.

Determining Which Port You Have Connected To

When connected to a multi-port node, you can determine which port you are on, at the node, by using the JHEARD command. A typical node response to the JHEARD command may appear on your display as shown:

N66046/2* 12/01/87 14:32:69
NØKN-1/1 12/01/87 16:25:01
WØXI/2 12/02/87 16:28:05
KCØKON/1 12/02/87 16:32:09

In this illustration the number following the slash (/) indicates the port the station was heard on. Your callsign will usually be the last one in this list.

You can now see that by comparing the port on which your call appears in the JHEARD list to the port indicated for other stations, you can determine whether to CONNECT or XCONNECT to the station of your choice.

KA-Node Commands for Remote Use

When accessed by radio, the KA-Node has several commands available. These commands are listed here for reference, with a description of each command. In these descriptions, the UPPER case characters of the command are required, while LOWER case characters are optional. Those items listed within [ ] are optional and if used the UPPER/LOWER case convention applies.

ABORT

Aborts a KA-Node Connect or Xconnect request if it is the first data sent after the connect request. It must be spelled out entirely.

Bye

Causes the KA-Node to initiate a disconnect.

Connect callsign [**S**tay]

Causes the node to issue a connect request to "callsign" in the usual AX.25 mode. If the connect is successful, a link will be made to the next node or end-user station called. The optional Stay feature provides a way to disconnect without loosing the entire link. Normally when a disconnect occurs,

whether issued by you or by the remote station, the connection to the KA-Node is also lost. Using the Stay option allows you to stay connected to the KA-Node when the remote station issues a disconnect.

Help

Causes the KA-Node to send a brief help list, showing all commands available, with the options and a short description of each command.

Jheard [**S**hort|**L**ong]

Causes the KA-Node to return its MHEARD (stations heard) log.

The short (JHEARD S) version of this command would produce the same list, without dates and times.

The long (JHEARD L) version of this command will include date/time stamp, the destination field, and any digipeaters used.

Nodes [**S**hort|**L**ong]

Causes the node to return a list of KA-Nodes it has heard, as well as K-Net, G8BPQ, NET/ROM and TheNet nodes. The format of the list is similar to that of the JHEARD list above.

Xconnect callsign

Causes the node to issue a connect request to the specified callsign, on the opposite port of the KA-Node.

K-NET

The K-NET node is an advanced network node, compatible with other network nodes, such as NET/ROM, THE-NET, and G8BPQ.

When the K-NET function is enabled, other stations can connect through it to other network nodes, or direct to a destination station.

Network nodes work together to configure a constantly updating network system, to aid individual packet stations in making contacts with distant stations they can not reach directly.

The advantage of a network node system is two-fold: automatic routing of connections to other network nodes, and increased data throughput. A network node "knows" how to automatically route data through neighboring nodes to distant nodes on the network. They do this by "hearing" other nodes broadcast this information. This means that a user connected to a node does not need to specify the particular route to take in order to reach a distant node as long as the local node contains a listing for that distant node. Using a network node can also dramatically increase the data throughput to distant locations. The packet data and the acknowledgements travel from node to node (rather than from end-to-end), greatly reducing the inevitable data collisions that will occur when attempting to communicate over long distances.

The defacto standard networking protocol, NET/ROM, was developed in the late 1980's by Software 2000, Inc. Since then, other node derivatives such as TheNET, TheNET Plus, TheNET X1-J, and G8BPQ evolved. Although these variants differ in their features, they all utilize the same basic networking protocol.

The K-Net feature adds the function of a dual-port network node to the operation of the KAM *XL*. All normal functions of the KAM *XL* can remain active, including PBBS operation, dual-port (packet) operations, and remote access. This means that the KAM *XL* can still be used in normal operation, while also providing the local area with a dual-port network node that operates in the background of normal TNC packet operations.

K-Net is fully compatible with the basic network protocols, and provides two ports that can be added to existing networks. It also supports the NET/ROM interface communication, through the AUX connector, and can be connected to a node stack.

K-Net Configuration

The factory default values in the KAM *XL* have the network node function disabled. To enable the K-Net node, the NETALIAS and NETCALL commands must be entered. NETALIAS is usually set to a mnemonic that gives users an idea about where the node is located (other network nodes do not care what the alias name is).

For example, LAW is a good NETALIAS for a network node installed in an area including the city of Lawrence Kansas. The NETCALL is the callsign of the network node. It consists of a valid callsign and SSID (such as NØKN-10), and must be different from any other callsign used in the KAM-*XL,* for its other functions. Entering a callsign in the NETCALL command will cause a soft reset as memory is allocated for the node operation.

Several of the network node configuration commands can only be changed while in command mode. Changing the parameter values of any of these commands (NETBUFFS, NETCIRCS, NETDESTS, ETLINKS, NETROUTE, and NETUSERS) will also cause a soft reset, as memory is allocated for their use. Their functions and parameter value ranges are listed in the command section.

Other K-Net node parameters can only be accessed or changed, while connected to the node as sysop. Unlike the KA-Node, which can not be accessed from the local terminal, a K-Net node will accept a connect request from the local terminal, allowing sysop access to change the network node parameter settings. Just send a CONNECT command to the NETALIAS or NETCALL callsigns, and the network node will respond in the same way it would respond to a user from another TNC.

To gain SYSOP access when connecting to the node from another TNC, the first command sent to the node must be the SYSOP command. The same password entry must then be sent, in the same way as when requesting SYSOP access to the PBBS or MYREMOTE.

Upon connecting to the node, it will not return a command line or node prompt, but simply sending a carriage return (pressing the ENTER key) will cause a display of the node commands available. To see the current setting of any node command, type that command name and ENTER.

A short description of any command is available, by entering Help (or ?) and the command name. Short descriptions of all available node commands, will be returned by the HELP HELP command.

Once the node has been enabled, some of its text messages should be set, to provide other users with helpful information about the K-Net node. First, connect to the node as sysop, and enter each command (CTEXT, INFO, or PORTS) followed by text messages.

CTEXT, for connect-text, is sent when a station connects to the network node. It may be a greeting message, followed by short instructions about how to get more help about the node operation.

INFO, or node information, could be a message indicating the location of the node or its coverage area, and node equipment (such as TNC type, radios, etc.).

PORTS, or port information, could be a message indicating the channels in use by the radios that are connected to each port of the TNC, and baud rates available.

Note: In order to successfully integrate any new network node into an existing network system, efforts should be made to coordinate with neighboring network node sysops. Many of the parameter settings of each individual node, will affect the operation of the entire network system, and if set to conflicting values, can degrade performance of the node network.

Networking terms

NODE - The term node, refers to a network node such as a G8BPQ, X1-J, or NET/ROM node. Non-network nodes such as a KA-Node, conference bridges, and digipeaters, do not apply to this concept of operation.

USER - A user is either a real live person using a TNC to connect to and use the network node, or a server (BBS) that is basically doing the same thing under computer control.

NEIGHBOR NODE - A neighbor Node is another nearby node that can be heard and connected-to direct, without using an intermediate node. Note that digipeater operation is allowed (2 max.). This means that a node can be "out of range", but can still be considered a neighbor since the connect path does not use any other nodes. All known neighbor nodes (those nodes from which nodes broadcasts are heard direct) are displayed with the ROUTES command.

DISTANT NODE - A distant node is a node that is too far away to connect to "direct", and requires the use of one or more network nodes to reach. Distant nodes will not be displayed by the ROUTES command.

DESTINATION NODE - A destination node is a node that your node knows how to connect to - either directly as a neighbor node, or by using one or more intermediate nodes. All known destination nodes (neighbor nodes, and distant nodes) are displayed with the NODES command.

All neighbor nodes are destination nodes, but all destination nodes are not necessarily neighbors. Destination nodes will automatically appear in the nodes table by virtue of monitoring their nodes broadcasts. A neighbor node will automatically be listed in the nodes table and routes table. Neighbor node broadcasts also contain information about other nodes that they can hear. These distant nodes will also be listed in your nodes table if they pass the criteria for being listed, by the setting of the MINQUAL command, and if there is sufficient room for them to be listed, as set by the NETDEST command.

K-Net SYSOP commands

SYSOP commands;

ADDNODE [alias:]call port neighbor [VIA digi1[,digi2]] quality [obscent]

Adds the specified new destination node, or modifies the entry of an existing destination node in the nodes table. If the optional obscent (Obsolescense Count) is set to 0 (zero), the node will be permanently listed in the nodes table and will not be updated or dropped from the nodes table by the K-Net auto-routing logic. If the neighbor node callsign entered is not in the neighbor routes table, it is added with the default quality for the specified port. As long as MINQUAL is equal to or less than QUALITY, destination nodes (neighbor nodes as well as distant nodes) will be added automatically to your nodes table as neighbor node broadcasts are received.

Example - ADDNODE KSLAW:NØKN-10 2 KCØKON-1 200

K-Net node responds: NODE ADDED WITH NEW ROUTE

ADDROUTE port call [via digi1[,digi2]] quality [!]

Adds or modifies the specified NETCALL of a neighbor node in the routes table. If the optional ! is included, the route entry is either locked if unlocked, or unlocked if locked , (i.e. toggle). An existing locked route does not have to be unlocked before it can be modified. Locking a neighbor's route is used to assure that an assigned quality will always exist for that neighbor. The locked quality will also be used in the automatic quality computation of other distant nodes contained in this neighbor's node broadcasts to determine if they should also be added to your nodes table. In the event that this locked neighbor disappears from the network, for whatever reason, and then returns, it will automatically be assigned the locked quality. During the time that this neighbor is absent, it, and distant nodes associated with this neighbor, may eventually be removed from the nodes table (even if the route is locked) because the obsolescence count for this neighbor node could drop to zero. If this neighbor's route is locked, it will still be listed in the routes table, but with a zero count for destination nodes using that route.

EXAMPLE – entering the command: ADDRoute 1 WD0EMR-1 110 !

K-Net responds: Route added and locked

This adds the route to the WD0EMR-l node to the routes table in the K-Net node. The route is "locked in" and assigned to port 1 with a quality of 110.

Locking a route assigns a fixed *quality* to a neighbor node. This can assure that any connects to a distant node using this neighbor node as a route will take the "hard coded" route, even if the route automatically generated by the K-Net node is different, such as may occur during band openings.

CQBC [ON|OFF/ON|OFF]

Defalut ON/ON

When set to ON for either or both radio ports, allows users to send CQ broadcasts from the node.

CTEXT [text] up to 128 characters

The connect message text sent to stations upon connecting to the NETALIAS callsign (but not when connecting to the NETCALL). Can be cleared by entering CTEXT %.

DELNODE [alias:]call port neighbor [via digi1[,digi2]]

Deletes the specified destination node from the nodes table. The entry must match the current entry in the list exactly, or the node will not be deleted.

DELROUTE port call [via digi1[,digi2]] quality

Deletes the specified neighbor node from the routes table. The entry must match the current entry in the list exactly, or the node will not be deleted. A neighbor node can not be deleted if there are any other nodes in the nodes table using this neighbor as a route.

INFO [text] up to 128 characters

Enters an information message, which is usually a description of the node location or area of coverage, and/or equipment list. It can be cleared by entering INFO %.

IDINT n/n (n = 0 - 255)

Default 10/10

Sets the interval, in number of minutes, of the node ID beacon from each port of the node. This is not a nodes broadcast, just an ID. Setting either or both numbers to 0 (zero), turns off the ID beacon.

L3TTL n (n = 0 – 255)

Default 25

Sets a limit on the maximum number of times a packet originated by an uplink station (normally an end user) at this node may be transferred through other nodes. Each time a message is handled by a node, the time-to-live for that message is decremented. If the L3TTL counter reaches 0 (zero), the message is discarded. It is possible for network nodes to create circular paths, and therefore a limit is required to prevent a packet from relaying in the node system forever.

L4DELAY n (n = 1 – 60)

Default 5

Sets the delay time in number of seconds after the node has received a level 4 frame from another node, before an ACK is returned. This allows a combined packet of the ACK and any data that may be ready to be sent to the same destination, to be sent together. Thus, sending only one frame instead of two or more.

L4LIMIT n (n = 0 65,535)

Default 900

Sets a “no-activity” timeout timer, in number of seconds, on a node crosslink. When a user connects to another node, the node first establishes a level 2 (AX.25) connect with that node, and then establishes a level 4 circuit on behalf of the user. When the user is finished, the level 4 crosslink is closed but the level 2 connection remains until the L4LIMT is reached, at which point is terminated.

When a user disconnects, the level 2 connection between the nodes remains intact and the L4LIMIT time is restarted. This decreases data congestion if another crosslink request using the same path occurs before the L4LIMIT expires, since the node will not have to re-establish the level 2 connect.

L4N2 n (n = 1 – 127)

Default 3

Sets the number of retries used to pass Level 4 data between nodes in the system. After the L4N2 count reaches 0 (zero), alternate paths will be tried.

L4T1 n (n = 5 – 600)

Default 120

Sets the time, in number of seconds, that the originating node will wait before resending a level 4 data packet if no acknowledgment is received from the destination node (end-to-end info-ACK). If set to small, multiple copies of the same packet can exist within the node system, even if the first packet was received correctly.

L4WINDOW n (n = 1 – 127)

Default 4

Sets the maximum number of outstanding frames that may exist in the network, for a given circuit. When the node has L4WINDOW un-acknowledged frames, it will not transmit any more freames until a level 4 info-ACK is received. Network nodes may allow up to 127 outstanding frames across the system. The L4WINDOW size is negotiated between nodes when a crosslink is requested, therefore its size should be standardized network-wide.

MINQUAL n (n = 0 – 255)

Default 70

Sets the minimum quality required to add a destination node to the nodes table.

NODESINT n (n = 0 – 255)

Default 60

Sets the time interval, in number of minutes, between node broadcasts. It should be set to an agreed-on interval, the same as all nodes in the network system.

OBSINIT n (n = 0 – 255)

Default 5

Sets the initial obsolescence value that is assigned to destination nodes. When a nodes broadcast is transmitted, the obsolescence value for each listed destination node, is decreased by one. When a node is listed in a nodes broadcast heard from another node, the obsolescence value for that node is increased by one. If the obsolescence value for a listed destination node drops below the OBSMIN limit, that node will not be included in nodes broadcasts. If the value drops to zero, the node will be removed from the nodes table, unless it had been added (by ADDNODE) to the nodes table, with an obsolescence value of zero.

OBSMIN n (n = 1 – 255)

Default 4

Sets the minimum obsolescence value, which will allow a destination node to be included in nodes broadcasts.

QUALITY n/n/n (n = 0 – 255)

Default 255/70/110

Sets the quality assigned to neighbor nodes, when their nodes broadcasts are heard, on each port. The first number is for nodes broadcasts heard though the AUX port, when it is connected directly to another TNC and communicating in NETROM mode (NBAUD >0). The second number is for nodes broadcasts heard through port 1, and the third number is for port 2.

K-Net USER commands:

BYE

Causes the node to disconnect from the user that issued the command.

BBS [/S]

Causes an internal connect to the PBBS in this TNC. When the /S option is included, will remain connected to the node after exiting the PBBS.

CONNECT [[port] call|alias [/S]]

Commands the node to connect to another node or enduser. When the /S option is included, will remain connected to the node after disconnecting the current link.

CQ [UI text]

Commands the node to broadcast the specified text.

DISPLAY

Displays a list of current node parameter settings.

HELP

When entered alone, displays a list of all commands available to the connected user. When entered followed by the name of a specific command, will display a short description of that command. Entering HELP HELP, will display short descriptions of all available commands.

INFO

Displays the information message that was entered by the SYSOP. It is usually a description of the node location or area of coverage, and/or equipment list.

LINKS

Displays a list of current AX.25 links existing in the node, including the callsigns of the linked stations, the AX.25 STATE, the port number, the TYPE of link, and the AX.25 version.

The AX.25 STATEs are: 1 for DISCONNECTED, 2 for CONNECT IN PROGRESS, 3 for FRMR CONDITION DETECTED, 4 for DISCONNECT ATTEMPT IN PROGRESS, 5 for CONNECTED, 6 for WAITING ACKNOWLEDGEMENT, 7 for DEVICE BUSY, 8 for REMOTE DEVICE BUSY, 9 for BOTH DEVICES BUSY, 10 for WAITING ACKNOWLEDGEMENT and DEVICE BUSY, 11 for WAITING ACKNOWLEDGEMENT and REMOTE DEVICE BUSY, and 12 for WAITING ACKNOWLEDGEMENT and BOTH DEVICES BUSY.

The TYPEs of links are: U for UPLINK, D for DOWNLINK, or X for CROSSLINK.

MHEARD [LONG|SHORT]

Displays list of callsigns recently heard on each radio port of the node. Including the LONG option, will also include the destination callsigns and any digipeaters used, and the time stamp.

NODES [{* | alias | call}]

Displays the list of all known destination nodes. The list includes the ALIAS and CALLSIGN of each node. If the optional * is included with the command, hidden nodes are also shown, and are marked with #. Entering the command and and specifying a node alias or callsign, will display up to three possible routes (neighbor nodes) of descending quality that will be used to establish a link with a specified destination.

PORTS

Displays test messages about the radio ports, that were entered by the sysop.

ROUTES

Displays a list of neighbor nodes, including radio port number, node callsign, quality value, the number of destination nodes, if the route is in use, and if the route has been locked in by the sysop.

STATS

Displays a summary of statistics concerning level 3 and level 4 activity on this node.

SYSOP

Command to request SYSOP access to the node. User must respond to the password query, using the password characters defined by RTEXT. See the remote access section.

USERS

Displays a list of users currently connected to node, the number of buffers currently available, uplinks, downlinks, and crosslinks.

Node Stacking

More radio ports can be added to this network node. The added TNC must be set to communicate through its serial port in Net/rom mode, at the same baud rate. The KAM *XL* communicates in Net/rom mode through its AUX port. The Net/rom interface mode is activated by setting the TNC command NBAUD to a baud rate matching the serial port baud of the other TNC.

When connecting to just one other TNC, a standard serial cable is all that is needed. When connecting to a node stack, a diode matrix is required.

NOTE: NBAUD and GPSPORT can not both be enabled at the same time. The AUX port of the KAM *XL* can be used for only one function at a time. Attempts to enable both functions at the same time will return an error message.

GPS NMEA Interfacing

The KAM *XL* can be interfaced with a GPS device that provides data in the NEMA-0183 interface standard. It has a complete set of commands to configure and control unproto (path) retransmissions of the NEMA strings, and can provide RAM storage for location messages (strings) for later retrieval.

Overview

The U.S. Department of Defense, to provide worldwide positioning and navigational information for U.S. military forces developed the Global Positioning System (GPS) initially for military use. Since then, a broad range of commercial, civilian, and amateur radio applications has been developed, based on the GPS.

The GPS consists of 24 satellites, each of which transmits positioning information continuously. GPS receiving units - devices that contain a receiver, LCD display, and (usually) a data port - collect this positional information and use it to compute position. This information can then be retransmitted by any means possible to report the position of the GPS device (and its vehicle).

Most GPS units sold today are NMEA compatible. That means that not only can they display latitude, longitude, and time on an LCD screen, but that information can be output through an RS-232 or compatible port. This port can then be connected to the serial port of a computer or TNC.

The GPS position information is presented in a special format of sentences of ASCII characters, as specified by a protocol called NMEA-0183. A number of these sentences are available with varying kinds of information, but the ones used most often for amateur radio activities are $GPGGA, and $GPRMC. These sentences contain information such as latitude, longitude, altitude, and time (in UTC, derived from the satellite clocks). The TNC, in GPS Mode, can capture this data and store it in a buffer, and retransmit it in beacons and/or record them in a large tracking buffer for later retrieval.

The TNC, while in GPS Mode, can also update its internal date/time clock to UTC, derived from the satellites.

GPS Equipment Requirements

To set up a packet GPS station to beacon GPS data for mobile position reporting, the following equipment would be needed:

A transceiver and antenna,

The KAM *XL*,

A GPS unit with an attached or external antenna, the has an RS-232 or compatible data output in NMEA 0183 format, with a cable to connect to another device.

Cabling a GPS Unit to the KAM-*XL*

The NMEA standard specifies that the signals in the GPS receiver data port follow the EIA-422 standard.

Technical note: Many GPS vendors simply use "TTL" voltage levels (+5 volts and 0 volts,) but use the same polarity as RS-232 signals. These units are capable of supplying proper input to the AUX port of the KAM *XL*. However, some GPS vendors invert the sense of this signal (true TTL), and these units will not directly interface with an RS-232 port.

Warning: The KAM *XL* serial ports use RS-232 voltages, which are + and - approximately 8 volts. Check the GPS device manual before attempting to connect it another device. If it includes a cable and/or indicates that it can be connected directly to the computers serial port, it can be connected directly to the AUX port of the KAM *XL* with the same cable. Kantronics is not responsible for damage to the TNC by incorrect connections to other devices, or connection to incompatible devices.

To connect the data port of a GPS unit to the KAM *XL*, a cable with at least two wires is required. A shielded cable is preferred. Refer to the GPS manual to determine which pins are used for signal ground, and data output. If the GPS device requires an initialization string input, a third wire for data input to the GPS would also be needed.

Connect the signal ground wire of the GPS data port to pin 5 of the KAM *XL* AUX port. This wire may be identified as "NMEA-" by some GPS vendors.

Connect the data output of the GPS data port to pin 2 of the TNC serial port. The data output pin may be identified as "NMEA+" by some GPS vendors. This line supplies the GPS NMEA sentences to the TNC.

Some GPS units may have a data input to allow for configuring their data output. If so, this is accomplished by passing commands to the GPS unit from a terminal or TNC, via an additional wire in the data cable. If this is the case, connect the third wire of the data cable from the input data pin of the GPS data port to pin 3 of the AUX port. Again, consult the GPS manual for the name of this pin, as pin names and functions vary by vendor. Also, make sure this pin will accept an RS-232 signal (+ and - voltages).

Most GPS devices that have a data output, have a default configuration with standard type output sentences. They may never need any data input or configuration. In this case, a two-wire cable is sufficient, to connect them to the KAM *XL*

Configuring the GPS Commands

Several commands are used to configure the KAM *XL* to capture and beacon, or store GPS data.

GPSHEAD selects the GPS string or up to four different strings to be captured and stored in the Location Text (LT) buffers. The entry is case sensitive, so be sure to enter the sentence header in the correct case. Most, if not all, NMEA sentence headers are in CAPITAL letters. The GPSHEAD for LT buffer 1 is set to $GPGGA by default. To configure buffer 2 to store the sentence beginning with GPRMC for example, enter the command as; GPSHEAD 2 $GPRMC.

BLT sets the beacon interval rates for each of the four LT buffers. To beacon LT buffer 1 at every 1 minute interval, enter the command as; BLT 1 E 00:01:00. To clear the buffer every time it has been

beaconed (so that old non-updated data is not transmitted more than once), include the optional parameter CLEAR after the time interval. If both ports of the KAM *XL* have been enabled, and are currently in Packet mode, the LT buffers can be beaconed from either one or both radio ports (and at different intervals, if desired).

LTP sets the digipeater paths for each of the LT buffers. Many digipeaters, that re-transmit UI-type packets to other APRS monitoring stations, use callsigns such as RELAY or WIDE. To set LT buffer 1 to be re-transmitted by any WIDE digipeater, enter the command as; LTP 1 APRS VIA WIDE.

GPSPORT enables the AUX port for GPS data input (and output) at the specified baud rate. Many GPS devices have a data output baud rate of 4800.

LTRACK allocates TNC memory for a GPS data storage buffer. Any one or up to all four LT buffers can be stored for later retrieval. The LTRACK buffer is then accessed through connection to the PBBS. If more memory is desired for a larger LTRACK buffer (or for other functions), the PBBS size can be decreased. But, it the PBBS must remain enabled with at least 1K of memory allocated to it, so that the LTRACK buffer can be accessed.

If the GPSHEAD string for any LT buffer is empty, that LT buffer can be set up as an auxiliary beacon, manually entering text in the that buffer, and setting BLT and LTP to beacon that text at the specified interval via the designated path.

GPS Device Initialization from the TNC

Some GPS receivers require input of a special string of characters for initialization before they will output any information. The TNC can be configured to send the initialization string to the GPS unit by entering the required string using the GPSINIT command. For instance, if the GPS receiver requires the initialization string $PGRMO,GPGGA,1, the command would be entered as;

GPSINIT $PGRMO,GPGGA,1

Upon power up of the TNC, or after a soft reset has been performed, that string is output from its AUX port to the GPS unit.

Other GPS Features

Slotted Beacons

The BLT command provides for the ability to specify not only the interval between beacons, but also a starting time for the beacons. This permits a "slotted" system of beacons by numerous stations. For instance, if the local area has 30 stations that each should beacon their location every 30 minutes. A beacon would be transmitted every n minutes from the time the user sets the time that the beacon should be transmitted. As an example, if BLT has been set as;

BLT 1 EVERY 00:30:00 START 00:00:01

The beacon would not start transmitting until 00:00:01 after midnight and then every 30 minutes after that. A second user could set the BLT with the command:

BLT 1 EVERY 00:30:00 START 00:01:01

In this case, these two users beacons would never be transmitter at the same time, but would beacon 1 minute apart. Using this system as an example, it would be possible to set all thirty users to beacon one minute apart, avoiding collisions.

Tracking Without Beacons

To configure the TNC to only store the LT beacons in the LTRACK buffer, without transmitting them, set the LTP to NONE for the associated LT buffer. As in:

LTP 1 NONE

When the destination call (path) is set to NONE, the TNC will not transmit the beacon, but since the BLT command is still active, the data will be stored in the LTRACK buffer, at the BLT specified interval.

Remote Access and GPS

When connected remotely to the TNC through its MYREMOTE callsign, and have properly responded to the password security check, any parameters can be changed, including the GPS parameters.

If the GPSPORT command has been enabled, by setting it to a baud rate greater than 0 (zero), text can sent out through the AUX port at its configured baud rate by sending the RPRINT command.

For example, to send the configuration string “$PGRMO,GPGSA,1” to a GPS unit that is connected to the AUX port, enter the command:

RPRINT $PGRMO,GPGSA,1

This requires that the DATA input to the GPS device be connected to the data output from the AUX port. The string does not, in fact, have to be destined for a GPS device. The device attached to the AUX port could be any type of device that accepts RS-232 input.

Other Notes

The LT buffers, LT beacons and LTRACK buffer can be used even without a GPS unit attached. Any text can manually be entered in the LT buffers, up to 128 characters total, using the LT command as in:

LT 1 This is LText buffer number 1

The LT buffers will be transmitted based on the BLT and LTP commands and stored according to the LTRACK command even when the TNC GPSPORT has not been enabled.

Other text can be specified in the GPSHEAD command. If the data input to the AUX port is in the same format as NMEA data, that begins with a specific character or word and ends in a CR/LF

(carriage return/linefeed) sequence, it can be stored in the LT buffers. Some weather station devices operate in this manner to report weather information.

GPS Command Summary

The following GPS commands are listed here for convenience and explained in detail in the Command Reference section.

BLT n {EVERY|AFTER} hh:mm:ss [START hh:mm:ss] / {EVERY|AFTER} hh:mm:ss [START hh:mm:ss] (n = 1 - 4)

Sets the interval between beacons for the associated LT string, for either or both radio ports.

GPSHEAD n string (n=1-4) (up to 8 chars)

Determines which GPS NMEA sentences will be stored in the LT buffers.

GPSINIT string (up to 128 characters)

Specifies a text string that will be sent to the attached GPS unit upon power-up.

LT n text (n = 1 - 4) (up to 128 chars)

Enters the specified text in the associated LT buffer.

LTP n dest [via call1[,call2,...]] / dest [via call1[,call2,...]] (n = 1 - 4)

Sets the destination callsign and any digipeaters to be used when transmitting the LT buffers.

LTRACK n [LT1] [LT2] [LT3] [LT4] [SYSOP] [TIME]

Allocates memory for a special tracking buffer used to store LT messages.

RPRINT text (up to 128 characters)

This is an immediate command, which sends the specified text string from the AUX port to the attached device (e.g. GPS unit).

GPS Device Manufactures and vendors

Garmin, 1200 E. 151st St., Olathe, KS 66092

ICOM America, Inc., 2380 116th Ave. N.E., Bellevue, WA 98004.

