

130-01 Broadband Seismic Recorder



130-01 System Startup (Version 2.8.7)

Refraction Technology



Refraction Technology, Inc.

**1600 Tenth Street, Suite A
Plano, Texas 75074
USA**

Voice: 214-440-1265

Fax: 972-578-0045

EMAIL: support@reftek.com

FTP: <ftp.reftek.com>

WWW: <http://reftek.com>

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Printed in USA

Preface

All references to a PDA device in this guide refer to any type of device that is compatible with the Palm™ operating system (OS) with RS232 (i.e., Palm IIIe™, Palm IIIxe™, Palm V™, Palm VII™, Palm M105™, Handspring Visor™, TRG Pro™, etc.)

This **REF TEK** manual provides startup and basic operating procedures with the 130 DAS family and related products. Cable drawings are also provided to allow several configurations.

REF TEK Support and update notifications

As a valued user of **REF TEK** equipment we would like to provide the best support possible by keeping you up to date with our product updates.

If you would like to be notified of any **REF TEK** product updates please spend a couple of minutes to register with the reftek customer support team.

To Register, either send an email to updates@reftek.com giving us your name and **REF TEK** product you currently have or fill out our online registration form at www.reftek.com/registration

Once we register your contact we will only send necessary notifications via email. The same notifications will be shown on our website's www.reftek.com/support page

Thanks,

Your **REF TEK** support team

Revision History:

| Rev | Date | Reason for change | Affected Pages |
|-----|----------|---|-------------------------------------|
| 0.1 | 1/12/02 | Initial release | |
| A | 10/04/02 | Release of 1.0 130 Software | |
| B | 1/03/03 | Updated Firmware procedure | Section 3.9 on page 42 |
| C | 3/03/02 | Updated DAS Channel connectors to include RT527. Added 130-8103 CLEA™ cable | Section 1.32 and 1.33 Page 64 |
| D | 05/12/03 | Added PPP Client connection setup Added optional sensor cables | Section 3 Section 5 - Page 76-82 |
| E | 06/02/03 | CPU Firmware 2.1.0 Release - Vote | All |
| F | 5/04/05 | Added EMI Shielding steps | Section 4.7 and 4.8 |
| | | Added RT527 Installation Section | Section 4.11 |

Names and Contents of Toxic or Hazardous Materials

| 部件名称 (Part) | 有毒有害物质或元素 (Hazardous) | | | | | |
|--------------------|-----------------------|-----------|-----------|----------------|--------------|---------------|
| | 铅 (Pb) | 汞 (Hg) | 镉 (Cd) | 六价铬 (Cr VI) | 多溴联 (PBB) | 多溴二 (PBDE) |
| 金属部件 (Metal Parts) | X | ○ | X | ○ | ○ | ○ |
| 电路模块 (PCB Modules) | X | ○ | ○ | ○ | ○ | ○ |
| 电缆及电缆组件 (Cables) | X | ○ | X | ○ | ○ | ○ |
| 塑料和聚合物部件 (Plastic) | ○ | ○ | ○ | ○ | ○ | ○ |

○: 表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T1 1363-2006 标准规定的限量要求以下。

X: 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T1 1363-2006 标准规定的限量要求。

注意: 在所售产品中可能会也可能不会含有所有所列的部件。

Notation Conventions

The following notation conventions are used throughout Ref Tek documentation:

| Notation | Description |
|----------|---|
| ASCII | Indicates the entry conforms to the American Standard Code for Information Interchange definition of character (text) information. |
| Binary | Indicates the entry is a raw, numeric value. |
| Hex | Indicates hexadecimal notation. This is used with both ASCII characters (0 – 9, A – F) and numeric values. |
| BCD | Indicates the entry is a numeric value where each four bits represents a decimal digit. |
| FP n | Indicates the entry is the ASCII representation of a floating-point number with n places following the decimal point. |
| < n > | Indicates a single 8-bit byte. When the contents are numeric, it indicates a hexadecimal numeric value; i.e. <84> represents hexadecimal 84 (132 decimal). When the contents are capital letters, it represents a named ASCII control character; i.e. <SP> represents a space character, <CR> represents a carriage return character and <LF> represents a line feed character. |
| MSB | Most Significant Byte of a multi-byte value. |
| MSbit | Most Significant Bit of a binary number. |
| LSB | Least Significant Byte of a multi-byte value. |
| LSbit | Least Significant Bit (bit 0) of a binary number. |
| YYYY | Year as a 4-digit number |
| DDD | Day of year |
| HH | Hour of day in 24-hour format |
| MM | Minutes of hour |
| SS | Seconds of minute |
| TTT | Thousandths of a second (milliseconds) |
| IIII | Unit ID number |
| | |
| n, nS | nano, nanoSecond; $10^{-9} = 0.000000001$ |
| u, uS | micro, microSecond; $10^{-6} = 0.000001$ |
| m, mS | milli, milliSecond; $10^{-3} = 0.001$ |
| K, KHz | Kilo, KiloHertz; $10^3 = 1,000$ |
| M, MHz | Mega, MegaHertz; $10^6 = 1,000,000$ |
| G, GHz | Giga, GigaHertz; $10^9 = 1,000,000,000$ |
| Kb, KB | Kilobit, KiloByte; $2^{10} = 1,024$ |
| Mb, MB | Megabit, MegaByte; $2^{20} = 1,048,576$ |
| Gb, GB | Gigabit, GigaByte; $2^{30} = 1,073,741,824$ |

Related Manuals:

| 130-01 System Documents | Number | PDF file |
|---|--------------|-------------------------|
| 130-01 System Startup | 1301-SYS-001 | 130_startup_01.pdf |
| PFC_130 Users Guide | 130-PFC-001 | 130_pfc.pdf |
| REF TEK Utilities Users Guide | UTILS-OP-002 | 130_utilities.pdf |
| Archive Utilities | ARC-OP-003 | arcutil.pdf |
| 130 Theory of Operations | 130-SYS-002 | 130_theory.pdf |
| 130 PFC Release Notes | 130-RN-001 | 130_PFCRN.pdf |
| 130 CPU Release Notes | 130-RN-002 | 130_CPURN.pdf |
| 130 RTCC Release Notes | 130-RN-003 | 130_RTCCRN.pdf |
| 130 Command Reference | 130-CR-001 | 130_command.pdf |
| 130 Recording Format | 130-RF-001 | 130_record.pdf |
| 130-GPS/01 | 130-TR-003 | gps01.pdf |
| 130-01 Board Documents | Number | PDF file |
| RT505 - A/D Board | 130-RT505 | RT505r.pdf ^a |
| RT506 - CPU Board | 130-RT506 | RT506r.pdf |
| RT520 - Lid Interconnect Board | 130-RT520 | RT520r.pdf |
| RT526 - MicroDrive/Flash Board | 130-RT526 | RT526rB01.pdf |
| RT527 - Sensor Control Board (Optional) | 130-RT527 | RT527rB01.pdf |
| RT535 - Mass Memory Board (Optional) | 130-RT535 | RT535rB01.pdf |
| Optional Manuals | Number | PDF file |
| SNDP Reference Guide | SNDP-S-002 | SNDPRef.pdf |
| SNDP Installation and Users Guide | SNDP-S-003 | SNDPUser.pdf |
| RTPD Installation and Users Guide | RTPD-S-004 | RTPD.pdf |
| RTP Protocol | RTPD-S-004 | RTP.pdf |
| RT_View Users Guide* | RTV-S-005 | RTView.pdf |
| RTCC REF TEK Command and Control Users Guide* | RTCC-S-006 | RTCC.pdf |
| RT_Display Users Guide* | RTD-S-007 | RTDisplay.pdf |
| RTPMonitor Installation and Users Guide | RTPM-S-008 | RTPM.pdf |
| 131A-01/3 Standard Triaxial Accelerometer 131A-01/2 Low Noise Triaxial Accelerometer | 131A-TR-004 | 131A.pdf |
| 131A-01/1 Uniaxial Accelerometer | 131A-TR-005 | 131A011.pdf |

a. r = Revision level of 130 Board

* = Programs included in the optional Reftek Command and Control Interface (RTI)

About this manual:

This 130-01 System Startup manual provides a detailed overview of the operations and setup of the **REF TEK** 130-01 DAS family. It covers the following broad operational topics:

- [1] Standard connections and considerations.
- [2] Startup and Periodic Maintenance.
- [3] Cable drawings

Software Version:

Current software and documentation is available on our web site. Some early units may require hardware modifications to use the latest software. Contact **REF TEK** if you have any queries on the compatibility of your unit(s) and the current software release.

Firmware Update:

To update firmware from the FTP site

1. Login to our FTP site at: <ftp.reftek.com/pub> as:
User name: Anonymous
Password: Your E-mail address
2. Find the 130 firmware at <ftp.reftek.com/pub/130/cpu/prom>.
3. Download the zip file of the most recently released firmware version.

Update firmware:

Updating firmware in a 130 DAS requires the presence of a firmware file on an installed Compact Flash device.

1. On power-up, the 130 checks the Compact Flash for the presence of '*main.s3*' in the root directory.
2. If the '*main.s3*' file is present on the Compact Flash, the 130:
 - (a) Reads the file
 - (b) DELETES the file, and
 - (c) Re-programs the internal flash memory.

Note: DO NOT DISTURB THE UNIT DURING THIS PROCESS.

