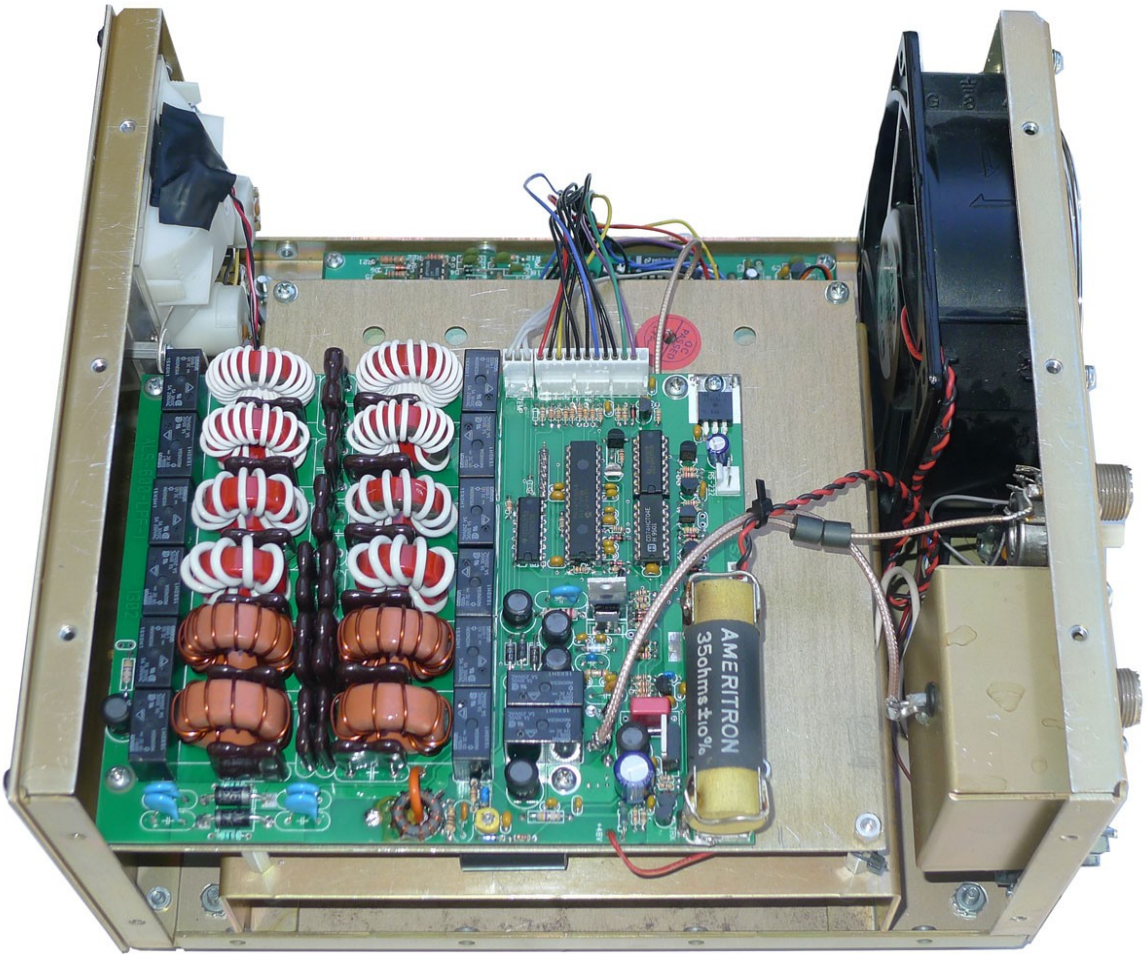
ALS-600-LPF User Manual



Introduction

ALS-600-LPF kit is a replacement for ALS600FB Output Filter board in Ameritron ALS-600 amplifiers.

Features:

- ✔ Automatic band change based on TX frequency.
- ✔ Fast and quiet PIN diode QSK RX / TX switch.
- ✔ Temperature controlled FAN for quiet operation.
- ✔ Automatic fault recovery.
- ✔ RS-232 serial port for remote panel, PC control and firmware upgrade.