Magellan Systems Corp., 960 Overland Ct., San Dimas, CA 91773.

Sony Electronics Inc., 1 Sony Dr., Park Ridge, NJ 07656.

Trimble - Mobile Computing Products, 645 N. Mary Ave., P.O. Box 3642,
Sunnyvale, CA 94088-3642.

Advanced GPS/APRS Digipeating

A common goal of mobile position reporting stations is to have their UI packets digipeated over a wide area or long distance, while moving though areas where the local digipeater callsigns may be unknown. An effective solution for not knowing local callsigns is to establish standard generic callsigns for digipeating stations and then use these names in digipeating paths. Of course, this requires the acceptance and use of standards for naming and using digipeating stations, by both the position reporting stations and the digipeating stations.

Common standards have been established by some local APRS groups to use digipeater names such as RELAY, WIDE, TRACE, and GATE. Check with a local GPS or APRS group before configuring the TNC with its UI digipeater capabilities. Digipeater naming conventions, and frequency usage may vary by area.

Improving Efficiencies of Advanced Digipeating

As described above, mobile location reporting stations use digipeating paths containing generic digipeating names (e.g., RELAY, WIDE, TRACE) to extend their range of reporting. Using generic digipeating enables a mobile station to use the same digipeating path as it moves around, since there will (presumably) always be nearby GPS/APRS digipeating stations with one or more of these generic names to pick up transmissions of UI packets, and re-transmit them to a wider area or on a different radio channel.

Using generically named digipeaters does result in wider coverage of GPS stations, but several inefficiencies may arise from this common practice (depending upon the availability and names of the digipeaters).

Among the problems that may arise in this situation, are:

(1) UI packets can be repeated much more than necessary, by the same or by different digipeating stations with the callsigns RELAY, WIDE, or TRACE clogging up the airwaves, and that

(2) several stations may re-transmit the same packet at the same time, resulting in a multiple transmissions that cannot be copied by other stations.

Kantronics' TNCs have a suite of UI digipeating commands that can be used to deal with inefficiencies that can arise when a number of digipeaters using the same generic names are located in the same area, and can transmit at the same time.

Overview of UI Digipeating Commands

The following UI digipeating commands support advanced GPS/APRS digipeating capabilities.

The UIDIGI command may be used to set up to four additional aliases/call signs for "special" digipeating service. To-be-digipeated packets received containing one of these aliases will be repeated (once) with the call sign (MYCALL) of the digipeater substituted for the alias in the digipeated frame.

UIFLOOD and UITRACE are a bit more exotic. Each provides for multi-hop digipeating with just one digipeater address per packet, thereby keeping the transmission time short. To digipeat through three TNCs supporting the UIFLOOD command, a reporting station might set a GPS position path as LTP 1 GPS via wide3-3.

A digipeater TNC supporting "wide" set by the UNIFLOOD command and hearing the reporting station's transmission would then digi the UI location packet (assuming it had not done so already, within a preset time), using an address of wide3-2. In turn each similar digipeater down line would digi the reporting station's UI packet and reduce (decrement) the SSID of the digipeater address again.

A TNC using UIFLOOD has the option of inserting MYCALL, creating two digipeater addresses rather than one, in each transmitted digi packet.

Each time a UITRACE packet is digipeated, each digi adds its MYCALL, thus creating a "trace" or return path. In effect, the size of the packet grows by one digipeated address with each hop.

The current setting of UIDWAIT determines whether or not a delay is added to UI digipeat packets (those formed by UIDIGI, UIFLOOD, or UITRACE) before transmission, once the channel is clear. If UIDWAIT is ON, the delay is determined by SLOTTIME and PERSIST settings.

The purpose of the UIGATE (which is in multi-port devices only) is to prevent heavy high speed UI frame activity from congesting ("flooding") the low speed (port 1) frequency.

Note: Digipeater priority for call signs is as follows: MYCALL, MYNODE, MYALIAS, UIDIGI, UIFLOOD, UITRACE (e.g. if the same call sign has been assigned to MYALIAS and UIDIGI, a to-be-digipeated frame with that call sign will be digipeated according to the rules that apply to MYALIAS.)

Configuring Digis for HF/VHF Gateway Operations

The commands MYGATE and UIGATE are used to configure the KAM *XL* as a cross-port digi for UI packets. MYGATE sets the callsign of the cross-port digi, and UIGATE enables or disables the direction of the gateway. For example, if UIGATE has been set to OFF/ON, it can gateway from port 2 to port 1, but NOT from port 1 to port 2.

Bibliography

For details about APRS (A Packet Reporting System) developed by Bob Bruninga, WB4APR, consider obtaining a copy of "Getting On Track with APRS," by Stan Horzepa, 157 page paperback, published in 1996 by the ARRL, 225 Main Street, Newington, CT 06111.

For more information on the Global Positioning System, we recommend the following resources:

General Information

Bruninga, Bob, WB4APR, "Automatic packet reporting system (APRS)", 13th ARRL Digital Communications Conference Proceedings, 1994. (available from: ARRL, 225 Main Street, Newington, CT, 06111)

Sproul, Keith, WU2Z, "MacAPRS", 13th ARRL Digital Communications Conference Proceedings, 1994.

Technical Information

Collins, J., et al., GPS Theory and Practice, Second Edition, Springer-Verlag, 1993.
Etherington, Michael, "FM subcarrier network extends differential GPS nationwide", Mobile Radio Technology, February 1994.

Kaplan, Elliot, "The global positioning system (GPS)", Communications Quarterly, Summer 1994.

Langley, R., "The mathematics of GPS", GPS World Magazine, July/August 1991.
"NMEA 0183 ASCII Interface Standard", (NMEA 0183 version 2.0), NMEA, P.O. Box 50040, Mobile, AL 36605.

OTHER FUNCTIONS

Some of the following modes of operation require special software, so they may not be available when using standard terminal programs such as Pacterm or Procomm Plus.

TELEMETRY

Analog Inputs

The eight analog inputs are available in the TELEMETRY connector. These inputs can be used to measure external "DC" voltages from 0V to + 6.6 VDC with up to 8-bit accuracy.

An immediate reading of the analog inputs is taken and the measurements displayed, when the ANALOG command is given.

RANGE sets the range of values that are displayed for each input. For example, to set the range of the display to directly match the voltage input, set the RANGE command to 0 – 6.600. The range of each of the eight analog inputs are set independently.

The TELEMETRY command sets up a beacon that contains measurements of selected inputs at specified intervals.

Note: To measure voltages greater than + 6.6 VDC, the signals should be attenuated to divide them down in voltage. Choose resistance values to scale the desired input voltages to a maximum of + 3.3 VDC at the microprocessor pin. External voltages should never be allowed to exceed +50VDC.

Remote Control

Six control output lines are also available. They are open-drain FET transistor switches, and are controlled by the command CTRL. The TELEMETRY, PORT 1, and PORT 2 connectors each contain two control lines. One of the control lines in Port 1 (HF) is used in CW mode, for CW key output when the CWOUTPUT command is set to KEY. If the CWOUTPUT command is set to AUDIO, that control line is available, and operates the same as the other 5 control lines.

Copying NWS EMWIN Weather Broadcasts

EMWIN signals are simply a stream of ASCII characters sent at 1200 baud. Using the HF ASCII mode with a 1200 baud setting, these signals can be received and demodulated though port 1. A special computer program is required to display some of the EMWIN data. For current information about EMWIN and software to display its data, refer to sources on the Internet.

DAMA

DAMA (Slave Mode) as used by many amateur radio operators in Germany, Belgium, Luxembourg, the Netherlands, France, Switzerland and other parts of Europe in included.

Note: To the best of our knowledge there are no DAMA nodes in operation in the US or anywhere else outside of Europe.

What is DAMA?

DAMA (Demand Assigned Multiple Access) is a network protocol for regulating packet traffic to eliminate or dramatically reduce collisions among users on the crowded channels available to amateurs in densely populated northern Europe.

As the European channels have become more and more crowded and more and more DAMA systems have been established, it has become a necessity for TNCs to be equipped with the DAMA slave protocol in order to use the local networks.

In the DAMA system, a "master" node is set up in each local area to control transmissions from all stations connected to the node. By local agreement, users do not connect directly to each other; they connect only through the master.

DAMA was developed in Germany by NORD><LINK. (References to more in-formation on DAMA are provided in the bibliography at the end of this section.)

What Does a DAMA System Look Like?

The DAMA master node requires a computer running specialized DAMA software. TheNetNode (TNN) software, developed by NORD><LINK is one such specialized program which is used in the computer of a DAMA master along with one TNC, with a special EPROM for each radio frequency used on the sys-tem.

RMNC/FlexNet software is another program, which is very popular in Germany. Within each Local Area Network (LAN), end users set themselves up as DAMA "slaves," using specially equipped TNCs, which contain firmware (EPROM) that can operate in a DAMA "slave" mode (such as the Kantronics TNCs with DAMA slave mode support). The slaves may use a standard terminal or host mode program or any of a variety of specially written European programs, such as SP, Grafik Packet and ESKAY, some of which make use of the KISS mode feature of the TNC.

To use the DAMA system, the user connects to the DAMA master with a normal connect frame. When the master responds to the connect frame, the TNC is automatically placed into DAMA slave mode. The DAMA master polls each slave within the LAN in a "round-robin" fashion (somewhat like the token passing method) and the slave TNCs transmit packets when the master has granted permission to do so. The slave TNCs continue to be polled with priority among the slaves assigned according to the number of times each responds with information frames (as opposed to rr frames - i.e., no data to send). Priority is dynamically assigned so that those stations that are sending information are polled more frequently than idle stations. However, once an "idle" station responds with information, its priority is upgraded.

Communication over the wider area is handled between the DAMA master nodes, which are connected to each other using a standard NET/ROM(tm) type protocol. For the DAMA system to work effectively, each slave associates with only one master node and connects only to that master. If an end user is connected to more than one master, each master will poll the slave TNC according to its polling schedule. When polled, the slave TNC will transmit all frames it has avail-able to whichever master polls it. This would increase the probability of collisions with other users, thus defeating the purpose of the DAMA system.

The following commands enable and configure DAMA mode in the KAM *XL*: DAMA, and DAMACHCK

Set DAMA to ON to operate as a DAMA slave station, once a connection is established with a DAMA master station.

Sets a time-out timer (in 10-second increments) to specify how long to wait to be polled by a connected DAMA master station before disconnecting and reverting to CSMA operation.

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Medcalf, Karl, WK5M. "DAMA - Another Network Solution." Proceedings of the 14th Computer Networking Conference. American Radio Relay League, Newington, CT, USA 06111.

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Schmid, Detlef J., DK4EG. "DAMA - A New Method of Handling Packets?" Trans. Mark Bitterlich, WA3JPY. Proceedings of the 8th Computer Networking Conference. American Radio Relay League, Newington, CT, USA 06111. Published in German as "DAMA, ein neues Verfahren für Packet Radio?" cq-DL April 1989.

TheNetNode (TNN) Copyright 1994, NORD><LINK e.V., c/o Klaus-Dieter Vieth, Goergesstrasse 3, D-38118 Braunschweig, Germany. NET/ROM is a trademark of Software 2000, Inc.

CAUTION! The DAMA firmware in Kantronics' TNC is based on documentation published in the ARRL Computer Networking Conference papers (see Bibliography) and documentation provided by NORD><LINK, the developers of DAMA. This firmware was tested with TheNetNode firmware (Version 1.56), TFKISS (Version 2.0) and by volunteer testers in Europe with firmware used in existing DAMA networks.

Kantronics cannot be responsible for subsequent changes to the DAMA protocol, which may render this firmware obsolete, nor guarantee satisfactory operations with newer versions of the protocol and/or complementary software.

Tuning in to received signals

Most of the non-packet HF modes use two tones, a MARK and a SPACE, to send and receive data. This includes RTTY, ASCII, AMTOR and its variations, PACTOR, and G-TOR. CW and PSK31 modes are tuned in a different manner.

The BARGRAPH display on the front panel of the KAM *XL* is a tuning aid to properly adjust the receiver frequency to decode signals. The right end of the BARGRAPH is MARK, and the left end is SPACE.

Adjust the receiver frequency so that the tuning BARGRAPH is lighted brightest at both ends.

In CW mode, the BARGRAPH will rest to the right end. Adjust the receiver so that received signals cause the BARGRAPH to deflect to the left.

Exiting non-packet modes

When sending the <Ctrl+C>X command directive to exit the mode, any data left in its transmit buffer (data not yet transmitted) will be discarded.

If Packet mode in the HF port has been enabled (by setting HBAUD for port 1 to a number greater than 0 (zero), exiting the non-packet HF mode returns to command mode and Packet mode.

CW

At the command prompt, type CW and press return. The KAM-*XL* will enter the CW mode, ready to receive Morse code at the speed specified by the CWSPEED command. To enter CW mode at a speed other than as specified by CWSPEED, enter the command CW and the desired speed. A message indicating the current CW speed will be displayed:

—20-20—

and the KAM *XL* will be ready to receive and decode CW signals at the indicated wpm rate.

Receiving CW

If the speed of the CW signal being received from another station is more than 10 wpm different than the current setting CWSPEED, the automatic speed tracking will not be able lock on and decode the received signal. The <Ctrl+C>U directive will unlock the tracking, allowing a much greater speed range to be tracked. Resending the <Ctrl+C>U directive, will display the current tracking speed. To lock the CW transmit speed to be the same as the new receive speed, send the <Ctrl+C>L directive.

Tuning in a received signal

When in CW mode and no signals are being received, the tuning bargraph will rest to the left side. Adjust the receiver frequency on the radio so that a received CW signal causes the KAM *XL* tuning BARGRAPH to move all the way from the left to the right. The CWTONE command sets the audio tone frequency to be detected. Its initial setting is 750 HZ, which will match or will be very close to the offset between receive and transmit in many models of transceivers.

The receive speed in CW will automatically adjust or track to match the speed of a received signal within approximately +/- 10 words per minute, centered at the CWSPEED setting or the speed entered with the CW command.

If Es and Ts are displayed while receiving, try setting the CWBAND command to a smaller value. This narrows the input bandpass filter, while it makes tuning a bit more difficult, it eliminates much of the noise on nearby frequencies that results in poor copy. If a properly tuned CW signal results in the tone being received at some audio frequency other than 750 Hz, the CWTONE command can be adjusted to match the center frequency of the receiver's filters.

Transmitting CW

To transmit CW, the KEY OUT pin (pin 4) from the HF radio port of KAM *XL* must be wired to the CW key jack on the transceiver. An FET switching transistor applies a connection to ground on this pin when sending CW. Make sure that the transceiver is configured for a straight key input, and is not using its own internal electronic keyer. The radio should be set to the CW mode, and configured the same way as when sending CW with a straight key. It may need to be set for VOX operation to transmit when activating the key.

If a connection has also been made from the HF port to the microphone jack on the radio, the PTT signal can be used to put the radio into transmit mode. Set the command CWOUTPUT to KEY PTT. When configured this way, the PTT will go to active state when the KAM *XL* is transmitting, and CW will be sent by the CW KEY line.

It is also possible to generate audio tone CW (audio tones applied to the microphone input of the radio). This is useful to send CW with an FM radio (i.e., 2 meters) for code practice, or when connecting the KAM *XL* to an audio amplifier and speaker for local code practice. To use this mode, the CWOUTPUT command must be set to AUDIO PTT. The frequency of the CW audio tone is controlled by the CWTONE command.

To begin transmitting CW, enter the <Ctrl+C>T directive. Type the message on the keyboard, followed by <Ctrl+C>E. This will return to receive mode when the message has been transmitted. To return to receive mode immediately, send <Ctrl+C>R. Characters that have not yet been transmitted, will remain in the transmit buffer until they have been transmitted, or will be discarded when exiting CW mode.

In CW operation, several prosigns (character combinations) are used to indicate end of message, break, wait, and many other common phrases. To transmit these phrases, type the keystroke shown to send the predefined PROSIGN.

Keystroke	Prosign	Meaning
+	AR	End of Message
=	BT	Break or Pause

%	AS	Wait
&	KA	Attention
#	SK	End of Transmission
(	KN	Invitation to Transmit
*	AA	All After
!	SN	Attention

Other characters can be combined into a prosign, by preceding them with the PROSIGN character, which is set by the PROSIGN command to be the \.

In addition, the MORSE command allows several special code combinations to be defined. A typed character can be defined as one of the CW characters in the chart, to be transmitted when that key is typed. Also, the CW characters in the chart can be defined to display a specific character, when that CW character is received.

If the CWOUTPUT command does not include the PTT option, the Transmit LED on the front panel of the KAM *XL* will not light when transmitting in CW, and the PTT line will not be activated.

CW Directives

While in CW mode, several command functions are active, and cause these actions as indicated:

<Ctrl+C>E Return to receive mode when transmit buffer is empty

<Ctrl+C>L Lock transmit and receive speed to current receive speed

<Ctrl+C>R Return to receive mode immediately. (If the transmit buffer isn't empty, the remaining data will stay in the buffer.)

<Ctrl+C>T Enter transmit mode

<Ctrl+C>U Unlock receive speed to allow tracking of incoming signal. Transmit speed stays at current setting.

<Ctrl+C>X Exit CW, discard any data in the transmit buffer, and return to Command mode.

<Ctrl+C>n Change operating speed (the number n = wpm)

n	speed	n	speed
1	5	6	30
2	10	7	35
3	15	8	40
4	20	9	45
5	25	0	50

To exit CW mode and return to the Command mode, type <Ctrl+C>X.

RTTY

To operate in the radio teletype (RTTY) mode, at the command prompt enter the command RTTY, and return. The baud rate used will be as specified by the command RBAUD. A message indicating the mode and baud rate will be displayed:

—RTTY 45—

and the KAM *XL* will be ready to receive RTTY signals at the indicated baud rate.

To enter RTTY at a baud rate different than that specified by RBAUD, enter the RTTY command and the desired baud rate (e.g., RTTY 75).

Receiving RTTY

RTTY uses 2 signal levels, as do many HF modes, to transfer information. These two signal levels are received as tones, usually called a MARK and SPACE. In the KAM *XL*, the default MARK tone frequency is 2125 HZ, and the SPACE frequency is 2295 HZ. The difference between the MARK and SPACE tones is 170 HZ, usually referred to as the SHIFT. The command SHIFT, sets the difference between the MARK and SPACE. If SHIFT is set to MODEM, any tone frequencies between 50 HZ and 4000 HZ can be used for MARK and SPACE, as long as the frequency of MARK is less than SPACE.

Tuning RTTY signals

When tuning in an RTTY signal, adjust the receivers operating frequency so that the tuning bargraph on the KAM XL lights brightest at both ends. If the received signal is RTTY, but is displayed as garbled characters, the signal may be inverted (space/mark, instead of mark/space). If this is the case, send the directive <Ctrl+C>I to invert the demodulator in the KAM *XL*, or set the receiver to the opposite sideband and retune it to receive the signal again.

Note: IF the command AUTOSTRT is ON, received RTTY data will not be displayed until the characters specified in the MYAUTOST command have been received.

Transmitting RTTY

To transmit RTTY, type <Ctrl+C>T. This causes the KAM *XL* to key your transmitter, the bargraph in the KAM *XL* goes dark, and the transmit LED light. Type the message you wish to send and when you are through, type <Ctrl+C>E. The KAM *XL* will transmit your message and, when the data has been transmitted, return to the receive mode.

Use the <Ctrl+C>n directives listed below to change speeds while operating the RTTY mode.

To leave the RTTY mode and return to Command mode, type <Ctrl+C>X.

RTTY Directives

While in RTTY mode, several command functions are active, and cause these actions as indicated:

<Ctrl+C>E Return to receive mode when the transmit buffer is empty

<Ctrl+C>I Invert received MARK/SPACE signals and invert transmitted MARK/SPACE if using AFSK (SSB)

<Ctrl+C>L Send LETTERS shift character

<Ctrl+C>N Send FIGURES shift character

<Ctrl+C>R Return to receive mode immediately. (If the transmit buffer isn't empty, remaining data will stay in the buffer.)

<Ctrl+C>T Enter transmit mode

<Ctrl+C>X Exit RTTY, discard any data in the transmit buffer, and return to Command mode.

<Ctrl+C>n Change operating speed. n = speed (baud) Entering a zero, selects the default baud as specified in RBAUD.

n	baud rate
1	45
2	50
3	57
4	75
5	100
6	110
7	150
8	200
9	300
0	RBAUD

MARS Feature

When the command CODE RTTY MARS has been set, several special functions are enabled while in RTTY mode.

A. Typing <Ctrl+G> on the keyboard automatically sends (FIGS)JJJJJSSSSS(LTRS) over the radio. This is an attention signal.
B. Upon transmiting, (with <Ctrl+C>T), 5 SPACES followed by <CR><CR><LF> are transmitted before any other data.
C. Typing <Ctrl+P> will signify a page break in a long message by transmitting <CR><CR><LF><LF><LF><LF>.
D. Typing <Ctrl+Z> will transmit the end-of-message signal <CR><CR><LF><LF><LF><LF>NNNN and 12 LTRS shift characters.

To fully comply with the MARS RTTY guidelines published in FM 11-490-7, these commands also need to be set; CRADD ON, LFADD ON, AUTOCR 69, AUTOLF OFF, CRSUP OFF, and LFSUP OFF.

When CRADD and LFADD are set to ON, <CR><CR><LF> are transmitted when the return key is pressed on the terminal. AUTOCR set to 69 causes <CR>CR><LF> to be inserted into transmitted text after 69 characters have been received from the terminal, without a carriage return. These commands insure that transmitted data meets the guidelines.

To display exactly what is received from the other station, set CRSUP OFF and LFSUP OFF so that the KAM *XL* does not suppress any of the received carriage return or line feed characters.

ASCII

Entering the command ASCII, places the KAM *XL* in ASCII receive mode, at the baud rate specified in the ASCBAUD command and will be ready to decode a properly tuned ASCII signal and display the information on the terminal.

The mode and baud rate will be displayed to the terminal:

—ASCII 110—

To operate ASCII at a different baud rate, enter the ASCII command with a desired baud rate (e.g., ASCII 200). The baud rates available are 20 to 1200 baud.

Receiving ASCII

Like RTTY, ASCII uses 2 signal levels to transfer information. These two signal levels are received as tones, usually called a MARK and SPACE. The default MARK tone frequency is 2125 HZ, and the SPACE frequency is 2295 HZ. The difference between the MARK and SPACE tones is 170 HZ, usually referred to as the SHIFT.

The command SHIFT sets the difference between the MARK and SPACE. If SHIFT is set to MODEM, any tone frequencies between 50 HZ and 4000 HZ can be used for MARK and SPACE, as long as the frequency of MARK is less than SPACE. When SHIFT is set to 170, 425, or 850, the Mark tone is 2125 HZ, and the SPACE tone will be 2125 + the specified SHIFT value.

Tuning ASCII signals

When tuning in an ASCII signal, adjust the receivers operating frequency so that the tuning bargraph on the KAM XL lights brightest at both ends. If the received signal is ASCII, but is displayed as garbled characters, the signal may be inverted (space/mark, instead of mark/space). If this is the case, send the directive <Ctrl+C>I to invert the demodulator in the KAM *XL*, or set the receiver to the opposite sideband and retune it to receive the signal again.

Note: If AUTOSTRT is ON, received ASCII will not be displayed until the characters specified by the command MYAUTOST have been received.

To decode and display EMWIN signals, set the ASCII baud rate to 1200 baud, when entering the ASCII mode (i.e. ASCII 1200).

Transmitting ASCII

To transmit ASCII, type <Ctrl+C>T. The transmitter will be keyed, the tuning bargraph will go dark, and the transmit LED will light. Enter the message to be transmitted, then type <Ctrl+C>E. Transmit will stop when the data has all been sent, returning to the receive mode.

While in ASCII mode, the baud rate can be changed by using the <Ctrl+C>n directives listed below.

To leave the ASCII mode and return to Command mode, type <Ctrl+C>X.

ASCII Directives

While in ASCII mode, several command functions are active, and cause these actions as indicated:

<Ctrl+C>E Return to receive mode when transmit buffer is empty.

<Ctrl+C>I Invert received MARK/SPACE signals and invert transmitted MARK/SPACE if using AFSK (SSB)

<Ctrl+C>R Return to receive mode immediately. (If the transmit buffer isn't empty, the remaining data will stay in the buffer.)

<Ctrl+C>T Enter transmit mode

<Ctrl+C>X Exit ASCII, discard any data in the transmit buffer, and return to Command mode.

<Ctrl+C>n Change operating speed. (n = baud rate) Entering a zero, selects the default baud as specified in ASCBAUD.

n	speed (baud)
1	45
2	50
3	57
4	75
5	100
6	110
7	150
8	200
9	300
0	ASCBAUD

AMTOR (includes LAMTOR, FEC, SELFEC, NAVTEX)

AMTOR Operation

Several modes of AMTOR operation are possible. Each AMTOR station is identified by a SELCAL (Selective Call) which is derived from an amateur callsign. The accepted practice in AMTOR is to use the first letter and the last three letters of a callsign as an AMTOR SELCAL. The SELCAL is automatically generated when the KAM *XL* is first initialized, using the callsign entered. The SELCAL can be changed at any time, with the MYSELCAL command.

In addition, the KAM *XL* supports a 7-character SELCAL and generates a unique SELCAL for this mode from its callsign. The KAM *XL* will accept a link from another station with either the 4-character or 7-character SELCAL.

Mode A AMTOR is called ARQ and is a connected mode allowing communication with just ONE other station at a time. The two stations send data back and forth at a rapid interval (every 450 milliseconds); therefore, this mode requires radios capable of switching from receive to transmit and back very rapidly.

Radios that use mechanical relays to switch between receive and transmit, typically do not switch fast enough to operate Mode A AMTOR.

Mode B AMTOR is normally called FEC. This is a broadcast mode, allowing simultaneous reception by several stations. Since there is no back-and-forth transmission between stations as in AMTOR mode A, the switching speed of the radio is not significant. A subset of FEC is called SELFEC—Selective FEC. In this mode, the display of received messages can be limited to only those beginning with the callsign (or name) as specified in the MYSELCAL and MYGROUP commands.

LAMTOR mode is listen-only AMTOR. In this mode, data from other stations communicating with each other using Mode A AMTOR (ARQ), Mode B AMTOR (FEC), SELFEC, or NAVTEX broadcasts, can be displayed.

For more information on AMTOR theory, read the American Radio Relay League Operating Manual.

Mode A (ARQ) Operation

To operate Mode A AMTOR, start from Command Mode (cmd:). Type the command AMTOR and press return. This enters the AMTOR standby mode, and the message “AMTOR STANDBY” will be displayed. In this mode you can monitor other stations transmitting FEC (calling CQ), transmit FEC to call CQ, and respond to a Mode A link request from another station. NOTE: You will not be able to monitor or transmit FEC from this mode if ARQBBS is ON. If AUTOSTRT is ON, you will only copy SELFEC transmissions from other stations if they contain your SELCAL in the transmission.

Calling CQ

To call CQ, type <Ctrl+C>T. The transmitter will be keyed, the tuning bargraph will go dark, and the transmit LED will light. Type a typical CQ message, such as:

CQ CQ CQ CQ DE NØKN NØKN (NNKN)
CQ CQ CQ CQ DE NØKN NØKN (NNKN)
CQ CQ CQ CQ DE NØKN NØKN (NNKN)
SELCAL: NNKN NNKN
PSE K K K

When finished typing the CQ message, end with <Ctrl+C>E. This causes a return to AMTOR standby mode after the message has been sent. And the AMTOR STANDBY message will be displayed to the terminal, and monitoring for link requests or mode B transmissions from other stations will resume.

When a station links to the KAM *XL*, it becomes the Information Receiving Station (IRS), and the station that called is the Information Sending Station (ISS). When the other station transmits data, it will be received and displayed to the terminal.

At some point in the conversation, the other station will send a change-over request to then become the IRS, or receiving station. Normally the other station will make some kind of statement in the message to indicate that he is going to let you send data. Now, as the ISS station, you can send data to him. For instance, he might say, "SO HOW COPY?" then types a +? (change-over), which is transmitted to you.