Follow these steps to update the firmware of a 130 DAS:

1. Unzip the 'main.s3' file from the downloaded zip file of the most recently released firmware.
2. Copy the desired firmware image to the root of the Compact Flash as 'main.s3' using a PC with a Compact Flash reader or ftp into the 130 DAS, with a Compact Flash installed, in binary mode.
3. With the Compact Flash with the main.s3 image installed in the 130 DAS, issue a reset command.

(a) If you are at the 130 DAS:

- **(a) Issue a Reset command from a PDA running PFC_130 or Physically disconnect and reconnect power to the unit.**
- **(b) Observe the LCD for the following messages:**

READING DISK DO NOT DISTURB
WRITING FLASH DO NOT DISTURB

- **(c) The 130 DAS resets and returns to normal messaging.**

(b) If you are remotely connected to a 130 DAS via telemetry mode:

- (i) If you are connecting remotely by a TCP connection:
 - **(a) First connect**
 - **(b) Discover the unit**
 - **(c) Acquire status**
- (ii) Issue a reset command from the Status screen
- (iii) Delete the unit from the Station List screen:
 - **(a) Wait at least 5 minutes**
 - **(b) At the Connections screen (reconnect id using a TCP connection) issue a Station Discovery again to discover the 130 DAS station.**

Note: DO NOT DISTURB THE UNIT until the start-up LCD message reappears.

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Logfile example



Section 1 Overview

1.1 Introduction

This section describes operations and maintenance requirements for the **REF TEK 130-01** Broadband Seismic Recorder. It includes the following:

- An explanation of the general purpose of the 130 DAS units.
- Standard faceplate connection functions, pinout, and associated cables drawings.
- General **130-01** DAS control considerations and operation.
- Port settings and modem communications.
- Hardware modularity.
- Frequently Asked Questions about the **130-01**.



WARNING: A 130 DAS is shipped pre-configured with a default IP address. Be sure to change this address before connecting the DAS to an ethernet port.



WARNING: The 130 DAS uses a 10BaseT ethernet chip. The 130 DAS ethernet port will not work when connected to all 100BaseT and some 10/100BaseT ethernet hubs.

1.2 Specifications

| Mechanical | |
|-------------------------------|--|
| Size: | 5.3" High x 7.3" Wide x 13.5" Long |
| Weight: | 4.5 lbs. (2 kg) |
| Watertight Integrity: | IP 67 |
| Shock: | Survives a 1 meter drop on any axis |
| Connectors | |
| Channel Input: | PT07A14-19S (2 each for a 6 Channel DAS) |
| Power: | PT07A12-4S |
| NET: | PT07A14-19P |
| Serial: | PT07A12-10P |
| GPS: | PT07A12-8S |
| Power | |
| Input Voltage: | 10 to 16 VDC |
| Average Power: | ~1 W (3 channel, No Communications) |
| | ~1.4 W (3 channels, With Communications) |
| | ~1.7 W (6-channels, No Communications) |
| | ~2.1 W (6-Channels, With Communications) |
| A/D Converter | |
| Type: | $\Delta - \Sigma$ modulation, 256 KHz base rate 24-bit output resolution |
| Channels: | 3 or 6 channels |
| Input Impedance: | 2 Mohms, 0.002 μ Fd, differential @ x 32 25 Kohm, 0.002 μ Fd, differential @ x1 |
| Common Mode Rejection | Greater than 70 db within ± 2.5 VDC |
| Gain Selection: | x1 and x32 |
| Input Full Scale: | 20 VPP @ x1 0.625 VPP @ x32 |
| Bit Weight: | 1.589 μ volts @ x1 49 nV @ x32 |
| Noise Level: | ~1 count RMS at 50sps @ x1 |
| Sample Rates: | 1000, 500, 250, 200, 125, 100, 50, 40, 25, 20, 10, 5, 1 sps |
| Dynamic Range | >135 dB |
| Time Base | |
| Type: | GPS Receiver/Clock plus a disciplined oscillator |
| Accuracy with GPS: | ± 10 μ sec after validated 3-D fix and locked |
| Free-Running Accuracy: | 0.1 ppm over the temperature range of 0° C to 60° C 0.2 ppm from -20° C to 0° C |
| Auxiliary Channels | |
| Inputs: | 3 Channels Available on each Sensor Connector |

| | |
|-----------------------------|---|
| Communication | |
| NET Connector: | |
| Ethernet | 10-BaseT, TCP/IP, UDP/IP, FTP, RTP |
| Serial | Asynchronous RS-232, PPP, TCP/IP, UDP/IP, FTP, RTP |
| Serial Connector: | |
| Terminal | Asynchronous RS-232, 130 Command |
| Recording Mode | |
| Continuous: | Record length |
| Time Trigger: | A list of record times and lengths |
| Event Trigger: | STA/LTA with advanced features including bandpass filter LTA hold, etc. |
| Level Trigger: | Absolute value, user selectable: g, or % of full scale, or counts including bandpass filter |
| External Trigger: | External pulse on trigger input line |
| Recording Capacity | |
| Battery Backed SRAM: | 5 Mbytes |
| Flash Disk: | 4 Gbytes with two CFII cards 8 Gbytes also available |
| Recording Format: | |
| Format: | PASSCAL Recording Format |
| Compliance: | |
| | <i>CE</i> |

1.3 Purpose of the 130 Broadband Seismic Recorder

The **REF TEK 130-01** DAS units are rugged, portable, and versatile data recorders. The modular design of their hardware and software allows you to reconfigure them for various types of applications, both short- and long-term. Some specific uses include the following:

- Collecting seismic data from earthquakes and micro-seismic events in local, regional, and global studies.
- Broadband
- Aftershock
- Active-Source
- Micro-Zonation Survey
- Site Noise Survey

1.4 Standard Faceplate Connections

The functions of the standard connectors on the **130-01** Broadband Seismic Recorder faceplate are as follows:

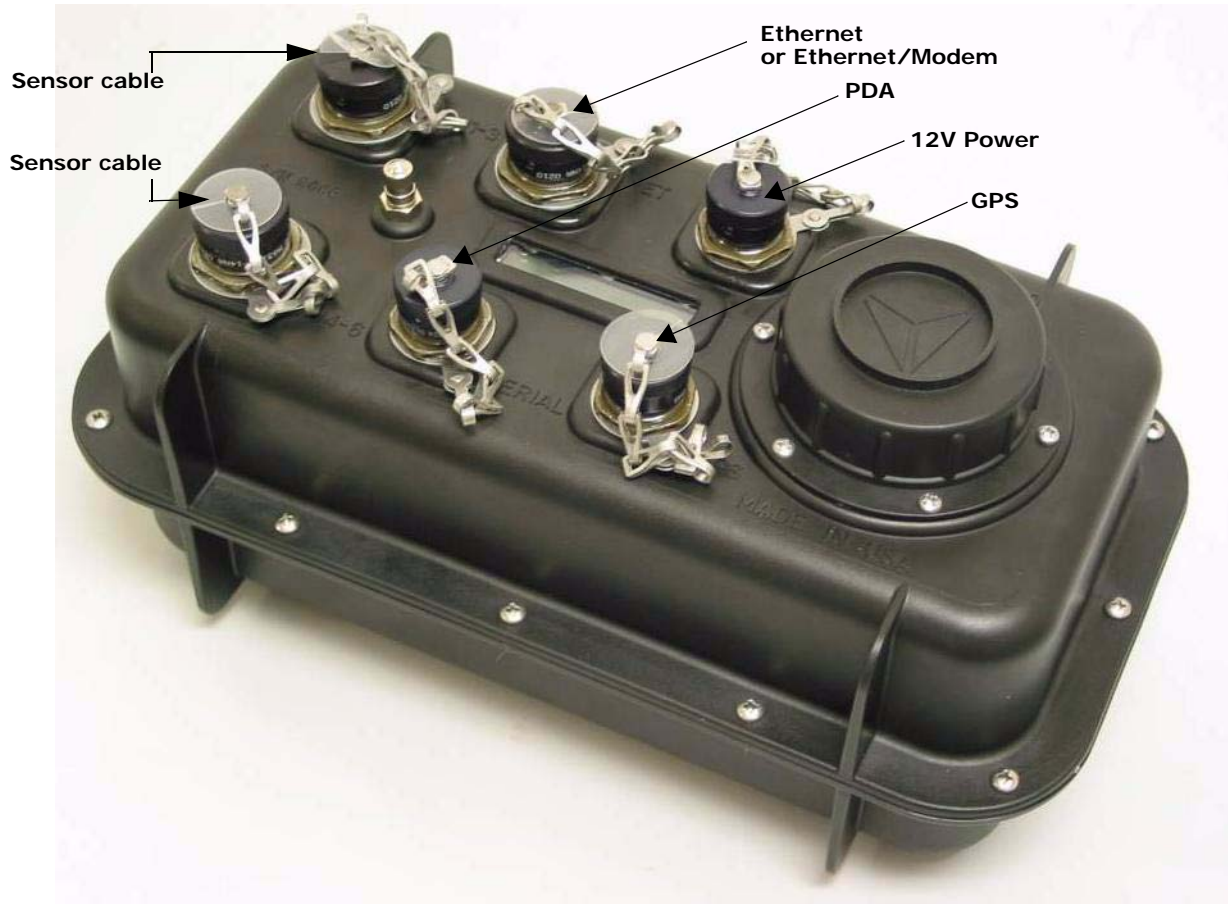


Figure 1 - 1 View of 130 top connections

1.4.1 Power connector

Power is supplied to the **130-01** DAS unit through one power connector. Hardware connection shows typical hardware connection for the **130-01** DAS. The following chart details individual connectors and **REF TEK** cable numbers.