Operation

Amplifier's Standby / Operate mode can be selected with the front panel switch or command thru RS-232 port.

Fault recovery is automatic – just release PTT for more than 3 sec and try again.

Band Change

Amplifier will monitor the exciter transmitting frequency and switch band low-pass filters as needed. Quick and robust algorithm can start band change in less than 2 milliseconds when transmitting in SSB or CW mode. To prevent relays hot switching, power module is disabled during band changes. Optionally, band low-pass filter can be selected from RS-232 port.

Fault Conditions and Recovery

When a fault condition occurs, the amplifier is bypassed and LOAD FAULT Led will blink a specific pattern to indicate the fault reason. There is no special Operator action required - just release PTT for more than 3 sec and the next start of transmission will try to recover.

LED pattern	Status message	Description
●○○○●○○○ short blink	NoPTT	RF input carrier found without asserting PTT while amplifier in OPERATE state. Amplifier is switched temporary in BYPASS until carrier is stopped for >3sec or PTT is activated. PTT line will be disabled when temperature switch is OPEN. Used while tuning antenna. Band filters will be always switched based on measured frequency.
●○●○○○ two blinks	PINBias	PIN diodes bias (300V) was low. Check the 50V / 25A fuse on the back of ALS600PS.
●○●○●○●○ fast blink	SWR	Reflected output power above trip point.
	PASWR	PA module reflected power above trip point.
●○●○●○○○ three blinks	OverHeat	Temperature is above trip point.
●●●●○○○○ slow blink	OverDrive	Forward output power above trip point.

Table 1

Notes:

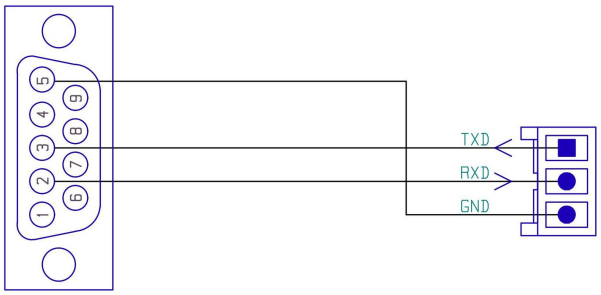
● = LED ON ○ = LED OFF

Serial Port

RS-232 compatible serial port connection is not mandatory for regular use. This optional connection can provide additional functionality:

- ✔ Helpful tool for diagnostic and changing internal parameters.
- ✔ Firmware upgrades.
- ✔ Remote monitoring and control. LCD panel or PC program showing Output / Reflected Power, Temperature and Amplifier Status can be used.