When the KAM *XL* receives and displays the +?, it becomes the ISS, and can now send data to the other station. When you want the other station to again send data to you, type the +? on your keyboard. The +? (change-over) is sent to the other station which now becomes the ISS station.
At the end of the contact (QSO), one of the two stations must "break the link."

This is equivalent to hanging up a phone at the end of a conversation. To break the link from the KAM *XL*, type the directive <Ctrl+C>D. The AMTOR shutdown sequence will then be sent to the other station, both stations will stop transmitting, and a CWID will be transmitted if the command ARQID is set to a number greater than 0 (zero).

Common practice among operators is that the ISS station sends a short message indicating that he is going to break the link. Usually this consists of something like "Link Down—SK."

Answering a CQ

While in the AMTOR Standby mode, you may see another station calling CQ and want to call that station. You must know the station's SELCAL, and this information is normally sent in the CQ message. In the example above, the station's SELCAL is NNKN. If you want to call this station, you must first leave the AMTOR Standby mode and get the command prompt (cmd:) from your KAM *XL*. To do so, type <Ctrl+C>X.

From the command prompt, type AMTOR NNKN and press return. Your KAM *XL* begins sending the link request to the other station and, after receiving the proper acknowledgements, the message " LINKED TO NNKN" will appear on the screen. You are now the ISS and you may begin typing your message to be transmitted.

From this point on, you will switch back and forth from sending station to receiving station with the changeovers as described above in "Calling CQ." When the conversation is finished, you or the station you are talking to must break the link.

If you want to break the link, type <Ctrl+C>D.

While receiving data from another station as the IRS station, you can “seize” the link and become the ISS station by entering the directive <Ctrl+C>T. When, use the normal +? change-over sequence to again become the IRS.

Mode B (FEC) Operation

To operate Mode B AMTOR, in Command mode (cmd:), type FEC and press return. No message will be displayed when entering FEC. In this mode any FEC transmissions from other station can be received, or FEC can be transmitted. Since FEC is a broadcast mode, transmissions can be copied by several stations at the same time.

To transmit FEC, enter the <Ctrl+C>T directive. This keys your radio, the bargraph on the KAM *XL* goes dark, and the red transmit LED lights. Type the message you want to send. At the conclusion of your message, type <Ctrl+C>E. Your KAM *XL* will transmit your message in FEC mode and return to the receive mode when all of the data has been transmitted.

Mode B (SELFEC) Operation

Receiving Mode B SELFEC

To receive only addressed FEC messages, set the AUTOSTRT command ON, then enter the AMTOR Standby mode or the FEC mode as described above. The KAM *XL* will now copy only Mode B SELFEC transmissions that begin with the specified SELCAL.

When a callsign was entered during autobaud (setup), a SELCAL based on that callsign was automatically calculated and stored. See the MYSELCAL command for details.

Transmitting Mode B SELFEC

To transmit a Mode B SELFEC broadcast, type FEC followed by the SELCAL of the desired receiving station and press return. The KAM *XL* keys the radio, the bargraph goes dark, and the red transmit LED lights. The entered SELCAL will be sent as the preamble to the transmission, followed by any message entered on the keyboard. To return to receive after all of the data has been transmitted, type <Ctrl+C>E. The KAM *XL* will unkey the transmitter and will be ready to receive ANY FEC transmission.

When ready to transmit again, type <Ctrl+C>T. The KAM *XL* will first send the SELCAL entered previously and the next typed message. The SELCAL is transmitted each time a new transmission is started, while in SELFEC mode. To exit SELFEC mode, type <Ctrl+C>X to return to the Command mode.

Listen AMTOR operation

To enter Listen AMTOR mode, in Command mode (cmd:), type LAMTOR and press return. This places the KAM *XL* in a monitor-only mode, enabling display of Mode A, Mode B, SELFEC, or NAVTEX/AMTEX transmissions.

While monitoring a Mode A link between two other stations, parts of those transmissions may be missed or repeated. This occurs because those linked stations are verifying that their data is transferred correctly to each other. There is no way when just monitoring to have the same verification.

If, while monitoring Mode A signals, received characters seem to be garbled, the <Ctrl+C>R directive will force the KAM *XL* to attempt to re-synchronize to the signal.

NOTE: The LAMTOR mode is receive only, and transmit can not be enabled.

Notes on AMTOR operation

An automatic CWID containing the text as specified by the CWIDTEXT command, can be sent during a Mode A link, if desired. Set ARQID to the desired number of minutes between CW IDs.
The CW ID speed is set by the CWSPEED command.

AMTOR is compatible with the SITOR mode used by some commercial stations.

AMTOR directives

While in AMTOR mode, several command directives are active, and cause these actions as indicated:

<Ctrl+C>A Abort link

<Ctrl+C>D Break link and remain in AMTOR Standby

<Ctrl+C>E Return to receive mode when transmit buffer is empty

<Ctrl+C>I Invert received MARK/SPACE signals and invert transmitted MARK/SPACE if using AFSK (SSB)

<Ctrl+C>R Return to receive mode immediately in FEC transmit. (If the transmit buffer isn't empty, the remaining data will remain in the buffer.) Re-sync if monitoring. If linked, inserts +? (changeover) immediately. (If the transmit buffer isn't empty, the remaining data will remain in the buffer.)

<Ctrl+C>T Enter transmit mode—seize ISS status

<Ctrl+C><Ctrl+T> Toggle TRACE mode ON/OFF

<Ctrl+W> Send Who-Are-You inquiry

<Ctrl+C>X Exit AMTOR, discard any data in the transmit buffer, and return to Command mode.

NAVTEX

NAVTEX/AMTEX Theory

Navtex transmissions are, in reality, Mode B AMTOR (FEC). What makes Navtex unique, however, is the actual message format. Navtex stations always transmit on 518 kHz LSB, and are generally located on the coastlines. The same format is now being used by the American Radio Relay League (ARRL) to transmit bulletins on a daily basis. These bulletins are transmitted during scheduled teleprinter bulletins.

At the beginning of a NAVTEX (or AMTEX) transmission, the sending station will send a preamble, identifying the station that is transmitting, the type of message, and the message sequence number. The preamble looks like this:

ZCZC AG25

The ZCZC is always present and indicates the beginning of a Navtex message. The receiving unit sees this as the indication that the identifier is coming next. The components of the identifier, as defined in the NAVTEX documentation, are:

B1 B2 B3 B4

B1 is used to identify the station that is transmitting, and consists of the letters A through Z. B2 indicates the messages class (A through Z). Note that class A, B and D messages must always be printed once. B3 and B4 are the sequence number for the message, and will have values from 00 through 99. Messages with sequence number 00 are always printed. When the message numbers reach 99, they wrap to 01 as the next number.

The following stations may be on the air and transmitting NAVTEX:

Halifax, Nova Scotia
Guam
Boston, MA
Honolulu, HI
New Orleans, LA
Kodiak, AK
Miami, FL
Astoria, OR
San Juan, Puerto Rico
Long Beach, CA
Chesapeake, VA
San Francisco, CA

For NAVTEX messages, the currently assigned message classes are as follows:

A Navigational warnings
B Meteorological warnings (storm warnings)
C Ice reports
D Search and Rescue Information
E Meteorological forecasts

F Pilot messages
G Decca message
H LORAN-C message
I Omega message
J Differential Omega message
Z QRU - no message on hand
K-Y Reserved

NOTE: K has been proposed for "other electronic navigational aid system message."

Once a message has been received from a particular station with less than a specified amount of errors, it will not be printed again, as the receiving system keeps track of the message numbers it has received. If it then sees the same message class and number from the same transmitting station, it will not output the message to the terminal.

For ARRL AMTEX bulletins, the defined B1 codes are as follows:

A ARRL issued bulletins
C CRRL issued bulletins (Canadian)
I IARU issued bulletins
J JARL issued bulletins
S AMSAT issued bulletins
X Miscellaneous

The currently assigned message classes are as follows:

A Emergency bulletins
B Priority bulletins
D Reserved
E DX bulletins
G General bulletins
K Keplarian bulletins
P Propagation forecasts
S Satellite bulletins
X Miscellaneous bulletins

NAVTEX/AMTEX Operation

As in the LAMTOR mode, Navtex is a receive-only mode, to receive and display message broadcasts.

To enter the NAVTEX/AMTEX mode, simply type NAVTEX from the command prompt and press return. At this point, nothing will be displayed to the terminal until a valid NAVTEX message is received.

Several commands affect the display of Navtex messages. They are; NAVSTA, NAVMSG, NAVERR, and NAVCLR.

NAVSTA selects which stations to display messages from (only those selected, or ALL).

NAVMSG selects which message classes to display (only those selected, or ALL).

NAVERR specifies the percent of errors allowed in a received message before considering the message as not being received properly, and discarding it. If message classes A, B, or D are left out of the list of valid message classes to be received, a WARNING message will be displayed, since the NAVTEX specification requires that these classes must be printed at least once.

NAVCLR will clear the buffer which stores message sequence numbers that have been received, allowing all messages to be received again. If the Navtex mode is used infrequently, it is advisable to clear the numbers, since the transmitting station may have already wrapped sequence numbers back around to those that have been received before.

To exit the NAVTEX mode and return to the command prompt, type <Ctrl+C>X. (Do not hold the Control key when you type the X.)

NAVTEX directives

While in NAVTEX mode, a few command directives are active, and cause these actions as indicated:

<Ctrl+C>I Invert received MARK/SPACE signals.

<Ctrl+C>X Exit NAVTEX and return to Command mode.

PACTOR (PTL, PTFEC)

Pactor Operation

Pactor operation is possible in two modes. The first mode, normally referred to as ARQ mode, is a "connected" or linked mode where two stations are in conversation with each other. Complete error checking occurs in this mode and the receiving station will request retransmission of any data frames containing errors. The KAM *XL* uses memory ARQ in this mode to improve reception.

The second mode of operation transmits data in an unconnected (or unlinked) state, allowing several stations to copy the transmission. This is referred to as the FEC mode, and is the mode used for calling CQ or for other PactorFEC broadcast transmissions.

Receiving stations do not use memory ARQ to copy FEC transmissions; therefore, a frame must be copied without any errors in order to be printed. It is possible that complete frames may be missed, when receiving FEC broadcasts.

Tuning Pactor signals

When tuning in a Pactor signal, adjust the receivers operating frequency so that the tuning bargraph on the KAM *XL* lights brightest at both ends.

Monitoring Pactor FEC

Entering the command PACTOR enters the Pactor Standby mode, and displays the message

<PACTOR STANDBY>

NOTE: Since the MONITOR command is ON by default, Pactor FEC or ARQ transmissions from other stations can be monitored and displayed.

Calling CQ or Transmitting FEC

To call CQ, start from the Pactor Standby mode, as in the directions above. To begin transmitting, type <Ctrl+C>T. The transmitter will turn on, and typed characters are transmitted in Pactor FEC mode. Type a CQ message, then type <Ctrl+C>E. When the message has been transmitted, the KAM *XL* will return to the Standby mode, and will be ready to respond automatically if another station attempts to link. A typical Pactor CQ might be:

CQ CQ CQ de NØKN NØKN NØKN
CQ CQ CQ de NØKN NØKN NØKN
CQ CQ CQ de NØKN NØKN NØKN
K K K

Linking to another station

When monitoring Pactor signals, stations may be seen transmitting CQ messages. To issue a link request to that station, first return to Command mode by typing <Ctrl+C>X.

Next, enter the PACTOR command and include the callsign of the station heard transmitting the CQ message. The KAM *XL* will start transmitting a link request to the other station. If the other station has properly acknowledged the link request, message " LINKED TO xxxxxx" will be displayed. Since you initiated the link, you are the Information Sending Station (ISS) and may begin entering a message. When finished, and ready to receive from the other station, type <Ctrl+C>E. A change-over request will be sent to the other station, allowing them to become the ISS station, so that messages they send can be received and displayed.

When the conversation with the other has been completed, one of the two stations must "break the link," or disconnect. To disconnect, type <Ctrl+C>D. It can be entered when you are either the IRS or the ISS. If you are the IRS at the time the disconnect command is entered, a changeover request will be sent first, and then perform the disconnect sequence.

NOTE: When attempting to link with a station which is a long distance away, the Pactor long-path link option may need to be used. It is usually only be required when the other station is more than about 5500 miles away. To issue a long-path Pactor link, precede the callsign of the station with an exclamation point (!), e.g. PACTOR !KBØNYK.

PTLISTEN Mode

Enter the PLISTEN command to enter PACTOR monitor-only mode. It allows reception of PACTOR FEC or ARQ Pactor signals, but will not allow transmitting and no response will be sent to any Pactor link requests.

To exit and return to command mode, type <Ctrl+C>X.

Pactor Directives

While in Pactor mode, several command directives are active, and cause these actions as indicated:

<Ctrl+C>A Abort a link or abort an attempt to link after the first invalid response code.

<Ctrl+C>D Disconnect

<Ctrl+C>E Changeover from ISS to IRS (ARQ mode) when transmit buffer is empty. Return to receive when transmit buffer is empty (FEC Mode).

<Ctrl+C>R Changeover from ISS to IRS (ARQ mode). Changeover is immediate; if data has not all been transmitted, it stays in the transmit buffer.

<Ctrl+C>T Seize the link if IRS (ARQ mode) Enter transmit mode (FEC mode)

<Ctrl+C>X Disconnect the link (if linked), discard any data in the transmit buffer and return to command mode.

<Ctrl+C>0 Set automatic baud rate

<Ctrl+C>1 Switch to 100 baud

<Ctrl+C>2 Switch to 200 baud

<Ctrl+C><Ctrl+T> Toggle TRACE mode ON/OFF

G-TOR (and GMON)

G-TOR operates as a synchronous ARQ mode, like AMTOR and Pactor, with an ARQ cycle of 2.4 seconds and baud rates of 100, 200, or 300 baud. All data frames are 1.92 seconds in duration and contain one control byte and two checksum bytes (CRC). Data frames contain 21 data bytes at100 baud, 45 data bytes at 200 baud, and 69 data bytes at 300 baud. Acknowledgements are 0.160 seconds in duration. The effective performance of two stations linked in G-TOR relies on the combined use of forward error correction, data interleaving, and its ARQ cycle with CRC checking.

G-TOR activity can be found on all the HF bands on frequencies where AMTOR and Pactor modes are used. For example, on 20 meters, activity can generally be found as listed below.

Note that G-TOR, Pactor, and AMTOR may tend to overlap.
CW 14.000 - 14.070 MHz
AMTOR, G-TOR, Pactor 14.072 - 14.085 MHz
RTTY 14.080 - 14.095 MHz
Packet 14.095 - 14.111 MHz

G-TOR Operation

The G-TOR protocol is a linked mode where two stations communicate with each other. Although the G-TOR mode does not incorporate a broadcast mode, G-TOR uses AMTOR FEC for its broadcasts (from G-TOR Standby), such as when calling CQ. If the MONITOR command is ON when entering the G-TOR mode, AMTOR FEC transmissions can be monitored.

The G-TOR mode uses the MARK and SPACE tones. The default values for them are MARK 2125 and SPACE 2295. They can be changed to make better use of filtering and/or IF shift tuning in the radio.

Entering the command GTOR enters the GTOR Standby mode, and displays the message

<GTOR STANDBY>

and will be ready to respond to link requests addressed to the MYGTCALL callsign.

If you now tune your KAM *XL* to a station transmitting AMTOR FEC, you'll be able to copy that transmission. You'll also be ready to receive a link request in G-TOR mode from another station.

To call CQ, type <Ctrl+C>T. The KAM *XL* will enter the AMTOR FEC transmit mode, will key the radio, and start transmitting. Enter a CQ message including your callsign (as set by MYGTCALL) on the keyboard. It is important to indicate in the message that you are asking for a G-TOR contact. For instance, you might send:

CQ CQ CQ DE KBØNYK KBØNYK—-GTOR
CQ CQ CQ DE KBØNYK KBØNYK—-GTOR

PSE ARQ IN GTOR MODE
K K K

After completing the CQ message, type <Ctrl+C>E. This will return the KAM *XL* to G-TOR Standby mode after all of the message has been transmitted.
The ARQBBS command must be set to OFF, to be able to manually initiate transmitting in GTOR mode. If ARQBBS is ON, the PBBS has control of transmitting, and linking stations will be automatically connected to the PBBS.

Tuning G-TOR

G-TOR signals are similar to AMTOR or Pactor signals in that MARK and SPACE tones are used. The BARGRAPH indicator will be lit at both ends when the receiver is properly tuned. When linked to another G-TOR station, the CON LED will be lighted. The speed LED is used in G-TOR to indicate G-TOR speed (green for 100 baud, yellow for 200 baud, and red for 300 baud).

Monitoring G-TOR

In the G-TOR Standby mode, G-TOR CQ calls or other G-TOR FEC broadcasts (which use the AMTOR FEC mode) can be monitored. In order to monitor two stations that are linked to each other in G-TOR mode, use the GMON command.

Linking to another station in G-TOR

When monitoring GTOR signals, stations may be seen transmitting CQ messages. To issue a link request to that station, first return to Command mode by typing <Ctrl+C>X.

Next, enter the GTOR command and include the callsign of the station heard transmitting the CQ message. The KAM *XL* will start transmitting a link request to the other station. If the other station has properly acknowledged the link request, message " LINKED TO xxxxxx" will be displayed. Since you initiated the link, you are the Information Sending Station (ISS) and may begin entering a message. When finished, and ready to receive from the other station, type <Ctrl+C>E. A change-over request will be sent to the other station, allowing them to become the ISS station, so that messages they send can be received and displayed.

When the conversation with the other has been completed, one of the two stations must "break the link," or disconnect. To disconnect, type <Ctrl+C>D. It can be entered when you are either the IRS or the ISS. If you are the IRS at the time the disconnect command is entered, a changeover request will be sent first, and then perform the disconnect sequence.

Speed changes

The data rate is automatically selected in G-TOR, based on the quality of the link between the two stations. A link will always begin at 100 baud. If the receiving station then detects a number of correctly received frames, as set by GTUP, it will request a speed change up to 300 baud. When operating at 300 baud or 200 baud, the receiving station will request a lower speed when it receives a number of incorrect frames in a row, as set by GTDOWN.

While linked to another station, the receiving station (IRS) controls the speed of the link. If you are the IRS, you can force the other station to send at 100 baud by using the <Ctrl+C>1 directive. The speed change request will be sent to the other station in the receive acknowledgments. Once the speed

change occurs, the KAM *XL* will not direct the other station to speed up again until the next changeover has occurred or the auto-speed directive <Ctrl+C>0 has been entered.

If the speed change fails to occur for any reason, the speed will revert to the one used prior to the <Ctrl+C>1 directive.

If you are the IRS and wish to increase the data speed, use the <Ctrl+C>2 directive to switch to 200 baud, or the <Ctrl+C>3 directive to switch to 300 baud. The speed change request will be sent to the other station, and if the request is successful, a request decrease the data speed will not automatically be sent even if the band conditions change, unless the auto-speed directive <Ctrl+C>0 has been entered. It is recommended that the auto-speed mode be used, so that the link won't fail immediately due to changes in band conditions. When data between stations is not flowing at a higher speed, it will automatically be decreased to retain the link and pass the data at a lower speed.

G-TOR mailbox

The KAM *XL* allows other stations to access its PBBS (mailbox) in GTOR mode, when its ARQBBS command has been set to ON, and it is in GTOR Standby mode. When ARQBBS is on, the PBBS controls transmitting, and any received link requests will be answered by the PBBS.

Formatting Data

When operating G-TOR, the following commands will apply in formatting transmitted data;

CRADD adds a CR after every CR sent from the terminal.
LFADD adds a LF after every CR sent from the terminal.
CRSUP suppresses EVERY OTHER consecutive CR.
LFSUP suppresses all LF characters in data sent to the terminal.

Remember that to send special characters to another station, those that are defined as control characters in the KAM *XL*, they must be "passed" as data (by preceding them with <Ctrl+V>) in order to transmit them.

Hints for G-TOR Operation

When choosing to use the FSK mode of a transceiver, the FSK output from the KAM *XL* must be connected to the FSK input of the transmitter. The actual tones transmitted are controlled by radio in this mode, and the MARK and SPACE commands in the KAM *XL* must be set to match the tones received. For instance, the default MARK and SPACE in the Yaesu FT-1000 are 2110 Hz for MARK and 2310 Hz for SPACE.

Caution: When linked to another station and desire to break the link, use the <Ctrl+C>A directive. This directive will attempt to send the proper QRT sequence to the other station, but if the KAM *XL* receives an invalid response sequence (unrecognized CS code), it will immediately return to GTOR Standby and discard any pending data. When attempting to break the link with the <Ctrl+C>X directive, the KAM *XL* will attempt the QRT sequence, but will only return to packet mode after receiving the proper acknowledgement (CS code) or after GTERRS attempts to break the link. This could take a long time.

When attempting to link to a nearby station, it is possible that the transceivers (yours and the other station's) may not switch fast enough to permit a link to occur.

In this case, both stations should set their TXDTOR command to a higher value (try 7, 8, or 9). This has been proven to allow links on very short paths with very slow-switching radios.

NOTE: Do not change TXDTOR while linked. This is only possible with Host mode programs, but changing these values while linked will cause the link to fail.

Binary Files and G-TOR

The G-TOR mode provides complete data transparency, allowing binary file transfers between G-TOR stations. The ability to send and receive binary files in this mode will depend on the terminal program used. Since G-TOR provides complete error detection and correction, binary files should be sent from the terminal program in a raw data mode—that is, no error correction protocol (such as X-modem).

Host mode programs simply include the raw binary data in the data stream; however, if using a standard telephone modem type of communications program, it is possible to allow the KAM *XL* to send raw binary data. To do this, once linked to another station in G-TOR, type the <Ctrl+C>B directive. This places the KAM *XL* in a data transparent mode, allowing ALL characters to be transmitted (ASCII or BINARY) from the computer.

CAUTION: When this has been done, no special characters are recognized by the KAM *XL*, and no directives are available. Thus, typing <Ctrl+C>E, for instance, will NOT cause a changeover; it will simply transmit the <Ctrl+C> and E as characters to the other station. To exit this data transparency mode, send a modem break signal. Most telephone communications programs support this feature. (Procomm Plus, for instance, sends a modem break when entering <Alt+B>. If your communications program does not support the modem break, you will not be able to leave the data transparency mode.

The KAM *XL* will automatically exit data transparency if the other station breaks the link, or anytime the linked state is exited (due to errors or too many retries).

Summary of GTOR Directives

While in GTOR mode, several command directives are active, and cause these actions as indicated:

<Ctrl+C>A Abort a link or abort an attempt to link after the first invalid response code.

<Ctrl+C>B Enter data transparency mode (for binary file transfer)

<Ctrl+C>D Disconnect from the station you are linked to. A changeover will be performed if required, and the KAM *XL* will return to GTOR Standby mode.

<Ctrl+C>E (ARQ mode) Changeover from ISS to IRS when all pending data has been transmitted. (FEC mode—AMTOR FEC) Return to receive when transmit buffer is empty (used when calling CQ).

<Ctrl+C>R When linked, changeover from ISS to IRS immediately. Return to receive immediately in FEC mode.

<Ctrl+C>T Seize the link if IRS (ARQ mode) Enter AMTOR FEC transmit mode

<Ctrl+C>X Disconnect the link (if linked). When in STANDBY mode, discard any data in the transmit buffer and return to command mode.

<Ctrl+C>0 Set automatic baud rate selection

<Ctrl+C>1 Force 100 baud operation (IRS only)

<Ctrl+C>2 Force 200 baud operation (IRS only)

<Ctrl+C>3 Force 300 baud operation (IRS only)

<Ctrl+C><Ctrl+T> Toggle TRACE mode ON/OFF

MODEM BREAK Exit data transparency mode

PSK31

At the command prompt, type PSK31, and ENTER.

Upon entering PSK31 mode, the mode indication is displayed:

<125-2000-3875>

The KAM *XL* is now in receive mode can decode a properly tuned PSK31 signal, and will display monitored information on the terminal.

The default modulation type is PSK. To switch to QPSK, enter the <Ctrl+C>Q directive. To return to PSK modulation, enter <Ctrl+C>P.

Tuning PSK31 Signals

When first entering PSK mode, the tuning bargraph will display an audio bandwidth from 125 Hz to 3875 Hz, centered at 2000 Hz. In this audio bandwidth, several PSK signals may be detected.

If a signal is indicated by the lighting of LED number 4 on the tuning BARGRAPH, enter <Ctrl+C>4 to zoom-in to that signal. The audio center frequency will be adjusted accordingly, and the new audio bandwidth and center frequency will be displayed. The bandwidth of the BARGRAPH display will be narrowed by about half, after each zoom-in. If that signal is centered, enter <Ctrl+C>6 to zoom-in closer to that signal.

Received PSK31 signals can also be tuned in by manually adjusting the receiver. Since PSK31 is a very narrow signal, a fine tuning rate on the receiver (and a steady hand) is very helpful.

A PSK squelch control is activated by the <Ctrl+C> and > or < keys. Increase the squelch level with <Ctrl+C>>, or decrease it with <Ctrl+C><. A default squelch setting is controlled by the setting of the SQUELCH command.

Transmitting PSK31

To transmit, type <Ctrl+C>T. This keys the transmitter, blanks the bargraph (while the BARGRAPH command is set to RCV), and the transmit LED is lighted. Type the message to send and <Ctrl+C>E to return to receive mode when the message has been transmitted.

Exiting PSK mode

To leave the PSK31 mode and return to Command mode, type <Ctrl+C>X.

PSK31 Directives

While in PSK-31 mode, several command directives are active, and cause these actions as indicated:

<Ctrl+C>E Return to receive mode when the transmit buffer is empty

<Ctrl+C>P Selects PSK modulation.

<Ctrl+C>Q Selects QPSK modulation.

<Ctrl+C>R Return to receive mode immediately. (If the transmit buffer isn't empty, remaining data will stay in the buffer.) If sent while still in receive mode, will cause a re-sync to the signal currently in the center of the tuning BARGRAPH.

<Ctrl+C>T Enter transmit mode

<Ctrl+C>1, <Ctrl+C>2, <Ctrl+C>3, <Ctrl+C>4, <Ctrl+C>5, <Ctrl+C>7, <Ctrl+C>8, <Ctrl+C>9, <Ctrl+C>0; Tuning BARGRAPH LED positions, to zoom in to, when tuning individual signals.

<Ctrl+C>6 Zoom IN, when the desired signal is near the center of the tuning bargraph.

<Ctrl+C>X Exit and return to Command mode (packet). Any data left in the transmit buffer at this time is thrown away.

<Ctrl+C>Z Zoom OUT, to show a larger frequency bandwidth in the tuning BARGRAPH.

<Ctrl+C>< Decrease squelch level

<Ctrl+C>> Increase squelch level

Kantronics KAM *XL* Command Set

All TNC commands are documented below, in alphabetical order. The underlined characters in a command's name show the short-cut version of the command. Required or optional parameters are shown after the command name, as are allowable ranges of values, where appropriate.

8BITCONV {ON|OFF}

Default ON

When ON, transmission of 8-bit data in CONVERS Mode is allowed.
When OFF, the 8th data bit is stripped (set to 0) in all transmitted and received data.
KA-Node, DIGIPEAT, and PBBS operations are unaffected by this command.

See also: TRANS

ABAUD n (n = 0|300|600|1200|2400|4800|9600|19200|38400)

Default 0

Sets the baud rate used for data through the TNC serial port.

When set to 0, the AUTOBAUD routine will run upon power-up. This routine looks for an asterisk (*) character from the attached computer to set the ABAUD parameter. When the asterisk is received from the computer or terminal, ABAUD will be set to match the baud rate of the terminal.

When ABAUD is changed from one baud rate to another, a SOFT reset is required to enable the new setting. This is done either by sending a RESET command, or powering the unit OFF and back ON.

To make a change of the communication baud rate between the terminal and the KAM *XL*, change the ABAUD setting first, then change the baud rate setting in the terminal program in the computer.

If, after changing the ABAUD setting, the terminal can not be set to the same baud rate, a hard reset will be required (which will erase ALL parameter changes, returning them to factory default values), to allow the KAM *XL* to be re-initialized. (See HARD RESET section.)