| Recorder faceplate connector | Connector and Cable | 130 Pin | Pin Desc | Electrical Desc | Voltage Range |
|------------------------------|---------------------|---------|----------|-----------------|---------------|
| Power | PT06A12-4P | A | +12 VDC | Input | 10-15 VDC |
| Cable: | 130-8075 | B | +12 VDC | Input | 10-15 VDC |
| | | C | DGND | Power Return | |
| | | D | DGND | Power Return | |

1.4.2 Control Connector (Serial)

The **130-01** DAS unit's **SERIAL** connector provides general-purpose serial communications. Commonly, a personal computer, such as a DOS-based desktop, laptop, or PDA using **REF TEK** software is connected here to monitor and control **130-01** DAS operations.

| Recorder Faceplate Connector | Connector and Cable | 130 Pin | Pin Desc | Electrical Desc | Voltage Range |
|------------------------------|---------------------|---------|----------|---------------------|------------------------|
| Serial | PT07A12-60 | A | TX B | Output RS232 | ±5 Volts |
| | | B | RX B | Input RS232 | ±12 Volts |
| | Serial device | C | RTS B | Output RS232 | ±5 Volts |
| Cable(s): | 130-8062 Palm | D | CTS B | Input RS232 | ±12 Volts |
| | 130-8025 | E | DSR B | Input RS232 | ±12 Volts |
| | | F | DCD B | Input RS232 | ±12 Volts ₁ |
| | | G | DTR B | Output RS232 | ±5 Volts |
| | | H | | No Connect | |
| | | J | DGND | PWR | |
| | | K | PWR | Output ₂ | + 5 Volts ₁ |

- Volts₁ = Controlled by software

- Output₂ = Protected by self resetting fuse

1.4.3 GPS Connector

The **GPS** connector allows an external clocking device, such as the **REF TEK** 130-GPS Global Positioning System clock. This connector provides power and serial connections to the 130-GPS Receiver via the 130-8015 cable. See the 130-GPS manual for more information.

| Recorder Faceplate Connector | Connector and Cable | 130 Pin | Pin Desc | Electrical Desc | Voltage Range |
|------------------------------|---------------------|---------|----------|----------------------|--------------------------|
| GPS (External Clock) | PT06A12-8P | A | GPS 1Hz | Input Pulse | 0-5 Volts |
| | | B | DGND | PWR/Signal GND | |
| Cable(s): | 130-8015 | C | GPS RX | Output RS232 | ±5 Volts |
| | 130-8015R | D | DGND | PWR/Signal GND | |
| | | E | GPS TX | Input RS232 | ±12 Volts |
| | | F | PWR 12V | PWR | 10-15 Volts ₁ |
| | | G | GPS RST | Output Pulse | 0-3.3 Volts |
| | | H | PWR 5V | 5 Volts ₁ | Default |

- Volts₁ = Controlled by software and protected by a self resetting fuse

1.4.4 Net Connector

Communications between the **130-01** DAS and an external TCP/IP and/or Modem occur across the **130-01** DAS unit's **NET** connector. The cable (130-8004) has two connectors to allow two connections, one for ethernet and one for serial communications.



WARNING: A 130 DAS is shipped pre-configured with a default IP address. Be sure to change this address before connecting the DAS to an ethernet port. Any IP addresses on one of the same subnets, as the 130 DAS unit, may connect using FTP and/or the command socket. However, the 130 DAS unit restricts the external IP addresses from which it will accept connections, to the equivalent of a Class C subnet containing the RTP host. If no RTP host is set for an interface, no connections can be established to the unit from outside its subnet.



WARNING: The 130 DAS uses a 10BaseT ethernet chip. The 130 DAS ethernet port will not work when connected to all 100BaseT and some 10/100BaseT ethernet hubs.

- [1] This connector also functions as the point of input for the external trigger. It also serves as the point of output for an event detection pulse.
- [2] There is also a 12VDC nominal input on this connector to allow for lab setup via ethernet using only this connector.

| Recorder Faceplate Connector | Connector and Cable | 130 Pin | Pin Desc | Electrical Desc | Voltage Range |
|------------------------------|---------------------|---------|----------|-------------------------------|------------------------|
| Net Communi- cations | PT07A14-19P | A | TX A | Output RS232 | ±5 Volts |
| | Modem | B | RX A | Input RS232 | ±12 Volts |
| | Ethernet 10BaseT | C | RTS A | Output RS232 | ±5 Volts |
| | Serial PPP | D | CTS A | In RS232 | ±12 Volts |
| | Freewave | E | DSR A | In RS232 | ±12 Volts |
| Cable(s): | 130-8004 | F | DCD A | In RS232 | ±12 Volts |
| | 130-8019 | G | COM1PWR | PWR VDC ₁ | +5 Volts ₂ |
| | | H | ENET TX+ | Output Ethernet ₃ | |
| | | J | ENET TX- | Output Ethernet ₃ | |
| | | K | ENET RX+ | Input Ethernet ₃ | |
| | | L | ENET RX- | Input Ethernet ₃ | |
| | | M | ENETPWR | PWR Ethernet ₄ | +12 Volts ₅ |
| | | N | DGND | | |
| | | P | DGND | | |
| | | R | DTR A | Output RS232 | ±5 Volts |
| | | S | TRIGOUTB | Output, Tristate | 0-5 Volt Pulse |
| | | T | TRIGINB | Input | 0-5 Volt Pulse |
| | | U | +12VDC | Input | 10-15 VDC ₆ |
| | | V | OSC | Output, Tristate ₇ | 0-5 Volts |

- VDC₁ = Controlled by software
- Volts₂ = Protected by self resetting fuse
- Ethernet₃ = Transformer coupled
- Ethernet₄ = Controlled by software and protected by self resetting fuse
- Volts₅ = Tracks main input voltage
- VDC₆ = Alternate main power input
- Tristate₇ = Controlled by software

1.4.5 Channel Input Connectors

Both three channel and six channel units have channel input connectors on the faceplate. The three channel unit has a red “sticker” over the (Channel 4-6) connector socket to designate the unit as only three channel. Signals from an external sensor enter the **130-01** DAS through the channel input connector labeled **CH 1 - 3**. Six channel 130 DAS units (130-01/6 and 130-02/6) use a second input connector labeled **CH 4 - 6**. Channel connectors also provide pins for calibration signals to be sent to a sensor.



Note: The 130-01 DAS (Station Info) PDA display will show how many channels are enabled for your 130-01 DAS.

1.4.6 Channels 1-3 connector signals

| Recorder Faceplate Connector | Pin | Name | Dir | Electrical Desc | Voltage Range | Note |
|-------------------------------|-------------|-------------|---------------------------|--------------------------------|---------------|---------|
| Channels 1-3 On All models | A | Ch1+ | In | Channel 1 input + | ±10 Volts | |
| | B | Ch1- | In | Channel 1 input - | ±10 Volts | |
| | C | Ch2+ | In | Channel 2 input + | ±10 Volts | |
| | D | Ch2- | In | Channel 2 input - | ±10 Volts | |
| | E | Ch3+ | In | Channel 3 input + | ±10 Volts | |
| | F | Ch3- | In | Channel 3 input - | ±10 Volts | |
| | G | AGnd | In | Analog ground | | |
| | H | Pwr 123 | Out | Sensor Power | 10-15 Volts | 1, 2, 3 |
| | J | PGnd | - | Power ground | | |
| | K | CalEn- 123 | Out | Calibration Enable active low | OC | 4, 6 |
| | L | CalEn+ 123 | Out | Calibration Enable active high | OC | 5, 6 |
| | M | Center- 123 | Out | Center Enable active low | OC | 4, 6 |
| | N | CalSig 123 | Out | Calibration signal | ±5 Volts | 6 |
| | P | Aux1 | In | Aux (Mass Position) channel 1 | ±10 Volts | 6 |
| | R | Aux2 | In | Aux (Mass Position) channel 2 | ±10 Volts | 6 |
| | S | Aux3 | In | Aux (Mass Position) channel 3 | ±10 Volts | 6 |
| | T | DGND | - | Digital Ground | | |
| U | Center+ 123 | Out | Center Enable active high | OC | 5, 6 | |
| V | Sensor ID1 | In/ Out | Sensor ID | 0-5 Volts | 6 | |

Note: 1 = Tracks main input voltage

Note: 2 = Protected by self resetting fuse.

Note: 3 = Output on/off controlled by software

Note: 4 = Open Collector, pulls to Ground

Note: 5 = Open Collector, pulls to + 5 V

Note: 6 = Functions provided by Optional RT527 Sensor Control board

1.4.7 Channels 4-6 connector signals

| Recorder Faceplate Connector | 130 Pin | Name | Dir | Electrical Desc | Voltage Range | Note |
|------------------------------|---------|------------|--------|--------------------------------|---------------|---------|
| Channels 4-6 | A | Ch4+ | In | Channel 4 input + | ±10 Volts | |
| On All models | B | Ch4- | In | Channel 4 input - | ±10 Volts | |
| | C | Ch5+ | In | Channel 5 input + | ±10 Volts | |
| | D | Ch5- | In | Channel 5 input - | ±10 Volts | |
| | E | Ch6+ | In | Channel 6 input + | ±10 Volts | |
| | F | Ch6- | In | Channel 6 input - | ±10 Volts | |
| | G | AGnd | In | Analog ground | | |
| | H | Pwr 456 | Out | Sensor Power | 10-15 Volts | 1, 2, 3 |
| | J | PGnd | - | Power ground | | |
| | K | CalEn-456 | Out | Calibration Enable active low | OC | 4, 6 |
| | L | CalEn+456 | Out | Calibration Enable active high | OC | 5, 6 |
| | M | Center-456 | Out | Center Enable active low | OC | 4, 6 |
| | N | CalSig 456 | Out | Calibration signal | ±5 Volts | 6 |
| | P | Aux4 | In | Aux (Mass Position) channel 4 | ±10 Volts | 6 |
| | R | Aux5 | In | Aux (Mass Position) channel 5 | ±10 Volts | 6 |
| | S | Aux6 | In | Aux (Mass Position) channel 6 | ±10 Volts | 6 |
| | T | DGND | - | Digital Ground | | |
| | U | Center+456 | Out | Center Enable active high | OC | 5, 6 |
| | V | Sensor ID2 | In/Out | Sensor ID | 0-5 Volts | 6 |

Note: 1 = Tracks main input voltage

Note: 2 = Protected by self resetting fuse.