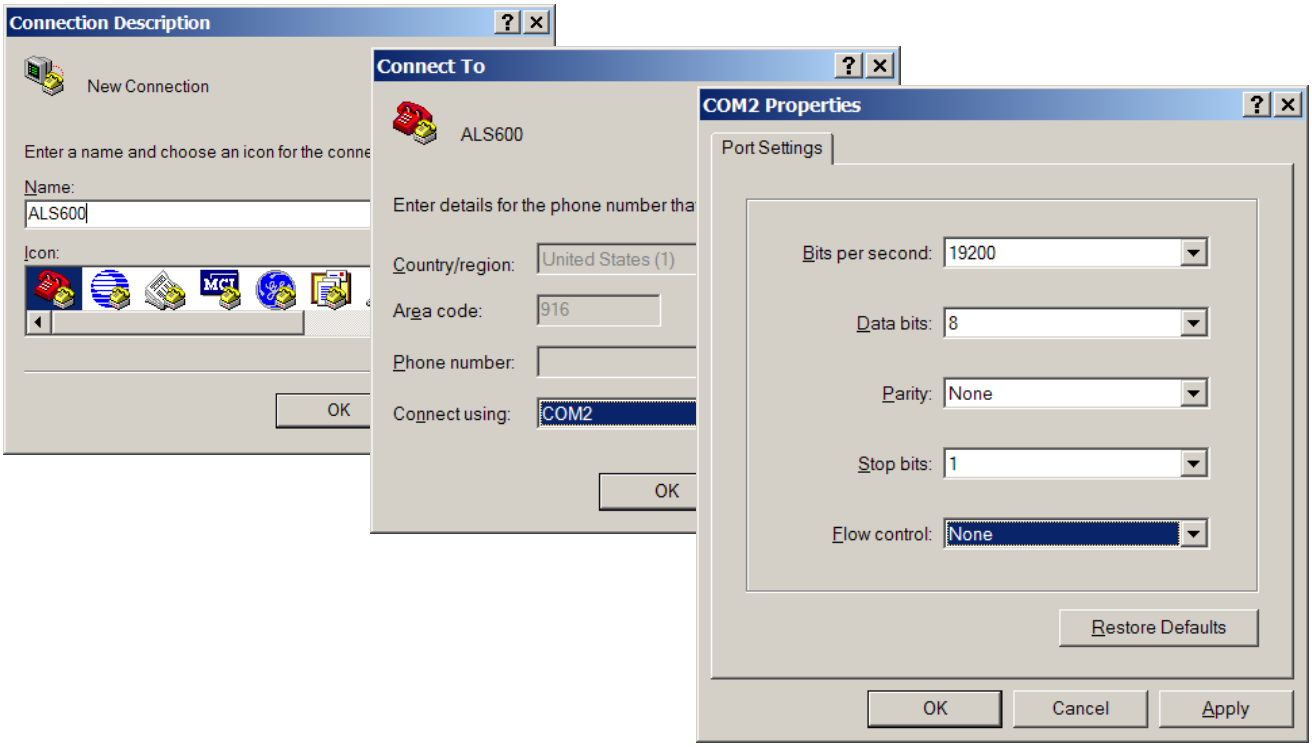
DB9 Male Connector
Use NULL modem cable
to connect to PC



ALS-600-LPF

RS-232 Wiring diagram

Terminal emulator program such as HyperTeminal can be used to connect with ALS-600 amplifier. Default settings are: **19200 baud, 8bits, no parity, 1 stop bit, no flow control**. Start HyperTerminal program and configure a new serial port connection:

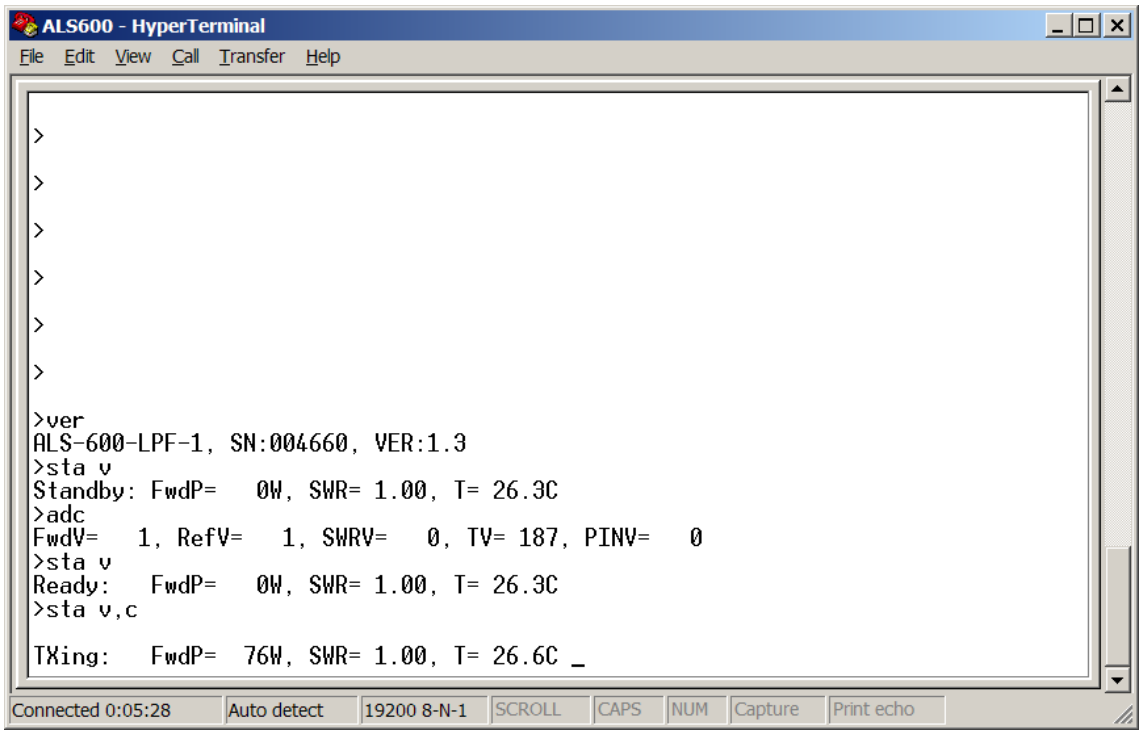


Commands begin on a new line and can have up to 9 parameters separated with a comma. Parameters in square brackets [ ] are optional, and all next parameters need to be entered. Left / Right arrows, Backspace and Del keyboard buttons can be used for line editing. CTRL-X will abort and clear entire line. Commands are executed by pressing Enter key. Examples in this manual will be printed in *italic* typeface.

Enter key will be represented with ↵ symbol.

Following example shows how to check the firmware version. Comments are added in this manual for clarification on some lines after < symbol.

```
>ver↵                                   <send command ver
ALS-600-LPF-1, SN:001001, VER:1.3       <shows response from ALS-600
>                                       <if enabled prompt is returned on new line
```



It is very helpful to have a text file open in NotePad or other text editor to copy and paste command lines for backup purposes. Logging to file functionality can be used for backup. Factory default settings are shown in brackets.

Fan Display / Set Command

Cooling fan speed is regulated by changing the applied voltage from 4V (0%) to 12V (100%). When measured heat sink temperature is below or equal to *LowC,* fan speed will be set to *Low%. When temperature is between LowC and HiC points, fan speed will vary proportionately between Low% and Hi% settings. If temperature is higher than HiC point, fan speed will be set to Hi%. While transmitting, fan speed will be always higher than TX% setting.*

```
fan [0..100%]↵
fan [set], [LowC, Low%, HiC, Hi%, TX%]↵
```

Parameters:		*Factory defaults*
LowC	*– low temperature point*	*(30C)*
Low%	*– low fan speed*	*(30%)*
HiC	*– high temperature point*	*(50C)*
Hi%	*– high fan speed*	*(100%)*
TX%	*– TXing fan minimum speed*	*(50%)*

```
-- examples --
>fan↵                                  <display fan current speed and amplifier temperature
37%, T= 32.3C
>

>fan 70↵                               <set speed manually to 70%
>fan 0↵                                <resume to automatic fan temperature control

>fan set, 30, 40, 80, 100, 70↵         <change fan settings
>

>fan set↵                              <display current fan settings
fan set, 30, 40, 80, 100, 70↵          <copy this line and paste it in text editor for backup
>
```

Use `nvmem save` command to make any changes permanent.

Band Display / Set Command

Displays last measured carrier frequency and selected band number.
Switch Low-pass filter without sending carrier.

```
band [1..6]↵
```

```
-- examples --
>band↵                                 <display measured frequency and LP filter selected
Freq=14176KHz, Band=4
>

>band 1↵                               <switch to Low-pass filter 1  (160M band)
>
```

Baud Rate / Set Command
Changes the serial port baud rate immediately.
Use *nvmem save* command to make it permanent.
Available serial baud rates are: **9600, 19200, 57600**

```
-- examples --
>baud 57600↵
Switch to 57600                    <change your terminal to new baud rate
```

Standby command
Turn the amplifier in Standby (bypass) mode.

```
-- examples --
>stby↵
>
```

Operate command
Turn the amplifier in Operate mode.

```
-- examples --
>oper↵
>
```

Note: After power-up Amplifier mode is determined by Standby / Operate switch state.