See also: RESET, RESTORE

AMTOR {xxxx{xxxxx}}

Immediate

Entering the AMTOR command alone enters the AMTOR STANDBY mode. In STANDBY mode, the KAM *XL* can respond to a link request from another station, when the request is addressed to any of its MYSELCAL variables. It can display received MODE B (FEC) signals, or can transmit MODE B (if ARQBBS is OFF). STANDBY mode can also be used to monitor for idle (FREE) signals, from commercial SITOR shore stations (such as WLO or Globe Wireless).

Entering AMTOR and the SELCAL of another station (at the command prompt, cmd:) will start a link sequence to that station.

The AMTOR mode in the KAM *XL* is compatible with its commercial cousin, called SITOR.

See also: ARQBBS, ARQID, ARQTIME, AUTOSTRT, CANLINE, CWID, FEC, FREEQUAL, LAMTOR, MISSCHAR, MYGROUPS, MYSELCAL, PMODE, REPHASE, TXDTOR, TXDFEC, and the AMTOR and HF E-MAIL sections of the OPERATING MODES chapter.

ANALOG

Immediate

The response to the ANALOG command is in the following form:

AN0/AN1/AN2/AN3/AN4/AN5/AN6/AN7

Displays a decimal number, as specified in the command RANGE, for each of eight analog inputs to the TELEMETRY port.

The 0-255 decimal value corresponds to an input voltage in the range of 0 to +3.3 volts. The decimal value range of each analog input can be set with the RANGE command.

Data can be gathered from a remote site by (successfully) connecting to MYREMOTE and then issuing the ANALOG command.

A packet beacon, containing samples of the ANALOG inputs, can be transmitted in at regular intervals, a specified by the TELEMETRY command.

See also: MYREMOTE, TELEMETRY, RANGE, and REMOTE ACCESS in the OPERATING MODES chapter.

ARQBBS {ON|OFF}

Default OFF

When set to ON, the PBBS will automatically respond when other stations link to the KAM *XL*, when it is in STANDBY state in the AMTOR, G-TOR, PACTOR (or TOR) ARQ modes.

When OFF, the PBBS can only be accessed in packet mode.

Note: if ARQBBS is ON, transmitting is controlled by the PBBS, and can not be enabled manually from the terminal.

See also: ARQID, PBBS.

ARQID n (n = 0-31 minutes)

Default 9

Sets the time interval for an automatic CW ID when operating AMTOR, G-TOR, or PACTOR, ARQ modes.

The CW ID, contains the text as set in the CWIDTEXT command, and is transmitted at the speed set by the CWSPEED command.

Setting ARQID to 0 disables the automatic ID.

See also: ARQBBS, CWID, CWIDTEXT.

ARQTIME n (n = 1-10)

Default 2

Sets the timeout interval when attempting to link to another station in AMTOR ARQ mode. The interval is set in increments of 64 ARQ cycles, approximately 28.8 seconds.

See also: AMTOR.

ASCBAUD n (n = 20-500 baud)

Default 110

Sets the default baud rate in ASCII mode, when the ASCII command is entered with no baud rate specified.

See also: ASCII.

ASCII [n] (n = 20 - 1200 baud)

Immediate

Enters ASCII mode. If the optional value n is specified, ASCII mode is started at that baud rate.

When the ASCII command is entered alone, the baud rate specified in the ASCBAUD command is used.

See also: ASCBAUD, AUTOSTRT, CANLINE, PMODE, and the ASCII section of the OPERATING MODES chapter.

AUTOCR n (n = 0-255 characters)

Default 0

A carriage return <CR> character is automatically inserted after n characters are transmitted in the RTTY, ASCII, AMTOR, G-TOR, or PACTOR, modes. Setting AUTOCR to 0 disables automatic carriage returns.

AUTOLF {ON|OFF}

Default ON

When set to ON, a line feed is added after each carriage return, in data sent to the terminal.

When set to OFF, line feed characters will not be added.

If the terminal does not automatically advance to a new line after a carriage return is received (and line overprinting occurs), set this command to ON.

This command affects only the data sent to the terminal, not data sent to the radio.

See also: CR, LFADD

AUTOSTRT {ON|OFF}

Default OFF

When set to ON, and operating in RTTY or ASCII mode, display of received information will only start after the characters specified in the MYAUTOST command have been received. Display will continue until four "N"s are received to signify the end of the message, or when the receive signal has been lost for 30 seconds.

In the AMTOR or FEC modes, only AMTOR SELFEC messages containing any of the SELCALs as specified in the MYSELCAL or MYGROUP commands will be displayed. A loss of lock will cause display of received data to stop.

When set to OFF, all characters are displayed when received.

See also: FEC, MYAUTOST, MYGROUP, MYSELCAL.

AX25L2V2 {ON|OFF}

Multi-Port

Default ON/ON

Provides compatibility with all known packet units implementing the AX.25 protocol.

When set to ON, Level 2 Version 2 protocol is implemented and the TNC will automatically adapt to whichever version the connecting station is using.

When set to OFF, Level 2 Version 1 is implemented. Set this command to OFF when digipeating through other units which do not digipeat version 2 packets. Set this command OFF when using several digipeaters (not nodes) to send packets, or when conditions are marginal between the two stations involved.

NOTE: Changing this setting after connecting to another station will have no effect on the current connection.

The major difference in V1 and V2 protocol is the method used to handle retries. In the connected mode, if a packet is sent and not acknowledged, Version 1 will re-send the entire packet and then disconnect if the RETRY count is reached. Version 2 will first send a poll, the response to this poll will determine if the packet was received. It is possible that the ACK was collided with and therefore the data packet does not need to be re-sent. If the ACK shows that the data packet was not received, it will be re-transmitted. Each time a poll is answered the TRIES count is reset to 0. If the RETRY count is reached, version 2 will attempt to re-connect unless RELINK is OFF. If the re-connect attempt is unsuccessful, then version 2 will issue a disconnect.

See also: RELINK, RETRY, TRIES

For more information, see the book AX.25 “Amateur Packet-Radio Link-Layer Protocol Version 2.0” October 1984, which can be obtained from the ARRL.

AXDELAY n/n (n = 0-255)

Multi-Port

Default 0/0

The value of "n" is the number of 10 millisecond intervals to wait, in addition to TXDELAY, after keying the transmitter and before data is sent.

This additional key-up delay may be needed when operating packet through a standard "voice" audio repeater.

See also: AXHANG

AXHANG n/n (n = 0-255)

Multi-Port

Default 0/0

When audio repeaters with a long hang time are used in the packet path, this command can be used to bypass added key-up delay specified by the AXDELAY command. If a packet has been heard within the AXHANG period (indicating that the repeater is still transmitting), it will not add the AXDELAY to the key-up time of its response packet.

Each "n" increment specifies 10 millisecond of delay.

See also: AXDELAY

BARGRAPH {ON|OFF|RCV}

Default RCV

When set to ON, the tuning bargraph is active during receive and transmit.

When set to OFF, the tuning bargraph is disabled, and will not light.

When set to RCV, the tuning bargraph lights in receive mode only.

Note: If HBAUD is set to 0 (zero) for port 1, the tuning bargraph will not light in packet mode. It will only light when a non-packet HF mode has been selected.

See also: HBAUD

BEACON [EVERY|AFTER] n / [EVERY|AFTER] n (n = 0-255 minutes)

Multi-Port

Default EVERY 0/EVERY 0

Sets the interval of time (in minutes) to transmit a beacon packet, containing the text as specified in the BTEXT command. The beacon will be transmitted VIA any digipeaters specified by the UNPROTO command.

When the keyword “EVERY” is used, a beacon packet will be sent every n minutes, when the channel is available.

When the keyword AFTER is used, a beacon packet will be sent ONCE after the specified interval when no channel activity has been detected. This AFTER option can be used to maintain some packet activity on a channel, but will not continue to transmit beacons while the channel is busy with normal packet communications.

A value of 0 turns the beacon OFF.

See also: BTEXT, UNPROTO.

BITS n (n = $00-$FF)

Default $00

Specifies the bits to be inverted when receiving a (5 bit) RTTY or (8 bit) ASCII signal.

This may enable correct decoding of RTTY or ASCII signals that have some bits inverted.

For example, setting BITS $F0 (bit pattern 1111000) would invert the first four bits of received ASCII or RTTY signals.

Data transmitted in the RTTY and ASCII modes are not affected by this command.

BKONDEL {ON|OFF}

Default ON

When set to ON, the sequence backspace-space-backspace is sent to the attached terminal when the character specified by the DELETE command is entered.

When set to OFF, the backslash character "\" is sent to the terminal when the DELETE character is entered.

See also: DELETE, REDISPLAY

BLT n {EVERY|AFTER}hh:mm:ss [START hh:mm:ss] / {EVERY|AFTER}hh:mm:ss [START hh:mm:ss]

(n = 1-4)

Multi-Port

Default EVERY 00:00:00/EVERY 00:00:00
(For each of the 4 LT buffers)

Sets the beacon interval for the associated LT (Location Text) buffer.

n specifies the LT buffer number (1-4).

When the keyword EVERY is used, the LT buffer will be transmitted at the interval specified by the hh:mm:ss parameter (in hours:minutes:seconds).

If the optional START parameter (followed by a time (hh:mm:ss) in 24 hour format) is used, the BLT beacon will not start until the specified time. The beacon will then be transmitted according to the BLT interval specified. If the current time is past the specified START time, the beacon will start at the next scheduled interval.

When the keyword AFTER is used, the beacon will be transmitted once after no activity is detected on the channel for hh:mm:ss time. The optional START parameter is not allowed when AFTER is used.

BLT beacons are transmitted VIA any digipeaters specified by the LTP command.

See also: LTP.

BREAK {ON|OFF}

Default OFF

When set to ON, a modem break signal from the terminal will cause a return to COMMAND mode from Converse or Transparent Mode.

When set to OFF, a modem break signal has no effect. See also: COMMAND

BTEXT text/text (0-128 characters)

Multi-Port

Default (blank/blank)

BTEXT specifies the text to be transmitted in a BEACON packet. Any combination of characters and spaces may be used, up to a maximum of 128. Control characters (such as a carriage return) can be entered in the text by preceding them with the PASS character.

Entering “BTEXT %" will clear BTEXT.

See also: BEACON, PASS.

BUDLIST [ON|OFF] [NONE | {+|-}{<|>}call | call1,call2,...]

Default OFF NONE

Used to determine which received packets will be displayed.

When set to OFF or NONE, BUDLIST allows display of monitored packets from all stations, even if the callsign of that station is listed.

When set to ON, only those packets monitored from any of the callsigns in the list will be displayed. The maximum number of callsigns allowed in BUDLIST is 10. Up to 10 callsigns may be entered at once, using the format shown after the command name, and the new list of from 1 to 10 callsigns will replace whatever list was there before.

Single callsigns can be added to or removed from the list, with the appropriate command entry (BUDLIST +callsign, or BUDLIST –callsign).

A callsign entered without a SSID will match any SSID of that callsign. To match a specific SSID only, enter the callsign with that SSID: for example, callsign-n, where n = 0-15.

More selective monitoring is enabled when the command entry includes a callsign (or two callsigns) combined with ">" and/or "<" characters. For example, entering ">callsign" will enable monitoring of packets TO that callsign, assuming BUDLIST is ON. Entering "<callsign" will enable monitoring of packets FROM the callsign, entering "callsign1>callsign2" will enable monitoring of packets from callsign1 to callsign2, and entering "callsign1<>callsign2" will enable monitoring of packets from callsign1 to callsign2 and vice versa.

Note that an entry of callsign1>callsign2 or callsign1<>callsign2 counts as 2 of the 10 allowed callsigns.

See also: MONITOR, SUPLIST

CALIBRATe

Immediate

Used to transmit test signals on radio ports 1 or 2.

Use the STATUS command first, to determine the current radio port. To use the other radio port, use the STREAMSW command character or the PORT command (a PORT command change requires a soft reset to enable the change), to change ports.

When transmitting in CALIBRATe mode, the transmit audio output level can be adjusted to provide the proper amount of transmit audio to the radio.

The uses of the CALIBRATE command are explained in the Calibration section.

Note that the CALIBRATE function is not available when in HOST mode.

See also: PORT, STATUS, STREAMSW, XMITLVL, and the CALIBRATe section in the appendix.

CANLINE n (n = $00-$FF)

Default $18 <Ctrl+X>

Sets the character used to cancel the current un-ENTERed line.

When in Convers or Command Mode entering the CANLINE character will cancel (delete) all characters input from the keyboard back to the last un-PASSed carriage return (unless in Convers Mode with CPACTIME turned ON and PACTIME has expired, or PACLEN has been reached).

When in TRANSPARENT mode, the CANLINE character is transmitted as data.

See also: CANPAC, CPACTIME, PACLEN, PASS, SENDPAC, TRANS.

CANPAC n (n = $00-$FF)

Default $19 <Ctrl+Y>

Sets the character used to cancel the last untransmitted packet. When in the Convers Mode, entering the CANPAC character will cancel all keyboard input, back to the last un-PASSed SENDPAC character (unless CPACTIME is turned ON and PACTIME has expired, or PACLEN has been reached).

When in Command Mode, entering the CANPAC character will stop output back to the terminal. Entering the character a second time, re-enables normal output.

When in TRANSPARENT mode, the CANPAC character is transmitted as data.

See also: CANLINE, CPACTIME, PACLEN, SENDPAC, TRANS

CD {INTERNAL|EXTERNAL / INTERNAL|EXTERNAL}

Multi-Port

Default INTERNAL/INTERNAL

Selects the type of carrier detect to use for detecting received signals through the radio ports.

When set to INTERNAL, energy and data type carrier detects are used. Receive audio can be from either a speaker type output, or fixed-level unsquelched output from a radio. The XCD function remains active and can be used to prevent packet transmission.

When set to EXTERNAL, a carrier detect signal must be supplied by an external device through the XCD pin on the radio port. A connection to ground, indicates active carrier detect.

See also: SWP

CHECK n/n (n = 0-255)

Multi-Port

Default 0/0 (disabled)

When set to number greater than 0, this "timeout" command is used to send a packet requiring acknowledgement (a poll), n * 10 seconds after there has been no data exchange with a connected station. If an acknowledgement has not been received after a number of polls (set by RETRY), a standard disconnect sequence will be initiated.

One purpose of this command is to insure that the TNC will disconnect from another station after a given time, if the link to that station has failed (for whatever reason).

When using Version 1 (AX25L2V2 OFF), a CHECK timeout will initiate an immediate disconnect.

See also: AX25L2V2, KNTIMER, RELINK, RNRTIME, TRIES

CMDTIME n (n = 0-15 seconds)

Default 1

Sets the guard time for entry of the required characters, as defined in COMMAND, to exit Transparent interface mode and binary transfer in G-TOR mode, and return to command mode.

If CMDTIME is set to zero the only way to exit from Transparent Mode is a modem break signal, assuming BREAK is set to ON, and entering the COMMAND character will cause that character to be transmitted as data. If BREAK is also set to OFF, a Hard Reset must be performed to clear all current parameter changes, and allow the unit to be re-initialized.

See also: COMMAND, TRANS, BREAK.

CMSG {ON|OFF|DISC|PBBS}

Multi-Port

Default OFF/OFF

When set to ON, the text defined in the CTEXT command will be sent to the station connecting to MYCALL.

When set to DISC, CTEXT will be sent to the connecting station, and then disconnected.

When set to PBBS, the CTEXT will be sent to the connecting station, and then the connection will automatically be transferred to the PBBS (if the mailbox has been enabled, and is not already connected to another station). If the PBBS is not available, a BUSY message will be sent, and the station will be disconnected.

When set to OFF, CTEXT will not be sent to the connecting station.

See also: CTEXT, PBBS

CODE [ITA2|US|LCRTTY|APLINK|MARS]

Default ITA2

Immediate

Selects the character set used in the RTTY and AMTOR modes.

ITA2 selects the International Telegraph Alphabet Number 2, US selects the U.S. character set, LCRTTY provides a complete upper/lower case character set, and APLINK uses the full printable character set developed by G3PLX and W5SMM (currently used on APLINK BBS systems).

When set to MARS, special characters can be used as required by the Military Affiliate Radio System. (See the MARS Feature section of this manual.)

COMMAND n (n = $00-$FF)

Default $03 <Ctrl+C>

Defines the Command Mode entry character.

When in converse mode, entering a single COMMAND character will cause a return to command mode.

When in TRANSPARENT or GPS interface modes, three COMMAND characters must be sent within CMDTIME, to return to command mode.

See also: CMDTIME, CONVERS, TRANS

CONLIST [ON|OFF] [NONE|{+|-}callsign | callsign1,callsign2...]

Default OFF NONE

CONLIST is used to determine which stations (callsigns) may use your station for ANY purpose, including digipeating. The maximum number of callsigns allowed in CONLIST is 10.

A list of up to 10 callsigns may be entered at once, by entering the CONLIST command and a list of callsigns. A callsign entered without a SSID will match any SSID of that callsign. To match a specific callsign and SSID only, enter that callsign with that SSID.

Single callsigns can be added to the list, by entering the CONLIST command with +callsign (as long as there is room for the new callsign in the list), or removed from the list with the CONLIST command and –callsign.

When ON, and a callsign or list of callsigns has been entered, the TNC will recognize only those packets received with a callsign that appears in the list, and connections to any callsign that is not in the list, will not be allowed.

When OFF, the TNC will process all packets.

To remove all items from the current list, enter CONLIST NONE.

CONMODE {CONVERS|TRANS}

Default CONVERS

Controls the communication mode of connected packet links to other stations, if the NOMODE command is set to OFF.

If already in Convers or Transparent Mode (which may be set by the PMODE command) when the connection is completed, the communication mode will not be changed. If part of a command has been entered when the connection is completed, the mode change will not take place until the command or CANLINE has been entered.

See also: CANLINE, CONNECT, CONVERS, NOMODE, TRANS.

CONNECT call1 [VIA call2,call3,...,call9]

Immediate

Used to establish a "connect" link with another station in packet mode, using the current selected radio port. A STATUS command can be sent to determine which radio port and stream is currently selected.

call1 = callsign to be connected to, and any callsigns entered after VIA, are digipeater stations to use (when needed) to reach the other station. . A maximum of 8 digipeater addresses (callsigns or aliases) can be specified.

Each callsign may also have an optional Secondary Station Identifier (SSID) specified as -n, where n = 1-15. The digipeat callsigns are specified in the order in which they are to relay transmitted packets.

Upon successful connect, the mode set by CONMODE will be entered, if NOMODE is OFF.

Connect requests may only be initiated in the Command Mode and the current stream will be used.

If a connect is in progress or already established, the connect path may be changed by simply re-issuing the CONNECT command with the new path. This must be done on the same stream as the original connect. CAUTION: packets en route between your station and the reconnected station may be lost.

Entering the CONNECT command alone, will display the status of the current stream.

See also: CONMODE, CONOK, DBLDISC, MAXUSERS, NOMODE, RETRY, RING, STATUS, STREAMSW, and PORT

CONOK {ON|OFF/ON|OFF}

Multi-Port

Default ON/ON

When set to ON, connect requests from other TNCs can be automatically acknowledged.

When set to OFF, connects from other TNCs are not allowed. The requesting station will be sent a <DM> packet, and a message "connect request: (callsign of station attempting to connect)" will be output to the terminal.

When CONOK is OFF, the internal PBBS will still acknowledge a connect request from the local terminal.

See also: CONMODE, CONNECT, INTFACE, MAXUSERS, MONITOR, NOMODE, USERS.

CONPERM {ON|OFF}

Default OFF

Setting CONPERM to ON forces the connection on the current stream to become permanent and causes the TNC to attempt to reconnect when it is restarted. CONPERMED connections are shown with /P in the status display, which is generated by the STATUS command.

Entering the CONPERM command when no connection to another exists, will do nothing. See also: STATUS

CONVERS

Immediate

Entering the CONVERS command will cause entry into Conversational Mode on the current I/O stream. If a connection to another station exists on the current stream, characters can be sent to that station. If the current stream is not connected, typed characters are transmitted in an unconnected information packet.

Hint: K is the same as CONVERS, for quicker entry.

To return to command mode, enter the COMMAND character <CTRL+C>.

See also: K, COMMAND

CPACTIME {ON|OFF}

Default OFF

Determines when a packet is transmitted in CONVERS mode.

When set to OFF, packets are transmitted when the SENDPAC character is entered or when PACLEN is achieved.

When set to ON, packets are transmitted at intervals determined by PACTIME (as in TRANSPARENT mode), but the local editing and echoing features of CONVERS Mode remain enabled.

See also: CONVERS, CR, K, PACLEN, PACTIME, SENDPAC, TRANS.

CR {ON|OFF}

Default ON

When set to ON, the SENDPAC character (normally carriage return) is appended to all packets sent in Convers Mode, except when PACLEN is exceeded. Setting CR ON and SENDPAC to $0D results in a natural conversation mode. Each line is sent when a "CR" is entered and arrives at its destination with the "CR" appended to the end of the line. To avoid overprinting, AUTOLF may need to be ON at the receiving end.

See also: AUTOLF, LFADD, SENDPAC.

CRADD {ON|OFF}

Default OFF

When set to ON, and in RTTY, ASCII, G-TOR, or PACTOR modes, a carriage return will be added to every carriage return received from the terminal to be transmitted.

When OFF, no extra carriage returns are added to transmitted data. See also: LFADD

CRSUP {ON|OFF}

Default OFF

When ON, every other carriage return in received data is suppressed (when no data is between them) before sending the data to the terminal.

When OFF, all carriage return characters are left in the received data as it is sent to the terminal.

When mechanical teleprinter machines were used, it was normal practice to transmit two carriage return characters, to allow time for the mechanical carriage to return to its starting position. This command can be turned on to filter out that “extra” carriage return.

See also: AUTOLF, LFSUP.

CSTAMP {ON|OFF}

Default OFF

When ON, the daytime stamp is printed with all "*** CONNECTED TO" and "*** DISCONNECTED" messages displayed to the terminal.

See also: CONNECT, DAYTIME, DISCONNECT, MSTAMP.

CTEXT text (0-128 characters)

Default (blank)

Specifies the text to be sent in to a connecting station in response to a connect request, provided that the parameter CMSG is not OFF.

Enter any combination of characters and spaces up to maximum length of 128. Control characters can be entered by using the PASS character.

Entering a single "%" will clear CTEXT. (Does not apply to the CTEXT for the K-NET node)

See also: CMSG, CONNECT, PASS.

CTRL [a/b/c/d/e/f/g] {OFF|ON|LONG|n|MUTE m} (n = 1 - 20) (m = 1 - 9)

Immediate

Controls the status of two output control lines (switches) in the TELEMETRY port, radio port 1 and radio port 2.

Each control line may be turned ON (connection to ground), turned OFF (open connection), pulsed ON for 1.5 seconds, or pulsed ON "n" times where each pulse is 0.1 second in duration.

With the MUTE option, that control line can be used to mute voice repeater outputs. This parameter is saved in battery backed RAM. When MUTE is specified, the output control line will be a filtered version of the RCV led, with about a 10*m msec attack time. If the RCV led is active for m consecutive samples at 10 msec intervals, the CTRL line will activate; if the RCV led is off at any sample, the CTRL line will open. These are open drain outputs and are pulled to ground when active.

For more information, see the section on "Connecting to your Radio" in this manual.

Do not allow more than 200mA of current in this circuit or a voltage exceeding +50VDC.

CW [n] (n = 5-99 wpm)

Default 20

Immediate

Entering CW alone enters the CW mode.

If n is not specified, the speed set in CWSPEED will be used for transmit and receive.

Specifying n will enter the CW mode at the desired speed. When receiving, CW signals will be decoded automatically within approximately +/-20 WPM from the current selected speed.

See also: CANLINE, CWAUDIO, CWBAND, CWSPEED, CWTONE, MORSE, PMODE, and PROSIGN.

CWBAND n (n = 10-1000 Hz)

Default 200

Sets the audio bandwidth filter for CW reception.

CWFARNSW n (n = 5-99 wpm)

Default 15 wpm

Sets the character speed used when operating CW and the CWSPEED is less than CWFARNSW.

Characters are transmitted at this speed, with additional time added between characters, to lower the CW word rate to your selected speed.

See also: CWSPEED.

CWID [EVERY|AFTER / EVERY|AFTER] n (n = 0-255 minutes)

Multi-Port

Default EVERY 0 / EVERY 0

Specifies the interval for automatic CW station identification, containing the text characters defined in the CWIDTEXT command.

Setting a value greater than 0, activates the CWID under the conditions specified. Each increment specifies a 1 minute interval.

If the optional keyword Every is used, a CWID will be transmitted every n minutes.

If the optional keyword AFTER is used, a CWID will be transmitted ONCE after the specified interval with no channel activity.

Setting a value of 0 disables the CWID.

See also: MYCALL, CWIDTEXT

CWIDTEXT text (0-15 characters)

Default DE (MYCALL)

Sets the text to be transmitted during automatic CWID, or during an ARQID (in AMTOR, G-TOR, and PACTOR, modes).

The text will be transmitted at intervals specified by the CWID or ARQID commands.

See also: ARQID, CWID

CWOUTPUT {OFF|{KEY}{PTT}{AUDIO}}

Default KEY

When set to KEY, the CWKEY output line (port 1, pin 4) is used to transmit the CW signal.

When set to AUDIO, the CW signal will be transmitted by AFSK (instead of using the CWKEY line output). This setting is used to transmit an audio CW signal with FM or SSB radios that do not have a CW mode or CW key connection.

When the option PTT is entered, the PTT line will be keyed (ON) while transmitting CW. This is required when transmitting CW by audio tone (AFSK).

When set to OFF, there is no transmit CW output signal, but receive in the CW mode is unaffected.

CWSPEED n (n = 5-99 wpm)

Default 20 wpm

Sets the CW speed in CW mode, and during a CWID. If set to a value less than CWFARNS, Farnsworth word spacing is used when transmitting.

See also: CW, CWFARNS.

CWTONE n (N = 50-2000 Hz)

Default 750 Hz

Sets the center frequency of the CW receive filter, and sets the transmitted AFSK CW tone frequency when CWOUTPUT is set to AUDIO.

See also: CWOUTPUT.

CWWEIGHT n (n = 0-15)

Default 0

Adds weighting to a transmitted CW signal.

The normal DASH is three times the length of the DOT. If n is set to a number higher than 0, the DASH will be three times the length of a DOT PLUS (n*0.1) DOT times longer than normal.

For example, if n is set to 7, then 7 * 0.1 (or 0.7), and the DASH would be 3.7 times the length of the DOT.

DAMA {ON|OFF}

Default OFF

When ON, the TNC can operate as a DAMA slave station, once connection is established with a DAMA master station.

When OFF, DAMA is disabled and the TNC operates in standard Packet mode (i.e., CSMA -Carrier Sense Multiple Access).

See also: DAMACHCK, DAMA section in the Operating Modes chapter.

DAMACHCK n (n = 0 to 255)

Multi-Port

Default 18/18

Sets the DAMA timeout timer in 10-second increments. If connected to a DAMA master station (that is, operating in DAMA slave mode) and the master does not poll for data before the DAMACHCK timer expires, the TNC will revert to CSMA operation and disconnect from the DAMA master.

See also: DAMA

DAYSTR {(date/time display format) and/or text}

Default mm/dd/yy hh:mm:ss

Sets the FORMAT of the date/time display, and for all time stamps, including the PBBS, KA-Node, MHEARD list, etc., using the lower case letters m, d, h, y, and s, as described below.

The lower-case characters (m, d, y, h, and s) will be replaced with the corresponding date/time data from the internal clock.

The lower-case m will be replaced with the minutes the first time it appears after a lower-case h.

If h, m, y, d, or s is specified as a single character and the day/time value is less than 10, it will be displayed as a single digit. If specified as two characters, the result will be a two digit display for values under 10.

If the month is entered as three lower-case m characters, it will be displayed as the first three characters of the month name (JUL).

If the year is specified as four lower-case y characters, it will be displayed as 4 digits.

A small number of other UPPER CASE text characters (such as a time zone) or numbers may be entered, and will be displayed as and where entered.