Note: 3 = Output on/off controlled by software

Note: 4 = Open Collector, pulls to Ground

Note: 5 = Open Collector, pulls to + 5 V

Note: 6 = Functions provided by Optional RT527 Sensor Control board

1.5 General Recorder Control Considerations

The **130-01** DAS is a microprocessor-based instrument, using an Hitachi SH3 microprocessor. Each **130-01** DAS unit contains a programmable flash memory chip that contains the **130-01** DAS firmware (control code, micro-processor instructions and Xilinx images). Occasionally, Refraction Technology revises the **130-01** DAS firmware, adding features and improving efficiency. In most cases, you can upgrade the **130-01** firmware in your **130-01** DAS by downloading new code via ethernet. To download new code see "To update firmware from the FTP site" on page 4-85. Contact Refraction Technology to determine the applicability and advantages of such an upgrade.

In addition to the CPU control code in the **130-01** DAS, the **130-01** DAS requires that you download specific parameter information to instruct it exactly how and when to record data and perform other system functions. **REF TEK** provides the specific software that instructs the **130-01** DAS how to perform system functions; it is called the PDA Field Controller program (**PFC_130**) for a PDA device and is documented in the ***PFC_130 Users Guide (130-PFC-001)***. **REF TEK** also provides **RTCC** software for command and control with a PC or workstation. Also Refraction Technology maintains release notes on its ftp and WWW site.

1.5.1 General Recorder operation

Refraction Technology provides **PFC_130** and **RTCC** interface software. Refer to the ***Command Format Specification*** part of the ***130 Command Specification (130-CR-001)*** for additional help. In all cases, you must use some version of **130-01** DAS control interface software to select parameters. Any such interface must include the following functions:

- Setting parameters
- Sending parameters to the 130 DAS
- Starting data acquisition

The **130-01** DAS collects data based on the series of parameters that you select and download from the control interface. All 130 DAS units have multiple datastream capability, allowing users a vast array of possible parameter combinations.

You may set the following parameters for **each** datastream:

- Which input channel or channels to include
- Sample rate
- Data format (recording resolution)
- Trigger type

The possible values for these parameters, as well as the possible combinations of parameters, are different for **130-01** DAS units with different hardware configurations, different versions of control firmware, or both. For a comprehensive explanation of your **130-01** DAS unit's specific capabilities and limitations, refer to the appropriate **REF TEK** manual: *130 Theory of Operations (130-SYS-002)* or to the individual board and schematic documents.

The trigger type selected for a datastream defines the particular mechanism that determines when the **130-01** DAS collects data. The various predefined trigger types supported are as follows:

- Continuous trigger
- Level trigger
- Cross trigger
- External trigger
- Time Interval trigger
- Time List trigger
- Event trigger
- Vote trigger

Each trigger has its own set of parameters that determines the exact conditions under which the **130-01** DAS records data.

Detailed explanations and methods for using all **130-01** DAS unit parameters, including datastreams and triggers, are provided in subsequent sections in this manual.

Refraction Technology pre-sets and tests the hardware of each **130-01** DAS before you receive the unit to ensure that it performs as specified. The **130-01** DAS units do not require hardware adjustments for normal operations. You may use a **130-01** DAS unit as a stand-alone recorder, or you may use a network of many **130-01** DAS units deployed over a survey site. During field operations, the **130-01** DAS can store data either in its own internal RAM or Compact Flash. The **130-01** has two ports (Ethernet and Telemetry) that allow connection to networks locally or remotely (by radio, telephone, or satellite relays). Some networks include both local and remote interconnections.

All **130-01** DAS units employ hardware, firmware, and interface software that complies with the requirements of the IRIS PASSCAL Program, portable and telemetry stations, US ARRAY (the USGS and ANSS) specification for national, regional, strong motion, and structural stations.

1.5.2 Power Considerations

This section describes current draw, power load, and general power supply considerations for **130-01** DAS units, peripherals, and sub-systems.

All **130-01** DAS units operate on nominal 12-volt power (10 to 15 VDC). This range allows a **130-01** DAS unit to be powered from an ordinary lead acid battery that can be charged from either a solar or AC power source.

To ensure continual, uninterrupted power to your **130-01** DAS and peripherals, use a well regulated power supply that can deliver at least 1.25 times the maximum current that the load of your combined system components requires. Be sure to account for the cable resistance (especially if you build your own cables). Power for an external modem is available from the modem port connector (5 VDC or 12 VDC). Also 12 VDC is available on the two channel connectors.

In general, perform the following to ensure a sufficient power supply:

1. Use the specification data and add the maximum current draw for the **130-01** DAS and each peripheral that uses the same power supply to obtain the maximum total current they will draw at any given time then add at least 25%.
2. Check your power supply's specifications to ensure that it can handle this load. The power specifications for **130-01** DAS units are provided for each configuration of **130-01** DAS. Contact Refraction Technology if you require more accurate calculations or other information regarding power considerations.

Solar power setups are frequently used in remote locations and these are available in several capacities that cover the various equipment configurations. Solar power arrays supplied by **REF TEK** include solar panels, battery charge regulators, and protective safety devices, but they may or may not include the actual batteries.

1.6 Port Settings & Modem Communications

A **130-01** DAS provides several communications ports. This part describes the available communications ports, and other considerations regarding the use of modems. The ports are:

- Serial PPP port
- Ethernet port



WARNING: A 130 DAS is shipped pre-configured with a default IP address. Be sure to change this address before connecting the DAS to an ethernet port.



WARNING: The 130 DAS uses a 10BaseT ethernet chip. The 130 DAS ethernet port will not work when connected to all 100BaseT and some 10/100BaseT ethernet hubs.

To perform a minimal setup of the **130-01** DAS unit, follow the instructions in Chapter 2, "Startup" on page 2-27 of this manual. To setup port connections refer to the *PFC_130 Users Guide*.



Note: With a modem, the user can provide a user defined init string that will be sent to an externally attached modem at powerup.

1.6.1 Control (Serial) Port

Each **130-01** unit provides two bi-directional, asynchronous serial ports. The first of these ports is accessible at the **Serial** connector on the **130-01** DAS unit's faceplate. This port has the following primary functions and characteristics:

| Function | Characteristics |
|-------------------|---|
| Primary Function | Allows command and control input from a peripheral control device such as a palmtop device. |
| Configuration | This port is not user-configured. Recorder software always sets this port to 9600 baud, no parity, 8 data bits, and 1 stop bit. |
| Hardware Location | This port is accessible at the Serial connector on the 130 DAS faceplate. |
| Other Features | Software controlled output |

1.6.2 Serial PPP Port

Each **130-01** unit provides a second bi-directional, synchronous serial port, accessible at the **Serial** connector on the **130-01** DAS unit's faceplate. This port, commonly called the Serial PPP port, has the following primary functions and characteristics:

| Function | Characteristics |
|-------------------|---|
| Primary Function | This port runs the REF TEK Protocol (RTP). RTP provides a full-duplex, packet-orientated, reliable, transport over UDP network connections. |
| Configuration | Using your control interface software, you can set this port's communications configuration as needed. By default, the 130-01 DAS software sets it to 19,200 baud, no parity, 8 data bits, and 1 stop bit. |
| Hardware Location | This port is accessible at the Serial connector on the faceplate. |
| Other Features | Software controlled output |

1.6.3 NET Port

In addition to the serial port, each **130-01** DAS provides one ethernet port. This port, accessible at the communications **Net** connector on the **130-01** DAS unit's faceplate, has the following primary functions and characteristics:

| Function | Characteristics |
|-------------------|--|
| Primary Function | This port performs high-speed transfer of data and status information. It can be used with RTCC to configure the 130-01 DAS, RTPD for data connection and FTP for file transfer. |
| Configuration | The 130 ethernet port address and mask can be configured using the PFC_130 program running on the palmtop. |
| Hardware Location | This port is accessible at the NET connector on the faceplate. |
| Other Features | Software controlled output or input |

When the Ethernet Link is down and acquisition is turned on, data loss could occur if the following are not verified:

1. Check your Ethernet Settings (See the *PFC_130 Users Guide*) on the PDA device connection setup screen.

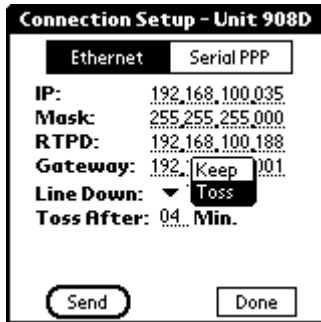


Figure 1 - 2 Verify ethernet setup screen

2. Check the IP Address, Mask, Host, and Gateway Addresses entered in the PDA device *Connection Setup* screen (See the *PFC_130 Users Guide*).
3. If data is sent via the ethernet, make sure the serial Host address has been "zero-ed" out on the Serial PPP *Connection Setup* screen (all zeros in the Host field).