Save to NVMEM / Restore defaults command
After power-up the amplifier will read operational and calibration parameters form Non-Volatile Memory (NVMEM) and copies them to RAM.
Any changes will modify only the values stored in RAM.
Save RAM to NVMEM to make changes permanent.
If you want to go back to previously stored values, just restart the amplifier.

```
-- examples --
>nvmem save↵                      <save all parameters to NVRAM
Write Successful!
>
>nvmem default↵                   <restore factory defaults to NVRAM
Factory defaults restored!
>
```

ADC Display / Calibration Command

Three 10bit Analog to Digital converters are used to measure power and protect the amplifier. Output power (*FwdV*) and Reflected power (*RefV)* are measuring the voltage coming from the output RF bridge and peak detectors – same as cross-needle meters.
SWRV is measuring the reflected power voltage between PA module and switched Low pass filters.
To convert measured voltages to power readings, the firmware uses formula (1):

(1) FwdP = (FwdV * FwdV) / Fwdcal

Calibration of each power reading can be done by adjusting each calibration constant between 1 to 65535.

```
adc [cal], [Fwdcal, Refcal, SWRcal]↵
```

Parameters:		*Factory defaults*
Fwdcal	*– forward power calibration constant*	*(1100)*
Refcal	*– reflected power calibration constant*	*(1100)*
SWRcal	*– PA module reflected power calibration constant*	*(5600)*

```
-- examples --
>adc cal, 1250, 1100, 3000↵          <set calibration constants
>
>adc cal↵                            <display calibration constants
adc cal, 1250, 1100, 3000            <copy this line for backup
>
>adc↵                                                  <display ADC readings
FwdV=   1, RefV=   1, SWRV=   1, TV= 211, PINV=   1    <raw 10bit  [0..1023]
>
>adc↵
FwdV= 826, RefV= 116, SWRV= 463, TV= 220, PINV= 259    <TXing
>
```

PINV A/D converter is used internally to generate and regulate the PIN diodes bias voltage.
TV A/D converter is sampling the temperature sensor and it is converted to deg. Celsius.

Use `nvmem save` command to make any changes permanent.

Fault Trip Point / Set Command
Set / display amplifier protection trip points.
FwdP and RefP are measured at amplifier output, after peak detectors – same as cross-needle meters. SWRP is measured between PA module and Low pass filters.

trip [FwdP, RevP, SWRP, TC]↵

Parameters:		*Factory defaults*
FwdP	*– max forward power [100..800W]*	*(650W)*
RevP	*– max reflected power [10..100W]*	*(80W)*
SWR P	*– max reflected power [10..200W] at PA module*	*(160W)*
TC	*– max temperature [0C..90C]*	*(80C)*

```
-- examples --
>trip 650, 75, 90, 80↵        <change trip points settings
>
>trip↵                        <display current trip points settings
trip 650, 75, 90, 80          <copy this line and paste it in text editor for backup
>
```

Use *nvmem save* command to make any changes permanent.

Status Command
Display Amplifier Status word, Forward power, Reflected power, PA module Reflected power and temperature. Information can be displayed continuously 5 times per sec. for monitoring.

sta [v], [c]↵
sta d↵

Parameters:

v	*– display status in verbose format .*
c	*– display continuously on same line, until CTRL-X is send.*
d	*– display line each time Amplifier Status word was changed.*

Returned Amplifier Status 16bit word description

$0fsb

- ***b*** *4bit selected band:*
  - *$0-> band is not determent*
  - *$1->160M, 2->80M, 3->40M, 4-> 20M, 5->15M, 6->10M*
- ***s*** *4bit Amplifier state machine:*
  - *$0-> Bypassed*
  - *$1-> Ready*
  - *$3-> TXing*
  - *$9-> NoPTTCAR*
  - *$C..$F-> Fault condition states*
- ***f*** *4bit Fault codes:*
  - *$0-> no Fault*
  - *$1->* NoPTT
  - *$2-> PINBias*
  - *$3-> PINBiasRamp*
  - *$4-> PASWR*
  - *$5-> SWR*
  - *$6-> OverDrive*
  - *$7-> OverHeat*

```
-- examples -
>sta                                                    <display status in HEX
$0034, FwdP= 614W, RevP=  11W, SWRP=  36W, T= 34.6C     <TXing on 20M

>sta v                                                  <verbose
TXing:   FwdP= 621W, SWR= 1.31, T= 34.6C

>sta v↵
Standby: FwdP=   0W, SWR= 1.00, T= 32.3C
>

>sta v↵
Ready:   FwdP=   0W, SWR= 1.00, T= 32.3C
>

>sta v↵
FAULT -> SWR                          <fault message details can be found in Table 1
>
```