Remember that ALL lower case m, d, y, h, and s characters will be replaced by actual values. Some examples (the first line is the default entry) of setting the DAYSTR command and the resulting time/date display are:

DAYSTR setting	Displayed Date/Time
mm/dd/yy hh:mm:ss	07/08/01 12:14:22
m.d.y h:mm:ss	7.8.1 12:14:22
d.mm.yy h:mm	8.07.01 12:14
mmm d yyyy h:mm CST	JUL 8 2001 12:14 CST
TIME: hh:mm DATE: mmm d, yyyy	TIME: 12:14 DATE: JUL 8, 2001

DO NOT enter an actual date or time in DAYSTR (use DAYTIME to set or change the date and time). If actual date and time number characters are entered with the DAYSTR command, only those characters will be displayed and the clock will appear to stop. If this has happened, simply re-enter the DAYSTR with the lower case characters as shown in one of the lines in the left column above.

See also: DAYTIME

DAYTIME yymmddhhmm[ss]

DAYTIME is used to set or change the date and time.

When date and time is entered in the specified input format, the values entered are used to set the software clock/calendar.

The software clock/calendar is then used for the various “heard” lists, “stamp” functions, and for messages received in the PBBS.

When entering the daytime digits, enter them with two digits each for the year, month, day, hour, minute, and (optionally) seconds, with no spaces, dashes, or slashes, and in that order.

If DAYTIME is entered alone, the date and time is displayed using the format defined by the DAYSTR command.

See also: CSTAMP, DAYTWEAK, DAYSTR, MHEARD, MSTAMP, PBHEARD.

DAYTWEAK n (n = 0-15)

Default 8

Adjusts the software clock, if needed, for accurate time keeping.

Increasing the parameter will slow the clock, decreasing the parameter will speed up the clock. Each count corresponds to .40 seconds increase or decrease per 24 hours. Ambient temperature will affect the clock to some degree.

DAYTWEAK has no effect on the battery-backed clock (BBC); that clock is set only by using the DAYTIME command. The software clock stops when a soft reset or powering off occurs, and upon power on the software clock is set to the value of the BBC.

DBLDISC {ON|OFF}

Default OFF

Determines how many disconnects will be issued when the Disconnect (DISC) command is used.

When set to OFF, only one disconnect will be sent when DISC is issued.

When set to ON, allows your station to disconnect from a distant station immediately when you issue the Disconnect (D) command. By issuing two Disconnects instead of one with your Disconnect (D) command, your station will not wait for the distant station to acknowledge a Disconnect (D) command (i.e., the first one sent) before disconnecting.

See also: DISCONNE

DELETE n (n = $00-$FF)

Default $08 <Ctrl+H>

Sets the character to be used as the delete character. When this character is typed, the last input character is deleted. The most common settings are $08 (backspace) and $7F (delete).

See also: BKONDEL

DIDDLE {ON|OFF}

Default ON

When ON, a diddle character is sent when no characters are available from the keyboard or buffer during transmission in RTTY or ASCII mode. In RTTY, the diddle character is the LTRS character; in ASCII, the diddle character is a null.

When OFF, and no characters are in the transmit buffer, a constant MARK frequency is transmitted.

DIGIPEAT {ON|UIONLY|OFF}

Default ON

When ON, any received packet specifying a digipeater callsign that matches MYCALL, MYALIAS, or MYNODE (if KA-Node is active) as the next digipeater in line, will be retransmitted.

Each station included in the digipeat list relays the packet in the order specified in the address field. Digipeating takes place concurrently with other TNC operations and does not interfere with normal connected operation of the station.

When OFF, digipeat operations (via MYCALL, MYALIAS, or MYNODE) are disabled.

When set to UIONLY, only UI frames from other stations can be digipeated, connect requests and connected type packets are ignored.

See also: HID, MYALIAS, MYCALL, MYNODE

DISCONNE [MYPBBS|MYREMOTE|MYNODE x]

(x=KA-Node)

Immediate

When entered without options, DISCONNE will initiate an immediate disconnect request on the current I/O stream. A successful disconnect results in the display of *** DISCONNECTED.

If the RETRY count is exceeded while waiting for the connected station to acknowledge, the TNC moves to the disconnected state on that stream. Entering a second Disconnect command before RETRY has expired will result in an immediate disconnect, but may leave the other station thinking it is still connected. Disconnect messages are not displayed when the TNC is in Transparent Mode.

If DISCONNE MYPBBS is entered, the personal mailbox will disconnect the current user of the mailbox.

If DISCONNE MYNODE x (x = KA-Node circuit A, B, C, etc.) is entered, the node will disconnect the stations linked through the node on the circuit specified.

If DISCONNE MYREMOTE is entered, the station connected to the MYREMOTE callsign will be disconnected. This is also a valid remote command, and can be used to end your own remote connection.

See also: DBLDISC, NEWMODE, RETRY, STATUS

DISPLAY [c] {ASYNC|AMTOR|ASCII|CHAR|CW|GPS|GT|ID|LINK|MONITOR |NET|PBBS|PT|RTTY|TIMING|XTRA}

Immediate

When entered alone, a list of all command and parameter settings will be displayed.

When entered with a specific subgroup, a display of command and parameter settings relating to that group will be displayed.

Subclasses of related parameters are:

ASYNC: asynchronous port parameters (TNC to computer)
AMTOR: parameters affecting AMTOR (ARQ and FEC) and NAVTEX/AMTEX modes
ASCII: parameters affecting ASCII mode
CHAR: special TNC characters
CW: parameters affecting CW mode
GPS: parameters related to GPS operations
GT: parameters affecting G-TOR mode
ID: ID parameters
LINK: parameters affecting packet link (TNC to TNC)
MONITOR: monitor parameters
PBBS: mailbox commands
PT: parameters affecting Pactor mode
RTTY: parameters affecting RTTY mode
TIMING: timing parameters
XTRA: some transmission related parameters, such as FSKINV
When entering DISPLAY and a single command name, the current setting for that command will be displayed.

See also: Display Listings section

DWAIT n (n = 0-255)

Multi-Port

Default 0/0

Defines a delay to be used to avoid collisions with digipeated packets.

The value entered for "n" is the number of 10 ms intervals, after last hearing data on the channel, to wait before transmitting packets.

It is used to allow other digipeater stations to have higher-priority access to the channel. However, using the commands PERSIST and SLOTTIME (instead of DWAIT), can provide a better way to avoid packet collisions.

See also: DIGIPEAT, PERSIST, SLOTTIME.

ECHO {ON|OFF}

Default ON

When ON, characters sent from the terminal are echoed back and displayed.

If each typed character is displayed twice, set ECHO to OFF.

See also: BKONDEL, FLOW.

ESCAPE {ON|OFF}

Default OFF

Specifies the character displayed when an escape character ($1B) is received in a packet.

When OFF, $1B is displayed (usually as a left-pointing arrow). This is useful if your terminal program interprets ESC characters as screen positioning commands (ANSI).

When ON, a received escape character is displayed as a dollar sign ($).

FEC [xxxx[xxxxx][callsign]]

Immediate

When entered alone, starts the FEC receive mode.

When an optional xxxx[xxxxx] selcal is specified, a SLEFEC transmission is initiated. The optional xxxx[xxxxx} can be any of the following:

AMTOR (476) SELCAL (4 characters, 4 digits or 5 digits)
AMTOR (625) SELCAL (7 characters or 9 digits)

See also: AMTOR, AUTOSTRT, CANLINE, LAMTOR, PMODE, TXDFEC.

FILTER {ON|OFF}

Multi-Port

Default OFF/OFF

When ON, control characters (hex $00-$1F) which may be present in monitored packets are not displayed. All control characters except carriage return ($0D) and line feed ($0A) will be filtered.

When OFF, all monitored characters can be displayed, which can cause an erratic display when monitoring packets from stations performing file transfers, node-to-node packets, or BBS-to-BBS packets.

DOES NOT affect receipt of control characters in packets received from a "connected" station.

See also: MONITOR

FLOW {ON|OFF}

Default ON

When ON, any character entered from the terminal will halt output to the terminal, until the current packet or command is completed by SENDPAC, PACLEN, or PACTIME. Canceling the current input with CANLINE, or by typing the REDISPLAY-line character, will also cause the display to resume.

When OFF, display of received data will continue while sending from the keyboard. When using a split-screen terminal program (with separated outgoing and incoming data areas), set FLOW and ECHO both to OFF, to allow received data to be displayed while data is sent to the TNC's transmit buffer.

See also: CANLINE, CANPAC, CPACTIME, ECHO, PACLEN, REDISPLAY, SENDPAC

FRACK n (n = 1-15 seconds)

Multi-Port

Default 4/4

Sets a delay of n seconds before re-sending an unacknowledged packet.

Each increment specifies 1 second intervals. After transmitting a packet which requires acknowledgment, the TNC waits FRACK seconds before incrementing the retry counter and sending the packet again. If the retry count (specified by the RETRY command) is exceeded, the current operation is aborted. If the packet address includes digipeaters, the time between retries is adjusted to FRACK * ((2 * m) + 1) where m is the number of digipeater stations specified. When the retried packet is sent, a random wait time is also added to avoid conditions where two units repeatedly collide with each other.

The FRACK timer begins when PTT is released (the packet has been sent) and is suspended when data carrier from the radio is present or when transmitting.

See also: CONNECT, RETRY.

FREEQUAL n (n = 0-31)

Default 20

Sets the maximum number of bits in error allowed when scanning for free signals (AMTOR standby mode only), and is used to detect commercial shore stations free signal transmissions in SITOR.

When more than n errors are detected, nothing is output. When less than or equal to n errors are detected, <FREESIG ...> is displayed.

When set to 0, scanning for free signals is disabled.

For more detail, see HF E-Mail in the non-packet modes of operation section.

FSKINV {ON|OFF}

Default OFF

Controls the polarity of the FSK output.

When OFF, MARK is open-collector and SPACE is ground.
When ON, the polarity of MARK and SPACE is reversed.

FULLDUP {ON|OFF|LOOPBACK}

Multi-Port

Default OFF/OFF

When OFF (i.e., half duplex), carrier detect status is used to determine channel availability.

When ON, the carrier detect status does not inhibit transmission.

Full duplex operation is usually used with a separate receiver and transmitter, on different channels.

When set to LOOPBACK, operation is the same as half duplex (i.e., FULLDUP OFF), but the receive circuit remains active while transmitting. This allows simple testing of the modem, by connecting wire between the transmit and receive audio pins on the radio connector to verify operation of the modem circuitry.

GMON

Immediate

Enters the G-TOR monitor mode, and allows monitoring G-TOR QSOs between other stations.

Enter <Ctrl+C>X to return to command mode.

GPSHEAD n string (n = 1-4) (string up to 8 chars)

Default 1 $GPGGA (string 2, 3, and 4 = <blank>)

Defines which GPS NMEA sentence types will be stored in the LT buffers. n (1-4) determines which buffer will be used to store the data, and string is a NMEA sentence header.

When a matching header is detected in GPS data, that sentence (up to 128 characters) is stored in the associated LT buffer.

To clear one of the four strings, enter the GPSHEAD command and buffer number, and nothing else, then press the ENTER key.

See also: BLT, LT, LTP, LTRACK

GPSINIT string (string up to 128 characters)

Default (blank)

Defines a string, which will be sent to the attached GPS unit upon power-up. This may be used to initialize or configure a GPS unit to provide only selected information.

To send more than one string, enter a <Ctrl+N> at the end of each sentence, and the TNC will send a CR/LF sequence to the GPS unit.

Enter the GPSINIT command and a single % to clear the string.

See also: GPSHEAD, INTFACE.

GPSPORT [baud] [NORMAL|INVERTED][CHECKSUM|NOCHECK]

Default 0 NORMAL CHECKSUM

When set to a non-zero value, the AUX port is used as a GPS I/O port, at the specified baud rate. Valid baud rates are 0, 300, 600, 1200, 2400, or 4800.

When NORMAL is specified, the sense (polarity) of the input is RS-232 (RS-232 voltages or 0-5v of the same polarity). Most GPS devices with data output have RS-232 or compatible output.

When INVERTED is specified, the input polarity is opposite of RS-232 (such as in true TTL signals).

When CHECKSUM is specified, only GPS sentences having valid checksums will be be accepted.

When NOCHECK is specified, all GPS sentences, with or without valid checksums, can be accepted.

Not all GPS units will append checksums to the GPS sentences that they send. Some GPS sentences are required to include a checksum while others do not.

See also: GPSINIT

GPSTIME {OFF|VALID|ON} {GGA|GLL|RMC|ZDA}

Default VALID RMC

Specifies how the internal real-time clock will be set from a GPS device.

When set to OFF, the internal real-time clock is not set from GPS NMEA strings.

When set to VALID, the internal real-time clock can only be set if the valid bit in the specified string is set (meaning that position has been acquired).

When set to ON, time and date is acquired from the specified string.

In any case, the specified string must include a valid checksum. The real-time clock will not be updated if the time received in a string is the same as the last time received. The

GGA and GLL strings do not include a date, the ZDA string does not include a valid bit, and some GPS units do not include a valid bit in the GLL string.

GTDOWN n (n = 2-30)

Default 6

Sets the number of consecutive bad G-TOR frames received, before decreasing speed to the next lower baud rate (from 300 to 200 or 200 to 100).

GTERRS n (n = 30-255)

Default 40

Sets the time-out attempts for G-TOR. When attempting to link with another station, the unit times out and returns to standby mode, after n attempts without a response.

When already linked, reception of n consecutive faulty frames results in a timeout.

GTFUZZY n (n = 0-3)

Default 3

Sets the maximum number of bits in a G-TOR data acknowledgement that may be corrupted.

GTOR [xxxxxxxxxx]

Immediate

Entering the G-TOR command alone, will enter G-TOR Standby mode, to monitor for an incoming link request (to the MYGTCALL), to transmit an FEC broadcast (as when sending a CQ message), or monitor FEC broadcasts from other stations (if MONITOR is set to ON).

Entering the G-TOR command with a callsign, will initiate a link attempt with station xxxxxxxxxx.

To discontinue a link attempt or break an existing link, use the <Ctrl+C>D directive, which will cause a return to G-TOR Standby mode, or use the <Ctrl+C>X directive, which will exit G-TOR and return to command mode (cmd: prompt).

NOTE: If ARQBBS is ON, the PBBS has control of transmitting, preventing manual transmit control. Also see: ARQBBS, ARQID, CWIDTEXT.

GTTRIES n (n = 0-9)

Default 2

Sets the maximum number of attempts to increase speed.

If unsuccessful after n attempts, will return to the previous G-TOR speed until receiving GTUP consecutive good frames.

GTUP n (n = 2-30)

Default 3

Sets the required number of consecutive good frames to be received, before trying to increase speed from 100 to 200 or 200 to 300 baud.

See also: GTTRIES.

HBAUD n/n (n = 300, 400, 600, 1200, 4800, 9600, 19200, 38400)

Multi-Port

Default 300/1200

Specifies the packet data baud rate, for each radio port.

The value entered first (before the slash character) is for port 2, the value after the slash is for port 1.

HBAUD affects only the radio port baud rates, and is independent of the terminal baud rate specified with ABAUD.

HEADERLN {ON|OFF}

Default ON

Sets the display format for monitored packets.

When ON, a carriage return is inserted between the header and the text in the display of monitored packets. This causes the packet header and time stamp (if on) to be displayed on one line, with the packet text displayed below it on the next line.

When OFF, monitored packet data will follow the header on the same line.

See also: CSTAMP, MCON, MONITOR, MSTAMP.

HELP [command]

Immediate

Entering the HELP command alone (or ?) will display a listing of all of the command names.

Entering HELP and a single command name will display a brief description of that command.

Using a wild card in the HELP command, such as "Help C*" will display brief descriptions of all commands beginning with C.

Entering HELP HELP, will display brief descriptions of all commands.

See also: DISPLAY

HID {ON|OFF}

Multi-Port

Default ON/ON

When set to ON, an ID packet will be sent every 9.5 minutes, while any packets are transmitted from your station.

When set to OFF, periodic identification packets will not be sent.

This command should be ON if digipeating with an alias callsign is enabled, or if the KA-Node or PBBS are enabled. These functions can use a callsign or an alias name.

The HID transmission will include the valid callsign (as set in MYCALL), as well as the callsigns and aliases of all other enabled functions.

See also: DIGIPEAT, ID, MYALIAS, MYCALL, MYNODE, MYPBBS, NUMNODES, PBBS.

HTEXT text

Default blank

Defines the hierarchical routing information used by the PBBS in messages forwarded from the PBBS to another BBS or mailbox.

A hierarchical address consists of your (sub-state, if used), state, country, and continent codes, separated by periods. Do not enter your callsign or the first period of your packet address.

See the PBBS (mailbox) section of the Modes of Operation chapter for more details.

Entering HTEXT % will clear any previously entered text.

Note: The PBBS will not be able to forward or reverse forward messages from other mailboxes or BBSs, unless HTEXT has been set. See also: PBFORWRD.

ID

Immediate

When entered, an identification (ID) packet is transmitted.

The ID packet is transmitted as an unnumbered information <UI> packet addressed to "ID", and contains the station identification as set in MYCALL, and the callsigns or aliases of all enabled functions (MYALIAS, MYGATE, MYNODE, MYPBBS). It will be digipeated via any addresses specified in the UNPROTO command.

The MYCALL will include a /R if DIGIPEAT is ON, MYALIAS/D (if a digipeater alias is entered), MYGATE/G (if the digipeat gateway is enabled), MYNODE/N (if the KA-Node is enabled), and MYPBBS/B (if the PBBS is enabled).

See also: HID, UNPROTO

INTFACE {TERMINAL|HOST|BBS|KISS|XKISS}

Default TERMINAL

Sets the mode of operation for the RS-232 port upon power-up or after a reset.

When set to TERMINAL, the full command set of the TNC is available.

When set to BBS, communication is the same as in TERMINAL mode, but certain messages are not displayed (i.e. ***connect request, ***FRMR, etc) for greater compatibility with full-service BBS programs such as WØRLI, WA7MBL, CBBS, etc.

When set to HOST, communication is in HOST frames only. All commands remain available, and operation of two modes at once through the radio ports are possible (packet on one port and a non-packet HF mode on the other port). For more information, see the HOST Operation section.

When set to KISS, communication is in KISS frames only, using software that implements the KISS code specified by Phil Karn. For more information, see the KISS Operation section.

When set to XKISS, communication is in KISS frames only, using software that implements the G8BPQ extended KISS protocol. For more information, see the KISS Operation section.

For instructions on exiting HOST, KISS, or XKISS modes, see the "Modes of Operation" chapter of this manual.

NOTE: After changing the setting to HOST, KISS, or XKISS, a soft reset is required to enable the new interface mode.

See also: RESET, Operating Modes sections.

INVERT {ON|OFF}

Default OFF

When ON, signals received in RTTY, ASCII, or AMTOR, and signals transmitted using AFSK, are inverted.

While in RTTY, ASCII, or AMTOR mode, entering a <Ctrl+C>I directive will toggle INVERT ON and OFF.

K

Immediate

Same as CONVERS. Causes entry into Conversational Mode on the current I/O stream.

See also: CONVERS

KNTIMER n (n = 0-255 minutes)

Default 15 minutes

After n minutes of no activity (data) on a KA-Node circuit, that circuit (both the input and output sides) will be disconnected.

Setting KNTIMER to 0 disables this feature.

See also: RNRTIME

KNXCON {ON|OFF}

Default OFF

When OFF, the cross-connect function in the KA-Node (from one radio port to the other) is disabled, and the Xconnect command will not be shown.

When ON, the Xconnect function is enabled, allowing users of the KA-Node to cross-connect from one radio port to the other (requires both ports to be in packet mode).

See also: NUMNODES, MYNODE.

LAMTOR

Immediate

Enters the receive only Listen AMTOR mode, for monitoring or receiving FEC, SELFEC, or ARQ signals from other stations. Transmit can not be initiated.

See also: AMTOR, FEC, MISSCHAR.

LCOK {ON|OFF}

Default ON

When ON, both upper and lower case characters are displayed.

When OFF, all lower case characters will be translated to upper case before being displayed to the terminal. (does not apply in Packet Transparent Mode)

LFADD {ON|OFF}

Default OFF

When set to ON, a line-feed character will be inserted after each CR transmitted in data mode.

When OFF, line-feed characters are not added to transmit data.

LFSUP {ON|OFF}

Default OFF

When ON, line-feed characters received from other stations are filtered out (suppressed), and are not displayed.

When OFF, the line-feeds received from the other station are not suppressed and are displayed to the terminal as received.

See also: AUTOLF, CRSUP

LGETCHAR $xx

Default $05 <Ctrl+E>

Specifies the character used to display the current contents of the LT buffers (in command or in converse modes), the same function as LT RESTART.

Programs such as APRS use this character to gather NMEA data, that has been captured and stored in the TNC.

LLIST [ON|OFF] [NONE|{+|-}callsign|callsign1,callsign2...]

Default OFF NONE

When ON, and a callsign or list of up to 10 callsigns is entered, those callsigns will be ignored, and can NOT use this TNC for ANY purpose, including digipeating. In addition, connections will not be possible to any station that in the list.

A single callsign can be added to (LLIST +callsign) the list, so long as there is room for the new callsign on the list, or removed from (LLIST -callsign) the list.

Enter LLIST NONE, to remove all callsigns from the list.

A callsign entered without a SSID will match any SSID of that callsign. To match a specific SSID only, enter the callsign with that SSID: for example, callsign-n, where n = 0-15.

LOWTONES

Default OFF

When set to ON, European low-tones are used.

LT n text (n = 1-4) (text up to 128 chars)

Default blank (for n = 1-4)

Entering LT alone will result in display of all 4 LT buffers.

The LT buffers (Location Text buffers), are used to store data from a GPS receiver (or other device sending data in the NMEA-0183 format), as specified by the GPSHEAD command.

The LT buffers can also accept text entered manually, such as your location coordinates, or any other message to be transmitted at intervals specified by the BLT command.

To clear any one of the 4 LT buffers, enter "LT n %", where "n" is the number of the buffer.

See also: BLT, GPSHEAD, LTP, LTRACK.

LTP n dest [via call1[,call2,...]] (n = 1-4)

Multi-Port

Default GPS/GPS (for n = 1-4)

Sets a destination, and any digipeaters (up to 8) to be used when transmitting each of the 4 LT buffers.

The default destination is GPS, but could be set to APRS, LOCATE, POSIT, or any other destination name or callsign, as recommended by the local area APRS/GPS users.

See also: LT

LTRACK n [LT1] [LT2] [LT3] [LT4] [SYSOP] [TIME]

Default 0

(n = Kbytes of RAM)

Allocates memory for a special tracking buffer used to store LT messages (limited by available RAM).

Specifying the LT1 through LT4 parameters determines which LT buffers will be stored in the tracking buffer, at the interval specified by each buffers respective BLT setting.

If SYSOP is specified, only a user with SYSOP privileges may access the LTRACK buffer.

If TIME is specified, a time stamp will be included, in front of each LT message.

The LTRACK buffer can only be accessed by first connecting to the mailbox (MYPBBS), and using the mailbox command LTR (List TRacking buffer). To see the syntax of this command, type HELP at the PBBS prompt.

See also: LTP, BLT, GPS operation section, PBBS operation section

MALL {ON|OFF}

Multi-Port

Default ON/ON

When ON, display of monitored packets will include connected and unconnected types of packets from other stations (if MONITOR is also ON).

When OFF, display of monitored packets will include only unconnected packets (UI frames).

See also: MONITOR

MARK n (n = 50-4000 Hz)

Default 2125 Hz

Sets the MARK tone frequency.

The MARK command must be set less than the SPACE command.

Note: The TNC specifications are for MARK values from 50 through 2400. Higher values (to 4000) are for experimental use.

See also: SPACE.

MAXFRAME n (n = 1-7)

Multi-Port

Default 4/4

Sets the maximum number of information packets, which can be outstanding (sent and not acknowledged) at any time.

A single transmission can contain MAXFRAME number of packets, and no new data packets can be transmitted until acknowledgement has been received. See also: PACLEN.

MAXUSERS n (n = 1-26)

Multi-Port

Default 10/10

Allocates the buffer memory required for the maximum number of simultaneous packet connections (to or from MYCALL) allowed on each radio port.

Changing the value of MAXUSERS will cause a soft reset (to change the memory allocation). MAXUSERS can not be changed while any packet connections exist.

Entering a value of 0 for either radio port, will disable that radio port. Except in a special case, when both ports are set to 0 (MAXUSERS 0/0), which leaves both radio ports enabled but allows only one packet connect at any time. This option is included for BBS services, which are able to accept only one user at a time.

See also: STATUS, STREAMSW, USERS.

MBEACON {ON|OFF}

Multi-Port

Default ON/ON

When ON, monitored packets addressed to Beacon or ID will be displayed (if MONITOR is also ON).

When OFF, monitored Beacon and ID packets, will not be displayed.

See also: BEACON, ID, MONITOR

MCOM {ON|OFF}

Multi-Port

Default ON/ON

When ON, monitored supervisory (control) packets will be displayed (if MONITOR is also ON).

Control packets are distinguished from information packets by the "<>" and "<<>>" character sets appended to the packet header. A letter is included with these characters, to denote the type of control packet received, e.g. <<c>> - a connect request packet.

The types of control packets are listed below.
<C> Connect request
<D> Disconnect request
<DM> Disconnected Mode
<UA> Unnumbered Acknowledge

In addition, the following bracketed information will be added to the Information packets as appropriate:
<UI> Unconnected Information frame
<Is> Information frame (connected);
s = send sequence number

For details on control packets, see the book “AX.25 Amateur Packet-Radio Link-Layer Protocol Version 2.0” October 1984, available from the ARRL.

See also: AX25L2V2, MONITOR, MRESP

MCON {ON|OFF}

Multi-Port

Default OFF/OFF

When ON, all eligible monitored packets (as determined by other monitor commands) will be displayed.

When OFF, and connected to another station, monitored packets will not be displayed. Only the data from the connected station (on the current selected stream) will be displayed.

When OFF, and not connected, all eligible packets will be displayed.

Any header information displayed will be determined by the settings of STREAMEV and STREAMCA.

See also: MONITOR, STATUS, STREAMCA, STREAMEV.

MHEADER {ON|OFF}

Multi-Port

Default ON/ON

When ON, the display monitored packets will include the packet headers.

When OFF, the display of monitored packets will not include the packet headers, and only the data contained in the packets (in I and UI frames) are displayed. The BUDLIST command can be used to restrict the display of monitored packets to those from selected callsigns.

See also: MONITOR, MCON, MBEACON, MALL, SUPLIST, BUDLIST

MHEARD [SHORT|LONG|CLEAR]

Immediate

When entered alone, displays a short list of callsigns heard in monitored packets, with the date/time the station was last heard. Callsigns listed with an *, indicates that the station was heard via a digipeater.

If the S (short) option is used, then only the callsigns of stations heard will be displayed.

If the L (long) option is used, all callsigns contained in the received packet including the digipeater paths, are displayed.

If the C option is used, the list is cleared.

Whenever PASSALL is ON, packets will not be checked for errors and no additions will be made to the MHEARD list.

See also: DAYTIME, PASSALL

MISSCHAR n (n = $00-$FF)

Default $20 (space)

Defines the character displayed when received character is invalid or unrecognized, when operating in AMTOR or NAVTEX modes.

See also: AMTOR, FEC, LAMTOR, NAVTEX.

MONITOR {ON|OFF}

Multi-Port

Default ON/ON

When ON, eligible monitored packets are displayed, according to the settings of MALL, MBEACON, MCOM, MCON, MRESP, MRPT, and MXMIT, commands, unless prohibited by SUPLIST, BUDLIST, or LLIST.

All monitor functions are disabled in the Transparent Mode.
When OFF, only packets resulting from a connect (connection) to the TNC will be displayed.

See also: BUDLIST, HEADERLN, LLIST, MALL, MBEACON, MCOM, MCON, MHEADER, MRESP, MRPT, MSTAMP, PID, SUPLIST

MORSE code TX RX

When the MORSE command is entered alone, the list of current defined special characters is displayed, as shown below.

Those codes that have not already been defined (those with $00 settings), can be set to transmit a desired ASCII character when entered, and/or display a desired ASCII character when received. Codes already defined can not be changed.