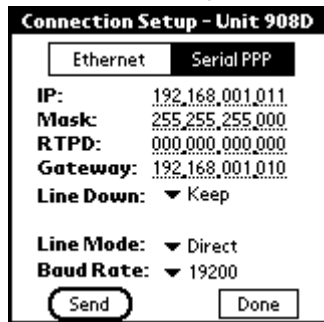


Figure 1 - 3 Verify serial PPP connection setup

Example NET configurations with Ethernet link down and acquisition on:

1. If the unit parameters in the Streams-Cfg screen are set to dump to disk ONLY then there is no effect.

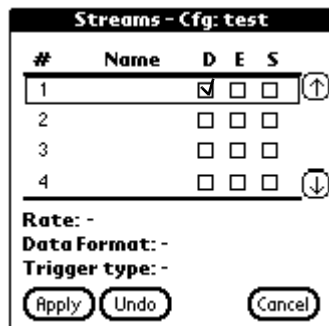


Figure 1 - 4 Streams-Cfg screen (Disk ONLY)

- If the unit parameters are set to dump to Ethernet and to disk, then the unit will dump the data to disk when the RAM reaches the dump point (default = 66% full), but the RAM will not empty until it is sent out over the Ethernet link.

| # | Name | D | E | S | |
|---|------|-------------------------------------|-------------------------------------|--------------------------|---|
| 1 | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | ↑ |
| 2 | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| 3 | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| 4 | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | ↓ |

Rate: -
Data Format: -
Trigger type: -

Apply Undo Cancel



Note: The RAM will continue filling until the RAM is full, acquisition will then stop, and the data will dump to disk again. The RAM is not cleared until the data goes to ALL specified dump locations in the parameter set (Disk and Ethernet in this example). So the Ethernet connection must be re-established in order for the RAM to clear.

- If the data is being sent only to Ethernet, then the RAM will fill and acquisition will stop. Once the Ethernet connection is re-established, the data in RAM will be sent out the Ethernet port and acquisition will re-start automatically.

| # | Name | D | E | S | |
|---|------|--------------------------|-------------------------------------|--------------------------|---|
| 1 | | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | ↑ |
| 2 | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| 3 | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| 4 | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | ↓ |

Rate: -
Data Format: -
Trigger type: -

Apply Undo Cancel

Note: There will be only a loss of data while the acquisition state is off.

1.7 Hardware Modularity

Four boards (*) form the basic **REF TEK 130-01** DAS. There are six primary boards for the **130-01**. Three of the modules are available on an optional basis. The following table identifies each module.

| Basic Set | Brd | Description | Purpose |
|-----------|-----|---|---|
| * | 1 | Lid Interconnect Board - (RT520-B01) | Power Supplies |
| | | | Lightning Protection |
| | | | Physical Interface |
| * | 2 | Compact Flash Board (RT526-B01) | Dual Compact Flash |
| | | For use with 130-Flash-1G For 130-01/3 and 130-01/6 models ONLY! | |
| | | | 340 Mbytes to 2 Gbytes |
| | | | (RT526-B01) Interface Board (located in the well) |
| | | | Dual Compact Flash |
| * | 3 | A/D Converter - (RT505-B05) | A/D Converter |
| | | Allows 1-3 Channels for 130-01/3 and 130-01/6 | 24-Bit ADC Channels (3 each board) |
| OPT | 4 | A/D Converter - (RT505-B06) | Lightning Protection |
| | | Adds 4-6 Channels to 130-01/6 and 130-02/6 | Input Pre-Amplifier |
| | | | Digital Anti-Alias Filters |
| OPT | 5 | Sensor Control Board - (RT527-B01) | Monitoring of Mass Position |
| | | | Re-Centering Command |
| | | | Calibration Commands and Signals |
| | | | Software controlled output |
| * | 6 | CPU Board - (RT506) | CPU |
| | | | Static Random Access Memory (SRAM) |
| | | | Battery Backed SRAM (6 Mbytes) |
| | | | Serial Port |
| | | | Ethernet Controller |
| | | | EIDE |
| | 7 | GPS (RT528-B01) interface board | Based on SiRF GPS Chipset |

The new circuit board dimensions are 10.6 x 4.5 x 0.62 inches (269 x 114 x 1.6 mm). Up to five boards will be stacked together rather than plugged into a backplane. The ADC circuits are shielded and their inputs are isolated on separate connectors from the primary system bus.

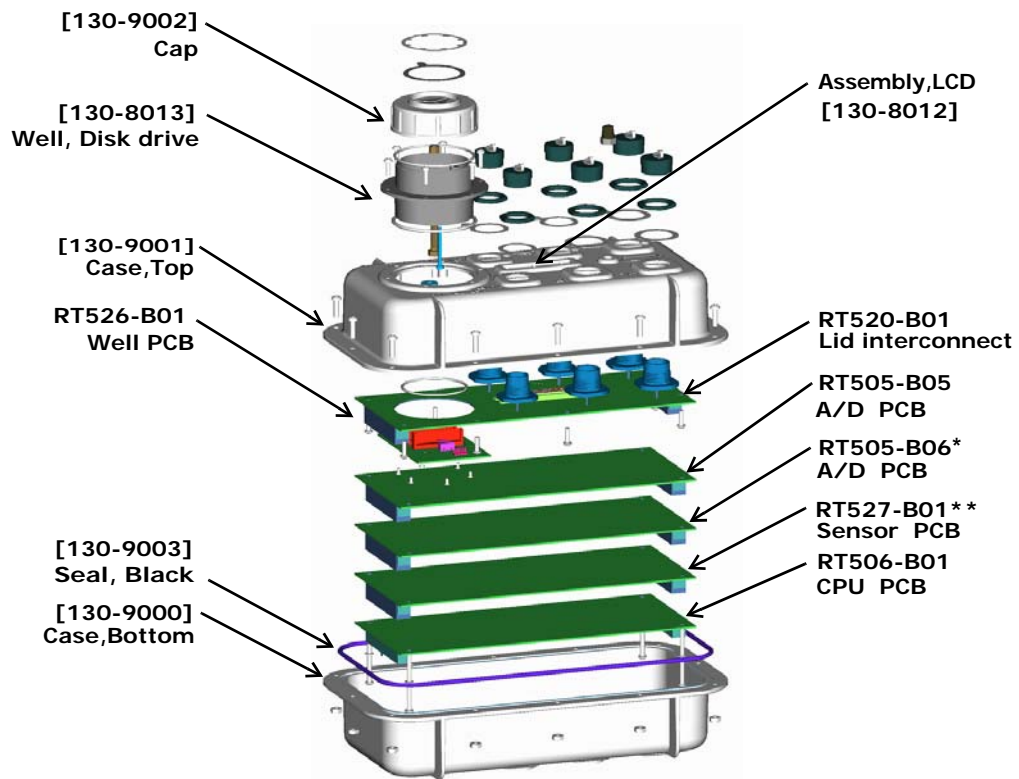


Figure 1 - 5 130-01/6 Hardware module exploded view



Note: * 130-01/3 - same as figure above without RT505-B06 A/D

Note: ** Optional board



Note: For some DAS units an EMI protective shield has been added to make the unit CE compliant. Care should be taken in removal when servicing the unit.

1.8 Frequently Asked Questions

1. Question: Does any data loss occur if acquisition is turned on and the NET is not connected?

The damage that occurs depends upon the parameters of the unit. If the unit parameters are set to dump to disk ONLY then there is no effect, otherwise RAM will fill and acquisition will stop. For further clarification see the explanation in the section "NET Port" on page 1-16.

2. Question: What happens if the Flash drive is pulled from the **130-01** when the LED is RED.

If the LED shows RED the drive is writing data and should not be removed until the LED changes to GREEN. Data loss can result from pulling a drive when the LED is RED. See further explanation in the "Periodic Maintenance checks" on page 4-76.

3. Question: Can a different sampling rate be used on different datastreams?

- Yes

The sample rate list can be broken into two groups:

Group One: The following rates are only available when recording a single sample rate for all streams: 1000, 500, 250, 125, 50 and 25.

Group Two: The following rates may be recorded in any combination within all streams: 200, 100, 40, 20, 10, 5 and 1.

| Case | Description | Example of |
|---|---|--|
| Selection of a sample rate from Group One. | When the user activates any of the other data streams, the sample rate chosen must be the SAME. | Selection of 125 SPS for Data Stream 1. This means that when Data Stream 2 is activated the sample rate is fixed at 125 SPS and there are no other sample rate choices available. |
| Selection of a sample rate from Group Two. | When the user activates any of the other data streams, ANY of the group two sample rates can be chosen. | Selection of 40 SPS for Data Stream 1. This means that when Data Stream 2 is activated the choice is selection of any of Group two sample rates (200, 100, 40, 20, 10, 5, or 1). |

All six channels run at the same base sample rate at this time.

4. Question: If two datastreams or more at different sampling rates, without a DSP, were set up, would all datastreams default to the sampling rate on datastream one?

It should default to the sampling rate of the **LAST** datastream, however it always is best to make sure to set all datastreams for the same sample rate.

5. Question: Could a customer send data serially over a spread spectrum radio to a router because data communication via 10/100 base-T as well as PPP on RS-232 and asynchronous RS-232 is supported?