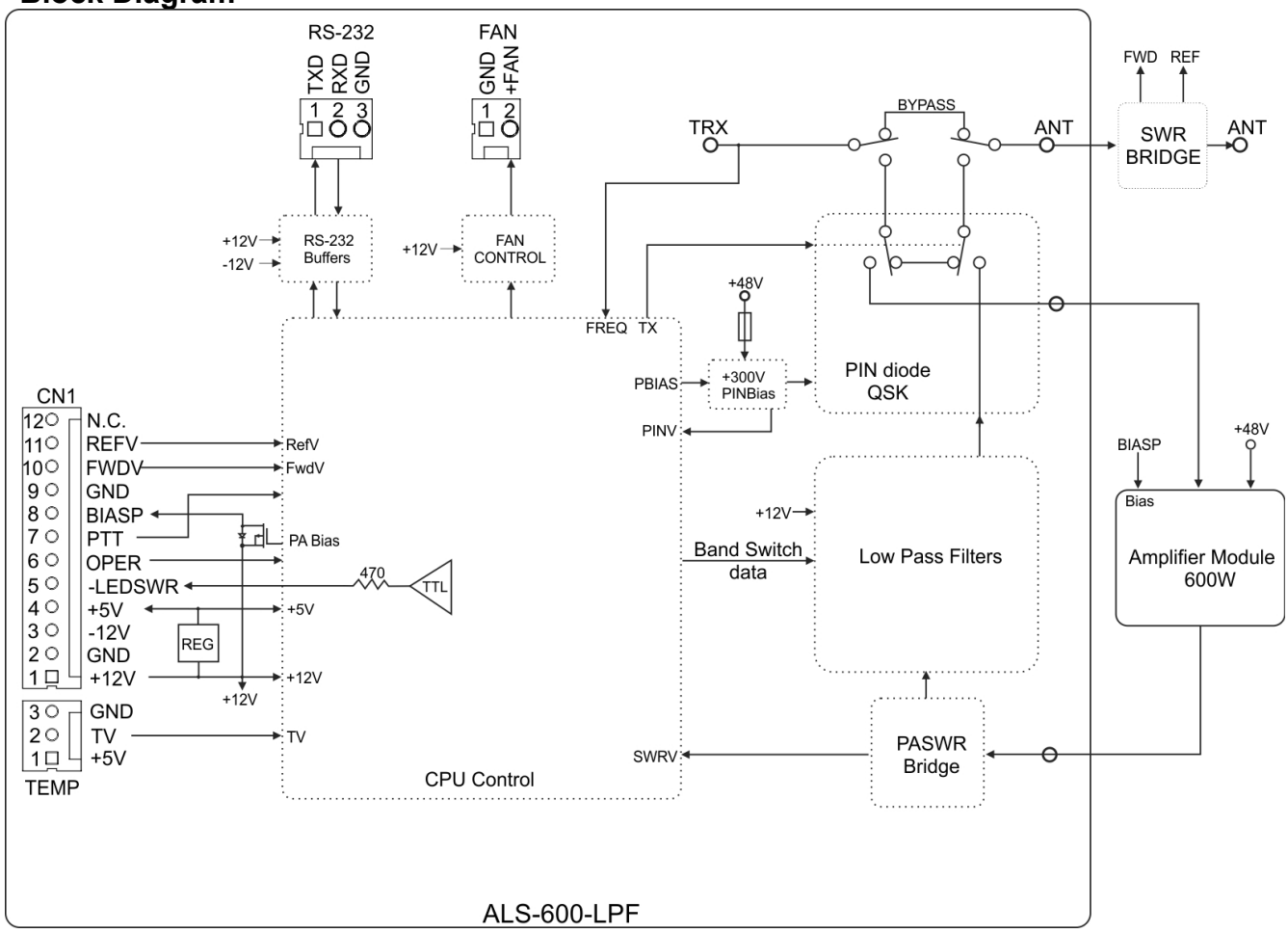
Display a line with debugging information when Amplifier Status was changed.

```
>sta d          <display status, flags, ADC and time elapsed from previous status change
>
```