When entering a code, the asterisk (*) is entered as a DOT, and the hyphen (-) is entered as a DASH.

The TX and RX columns represent an ASCII character value (can be entered in either DECIMAL or HEXADECIMAL). TX is the ASCII character transmitted when the associated code is entered. RX is the ASCII character displayed when the associated code is received. When two character values are entered together, those characters are displayed together.

Codes available for definition by the MORSE command are:

MORSE

CODE	TX	RX	CODE	TX	RX
**-	$00	$00	*-*-	$2A(*)	$4141(AA)
--*	$00	$00	--	$00	$00
***-*	$21(!)	$534E(SN)	**-**	$00	$00
**-*-	$00	$00	**-*	$00	$00
*-***	$25(%)	$4153(AS)	*-**-	$00	$00
--*	$2B(+)	$4152(AR)	*-*-	$00	$00
*-**	$00	$00	*-*-	$00	$00
--	$00	$00	-**-*	$2F(/)	$2F(/)
-**-	$00	$00	-*-**	$00	$00
-*-*-	$26(&)	$4B41(KA)	-*-*	$28(()	$28(()
-*--	$00	$00	-**-	$00	$00
-*-*	$00	$00	- *-	$00	$00
--*-	$00	$00	***-*-	$23(#)	$534B(SK)
*-***-	$00	$00			

See also: CW, PROSOGN, ASCII character value chart.

MRESP {ON|OFF}

Multi-Port

Default ON/ON

When ON, monitored packets include the AX.25 response packets listed below, if MONITOR and MCOM are ON.

If connected, MCON must also be on. The bracketed information will appear at the end of the header information. The "<" and "<<" characters are used to bracket and denote packets received as version 1 or version 2, respectively.

For example, "<<RR1>>" denotes a version 2 packet -(poll). In addition upper case characters are used to designate commands (polls) and lower case characters are used to denote responses for RR, REJ, and RNR.

For example, "<<rr1>>" is a response in version 2.
<FRMR> Frame Reject
<REJr> Reject, r = received sequence number
<RNRr> Device busy, r = received sequence number
<RRr> Receive Ready, r = received sequence number

In addition, the following bracketed information will be added to the Information packets as appropriate:

<I(s or r)> Information frame (connected);
s = send sequence number,
r = received sequence number

See also: AX25L2V2, MCOM, MONITOR

For more information, see the book “AX.25 Amateur Packet-Radio Link-Layer Protocol Version 2.0” October 1984, which may be obtained from the ARRL.

MRPT {ON|OFF}

Multi-Port

Default ON/ON

When ON, the display of monitored packets include the complete list of digipeater callsigns in the packet header. An asterisk indicates the station from which the packet was heard.

The MONITOR command must be ON, and if connected, MCON must also be ON.

When OFF, only the originating station and the destination station callsigns are displayed for monitored packets.
See also: MONITOR

MSTAMP {ON|OFF}

Default OFF

When ON, the display of monitored packets includes a time stamp (as defined by DAYSTR format). MONITOR command must be ON, and if connected MCON must also be ON.

See also: CSTAMP, DAYTIME, MONITOR.

MXMIT {ON|OFF}

Multi-Port

Default ON/ON

When ON, transmitted packets are displayed (as monitored packets), controlled by settings of MONITOR, MCOM, MCON, MRESP, TRACE, MSTAMP, HEADERLN, 8BITCONV and FILTER commands.

When OFF, transmitted packets are not displayed.

See also: MONITOR

MYALIAS xxxxxx-n (n = 0-15)

Multi-Port

Default (disabled/disabled)

Enables digipeating by the callsign or alias name entered.

The callsign or alias name can include up to six characters (plus optional SSID), and must be different than MYCALL, MYNODE, MYPBBS, or MYREMOTE.

Can be disabled by entering MYALIAS %.

See also: HID

MYAUTOST xxxxxxx

Default MYCALL

Specifies the callsign or name used for automatically starting receive operations in RTTY or ASCII modes, when AUTOSTRT is ON.

The callsign or name may contain up to seven (7) characters, allowing for MARS-type callsigns.

See also: AUTOSTRT

MYCALL xxxxxx-n (n = 0-15)

Multi-Port

Default (blank)/(blank)

Defines the valid callsign for operation of this TNC. The callsign or alias name can include up to six characters, plus optional SSID (Secondary Station Identifier).

All packets originated by this TNC will contain this callsign in the FROM address field.

Any packets received with this callsign in the TO address field or digipeat fields will be responded to appropriately (connect, disconnect, ack, digipeat, etc.).

When the TNC is powered on the first time, or has been Hard Reset, it will be in AUTOBAUD, saying "Press * to set baud rate". When an * is received, it will then request a callsign entry. The callsign entered is set in MYCALL, and is used to define callsigns or IDs for other functions (CWIDTEXT, MYGATE, MYGTCALL, MYGROUP, MYNODE, MYPBBS, MYPTCALL, and MYSELCAL.)

See also: CWIDTEXT, DIGIPEAT, ID, MYALIAS, MYNODE, MYPBBS, MYREMOTE, MYSEL

MYDGPS call

Default blank

Enables reception of differential GPS data in monitored packets, to be passed on to a GPS receiver.

When the AUX port is configured for GPS, and a UI packet (addressed to the call entered in MYDGPS) is received, the data from that packet is output on the AUX port.

See also: GPSPORT.

MYDROP n (n = 0-15)

Multi-Port

Default 0/1

Sets the KISS addresses of the radio ports.

See also: INTFACE, KISS Operation section

MYGATE xxxxxx-n

Default (MYCALL)-3

Enables cross-port digipeating, using the callsign or or alias name entered.

Accepts up to six characters (plus optional SSID), and should be different than those used for MYCALL, MYALIAS, MYPBBS, MYREMOTE, and MYNODE.

Entering MYGATE %, disables gateway digipeating.

See also: HID, UIGATE.

MYGROUP {cccc | nnnn | nnnnn | cccccccc | nnnnnnnnn |callsign}

Default {based on MYCALL}

Sets a SELCAL used for reception of SELFEC transmissions.

This allows several stations to use a group selcal and still maintain their own individual selcal.

Accepts 4 characters, 4 or 5 numbers, or 7 characters, 9 numbers, (CCIR 625) or an amateur callsign.

See also: AUTOSTRT

MYGTCALL xxxxxxxxxx

Default {based on MYCALL}

Sets the callsign to be recognized in G-TOR link requests.

Accepts up to 10 ASCII characters.

MYNODE xxxxxx-n (n = 0-15)

Default mycall-7

Sets the callsign or or alias name used by the KA-Node, when NUMNODES is set to a value greater than 0.

Accepts up to six characters plus optional SSID, which is different than those used for MYCALL, MYALIAS, MYPBBS, or MYREMOTE.

See also: DIGIPEAT, NDWILD, NUMNODES, KA-Node Operation section.

MYPBBS xxxxxx-n (n = 0-15)

Default (MYCALL)-1

Sets the callsign or alias name used by the mailbox, when PBBS is set to a value greater than 0.

Accepts up to six characters plus optional SSID, which is different than those used for MYCALL, MYALIAS, MYNODE, or MYREMOTE.

See also: LTRACK, PBBS, PBBS Operations section.

MYPTCALL xxxxxxxx

Default {MYCALL}

Sets the callsign to be recognized in PACTOR link requests.

Accepts up to 8 ASCII characters.

MYREMOTE xxxxxx-n (n = 0-15)

Default (blank)

Sets the callsign used for remote access.

Accepts up to six characters plus optional SSID, which is different than those used for MYCALL, MYALIAS, MYNODE, or MYPBBS.

RTEXT must also be entered, providing a password to enable remote access.

For details, see the Remote Access section of the Modes of Operation chapter.

See also: RTEXT, Remote Access section

MYSELCAL {cccc|nnnn|nnnnn|cccccccc|nnnnnnnnn|callsign}

Default {based on MYCALL}

Specifies SELCALs to be recognized when operating in AMTOR Mode A.

The convention used for AMTOR selcals is to use the first letter and the last three letters of your callsign as your 4-character selcal. The MYSELCAL will also accept 4 or 5 digit numbers and generate the corresponding 4-character selcal automatically from these numbers.

If you enter 7 characters, 9 numbers, or an amateur radio callsign, this command will use this as your 7-character selcal for the CCIR 625 form of AMTOR operation.

If you choose to enter your own seven characters, you must remember that the CCIR 625 recommendation does not allow the use of the letters G, H, J, L, N, or W. You must use the MYSELCAL command twice to change both the 4-character and the 7-character selcal. Both selcals are valid, and either one is recognized automatically.

See also: AMTOR, FEC

NAVCLR

Immediate

Clears the NAVTEX message log.

See also: NAVTEX

NAVERR n (n = 0-10)

Default 5

Specifies the maximum percent of errors allowed in a NAVTEX/AMTEX message, before the message is considered invalid.

If a message is received with less than n% errors, that message will be logged and displayed.

If the received message contains excessive errors, the message ***TOO MANY ERRORS XXXX will be displayed, that message will not be logged, and will be eligible to be displayed if received a second time.

See also: NAVTEX

NAVLOG

Immediate

Displays the log of NAVTEX/AMTEX messages which have been properly received, and won't be printed if received again.

The log can be cleared with the NAVCLR command

See also: NAVCLR,

NAVMSG c[ccc...]|ALL|NONE (c = A-Z)

Default ALL

Specifies which classes of NAVTEX messages are eligible to be displayed.

Three classes (A, B, and D) must always be accepted according to the specification, but may be eliminated by the user.

If any of these required message classes are not selected, a warning message will be displayed.

Specifying ALL will enable display of all classes of messages.

Specifying NONE will exclude all classes.

Message classes are listed in the NAVTEX section of this manual.

See also: NAVSTA, NAVTEX

NAVSTA c[ccc...]|ALL|NONE (c = A-Z)

Default ALL

Specifies the originating station(s) from which to display messages in NAVTEX mode.

When set to ALL, all NAVTEX station identifiers will be recognized.

When set to NONE, no NAVTEX station identifiers will be recognized, which will effectively disable copying any messages in the NAVTEX mode.

Any change in this setting will cause a soft reset.

See also: NAVMSG, NAVTEX

NAVTEX

Immediate

Enters the NAVTEX mode, to monitor for and display NAVTEX or AMTEX messages as allowed by the settings of NAVERR, NAVMSG, and NAVSTA.

(Refer to the NAVTEX section of this manual and the 8th Computer Networking Conference papers for details.)

See also: MISSCHAR, NAVCLR, NAVERR, NAVLOG, NAVMSG, NAVSTA, PMODE

NDHEARD [SHORT|LONG|CLEAR]

Immediate

Displays a list of nodes from which ID packets have been heard.

The list includes callsigns of KA-Node and K-Net nodes, as well as TheNet, NET/ROM and G8BPQ nodes, and the date/time the station was last heard. An asterisk"*" next to a callsign, indicates that the station ID packet was heard through a digipeater.

Nodes are identified as ALIAS (CALLSIGN), and KA-Nodes will be identified as: MYNODE (MYCALL).

If the S option is used (i.e. NDHEARD S) then only the callsigns of the stations heard will be displayed.

If the L option is selected, all callsigns contained in the received ID packet are displayed, including digipeaters.

If the C option is used, the nodes heard list is cleared.

See also: MYNODE

NDWILD {ON|OFF}

Default OFF

When OFF, the KA-Node will only recognize connect requests directed to its MYNODE call.

When ON, connect requests to any SSID of its MYNODE call will be recognized as connects to the KA-Node, if that SSID is not being used for any other function in the TNC.

See also: MYALIAS, MYCALL, MYNODE, MYPBBS, MYREMOTE

NETALIAS xx:x:xxx (up to 6 alpha-numeric characters) (blank/blank)

NETALIAS is an optional dual-port mnemonic that usually provides information about the location of the node. It exists only for the convenience of users. Network nodes automatically convert the NETALIAS to the associated NETCALL when setting up a circuit for a user. Changing or entering NETALIAS will not cause a soft reset.

NETBUFFS n (n = 1 - 255) (32)

The NETBUFFS command sets the number of node buffers available in the node. If the NETBUFFS reach zero, node operation may become unstable. Each NETBUFF allocated uses 260 bytes of RAM. Changing NETBUFFS will cause a soft reset as memory is re-allocated.

NETCALL xxxxxx-n {blank} (up tp 6 alpha-numeric characters plus optional SSID)

The NETCALL is the callsign of the K-Net node and can have an optional Secondary Station Identifier (SSID) extension of 1 to 15. The NETCALL must be entered before the K-Net can be operational and must be different from any other callsign used in the KPC-9612.
Entering a % as the NETCALL will clear both the Nodes and Routes tables, but not change any node-related parameters. Entering or changing the NETCALL will cause a soft reset as memory is re-allocated.

NETCIRCS n (n = 1 - 64) {5}

This command limits the number of Network Circuits available in the node. A *circuit* is a connection between two nodes. The *circuit* will contain an *uplink* (originated by a user or server), a *crosslink* (the other network node), and usually a *downlink* (to another user or server). The *downlink* will not exist until requested by the originating *uplink* user. The *circuit* will exist until either the destination user or

server or the originating user or server disconnects. The *circuit* will also be discontinued if one of the nodes determines that data can no longer be sent due to a retry time-out (L4N2), or if the inactivity timer (L4Tl) expires. Each NETCIRC allocated uses 50 bytes of RAM. Changing NETCIRCS will cause a soft reset as memory is re-allocated.

NETDESTS n (n = 1 - 255) {25}

Setting the NETDESTS determines the maximum number of destination nodes that can be stored in the K-Net node list. This list is sent to users when the NODES command is given to the K-Net node and also when the node does a nodes broadcast. Setting NETDESTS to a very large number (i.e. greater than 50 or so) is generally not a good idea since this can create long node broadcasts and long transmission times to users in response to a NODES command. Setting NETDESTS to a very low value can result with a desired node getting "bumped" out of the nodes table. After your K-Net has been in operation for a while, you should be able to determine how many of the destination nodes that are listed in your nodes table are *reliable* paths. The value that you enter for NETDESTS should be greater than this number, allowing room for other nodes as they become available. In any case, never allow the nodes destination table to become so large that it is filled with unusable and unreliable destination nodes. Very large nodes tables (>50 or so) are simply baffling to new users, and most of the time unusable to even experienced "node hoppers".

Although setting NETDESTS will place a "hard limit" on the number of destination nodes that can appear in the nodes table, proper setting of the K-Net QUALITY and MINQUAL commands will allow the number of destination nodes listed in your nodes table to "float" with changing band conditions and assure that reliable destination nodes are still listed. Each NETDEST allocated requires 31 bytes of RAM. Changing NETDESTS will cause a soft reset as memory is re-allocated.

NETLINKS n (n = 1 - 64) {10}

The NETLINKS command sets the maximum number of *uplinks, downlinks,* and *crosslinks* available to the node. An *uplink* is a user that connects directly *to* the K-Net node without using another network node. A *downlink* is a connection *from* the K-Net node directly to a user. A *crosslink* is a connection between two nodes. Each NETLINK allocated requires 130 bytes of RAM. Changing NETLINKS will cause a soft reset as memory is re-allocated.

NETROUTE n (n = 1- 32) {5}

This command sets the maximum number of neighbor nodes that can be listed with the ROUTES command. A neighbor node is a network node that your K-Net can hear "direct", without the benefit of being relayed by another network node. As with the NETDESTS parameter, if the setting of NETROUTE is too low, not all of your neighbors will be able to be listed. Setting NETROUTE to a higher number will allow you to see what the local node activity is and still have some room in reserve to handle itinerant nodes, and nodes that will show up during a band opening. Each NETROUTE allocated requires 39 bytes of RAM. Changing NETROUTE will cause a soft reset as memory is re-allocated.

NETUSERS n (n = 0 - 26) {5/5}

NETUSERS sets the maximum number of *uplinks* and *downlinks* from the node. This dual- port command places a limit on how many users can access or be accessed by the node. The NET USERS command will not cause a soft reset when changed.

NEWMODE {ON|OFF}

Default ON

When ON, the TNC will return to Command Mode if the station on the current I/O stream disconnects. The TNC will not return to Command Mode if the station disconnecting is on a different stream.

When OFF, a disconnect will not cause the TNC to change modes.

See also: CONNECT, DISCONNECT, STATUS

NOMODE {ON|OFF}

Default OFF

When OFF, a change to the mode specified by CONMODE will take place, upon connection to another station.

When ON, no mode change will take place upon connection to another station.

See also: CONMODE, CONNECT

NTEXT text (up to 128 characters)

Default (blank)

Specifies text (as a sign-on message) sent to stations connecting to the KA-Node.

Accepts any combination of up to 128 characters and spaces.

Enter "NTEXT %" to erase all entered text.

See also: MYNODE, NUMNODES

NUMNODES n (n = 0-26, depending on available RAM)

Default 0

Sets the number of circuits allowed through the KA-Node.

When set to 0, the KA-Node is disabled.

Changing the value of NUMNODES will cause a soft reset.

Approximately 4K of RAM is used for each circuit. Available RAM will depend on how much is already being for other functions, such as the PBBS, MAXUSERS, MYREMOTE, and K-Net.

An attempt to set a value of n larger than available RAM will allow, will cause display of a "Not enough RAM" message.

NUMNODES must be entered complete (with a new value) to change the number of available KA-Node circuits. If just checking the current setting, the short-form command NU will be accepted.

See also: MYNODE, KA-Node section

PACLEN n (n = 0-255 characters)

Default 128

Specifies the maximum number of characters allowed in the data portion of a packet, in both CONVERS and Transparent modes.

When the number of characters entered reaches the value of n, a packet is sent.

When set to 0, packets can contain up to 256 characters.

See also: MAXFRAME

PACTIME [EVERY|AFTER] n (n = 0-255)

Default After 10

Used to pace the formation (and transmission) rate of packets in
Transparent mode (or in CONVERS mode when CPACTIME is ON).

The PACTIME timer is necessary in transparent mode, since SENDPAC is ignored and treated as data. The timer is started when a byte is received from the terminal.

When AFTER is specified, packets are sent when input from the terminal stops for n*100 ms or when PACLEN is reached.

When EVERY is specified, packets are sent every n*100 ms or when PACLEN is reached.

See also: CPACTIME, TRANS

PACTOR [!][callsign]

Immediate

When entered alone, enters Pactor Standby mode, to monitor for incoming link requests (to the MYPTCALL) or display Pactor FEC or ARQ signals from other stations (if MONITOR for that port is ON).

If TRACE is also ON, each received Pactor frame will be displayed in hexadecimal format (not available in HOST mode).

Entering PACTOR and a callsign, will initiate a link attempt to that station.

If the optional ! is included (preceding a callsign), the link attempt (and resulting link) to the station specified, will use the long-path protocol (extended cycle timing) allowing longer distance communication. This can also be helpful in some cases where one or both stations transceivers have slow switching.

The <Ctrl+C>D directive will discontinue a link attempt, or break (end) an existing link with another station, returning to Pactor Standby mode.

Refer to the PACTOR section in the Operating modes section for full description and operation of PACTOR.

See also: ARQID, CWID

PASS n (n = $00-$FF)

Default $16 <Ctrl+V>

Selects the ASCII character used to allow entry of any character in Converse Mode.
To send a control character to another station, or to enter a control character in a text message, precede it with the PASS character.

In Transparent Mode all characters are passed, there are no special functions except the one combination to get out of transparent mode and transparent flow control characters.

See also: TRFLOW, TXFLOW.

PASSALL {ON|OFF}

Multi-Port

Default OFF/OFF

When ON, enables the display of received packets which may contain errors (incorrect checksum in the packet detected).

If a received packet contains beginning and ending flags, the TNC will attempt to decode the address field as well as the data field and display the packet as specified by other commands such as MONITOR.

MHEARD and NDHEARD logging are disabled when PASSALL is ON.

When OFF, packets will be displayed only if the CRC (error checking) is correct and as specified by other commands such as MONITOR.

PBBS n (maximum value of n depends on available RAM)

Default 480

Setting n greater than 0 activates the Personal Mailbox and allocates the specified amount memory for its use.

The amount of memory allocated will be n kilobytes, and may be limited by other functions that require memory (e.g. NUMNODES and MAXUSERS).

Changing the size of the PBBS memory allocation will not affect the contents of the mailbox (messages will be preserved, as long as the new size will still contain them), and will cause a soft reset.

Attempting to set the PBBS smaller than is required for existing messages will result in the display of "Messages would be lost" and no change will be made to the mailbox size. Messages must be deleted first, or set the PBBS size to 0 to remove all messages, then the PBBS can be set the desired smaller size.

Resetting the PBBS to the current size, will cause all messages to be renumbered beginning with 1.

See also: CMSG, MYPBBS, PBHEADER, PBLO, PBPERSON, PTEXT; PBBS section

PBFORWRD [bbscall [VIA call1,call2,...call8]][port][EVERY|AFTER n]

Default NONE EVERY 0

When a BBS callsign and interval is entered, enables eligible mail message forwarding to the specified BBS (also requires that HTEXT be set).

Any message placed in the PBBS containing an @BBS field (and is not marked as HELD (H) or FORWARDED (F)) is eligible for forwarding.

If the keyword EVERY is used, the PBBS will attempt to forward once every n hours (until successful).

If the keyword AFTER is used, the PBBS will attempt to forward eligible messages whenever a user disconnects from the PBBS, and every n hours after that (until successful).

Resetting the time interval will cause the PBBS to attempt to forward immediately.

After the PBBS has initiated a forward, it will also request a reverse forward if PBREVERS is ON. Note that full-service BBS systems must be configured to accept messages from, and allow forwarding mail to, your PBBS.

See also: PBREVERS, HTEXT

PBHEADER {ON|OFF}

Default ON

When ON, messages received from a full service BBS will be stored with the routing headers.

When OFF, the message routing headers are not stored, allowing messages to require considerably less space.

The routing headers are those lines in messages beginning with R:, which contain the hierarchical address information of all stations that have handled the message.

Note that the PBBS will ignore all lines beginning with R: until it sees the first line that does not have R: in column one. From that point on, all of the message will be stored, even if a line begins with an R:.

See also: PBBS section

PBHOLD {ON|OFF}

Default ON

When ON, any forward-able message received by the PBBS over the radio, will automatically be held for review.

A held message can be made available for forwarding by editing it and changing the H flag.

When OFF, forward-able messages received by the PBBS over the radio are not held, and are immediately eligible to be forwarded.

Any messages addressed TO or @ the MYCALL or MYPBBS in this TNC, are not forward-able messages.

See the PBBS Operation section for more detailed information.

PBKILLFW {ON|OFF}

Default OFF

When OFF, Private and Traffic types of messages will not be deleted (killed) from the PBBS after they have been forwarded, but will be marked with an F flag (forwarded).

When ON, Private and Traffic messages will be deleted from the PBBS after they have been successfully forwarded.

PBLIST [ON|OFF] [NONE|{+|-}callsign|callsign1,callsign2...]

Default OFF NONE

When set to ON, and a callsign or alias name (up to 10) is entered, messages placed in the mailbox addressed to any listed callsign or name (+ MYCALL and MYPBBS), will cause the front panel mail led to blink (when the PBBS is idle) until the message has been read.

PBBS commands (LISTMINE, READMINE, and KILLMINE) apply to all messages containing any callsign or name in the list, as well as MYCALL and MYPBBS.

A list of up to 10 entries can be made at once (replacing all current entries), or a single entry can be added (+callsign, if space allows) or removed (-callsign).

SSID's attached to callsigns are always ignored in the mailbox.

Enter PBLIST NONE, to remove all items from the current list.

When PBLIST is changed, the new list takes effect immediately for use with the PBBS commands (LISTMINE, READMINE, and KILLMINE), but the new list will not be used with the mail-status indicator until after the next disconnect from the PBBS or the next reset.

When PBLIST is OFF, only messages addressed to MYCALL and MYPBBS are affected by the PBBS commands LISTMINE, READMINE, and KILLMINE, or apply to the blinking mail led.

PBLO [OLD|NEW] [FIXED|VARIABLE]

Default NEW VARIABLE

When set to OLD, the PBBS messages are listed to the user in oldest to newest order.

When set to NEW, the newest message will be listed first.

When the second parameter is set to FIXED, the user cannot change the listing order.

When the second parameter is set to VARIABLE, the user may change the order in which messages will be listed by using the LO command within the PBBS.

See also: PBBS section

PBPERSON {ON|OFF}

Default OFF

When OFF, the personal mailbox will allow messages to be sent to any callsign.

When ON, only messages addressed to the MYCALL, MYPBBS, or PBLIST callsigns will be accepted over the radio, but a message entered from the terminal or by the SYSOP may be addressed to anyone.

See also: MYCALL, MYPBBS, PBBS

PBREVERS {ON|OFF}

Default ON

When ON, the TNC PBBS will request a reverse forward from another BBS after it has finished forwarding any mail to the other BBS. This does not affect the ability of another BBS to reverse forward from your PBBS, but only affects the action taken by the TNC after it has initiated a forward (PBFORWRD command).

Note: Your PBBS will not forward or reverse forward unless HTEXT is set.

See also: PBFORWRD

PERSIST n (n = 0-255)

Multi-Port

Default 63/63

Used with SLOTTIME, to implement an algorithm for channel access to send packets, in a more efficient way than with DWAIT.

The result of using the persistence algorithm is increased throughput under most channel conditions. When a packet is ready to be transmitted, and the channel is clear and available (no carrier or packet detected), the SLOTTIME timer starts. When the timer expires, a random number between 0 and 255 is generated. If the generated number is equal to or less than the PERSIST value, the data packet is transmitted. If the generated number is greater than the PERSIST value, the data packet is not transmitted, and the SLOTTIME timer is restarted.

In an example, assume a PERSIST setting of 63 and a SLOTTIME setting of 10 (the default settings). This SLOTTIME setting corresponds to 100 milliseconds. With a PERSIST setting of 63, the odds of transmitting after the first SLOTTIME are 1 in 4. (Actually the probability is PERSIST plus 1 divided by 256.) If the generated random number is greater than PERSIST, the timer restarts and waits for the timer to expire again before generating a new random number. This is repeated until the data packet is transmitted.

Decreasing the value of SLOTTIME will cause the random number to be generated more frequently, whereas increasing the PERSIST value will give a better chance (improve the odds) of transmitting the data packet.

Through careful choice of these values, it is possible to improve data throughput while at the same time permitting shared channel usage by other packet stations (where all stations use a similar value).

The persistence algorithm has been added on top of the DWAIT algorithm.

See also: SLOTTIME

PHEARD [CLEAR]

Immediate

Displays a list of callsigns of the last 10 stations that have connected to the PBBS.

The list includes the connecting stations callsign and the last time they connected and disconnected.

Enter PHEARD CLEAR, to clear the PHEARD list of all entries.

Callsigns will not be added to the list when PASSALL is ON.

See also: PASSALL

PID {ON|OFF}

Multi-Port

Default OFF/OFF

When OFF, only those packets with a protocol ID of $F0 (pure AX.25) are displayed (and according to the settings of the various monitor commands).

When ON, all packets displayed, will include the protocol ID with the packet header.

Some non-standard types of packets (those with protocol Ids other than $F0) can contain data or characters that can cause some computers to lock up. Net/Rom, TheNet, and G8BPQ nodes use a PID of $CF, while TCP/IP uses $CC and $CD.

When monitoring with PID ON, it would be recommended to also set FILTER to ON. This will prevent monitored data that may look like control characters from being displayed.

See also: FILTER

PMODE {NONE|ASCII|AMTOR|CW|FEC|GTOR|NAVTEX|PACTOR|RTTY|CONV|TRANS}

Default NONE

The PMODE command sets the mode of communication on power-up or after a reset.

When set to NONE, the power up mode is command mode (i.e. show the cmd: prompt).

Once started, non-packet modes of communication are controlled using directives (immediate commands issued by Ctrl+command letter), so there is no command line when in a non-packet mode of communication. Directives for a given non-packet mode of communication cannot be entered unless that mode of communication is active.

When PMODE is set to the name of any non-packet mode of communication (e.g., PACTOR), the specified mode of communication will be entered automatically upon power-up or reset, without any sign-on message.