The 130 DAS has three communication ports:

NET Connector: (1) Ethernet 10-Base T

(2) Serial PPP (Asynchronous, RS-232)

SERIAL Connector: (3) Serial Asynchronous, RS-232 for command and control **ONLY**.

The **130-01** DAS can be used with a spread spectrum radio by direct connection over serial PPP to the spread spectrum radio, no router required. The 130 DAS supports all types of Telemetry configurations.

Its is also possible for the serial line mode to be used with a modem and the user defined init string will be sent to an externally attached modem at powerup (i.e. 130-Modem).

1.9 Warranty Statement

Refraction Technology instruments are warranted free from defects of manufacture for one year from date of shipment¹. Any instrument malfunction occurring within this period, except due to improper usage, will be repaired or replaced at our option with no charge for parts and labor. When sending equipment to Refraction Technology for repair, the customer is responsible for freight and insurance charges. Refraction Technology will pay the standard freight cost to return repaired instruments to the customer. (See *Warranty/Non-Warranty Service for equipment return instructions*.)

In the event Refraction Technology supplies other manufacturers' equipment with systems, this equipment will have the same warranty as stated above provided the Refraction Technology nameplate is on the equipment; otherwise, the equipment will carry the warranty of the original manufacturer only.

It is the policy of Refraction Technology to continuously upgrade its DAS software. As new software versions become available, they will be supplied to the customer at no charge for two years. After that, upgrades will be available at a nominal charge. However, Refraction Technology is not responsible for any incompatibilities that may arise between new software and obsolete instrument models.

1. In the case where Refraction Technology installs or commissions the equipment under contract, the warranty period shall begin after acceptance, but in no case shall extend longer than 18 months from date of shipment.

1.9.1 Warranty/Non-Warranty Service

The customer must obtain a Return Material Authorization (RMA) number from Refraction Technology before returning any equipment. **Do not return any REF TEK supplied equipment without first obtaining an RMA number.**

The following policy is applicable for warranty/non-warranty equipment when a problem is encountered.

Contact Refraction Technology, by a means that is listed below, to obtain an RMA number.

Refraction Technology, Inc.

1600 Tenth Street, Suite A

Plano, Texas 75074

USA

Voice: 214-440-1265

Fax: 972-578-0045

EMAIL: support@reftek.com

FTP: ftp.reftek.com

WWW: http://reftek.com

1. Supply the indicated information at time of contact.
 - Description of Problem
 - Type of Instrument
 - Model No.
 - Serial No.
2. Package the equipment safely, preferably using the original packing materials. Include the RMA on the outside of the shipping container, a return address where the repaired equipment can be shipped and a contact telephone number.



Note: It is advised to use a shipping company that can provide a tracking number.

3. Ship the unit to the this address, freight prepaid:
 - **Refraction Technology, Inc.**
 - **1600 Tenth Street, Suite A**
 - **Plano, Texas 75074 USA**

1.10 Static sensitive device protection

WARNING: All Ref tek circuit boards are Static Sensitive and appropriate handling is required to protect each board from damage due Static discharge.

1. Please insure that when handling **REF TEK** circuit boards, the handler and the work bench are grounded. This is usually done via a grounding mat on the bench, which is ultimately grounded to the building ground and also attached to the handler.
2. When shipping individual boards they must be wrapped in anti-static protection, either anti-static bags or boxes. Reftek can supply these if requested.
3. Failure to protect against static increases the chance of boards being damaged and may void **REF TEK** warrantee.



Section 2 Startup

This section provides information on the following topics:

- **Getting started with the 130-01 DAS and quick power up.**
- **Minimum hardware configuration.**
- **Quickstart procedures to familiarize a new user with the system.**

2.1 Getting started with Your 130-01 DAS

This introductory material provides the following:

- A brief procedure to establish minimal hardware connections for the recorder in order to perform an initial system power-up.
- External cable list.
- Minimum hardware connection and power-up.
- A procedure to specify an abbreviated set of operating parameters, start and verify data acquisition, and save collected data to a file.

These instructions do not provide you with the detailed comprehensive information you need to prepare your recorder for field deployment and 'real' data collection. The complete process to establish all hardware connections, select and implement parameters, and perform data acquisition is only outlined in this section for rapid familiarization.

2.2 Establishing Minimal Hardware Connections

These instructions cover the hardware and connections needed to perform the recorder operations described in the rest of this section.

To perform the system power-up, you need the following hardware:

- A **130-01** DAS.
- A personal computer; either a PDA, laptop, desktop, or other appropriate control interface, including a dumb terminal.
- An external 12 volt power supply; you can use a 12 volt car battery.
- A cable to connect the control interface to the recorder (you can use a 130-8262 with a Ruggedized PDA).
- One cable to connect the power supply to the recorder (if you are using an Auxiliary Power Subsystem, you can use a **REF TEK** PT07A12-4S connector with a power cable).



Note: A sensor is not required for this exercise as the noise pick-up at the open input channel connector is sufficient. If you do have a sensor you must make the channel connections as described in the manual for your particular type of recorder and sensor.

Assuming you have obtained or made up all the required cables, proceed to make the following hardware connections:

1. Install the 130-GPS with a clear view of the sky.

WARNING: DO NOT install the GPS at the top of the pole or antenna.



2. Secure the appropriate cable from your PDA or PC control interface to your recorder. In most cases you'll connect the 130-8025 cable connector to the SERIAL connector on the recorder and secure the other end of that cable to the serial port of your PDA control interface.
3. Secure the PT06A12-4S connector on your external power cable to the POWER connector on the recorder. Secure the other end of the power cable to your 12 volt power supply so that connector pins A and B are both at +12 volts and pins C and D are the return lines.

4. Secure the PT06A14-19S connector from each sensor cable (2 each for 6 channel recorder) to each channel connector on the case top.
5. Secure the PT06A12-8S connector of the 130-8015 cable for the GPS to the GPS connector on the case top.

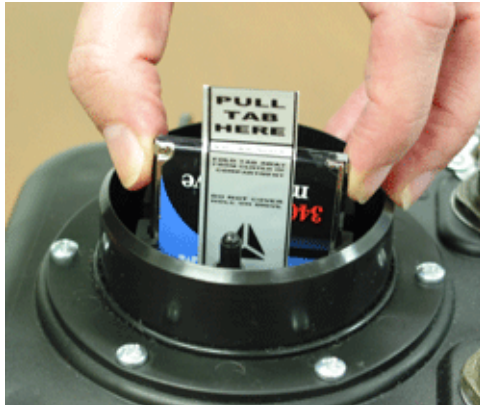
Install the Compact Flash

1. Remove the well cover from the **130-01** DAS as shown below.



Figure 2 - 1 Remove well cap

2. Remove the Compact Flash from the 130-Flash kit.



Note: Remember to hold the Compact Flash only by its edge as shown in Figure 2 - 2.

Figure 2 - 2 Install Compact Flash

3. Install the Compact Flash as shown in Figure 2 - 2.

4. With the Compact Flash in position in the guide rails, lightly press the drive, as shown below, to lock into position.



Figure 2 - 3 Installing the Compact Flash



Note: The 130-01 DAS is not shipped with the Compact Flash installed. ONLY remove the Compact Flash by holding the silver tape to prevent damage to the drive.

Power up the 130-01 DAS

1. Power up the PDA device.



Note: Since the PDA unit has RAM, it can potentially open to the screen it was last displaying when it was last powered-down. Reset the PDA to the PFC_130 icon by touching the *Home* button on the PDA.

2. Turn on the supply to apply voltage to the **130-01** Recorder and to your control interface.

Note: Wait at least 20 seconds and the LCD display should display the following:



Figure 2 - 4 130-01 LCD display

2.3 General GPS Operations

When the host 130 receives power the GPS:

1. Supplies +12 VDC to the GPS clock.
2. Issues a reset to the 130-GPS/01.
3. Sends a message to the GPS telling it to go to continuous mode.
4. Sends a message telling the GPS to go to NMEA mode and to output the "GPRMC" and "GPGGA" message once per second.

Once the GPS has locked (per GPRMC-valid bit) the 130:

1. Compares its time to GPS UTC time.
2. Begins phase locking for 30 seconds.
3. Uses the 1 Hz from the 130-GPS/01 to start and stop a counter to record the internal high-precision oscillator.
4. Uses the difference between the value from the 1st second and the value from the 30th second to determine the rate of drift of the oscillator.
5. The 30th value is also used to determine the phase error of the internal 1 Hz.
6. The oscillator is voltage-controlled and an adjustment is made to the controlling D/A value to zero out the oscillator drift, and also to correct for oscillator phase error.

In sleep mode the 130-01:

1. Puts the GPS into binary mode
2. Then into Push-to-fix mode (via serial commands), at which point the GPS will go to sleep.



Note: The GPS is still powered from the 130-01 but is drawing < 1 mA of power. The 130-01 will stay asleep until reset by the 130-01, or until it wakes up to check ephemeris data.

3. The GPS awakens itself it is only for about 3-4 seconds of time approximately once every 18 minutes to check ephemeris.

The 130 will awaken the GPS and repeat the above phase-locking algorithm every 20 minutes.

At initial power-up the **130-01** will leave the GPS on for approximately 15 minutes to do continuous phase-locking and oscillator adjustment.