Amplifier STATUS - FLAGS	ADC FwdV	ADC RefV	ADC SWRV	ADC TV	ADC PINV	Time elapsed x 0.3mS	
$0001-0002	*1*	*2*	*1*	*220*	*1*	*10925*	*<Standby on band=1*
>sta v							
Standby: FwdP= 0W, SWR= 1.00, T= 34.8C							
>oper							
$0011-000A	*1*	*2*	*1*	*222*	*1*	*8880*	*<operate state*
$0021-0003	*1*	*2*	*1*	*222*	*1*	*8826*	*<PTT activated*
$0071-0013	*26*	*10*	*994*	*225*	*338*	*42*	*<13mS later freq is determined*
$0034-0003	*734*	*231*	*665*	*223*	*264*	*58*	*<17mS Txing on band 4 full power*
$0044-0003	*657*	*192*	*2*	*223*	*262*	*31839*	*<10 sec later PTT released*
$0014-0003	*645*	*189*	*1*	*223*	*1*	*64*	*< Ready on band 4*
$0024-0003	*1*	*2*	*1*	*224*	*1*	*31891*	*<10 sec later PTT is activated*
$0034-0003	*707*	*364*	*709*	*225*	*333*	*45*	*<TXing on band 4 full power*
$05C4-0003	*630*	*323*	*675*	*225*	*277*	*395*	*<118mS later found SWR is to high*
$05E4-0003	*131*	*66*	*1*	*225*	*1*	*9036*	*<PTT was released for > 3sec*
$0514-0003	*120*	*60*	*1*	*225*	*1*	*301*	*<Ready after SWR fault for next PTT*
sta v							*<check status verbose*
FAULT -> SWR							
>							
$0024-0003	*1*	*2*	*1*	*209*	*1*	*10977*	*< PTT activated*
$0034-0003	*813*	*44*	*542*	*210*	*326*	*45*	*< 13mS Full power TXing on band 4*
$0044-0003	*681*	*32*	*2*	*209*	*283*	*17651*	*< 5 sec later PTT released*
$0014-0003	*668*	*32*	*1*	*209*	*1*	*61*	

To cancel debugging, press CTRL-X.

Block Diagram



CN1 Pinout

PIN	SIGNAL	DESCRIPTION
1	+12V	Power supply input +10VDC to +16VDC. Current RX/STBY ~ 0.3A; TX ~ 0.6A Max without Fan.
2	GND	Power supply return. Chassis ground.
3	-12V	Power supply input -10VDC to -16VDC. Current ~0.01A. Used only by RS-232 port.
4	+5V	Regulated power supply output. 5V / 0.1A Max. Used for LOAD FAULT Led.
5	-LEDSWR	TTL output with 470 Ohm in series. Controls the LOAD FAULT Led mounted on the front panel.
6	OPER	Operate / Standby Input – wired to front panel OPERATE switch. Standby = Open / GND; Operate = wired to +12V
7	PTT	PTT Input. Switch to TX when grounded. Wired to PTT jack on the back panel.
8	BIASP	+12VDC / 0.05A Max. power source for Amplifier Module bias. It is wired to 8V regulator input located on ALC board.
9	GND	Power supply return. Chassis ground.
10	FWDV	Forward Power Analog input wired to ALC board.
11	REFV	Reflected power Analog input wired to ALC board.
12	N.C.	Not connected

FAN Pinout

PIN	SIGNAL	DESCRIPTION
1	GND	Power supply return. Chassis ground.
2	+FAN	Fan power supply regulated output +4V up to +12V power supply input less 1.5V drop-out. Current 1A Max.