NOTE: If set to FEC or NAVTEX, you will not receive any message on your terminal when the unit is powered up. To exit any of these modes, type <Ctrl+C>, then the letter X.

There are three ways to initiate Packet communication using PMODE: To start Packet with the command line (cmd:), set PMODE to NONE. To start in Convers mode of Packet, set PMODE to CONV. To start in Transparent mode of Packet , set PMODE to TRANS.

Exiting Transparent Mode of Packet with three <Ctrl+C>s, will return to Command Mode.

See also: INTFACE, PORT

PORT {1|2}

Default 2

Select the default radio port, when power is applied, or after a reset.

After changing the PORT setting, a soft reset is required to enable the change (by power OFF/ON, or by RESET command).

To switch from the current radio port to the other, the STREAMSW can be used.

STATUS will report the currently active I/O port and stream.

See also: RESET, STREAMSW.

PROSIGN n (n = $00-$FF)

default $5C (\)

Defines the character used to introduce a CW prosign, when transmitting in CW mode.

When the selected character is entered during CW transmission or within text to be used for CW transmission, it will cause the NEXT TWO characters codes to be combined.

For example, \AS will cause the codes for A and S to be combined into the wait code, or AS.

See also: MORSE CODE.

PTDOWN n (n = 2-30)

default 6

Sets the number of consecutive bad frames received while in a PACTOR link, to cause a decrease in speed to 100 baud.

PTERRS n (n = 30-255)

default 80

Sets the time-out attempts when attempting to link with, or during a link to, another station in PACTOR mode.

After n link attempts without response, a link attempt will end, returning to PACTOR Standby mode.

During a link with another PACTOR station, reception of n consecutive faulty frames results in a timeout, returning to Standby mode.

PTEXT text (up to 128 characters)

default (blank)

Specifies the text sent with the initial PBBS (personal mailbox) sign-on message, to a station connecting to the PBBS.

Accepts any combination of characters and spaces up to a maximum of 128.

Entering "PTEXT %" will erase any text entered.

See also: PBBS

PTFECSPD {100|200}

default 100

Set the speed used in PACTOR FEC transmissions.

When set to 100, transmissions will be at 100 baud.

When set to 200, transmissions will be at 200 baud.

PTHUFF {ON|OFF}

default OFF

When ON, this command allows Huffman compression of 7-bit data in PACTOR mode. Compression is used only when it will result in greater throughput.

Any frames containing 8-bit data are not subject to Huffman compression.

When OFF, Huffman compression is disabled.

PTLISTEN

immediate

Enters the PACTOR Listen mode, and allows reception and display of PACTOR FEC or ARQ (linked) PACTOR signals from other stations.

Transmit can not be initiated while in this mode.

Use the <Ctrl+C>X directive to return to the command mode.

PTRPT n (n = 2-5)

default 2

When transmitting in PACTOR FEC, characters are transmitted n times.

This is done to improve the chances of other stations copying your message since FEC transmissions do not use memory ARQ.

PTSI {ON|OFF}

default OFF

When OFF, supervisory information exchanged between PACTOR stations is not displayed.

When ON, supervisory information is displayed.

PTSUM n (n = 0-120)

default 5

When linked to another station in PACTOR mode, n received frames are stored in an attempt to assemble a valid frame (a process called memory ARQ).

When frames with an invalid CRC-16 checksum are received, they are stored in memory.

When the sending station repeats the frame, and if the checksum is again invalid, that frame and the previous invalid frame(s) will be used in an attempt to assemble a good frame by combining the frames received.

PTTRIES n (n = 0-9)

default 2

Sets the maximum number of attempts to increase the speed of a PACTOR link to 200 baud.

If unsuccessful after n attempts, the link will remain at 100 baud until the number of consecutive good frames (as specified by PTUP) have been received.

See also: PTUP

PTUP n (n = 2-30)

default 3

Sets the number of consecutive good PACTOR frames to be received before requesting a speed increase to 200 baud.

RANGE

default 0-255/0-255/0-255/0-255/0-255/0-255/0-255/0-255

Converts analog inputs (in 0 to +3.3 volt input range at the uP pin) to the specified decimal value range.

See also: ANALOG, TELEMETRY

RBAUD n (n = 20-1200 baud)

default 45

Sets the default baud rate used when entering RTTY mode.

When operating in the RTTY mode, typing the <Ctrl+C>0 directive will also switch to the RBAUD rate.

See also: PMODE, RTTY

REDISPLA n (n = $00-$FF)

default $12 <Ctrl+R>

Defines the REDISPLAY input editing character.

The parameter n is the ASCII code for the character that will REDISPLAY the packet or command currently being entered.

See also: BKONDEL, CANLINE, CANPAC, FLOW

RELINK {ON|OFF}

Multi-Port

default OFF/OFF

When OFF, the TNC operating with AX25L2V2 ON does not attempt to automatically reconnect after a disconnect has occured.

When ON, the TNC operating with AX25L2V2 ON will attempt to automatically reconnect after RETRY is exceeded.

If using AX.25 Level 2 Version 1 (AX25L2V2 OFF) this command has no effect.

See also: AX25L2V2, RETRY, TRIES

REPHASE {ON|OFF}

default ON

When ON, and linked to another station in Mode A AMTOR, repeated errors will cause an automatic attempt to REPHASE with the other station.

When OFF, repeated errors will cause a return to AMTOR Standby mode.

See also: ARQID

RESET
immediate

When entered, causes a soft reset (same as a power off/on).

Contents of the mailbox (PBBS) are kept, and the NDHEARD, MHEARD, and PHEARD logs are not cleared.

Any existing connections, which have not been CONPERMed, will be lost, even though the other station still indicates a connection to your station. The initial sign-on message will be displayed.

Some of the commands require a soft reset to enable changes made to their parameters.
See also: INTFACE, MAXUSERS, MYREMOTE, NUMNODES, PBBS, RESTORE

RESTORE DEFAULT

immediate

Entering RESTORE D will cause all command and parameter changes to be lost, returning them to factory default settings.

PBBS messages, and all other data stored in battery-backed memory will be lost.

The TNC must then be re-initialized.

See also: RESET

RETRY n (n = 0-15)

Multi-Port

default 10/10

Specifies the number of times a packet, that requires an acknowledgement, will be transmitted.

Packets are re-transmitted n times before an operation is aborted (due to no response). The time between retries (when no acknowledgment is received) is specified by the command FRACK.

See also: AX25L2V2, FRACK, RELINK, TRIES

RING {ON|OFF}

default ON

When ON, three bell characters ($07) are sent to the terminal with each "*** CONNECTED TO" message (when another station initiates the connect).

RNRTIME n (n = 0-255)

default 0

RNRTIME is set in 10 second increments.

If a connection stays in a remote device busy state (continues to receive RNR frames) for RNRTIME, the TNC will disconnect.

If a KA-Node connection stays in a remote device busy state for RNRTIME, the KA-Node will disconnect both the input and output sides of that KA-Node circuit.

Setting RNRTIME to 0 disables this function.

See also: MRESP

RPRINT text (text up to about 250 characters)

immediate

Entering RPRINT and a string of text characters will cause those characters to be output through the AUX port.

It is intended to allow a remote SYSOP (from a station connected to, and using the MYREMOTE function of this TNC) to send a string of text to a device attached to the AUX serial port.

For example, the string of text could be a command to change the configuration of a GPS unit, or to change configuration settings in the controller of a repeater. (can not be used when the AUX port is configured in NET/ROM mode)

RTEXT text (text up 128 characters)

default (blank)

Sets a password string for remote access.

When connecting from a remote station to the MYREMOTE or attempting to enter the SYSOP mode of the PBBS, the TNC will send three lines of five numbers each, of which one line must be properly decoded (matching position number with string character) and returned.

See also: PBBS and Remote Access in the Operations sections.

RTTY n (n = 20-500 baud)

immediate

When entered alone, enters the RTTY mode at the RBAUD baud rate.

When entered with the optional parameter n, enters the RTTY at the baud rate of n.

See also: AUTOSTRT, CANLINE, PMODE, RBAUD

SCREENL n (n = 0-255)

default 0

Used to format data displayed to the terminal.

When set to a number greater than 0, a carriage return (CR) is inserted in data displayed to the terminal after n characters.

When set to 0, data is displayed as received.

See also: AUTOLF

SENDPAC n (n = $00-$FF)

default $0D <Ctrl+M> (CR)

Defines the character that will cause a packet to be transmitted in CONVERS Mode.

The default character (CR or carriage return), is normally sent by a terminal program when the ENTER or RETURN key is pressed.

See also: CPACTIME, CR

SLOTTIME n (n = 0-255)

Multi-Port

default 10/10

Specifies the amount of time (n * 10 milliseconds), between successive tries of the persistence algorithm.

See also: DWAIT, PERSIST.

SPACE n (n = 50-4000)

default 2295

Sets the SPACE tone frequency.

The SPACE command must be set higher than the MARK command.

Note: The TNC specifications are for SPACE values from 50 through 2400. Higher values (to 4000) are for experimental use.

See also: LOWTONES, MARK.

Squelch n (n = 0 – 16)

default 0

Sets the initial squelch level in PSK31 mode.

START n (n = $00-$FF)

default $11 <Ctrl+Q>

Defines the character that will cause the TNC to restart serial output to the terminal.

If set to $00 only hardware flow control will be used.

See also: STOP, XFLOW, XOFF, XON

STATUS [LONG]

immediate

When entered alone, causes a display of the number of bytes available (i.e., free bytes) in the RS232 input buffer, the current I/O stream, and any streams having a connected status.

When entered with the LONG option, causes the STATUS display to also include the status of all connect streams allowed (by MAXUSERS, PBBS, NUMNODES, and MYREMOTE).

The current KA-NODE input and output (IO) stream is also indicated. A pound sign (#) indicates that there is unacknowledged data in the buffers for that stream.

The number immediately following the # is the number of bytes outstanding.

The number in parentheses is the number of packets not yet acknowledged.

See also: CONPERM, MAXUSERS, MYREMOTE, NUMNODES, PBBS, STREAMSW

STOP n (n = $00-$FF)

default $13 <Ctrl+S>

Defines the character that will cause the TNC to stop serial output to the terminal.

If set to $00 only hardware flow control will be used.

See also: START, XFLOW, XOFF, XON

STREAMCA {ON|OFF}

default OFF

When set to ON, packet data received from a connected station will include the callsign of that station (if STREAMEV is also ON).

This setting is helpful when carrying on multiple packet conversations, by indicating the callsign of the station sending the displayed packet text.

See also: MCON, MONITOR, STREAMEV.

STREAMEV {ON|OFF}

default OFF

When OFF, the stream indicator is displayed only when a change in streams occurs.

When ON, packet data received from a connected station will include the stream identifier on which that station is connected. See also: MCON, MONITOR, STREAMCA, STREAMSW

STREAMSW n (n = $00-$FF)

default $7C (|)

Defines the character used to change to a different stream or port.

To change streams, enter the streamswitch character, port number (if switching radio ports), followed by the stream designator. The stream designator is an alphabetic character A through Z, or a through z, limited by the value of MAXUSERS.

The character selected can be PASSed in the Convers Mode by using a special PASS character, and will always be passed as data in the Transparent Mode.

If operating in the Transparent Mode and you wish to change streams, you must first return to the Command Mode.

See also: MAXUSERS, PASS, STATUS

SUPLIST [ON|OFF] [NONE|{+|-}call|call1,call2,..]

where call={callsign|{<|>}callsign|callsign{>|<>}callsign}

default OFF NONE

When ON, and a callsign or list of up to 10 callsigns is entered, display of monitored packets from those callsigns will be suppressed.

Up to 10 callsigns may be entered at once, using the format shown after the command name, and the new list of from 1 to 10 callsigns will replace all previous entries.

A single callsign can be added to (SUPLIST +callsign) the list, so long as there is room for the new callsign on the list, or removed from (SUPLIST -callsign) the list.

A callsign entered without a SSID will match any SSID of that callsign. To match a specific SSID only, enter the callsign with that SSID: for example, callsign-n, where n = 0-15.

When set to OFF or NONE, SUPLIST will not prevent the display of packets, even if it has callsigns listed.

Selective display is enabled when one or two callsigns are combined with a ">" and/or "<" character.

Note that an entry of callsign1>callsign2 or callsign1<>callsign2 counts as 2 of the 10 allowed callsigns.

See also: MONITOR

TELEMTRY n (n = 0-255)

default 0

Sets the interval of transmission of the telemetry beacon, every n*10 seconds. When transmitted, it will be sent as a UI broadcast packet, and will be addressed to BEACON via any path specified by the UNPROTO command.

When set to 0, the telemetry beacon is disabled.

The data contained in the telemetry beacon is in the form:

"T#nnn,an0,an1,an2,an3,an4,an5,an6,an7,bbbbbbbb", where:

- "nnn" is a decimal count for the telemetry beacon and is incremented each time the beacon is sent. When first started, or after a soft reset, the beacon counter begins at 001 (T#001). After reaching 999 (T#999), the counter cycles around to 000 (T#000).

- "an0", to "an7", are the decimal readings of the corresponding analog inputs.

- "bbbbbbbb" is the binary reading of the 8 analog input pins, where "b" = "1" means a Logic High on the pin and "b" = "0" means a Logic Low on the pin. The first "b" in the string of 8 binary digits is the most significant bit, and the last "b" is the least significant bit.

Leading zeros are shown for all telemetry readings.

See also: ANALOG

TOR

immediate

Enters the TOR Standby mode.

Allows for automatic response to other stations link requests (addressed to MYSELCAL, MYPTCALL, or MYGTCALL) in AMTOR, PACTOR, or G-TOR modes. Also, monitored FEC broadcasts will be displayed.

If INTFACE is set to TERM when a link request from another station is acknowledged, the displayed link message will indicate which mode is being used.

TRACE {ON|OFF}

Multi-Port

default OFF/OFF

When ON, all received frames are displayed in their entirety, in hexadecimal, including all header information. All packets which are eligible for monitoring also will be displayed in normal text.

When in the HF ARQ modes (AMTOR, PACTOR, or G-TOR), the TRACE information of each received frame will be displayed.

Note that TRACE information is not available when in HOST mode.

TRANS

immediate

Enters Transparent Mode, and all ASCII characters can be transmitted.

The current link state is not affected.

If the current stream is a connection to another station, characters are transmitted to and received from that station transparently.

If the current stream is not connected to any other station, characters can be transmitted (broadcast) transparently, but display of received characters is disabled.

To exit Transparent mode, send the transparent escape sequence (as defined by COMMAND and CMDTIME commands), or send a modem “BREAK” signal (if BREAK is set to ON).

For example, with default command settings (COMMAND set to $03 (CTRL+C), and CMDTIME set to 1 second), send three <CTRL+C> characters within 1 second of each other, with at 1 second of no keyboard input before and after the sequence.

See also: BREAK, CMDTIME, COMMAND

TRFLOW {ON|OFF}

default OFF

Enables software flow control from the computer while in the Transparent Mode. START and STOP characters are sent by the terminal program to control the flow of data between the computer and TNC, but will not affect characters received in data from another station.

When OFF, software flow control is not used in Transparent Mode, and those characters can be sent as data.

Hardware flow control will be expected from the computer by the TNC. The terminal program must be configured to use hardware flow control, and the RS-232 cable must include RTS and CTS lines.

If START and STOP are both set to $00 values, only hardware flow control can be used.

See also: TRANS, TXFLOW, XFLOW

TRIES [n] (n = 0-15)

Is a counter used to keep track of the number of attempts made to re-send a packet (on the current stream) which failed to reach its destination.

It can be manually set (usually to a lower number) to allow more attempts to be made, or to its maximum to end attempts on the current stream.

See also: RETRY

TXDELAY n (n = 0-255)

Multi-Port

default 30/30

Sets the key-up delay (n * 30 ms) between assertion of PTT, and beginning of packet data. Flags (characters to begin packet) are sent during the delay.

It should be set to allow enough time for the transmitter (and amplifier, if used) to come up to full power, and the other stations receiver to detect the signal, before data is sent. If set too short, the beginning of the packet may not be received by another station and the entire packet will be lost.

If set too long, un-necessary additional flags will be sent at the beginning of the packet (heard as a repetitive sound) making each packet longer and wasting air time.

TXDFEC n (n = 0-25)

default 0

Sets the number of extra seconds of phasing signals at the beginning of an AMTOR FEC transmission.

It allows more time for a receiving station to tune your FEC transmission and obtain a lock condition before transmission of data.

See also: FEC

TXDTOR n (n = 0-15)

default 5

Sets the key-up delay used in ARQ links in AMTOR, G-TOR, and PACTOR, modes. Each number increment sets a multiple of 10 ms.

TXFLOW {ON|OFF}

default OFF

Allows the TNC to send software flow control (XON and XOFF) to stop and restart the flow of data from the computer while in the Transparent Mode.

When TXFLOW is OFF, hardware flow control must be used between the computer and TNC. RTS and CTS must be connected between the TNC and computer for hardware flow control.

When TXFLOW is ON, software flow control between the TNC and computer in Transparent Mode will depend on the setting of XFLOW. XFLOW ON enables software flow control, XFLOW OFF disables it.

When software flow control is enabled, the TNC will send the XON and XOFF characters to the computer to control data flow.

When set for software flow control, all characters can be sent in Transparent Mode (including the XON and XOFF characters) by setting TXFLOW ON, XFLOW ON and TRFLOW OFF. You will not, however, be able to receive the START and STOP characters, since your terminal program should interpret them as flow control.

See also: TRANS, TRFLOW, XFLOW

UIDIGI ON [+|-] call1[,call2[,call3[,call4]]]

Multi-Port

default OFF NONE/OFF NONE

Up to 4 callsigns can be specified for special digipeater duty for unnumbered information <UI> packets.

If any of the UIDIGI calls appears in the to-be-digipeated field of a UI packet, and if MYCALL does not appear in the source field or any of the has-been-digipeated fields, the UIDIGI call in the to-be-digipeated field will be replaced by MYCALL with the H bit set and the packet will be digipeated.

See also: DWAIT, PERSIST, UIDWAIT, UNPROTO

UIDWAIT [ON|OFF]

Multi-Port

default OFF/OFF

When UIDWAIT is OFF, "special" digipeat packets (those formed by UIDIGI, UIFLOOD, or UITRACE only) have their usual channel access; there is no wait DWAIT or SLOTTIME added before transmission once the channel is clear.

However, if UIDWAIT is set ON, the packets waiting to be digipeated will be subject to the same wait times as not-to-be-digipeated packets awaiting transmission.

By subjecting "special" to-be-digipeated packets to a delay determined by SLOTTIME and PERSIST, it is more likely that to-be-digipeated packets of two or more stations in the same vicinity would not collide. This may be good if one wants to guarantee that a digipeated packet will "make it out" of its neighborhood but bad if one wishes to limit the number of times a packet is re-digipeated, such as in APRS applications.

See also: DWAIT, PERSIST, UIDWAIT

UIFLOOD name, n,[ID|NOID] (name = 5 char max)(n = 0-255)

Multi-Port

default disabled,30,NOID/disabled,0,NOID

When a UI frame is received with a call in the to-be-digipeated field of the form 'name'x-y where x is a number (1-7) appended to 'name' and y is a ssid (1-7), the ssid is decrement and the UI frame is digipeated without setting the H bit.

When the packet is digipeated, a checksum is formed over the source, destination, and data fields of the packet. This checksum is kept for n seconds (0-255). If an incoming UI packet is eligible for

digipeating as above, but its checksum matches one of those being saved, the packet is discarded (not digipeated).

The buffer holds a maximum of 64 checksums. If the optional parameter ID is selected, the MYCALL call sign is inserted in an additional digipeater address field with its H bit set.

See also: UIDWAIT

UIGATE [ON|OFF / ON|OFF]

Multi-Port

default OFF/OFF

When set to ON for either port, received to-be-digipeated packets addressed to the MYGATE callsign will be re-transmitted out the opposite port from which they were received.

When set to OFF for either port, received to-be-digipeated packets addressed to the MYGATE callsign will be ignored.

The settings can be used to allow gateway digipeating from one port to another, and prevent digipeating in the other direction. (for example, allow 300 baud to 1200 baud digipeating, but prevent 1200 baud to 300 baud digipeating, to avoid “flooding” an HF channel with VHF packets.)

See also: DIGIPEAT, MYGATE

UITRACE name

Multi-Port
default disabled/disabled

When a UI frame is received with a call in the to-be-digipeated field of the form 'name'x-y where x is a number (1-7) appended to 'name' and y is a ssid (1-7), and MYCALL does not appear in the source field or any of the has-been-digipeated fields, MYCALL with the H bit set is inserted before the to-be-digipeated field, the ssid of the to-be-digipeated field is decremented, and the UI frame is digipeated without setting the H bit of the to-be-digipeated field.

If the packet should already have 8 digipeater fields, MYCALL is not inserted.

See also: DWAIT, PERSIST, UIDWAIT

UNPROTO {call1 [VIA call2,call3..call9]|NONE}

Multi-Port

default CQ/CQ

Sets a destination address for unconnected packet broadcasts (as <UI> packet frames), and specifies names of any digipeater stations (up to a total of 8) to re-transmit the packet.

The digipeater list is also used when broadcasting BEACON and ID packets.

If UNPROTO is set to NONE, no unconnected packets will be sent except for BEACON and ID.

Each callsign may also have an optional Secondary Station Identifier (SSID) specified as -n, where n =1 -15. The digipeat callsigns are specified in the order in which they are to relay transmitted packets.

See also: BEACON, ID, MONITOR, MRPT

USERS n (n = 0-26)

Multi-Port

default 1/1

Specifies the number of channels (streams) which may be available to incoming packet connect requests from other stations. It is used to limit the number of other stations allowed to connect at one time.

Accepted packet connects will be assigned to the lowest available channel (beginning with A). If all available channels are already connected to other stations, a <DM> packet will be sent back to the requesting station and the message "*** connect request: (call)" will be output to the terminal, if permitted.

If USERS is set to 0, all packet connect requests from other stations will be denied.

The maximum number of USERs that can be specified, is limited by MAXUSERS. If an attempt is made to set USERS to a number higher than MAXUSERS, the extra is ignored and the message "USERS LIMITED BY MAXUSERS" will be displayed.

See also: INTFACE, MAXUSERS, STREAMCA, STREAMEV, STREAMSW

USOS {ON|OFF}

default ON

When ON, and a numbers shift has been received, the next space received will cause an unshift to letters in BAUDOT RTTY.

If CODE is set to LCRTTY, a space will shift to lower case.

VERSION

immediate

Causes a display of the model name and current firmware version.

WEFAX n m (n = 0-6000) (m = 1, 2 or 4)

immediate

Enters the Weather Facsimile (WEFAX) demodulating mode. It also requires the entry of n (samples per second), and m (number of bits per pixel, which sets the number of grey levels of each pixel).

The audio input is sampled n times per second. Each sample becomes one data-point sent over the serial port to the computer, where it will be used to display a single pixel on a weather map.

If m = 1 (or 0), a BLACK/WHITE decision is made on each sample. If m is specified as 2, two bits of data representing 4 grey levels are conveyed to the serial port for each pixel, and if m is set to 4, 4 bits representing 16 grey levels are conveyed to the serial port.

To avoid overrunning the serial port, set the serial port's rate to greater than (n) x (m) x (1/8) X (10).

A special computer program must be used to display WEFAX maps sent via the serial port.

See also: DAYTWEAK, WEFAX Reception Modes in the Operations section

WTEXT text (up to 128 characters)

default {DE MYCALL}

Specifies the text to be sent in response to a received WRU (who are you) command while linked in AMTOR ARQ mode only.

Accepts any combination of characters and spaces up to a maximum length of 128.

Entering a single % will clear WTEXT.

To use the WTEXT as an automatic logon for APLINK BBS systems, set the WTEXT to "DE call/selcal+?" or "QRA call/selcal+?". Be sure to include the "+?" as part of the WTEXT.

XFLOW {ON|OFF}

default ON

When ON, software flow control will be implemented according to the settings of START, STOP, XON, XOFF.

For normal software flow control set XFLOW ON, START $11, STOP $13, XON $11, and XOFF $13. The TNC expects the computer or terminal to respond to the flow control characters XON and XOFF, and the TNC responds to the START and STOP characters from the computer.

When set to OFF, the TNC will only use and recognize hardware flow control lines (CTS and RTS) to start or stop data. The RS-232 cable must be wired appropriately.

If the software flow control characters are set to $00, software flow control is not possible.

In the Transparent Mode flow control is also determined by the settings of TRFLOW and TXFLOW.

See also: START, STOP, TRFLOW, TXFLOW, XOFF, XON

XKCHKSUM {ON|OFF}

default OFF

Controls whether or not the XKISS CHECKSUM mode is active.

(Applies only when INTFACE is set to XKISS)

See also: XKPOLLED

XKPOLLED {ON|OFF}

default OFF

Controls whether or not the XKISS POLLED mode is active.

(Applies only when INTFACE is set to XKISS)

See also: XKCHKSUM

XMITLVL n (n = 0 - 63)

Multi-Port

default 40/25

Sets the output level of transmit audio from ports 1 and 2.

The level can be set manually for each (or both) ports, or can be set individually during the CALIBRATe procedure. While in CALIBRATe mode and transmitting from one port, the output level for that port can be adjusted up or down with the + and – keys.

See also: CALIBRAT

XOFF n (n = $00-$FF)

default $13 <Ctrl+S>

Selects the character sent by the TNC to the computer to stop input from the computer.

If set to $00 hardware flow control must be used. For software flow control, set this parameter to the character the computer expects to see to stop sending data to the TNC.

See also: XFLOW, XON

XON n (n = $00-$FF)

default $11 <Ctrl+Q>

Selects the character sent by the TNC to the computer to restart input from that device.

If set to $00 hardware flow control must be used. For software flow control, set this parameter to the character the computer expects to see to restart sending data to the TNC.

See also: XFLOW, XOFF

Appendix A: Installation

This appendix gives you additional information on installation and configuration beyond that given in the chapters on "Installing your KAM *XL*" and "Pacterm".

Precautions

The KAM *XL* is grounded through its connections to the transceiver, computer, and power supply. Make sure that the transceiver is properly grounded and the computer has equal ground potential. Follow the grounding instructions described in the transceiver manual.

The two pieces of multi-conductor cable provided with the KAM *XL* are shielded. If using other cabling, be certain it is shielded. We do not recommend the use of unshielded ribbon cable in an amateur radio environment.

The KAM *XL* includes a Lithium Cell in its memory backup circuit, which will cause it to retain changes to commands parameter settings and maintain the real-time clock. When used in a TNC, the Lithium Cell will typically last from 2 to 5 years. It is a common-type CR2032 lithium cell.

Lithium cells can leak or explode if heated, disassembled, recharged, exposed to fire or high temperature, or inserted incorrectly. When replacing a spent cell, follow proper disposal guidelines for lithium type cells.

Connecting to Radios

Port 2: This is a 9-pin DB style connector, with pin layout as shown below:

[diagram of DB-9 pin connector]

Pin No.	name	Function
1	TXA2	Transmit audio (AFSK out)
2	XCD2	External carrier detect
3	PTT2	Push-to-Talk
4	CTRL2B	Control line B (Port 2)
5	RXA2	Receive audio (AFSK in)
6	GND	Ground
7	FSK2	Digital output (of AFSK out)
8	CTRL2A	Control line A (Port2)
9	GND	Ground

Pin 1: Connects to the microphone input of the radio, providing the audio signal (AFSK) to be transmitted.

Pin 2: When a ground is applied to this pin, the KAM *XL* will not transmit packets. This pin is normally used as an external means of supplying carrier detect, but can also be used as a "hardware" transmit inhibit.

Pin 3: When the KAM *XL* needs to key the transmitter, it will apply a ground to this pin. This is an open-drain circuit and requires a positive voltage from the radio (not to exceed 50 volts and 200 mA).

Pin 4: This pin is the CONTROL B output. It is an open-drain circuit, controlled by the CTRL command. It may be used as a control line to external devices. (not to exceed 50 volts and 200 mA).

Pin 5: Receive audio from your radio connects to this pin. It will normally connect to the external speaker jack of a radio, but may be connected to a receive audio pin from a data jack or the microphone connector instead (if available). Its input impedance is 10K, but can be set to 600 ohms, by jumper J4.

Pin 6: This pin is connected to ground, same as pin 9.

Pin 7: This pin is a digital version of the AFSK output on pin 1. Either TTL (CMOS driven 0 or +5v), or open drain transistor (as set by jumper J3).

Pin 8: This pin is the CONTROL A output. It is an open-drain circuit, controlled by the CTRL command. It may be used as a control line to external devices. (not to exceed 50 volts and 200 mA).

Pin 9: This pin is connected to ground, same as pin 6.

Interfacing Hand-Held Radios

Most hand-held transceivers (HTs), use an electret type condenser microphone, which requires a voltage (supplied from the radio) to operate.

Typically, HTs obtain Push-To-Talk keying by completing a low-impedance circuit between the microphone input and PTT ground. A direct PTT input to the microphone input line of units with this type is not usable without some type of isolation.

When interfacing to an HT, isolation circuitry must be installed in the connecting cable between the TNC and the microphone connector on the radio.

Ground for PTT and audio circuits are supplied through the external speaker jack of the HT.

While you will need to check the exact requirements of your HT, the following guidelines may be useful:

A .1 uF capacitor (non-polarized) usually is required between the transmit audio output line from the TNC and the microphone input of the HT, to block the DC voltage normally supplied by the microphone circuit of the HT. Even if a capacitor is not required for connection to a particular radio, it can still be installed, and transmit audio (packets) will pass through to the radio.

ICOM HT radios key the PTT by providing a low impedance path from the microphone input to ground. To accomplish this in the cable between the TNC and the HT, install a resistor (approximately 3 to 4 K ohms) in series with the PTT line (from the KAM *XL* to the HT microphone input), in parallel with the transmit audio line (with its capacitor installed).

The ICOM 2A style wiring is most common, and can be used with most HT radios.

A connection to YAESU and Radio Shack HTs is similar, but uses a mono plug and a 2 to 2.5 K ohm resistor in the PTT circuit.

KENWOOD HT radios key the PTT line by connecting the sleeve of the microphone connector to the sleeve of the external speaker connector. In this case, a resistor is not needed in the PTT circuit. Simply connect the PTT wire directly to the sleeve of the microphone connector.

Most newer model KENWOOD HTs (TR2600 and later) use a three pin microphone connector. The transmit audio (AFSK) signal from the KAM *XL* connects to the RING and not the TIP of the microphone connector.

Port 1: HF and Packet

The connector labeled "Port 2" is a 9-pin DB style connector, and has the same pin configuration and functions as port 1.

Pin No.	name	Function
1	TXA1	Transmit audio (AFSK out)
2	XCD1	External carrier detect
3	PTT1	Push-to-Talk
4	CTRL1B	Control line B /CW Key out (Port 1)
5	RXA1	Receive audio (AFSK in)
6	GND	Ground
7	FSK1	Digital output (of AFSK out)
8	CTRL1A	Control line A (Port 1)
9	GND	Ground

Pin 1: Connects to the microphone input of the radio, providing the audio signal (AFSK) to be transmitted.

Pin 2: When a ground is applied to this pin, the KAM *XL* will not transmit packets. This pin is normally used as an external means of supplying carrier detect, but can also be used as a "hardware" transmit inhibit.

Pin 3: When the KAM *XL* needs to key the transmitter, it will apply a ground to this pin. This is an open-drain circuit and requires a positive voltage from the radio (not to exceed 50 volts and 200 mA).

Pin 4: This pin is the CONTROL B output. It is an open-drain circuit, controlled by the CTRL command. It may be used as a control line to external devices. (not to exceed 50 volts and 200 mA). This pin can also be used as CW output. See CW output command.

Pin 5: Receive audio from your radio connects to this pin. It will normally connect to the external speaker jack of a radio, but may be connected to a receive audio pin from a data jack or the microphone connector instead (if available). Its input impedance is 10K, but can be set to 600 ohms, by jumper J2.

Pin 6: This pin is connected to ground, same as pin 9.

Pin 7: This pin is a digital version of the AFSK output on pin 1. Either TTL (CMOS driven, 0 to +5v), or open drain transistor (as set by jumper J1).

Pin 8: This pin is the CONTROL A output. It is an open-drain circuit, controlled by the CTRL command. It may be used as a control line to external devices. (not to exceed 50 volts and 200 mA).

Pin 9: This pin is connected to ground, same as pin 6.

Transmit level

This section has information beyond that covered in the installation chapter, which documents the basic procedures for setting transmit level for port 2.

Drive level for this port should be set so that you achieve a deviation of about 3 kHz in an FM transmitter, or maintain a transmit audio signal within the normal ALC range in an HF SSB transmitter (important for HF modes, such as PSK31).

As with port 1, drive level for port 2 is set digitally, using your keyboard and the transmit level command (XMITLVL), or the calibrate (CAL) command.

Appendix B: Advanced Information

Disassembly and Assembly

Should you require access inside the KAM *XL* to reposition jumpers or for other purposes, remove the top cover as follows (while observing good static control procedures);

1. Turn off power to the KAM *XL*, and remove all cables from the unit.

2. Using a small Phillips screwdriver, remove the four (4) screws located on the right and left sides of the cover, and the four (4) screws on the top side of the cover.

3. Remove the top cover from the unit.

This will provide access to the top of the circuit board and all available jumpers, and in most cases, no further disassembly of the unit is necessary. Only if the circuit board must be removed from its chassis, should further disassembly be attempted. Note that this will void any warranty provided by Kantronics.

4. Remove the four(4) screws that secure the circuit board to the chassis.

5. Remove the ten (10) stud screws that secure the connectors to the rear panel of the chassis.

6. Remove the three (3) front panel screws, and remove the front panel.

7. The circuit board can then be lifted up and out of the chassis. The KAM *XL* uses low internal operating voltages and components can be damaged very easily by static discharges. Observe proper static protection precautions when handling the circuit board. Bending or flexing the circuit board can also cause damage.

To reassemble, reverse the above procedure.

Hard Reset

The HARD RESET process is provided to re-initialize the KAM *XL* to its factory default values. This function is enabled by setting the J10 inside the KAM *XL* to test position (both pins connected together).

This process may become necessary should operational problems be encountered or when upgrading your firmware to a new version.

During the HARD RESET procedure, an internal SELF-TEST is performed, and messages will be output to the terminal. The readout specified in step 5 below will be legible only if the terminal baud rate is 9600.

1. Turn OFF power to the KAM *XL* and remove the top cover, as described in the disassembly procedure.

2. Locate the Hard Reset jumper (J10). Refer to the parts location diagram for its position help in locating them.

3. Place the jumper on both pins.

4. Apply power to the KAM *XL*.

5. Observe on the terminal display:

CHECKSUM OK
……..
……..
……..
……..
RAM OK
512K BYTES
REMOVE TEST JUMPER

6. Turn power off.

7. Return jumper J10 to the normal position (one pin only).

8. Reassemble the KAM *XL* and return to operation.

Note: During the hard reset procedure, all battery-backed RAM memory locations are tested, which will cause all command changes and mailbox messages to be lost. When the reset jumper has been returned to its normal position (opened), the KAM *XL* will power up as a new unit, with all commands at factory default settings, and will be running its AUTOBAUD routine. It must then be initialized to return to normal operation.

Updating/Uploading new Firmware

Loading a new firmware program in the KAM *XL* flash ROM

1. can be loaded at a baud rate of 19,200 or 38,400 baud. To load new firmware at 19,200 baud, place jumper in J12 position of the KAM *XL* board. To load new firmware at 38,400 baud, place jumpers in J10 AND J12 positions.

2. can be sent from almost any terminal program (that is capable of the 19,200 or 38,400 baud rate)

Power off the KAM *XL*.

Remove the KAM *XL* top cover.

Locate jumper J12, next to the Hard reset jumper, and connect its 2 pins together.

Settings in the terminal program should be:

> 19,200 or 38,400 baud rate, depending upon the J10 and J12 jumper positions. (For 19,200 baud, place jumper in J12 position. For 38,400 baud, place jumpers in J10 and J12 positions.)
> NO PARITY, 8 DATA BITS, 1 STOP BIT,
> SOFTWARE, or XON/XOFF FLOW CONTROL,
> CHARACTER and LINE PACING set to ZERO or MINIMAL DELAY.

Power ON the KAM *XL*. A message will be displayed, with the unit serial number and "ARE YOU READY TO ERASE FLASH? (Y/N)",

Pressing the N key will do nothing.

Pressing the Y key will return the message " ERASING FLASH...". After 10-15 seconds the message "START LOADING FILE" will be displayed.

At this time, select the SEND ASCII FILE or SEND TEXT FILE function from the terminal program. Indicate the location of the KAM *XL* firmware file, it can be loaded from a disk, or copied to the hard drive and loaded from there, and send the file. As the KAM *XL* receives each line of data in the file, it will return an * character. You should see *'s marching across and down the screen at a fairly rapid pace.

If you see no *'s, re-check the terminal programs settings, to be sure that it is set for SOFTWARE flow control (XON/XOFF) and NOT HARDWARE flow control (RTS/CTS).

If the *'s do appear, but only very slowly, re-check the terminal program settings, to be sure that character and/or line delays (or pacing) are set to zero.

A Hard Reset, as described in the previous section, may be necessary after a new firmware version has been loaded.

Calibration

The CALIBRAT command is used to assist in adjusting the data transmit audio drive level, to properly modulate a transmitter.

The procedures listed below are a guideline for using the calibration command to adjust ports 1 and 2 for optimum performance.

Drive level for ports 1 and 2 are set by digital pots, providing an output level range of 1mV to 4V pp.

Default drive level for both ports is about 50 mV, corresponding to an XMITLVL command setting/count of 100.

Port 1:

To set drive level for port 1, the current I/O stream must be set to port 1.

Upon entering the CALibrate command, the following options will be displayed to the terminal:

HF CALIBRATE MODE: 300 BAUD

R receive
M send mark
S send space
T send square wave
B random
+ or - adjust XMITLVL while transmitting
X exit

XMITLVL: 40

Pressing R will return to receive
Pressing M will transmit a constant MARK (signal) until a key is pressed.
Pressing S will transmit a constant SPACE until a key is pressed.
Pressing T will transmit a square wave (space/mark) until a key is pressed.
Pressing B will send a random bit pattern with both tones.
Pressing the + key while transmitting increases transmit output level.
Pressing the – key while transmitting decreases transmit output level.
Pressing X will exit the calibrate mode.

Transmit Drive level

After entering the calibrate mode (CAL), you should use the T option to initiate the transmission of a square wave and then adjust the AFSK drive level by pressing the '-' or '+' key (and holding it down) until you achieve the drive level you need. Adjust the level to achieve about 3 to 3.5 kHz deviation from the transmitter.

When the deviation has been set, exit CAL mode, and check the parameter value for XMTLVL. Make a note of that value for future reference.

Port 2:

To set drive level for port 2, the current I/O stream must be set to port 2.

Upon entering the CALibrate command, the following options are displayed:

VHF CALIBRATE MODE: 1200 BAUD

R receive

M send mark
S send space
T send square wave
B random
+ or - adjust XMITLVL while transmitting
X exit

XMITLVL: 25

Pressing R will return to receive
Pressing M will transmit a constant MARK (signal) until a key is pressed.
Pressing S will transmit a constant SPACE until a key is pressed.
Pressing T will transmit a square wave (space/mark) until a key is pressed.
Pressing B will send a random bit pattern with both tones.
Pressing the + key while transmitting increases transmit output level.
Pressing the – key while transmitting decreases transmit output level.
Pressing X will exit the calibrate mode.

Transmit Drive level

After entering the calibrate mode for the high-speed port, you should use the T option to initiate a continuous signal and then use the '-' or '+' key to decrease or increase drive level.

When connected to an FM transmitter, make the adjustment (with the – and + keys), so that the transmitter produces about 3 kHz of deviation.

When connected to an HF SSB transmitter, make the adjustment so as not to exceed the normal ALC range (same as when adjusting drive using the microphone). This is very important for HF modes such as PSK31.

When the transmit level has been set, exit CAL mode with the X command, and check the parameter value for XMTLVL. Make a note of its value for future reference.

PTT (Push-to-Talk) Watchdog Timer

The KAM *XL* has push-to-talk watchdog timers for both ports. These timers are both enabled at the factory with jumpers J6 (port 1) and J5 (port 2).

If the PTT of either radio port is ON continuously for more than about 2 minutes, the watchdog timer will activate and release the PTT line to the transmitter.

To disable the Watchdog timer, connect the pins of J6, or J5, together.

Jumpers

Locations and descriptions of KAM *XL* Jumpers are given in this section.

Jumper #	Name
1	Port 1 FSK/TTL output
2	Port 1 receive input impedance
3	Port 2 FSK/TTL output
4	Port 2 receive input impedance
5	Port 2 PTT Watchdog timer
6	Port 1 PTT Watchdog timer
7	Port 2 transmit output – DC coupling
8	Port 2 transmit output - impedance
9	Port 1 transmit output – DC coupling
10	HARD RESET
11	Port 2 transmit output - impedance
12	FLASH FIRMWARE LOAD

Jumper Descriptions:

J1: Sets Port 1 Transmit data output to either FSK (FET transistor switch ON/OFF) center pin to pin 1, or TTL drive (0 to +3.3v) center pin to pin 2.

Default: FSK

J2: Sets Port 1 Receive input impedance. Open = 10K ohms, closed = 620 ohms.

Default: open

J3: Sets Port 2 Transmit data output to either FSK (FET transistor switch ON/OFF) center pin to pin 1, or TTL drive (0 to +3.3v) center pin to pin 2.

Default: open

J4: Sets Port 2 receive input impedance. Open = 10K ohms, closed = 620 ohms.

Default: open

J5: Port 2 PTT Watchdog. When open, the watchdog is enabled. PTT will discontinue after about 2 minutes of continuous transmit. When closed, the watchdog is disabled, and PTT will remain active as long as commanded.

Default: open (enabled)

J6: Port 1 PTT Watchdog. When open, the watchdog is enabled. PTT will discontinue after about 2 minutes of continuous transmit. When closed, the watchdog is disabled, and PTT will remain active as long as commanded.

Default: open (enabled)

J7: Sets the type of coupling for transmit audio (AFSK) from Port 2. When open, AC coupling is used, when closed, DC coupling is used.

Default: open (AC coupling)

J8: When closed, adds a load impedance to the transmit audio (AFSK) output on Port 2.

J9: Sets the type of coupling for transmit audio (AFSK) from Port 1. When open, AC coupling is used, when closed, DC coupling is used.

Default: open (AC coupling)

J10: When closed (and J12 open), and the unit powered ON, a SELF-TEST is performed, user memory is tested and cleared, and result messages displayed (at 19200 baud).

J11: When closed, adds a load impedance to the transmit audio (AFSK) output on Port 1.

J12: When closed, and the unit powered ON, the current FLASH ROM area is cleared and can be re-loaded. This is done when updating firmware to a newer version.

Appendix C:

Replacing the Lithium Battery

To replace the internal Lithium battery, remove the top cover from the KAM *XL* and carefully slip the battery out of the battery holder. You may need to use an insulated tool to assist in removal of the battery. When installing a replacement battery (CR 2032 or equivalent) be sure to insert the battery with its positive terminal against the top clip of the battery holder.

NOTE: When removing the lithium battery from the KAM *XL*, all stored parameter changes will be lost and the unit will revert to the factory default parameters.

Appendix D: In Case of Difficulty

Additional possible difficulties are covered in the "Trouble-Shooting" section of the "Pacterm" chapter.

The Kantronics KAM *XL* is manufactured to very stringent quality standards. If you have followed the installation procedures outlined in this manual, it is highly unlikely that you will encounter a failure. If you do have difficulty, use the procedures described in this section to assist in isolating and correcting the problem.

KAM *XL* Does Not "Sign-On" to Computer

1. Carefully recheck cabling between the computer serial port and the KAM *XL*.
2. Check carefully to insure that the Transmit Data, Receive Data, and Ground leads are connected to the proper pins.
3. If using a cable with a 5-wire connection to the computer serial port, try changing to a 3-wire connection. (Pacterm requires a 5-wire connection)
4. Check the terminal program to be certain it is configured with the correct communications parameters (serial port, baud rate, parity).
5. Try a "Hard Reset" using the Hard Reset jumper. (Set the terminal program interface baud rate to 19200 when performing a hard reset.)

Unable to "Connect" to another station

1. Issue a connect request and observe the TNC's XMIT LED. If the XMIT LED illuminates, check to insure that the radio is properly connected to the TNC's radio port.
2. Observe the radio to determine if it is being switched to the "Transmit" condition. If not, recheck wiring between the KAM *XL* radio port, PTT pin, and ground on the microphone jack.
3. If receive led on the KAM *XL* does not light when receiving packets from other stations, recheck the audio connection between the radio and the KAM *XL*.
4. If possible, monitor the signal from the transmitter with another radio. If the transmitter is keying to "Transmit" but weak or no audio is monitored, increase AFSK output as necessary by increasing the XMITLVL parameter value for this port. (See the XMITLVL parameter in the command reference for details).
5. Check to be sure the proper radio port on the KAM *XL* is selected, by entering the STATUS command. It will report the current I/O port. If needed, change ports by using the streamswitch character.

Cannot Transmit

1. If a connection has been made to the XCD pin on the radio port, and has been grounded, transmit is not possible on that radio port. Try disconnecting any wire from pin 2 on the db9.

Cannot Return to Command Mode

1. The single most common cause of this is that the STOP character (and usually XOFF) may have been inadvertently set to the same as the COMMAND character. This is usually caused by the use setting the streamswitch to the dollar sign ($). If using the $ as streamswitch, hex values

cannot be entered without PASSing the dollar sign. Symptoms for this usually are that the KAM *XL* will work fine in Command Mode, and can usually send to other stations on the air, but can't get back to Command Mode. With most PC terminal programs, pressing <Ctrl+C> will display the heart character, but still won't return to the cmd: prompt.

2. The KAM *XL* may be in transparent interface mode, and typing just results in transmitting. See the "Getting out of Transparent Mode" section in the "Interface Modes" chapter.
3. The TNC is in a different interface mode, and needs a different communication program, or the interface mode needs to be "exited" back to terminal mode. See the "Getting out of Host Mode" or “Getting out of KISS mode” sections, below.
4. The TNC has parameters set in such a way that return to command mode is not possible. In this case, a HARD RESET will be necessary.

Getting Out of Host Mode

If you want to use a "standard" terminal program after you have used a Host mode program, be aware that your TNC may still be in host mode when you first turn it on. If it is, you will not see the normal sign on message, but instead will see the message " SØØ ", sent by the TNC to indicate that it is in HOST Mode. If you see this message, you must first exit the Host Mode before you can start talking to your unit with a program such as Pacterm. You must send three characters to the TNC in order to exit the Host Mode.

First, send a FEND character (ASCII code 192), then the letter q (upper or lower case is ok), and finally an-other FEND character.

The KAM-*XL* will then leave Host Mode and send the usual Kantronics sign-on message.

To send the 3-character sequence from your keyboard, do the following:

1. Press and HOLD the ALT key. Type the numbers 192 (OR 0192 if using Hyperterm) from the numeric KEYPAD (do not use the numbers above the letters on the keyboard). Then release the ALT key.
2. Type "Q".
3. Press and HOLD the ALT key. Type the numbers 192 from the numeric KEYPAD (do not use the numbers above the letters on the keyboard). Then release the ALT key.

When your terminal program sends these characters, the TNC will switch you out of Host Mode and into Command Mode.

Appendix E: Additional Information

Messages from the KAM *XL*

The following are brief explanations of the most important messages that may be sent by your TNC.

Note: Since these messages are also sent by other Kantronics' TNCs, they refer to "TNC", not to "KAM *XL*".

***(callsign) busy

The packet station you were attempting to connect to (callsign) is unable to accept connects, and responded with a busy signal.

HF CALIBRATE MODE HBAUD: 1200
M send mark
R receive
S send space
T send square wave
B random
- or + adjust XMITLVL while transmitting
X exit
XMITLVL 40

This message appears on your screen when entering the Calibrate Mode for port 1. Press M to generate a MARK tone, R to receive a Kantronics Calibrate signal from another TNC, S to generate a SPACE tone, T to transmit a Kantronics Calibrate signal, - or + to adjust XMITLVL while transmitting, or X to return to the Command Mode.

VHF CALIBRATE MODE HBAUD: 1200
M send mark
R receive
S send space
T send square wave
B random
- or + adjust XMITLVL while transmitting
X exit
XMITLVL 25

This message appears on your screen when you enter the Calibrate Mode for port 2. The calibrate commands are the same as in port 1.

Already connected on stream n

You are attempting to connect to someone you are already connected to on another stream. The STATUS command will show you who you are connected to and on what stream (i.e., stream "n").

BBS BUSY

You have attempted to connect to your own PBBS, but the BBS is in use by another station.

Can't DISCONNECT

You are not connected on this stream so therefore cannot disconnect. This message will be followed by the stream and a "Link state is:" message, described later in this section.

Can't RECONNECT

You have attempted to reconnect to a station (by issuing a CONNECT command) but the callsign you entered is not the same as the station you are already connected to. You may only reconnect (via a different path) to the station you are connected to on this stream.

CHECKSUM ERROR

This message indicates that the Kantronics firmware in your TNC may be damaged. You may see this message when performing a hard reset, or any time a soft reset is performed (including initial power up), and an EPROM error is detected.

CHECKSUM OK

When performing a hard reset, this message indicates that the Kantronics firmware Eprom has passed the internal checksum test.

cmd:

This is the Command Mode's prompt for input. Any characters entered after the TNC prints "cmd:" will be used as command input and not packet data.

Command not available in NEWUSER mode

This message indicates that you have attempted to change one of the commands in the TNC, but that command is not currently available to you. This occurs when the INTFACE command is set to NEWUSER. To enable all commands, set INTFACE TERMINAL.

*** connect request:

A remote packet station has attempted to connect to you, but there is not a valid stream available for the connection. The remote station will be sent a busy message, packet. See the USERS and MAXUSERS commands for setting more streams and allowing more connects at one time if desired. Also be
sure CONOK is ON.

*** CONNECTED to call [VIA digi1....digi8]

A packet connection has taken place. This can happen by you issuing a connect request or a connect request coming in from a remote station. "call" will be the callsign entered in the remote stations MYCALL and if a path was used it will be shown.

*** DISCONNECTED

The packet connection no longer exists.

EH?

This is the TNC's generalized "I don't understand" message. A dollar sign ($) is used to point to the offending character. It will also appear if a required input item is missing, e.g.:

```
C KV7B V
          $
EH?
```

In this example, the required callsign after the VIA option is missing. Most commands that receive an EH? error are ignored. In a few cases, part of the command may be accepted and acted upon, as described under the message "Input ignored".

ENTER YOUR CALLSIGN=>

Type in your callsign. The TNC needs to know who you are to properly implement its protocol. Your callsign will be placed in the MYCALL parameter and used to generate the MYGATE, MYNODE and MYPBBS callsigns, and the CWIDTEXT.

xxxx FREE BYTES

This message indicated how many additional characters may be entered into the TNC packet buffer before the buffer is full.

***FRMR received:

A frame reject packet has been received for an unknown reason. The information field of this packet will display in hexadecimal value. This display may be useful in determining why the receiving station rejected your packet.

***FRMR sent:

Frame reject packet has been sent due to a detected error in protocol. Three bytes (6 hexadecimal characters) are displayed to assist in determining the reason for the reject.

Input ignored

Since the TNC command interpreter was kept small and simple, it will sometimes change parameters before it completes parsing some of the more involved commands. In some cases, options at the beginning of the command will have been acted on before a syntax error near the end of the line is reached. When this occurs, "Input ignored" is used to show what part of the line was ignored. The dollar sign points to the boundary: characters to the left were used; the character pointed to and those to the right were not, i.e., the line was parsed as if a <CR> was entered at the $.

Example:

```
BUDLIST QST,KBØNYK NØKN
$
Input ignored
```

Because the comma is missing, the command is interpreted as if it were BUDLIST QST,KBØNYK; the NØKN is ignored.

INVALID STREAM

The stream you have tried to change to is not valid. Port numbers must be numbers 1 or 2. Stream designators must be letters A - Z. MAXUSERS sets the upper limit on valid streams and which ports are valid.

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A message such as this (different for each product, but with this format) appears when the TNC is first turned on and after any soft reset, including changing the NUMNODES, PBBS, MAXUSERS or MYREMOTE commands, or issuing the RESET command.

Link state is:

This message is output in response to the CONNECT and DISCONNECT commands if the state of the link does not permit the requested action. It is prefaced by "Can't CONNECT" or "Can't DISCONNECT" as appropriate and will be followed by the current link state. A CONNECT command with no options will display the link state of the current stream.

Current link states are:

Both devices busy

Both TNCs involved in the connection are unable to accept any more data.

CONNECTED to (callsign v path)

Your TNC is currently connected to the indicated station, using the path given.

CONNECT in progress

Your TNC is attempting to establish a connection.

Device busy

Your TNC is unable to accept any more data from the remote station at this time.

DISC in progress

Your TNC is attempting to disconnect from another station.

DISCONNECTED

No connection exists on the current stream.

FRMR in progress

Your TNC has detected an error in the protocol. This is normally caused by two TNCs using the same callsign, resulting in both of them trying to respond to the same message.

Remote device busy

The remote TNC is unable to receive any more data from the radio at this time.

Waiting ACK and device busy

Your TNC has sent a packet to another station and is waiting for the acknowledgment, but your TNC is not able to accept any data from the radio at this time.

Waiting ACK and remote busy

Your TNC has sent a packet to another station and is waiting for the acknowledgment, and the remote TNC is not able to accept any data from the radio at this time.

Waiting ACK and both devices busy

Your TNC has sent a packet to another station and is waiting for the acknowledgment, but neither your TNC nor the other station's TNC is able to accept any data from the radio at this time.

Waiting acknowledgment

You have sent a packet of data to another station, and your TNC is waiting for the acknowledgment.

MESSAGES WOULD BE LOST

This message indicates that you have attempted to set the PBBS size too small to hold all of the existing messages in the mailbox. The size is not changed, and therefore no messages are lost. If you want to make the mail-box smaller, you must first delete some of the messages or set the PBBS to 0, erasing all of the messages, then set the new PBBS size.

NO KNOWN NODES

An NDHEARD list has been requested and the TNC has not heard any other nodes (e.g., KA-Nodes).

NOT ENOUGH RAM

This message indicates that you have attempted to set the NUMNODES, MAXUSERS, or PBBS to a value which requires more RAM memory than is currently available. It may also occur if you try to enable the MYREMOTE and there isn't enough memory left.

Not while connected

Some parameters cannot be changed if the TNC is connected to another station.

This message is printed if an attempt is made.

PBBS MESSAGE BUFFER NOT VALID!

TRYING TO RECOVER

When you turn on the TNC a check is made of the pointers relating to the PBBS. It appears that one or more of these pointers may not be correct. An attempt is made to correct them, but it is possible that some or all of the messages may be lost.

PRESS (*) TO SET BAUD RATE

You need to press the asterisk (*) key on your keyboard within two seconds of seeing this message. The TNCs autobaud routine will then detect what baud rate your computer is using, so the two devices can communicate.

RAM OK xxxK BYTES

This message appears when a hard reset is performed and indicates that the TNC has tested the installed RAM and has found no problems. It also reports the amount of RAM installed in your TNC.

RAM ERROR xxxK BYTES

If this message appears when you perform a hard reset, the TNC has detected a problem with the installed RAM, and reports how much of the RAM it found.

***retry count exceeded
*** DISCONNECTED

The number of tries set by the RETRY command has been exceeded. Therefore the connection has been broken.

S00

This message from the TNC indicates that it is in the HOST mode of operation, and has just performed a reset. To exit the Host mode, you must send three characters to the TNC from your keyboard. See the Host mode section of the manual for details. Two FEND characters precede this message and one FEND character follows this message, but they may not be visible (depending on your terminal program).

Value out of range

If the syntax of the command is legal, but the value specified is too large or too small for this command, the value out of range message is returned. A $ is used to point to the bad value.

was

Whenever one of the parameters is changed, the previous value is usually displayed.

Example: cmd:AX25 OFF: AX25L2V2 was ON