2.3.1 Using a PDA for configuration

1. Using the PDA device, open the PFC_130 program.

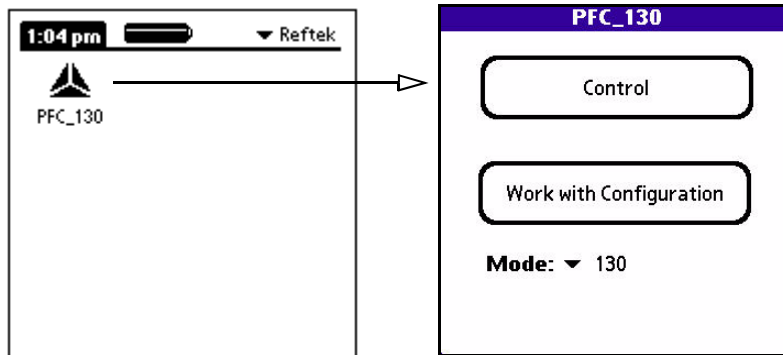


Figure 2 - 5 PFC_130 Start-up screen

2. Select **130** as the **Mode** from the pull-down menu.
3. At the Main PFC_menu tap the *Control* window to establish a connection.
4. A connect to DAS menu (Figure 2 - 6) will display initializing the connection to the DAS.

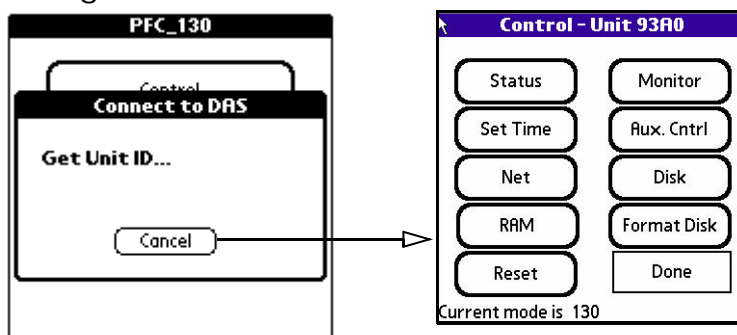


Figure 2 - 6 PFC_130 connection opens to Control window

5. Tap the *Status* window to check the current status of the **130-01** DAS.

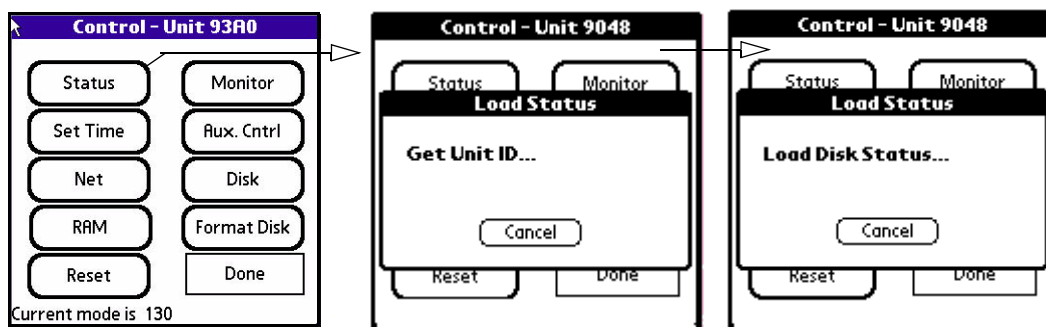


Figure 2 - 7 PFC_130 Status window

6. Two more screens will open to verify and load status information.

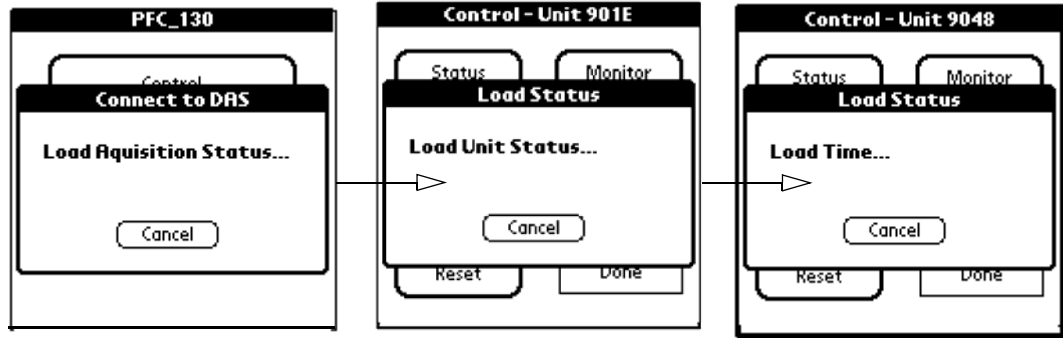


Figure 2 - 8 PFC_130 load status screens

7. The status screen will open to show status information for the **130-01** connection.

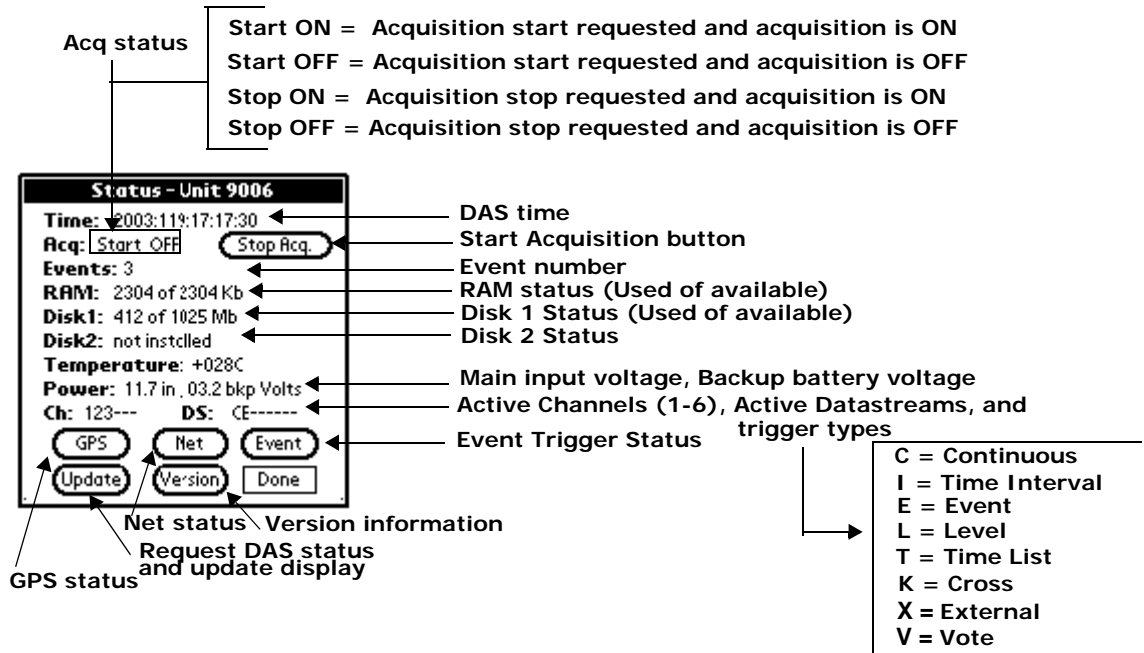


Figure 2 - 9 PFC_130 Status window

Check the GPS Status:

1. Click the **GPS** button to check the GPS status.

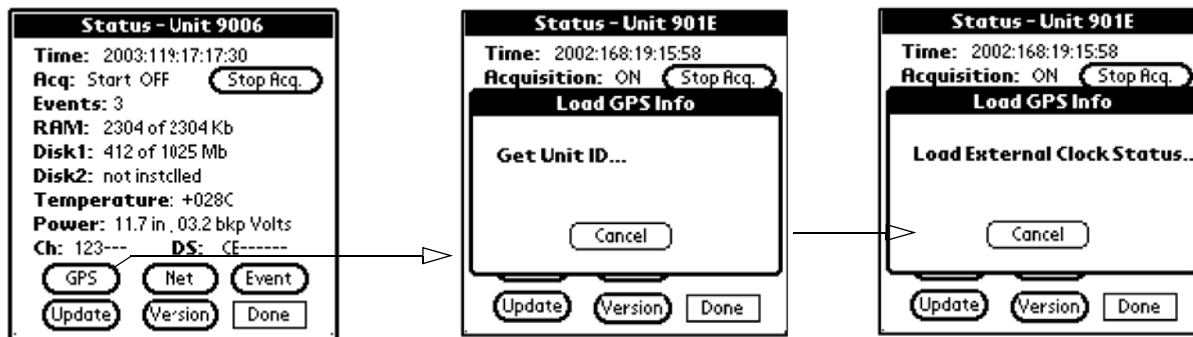


Figure 2 - 10 GPS Status connection screens

2. Click the **Update** button to update the GPS display.

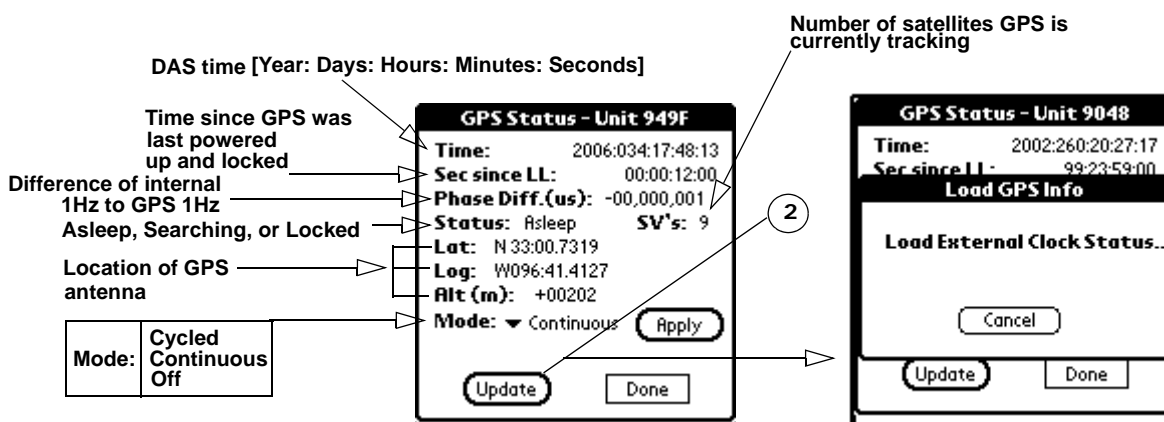


Figure 2 - 11 GPS Status and Update

To set the GPS Mode for how the GPS will be used to phase lock the internal VCXO:

3. Select one of the options, as described below, from the **Mode** drop-down menu

| Mode Option | Description |
|-----------------------------------|---|
| Before CPU firmware version 2.7.3 | Hard coded as Cycled |
| After 2.7.3 | |
| Continuous | The GPS is never turned OFF and the 130 performs its GPS wake cycles continuously. |
| Cycled | After the first GPS wake cycle, the GPS is powered OFF for 20 minutes. The GPS is then powered ON for one wake cycle and then powered OFF for 20 minutes again. The 130 repeats the 20 minutes OFF and ON for 1 GPS wake cycle while in the Duty-Cycle mode. |
| OFF | The 130 will turn the GPS ON for the first GPS wake cycle. After the first GPS wake cycle, the GPS is powered OFF and never powered ON again. |

4. Select the **Apply** button to accept the **Mode** option.

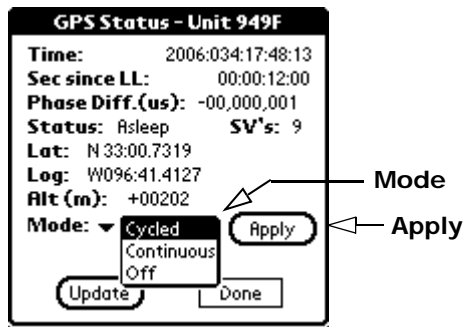


Figure 2 - 12 GPS Duty Cycle option

5. Return to the main PFC_130 menu by taping *Done* on the GPS menu and *Done* on the *Status* menu.

2.4 Example configuration

2.4.1 Create a configuration

Create an example configuration having 3 channels at 100sps to one datastream using the disk as a destination for the data:

1. Create a new configuration for the **130-01** DAS starting with the **New** menu.

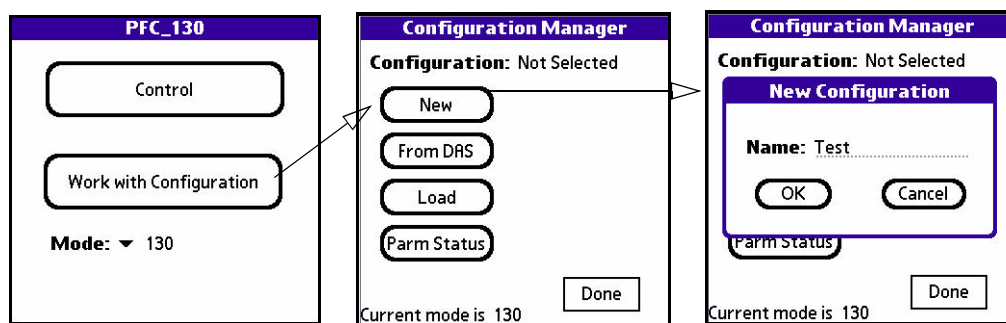


Figure 2 - 13 PFC_130 create a New 130-01 DAS configuration

2. Create and name the new configuration as "Test".
3. Tap **OK** to create the configuration and return to the Configuration Manager Menu.

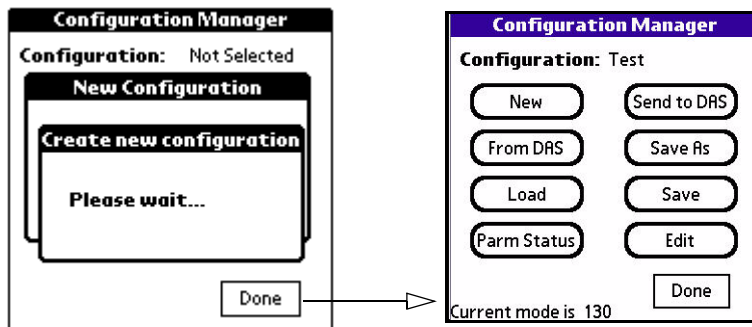


Figure 2 - 14 PFC_130 Edit a New Configuration

4. Edit the **130-01** DAS configuration, by tapping the *Edit* button.

5. Activate 3 channels by tapping the *Edit Channels* button and entering details for each channel from the *Channels Details* screen. Tap each channel to activate and enter parameters.

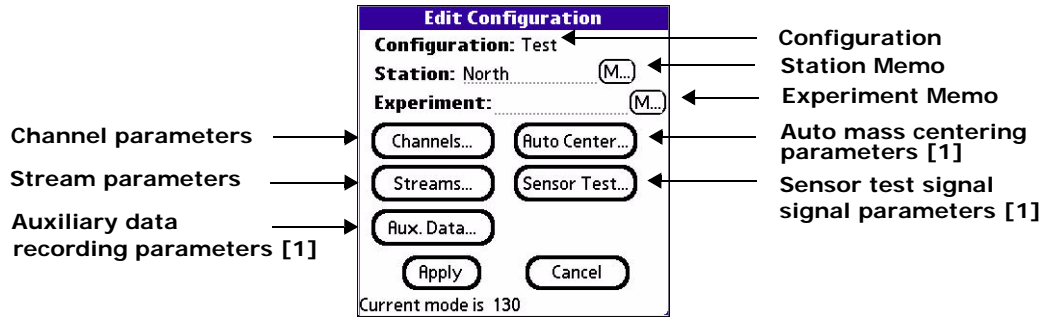


Figure 2 - 15 PFC_130 Channel configuration

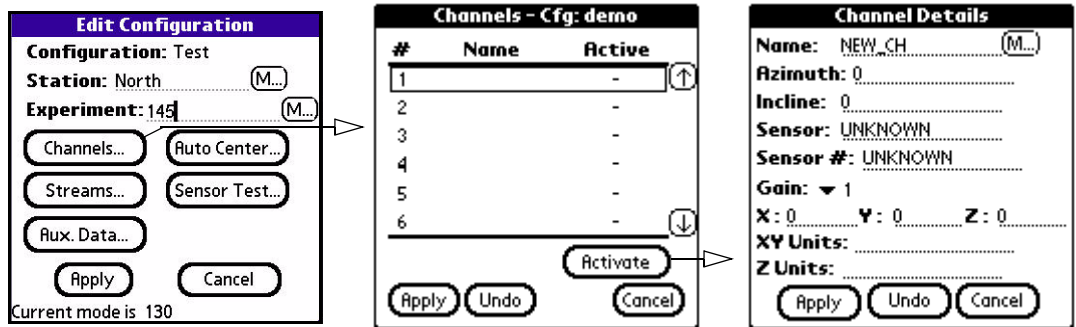


Figure 2 - 16 PFC_130 Channel configuration and details

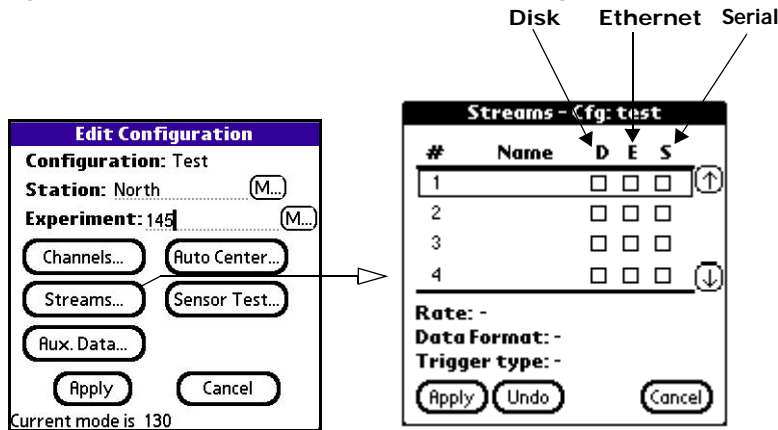


Figure 2 - 17 PFC_130 Edit Streams-Cfg

- Tap **Edit Streams** to enter Stream details and set the data destination to disk (D).

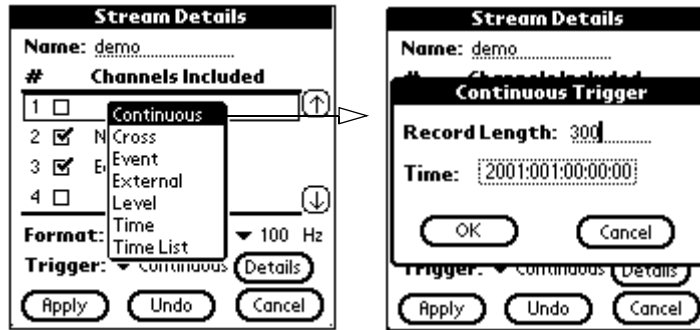


Figure 2 - 18 PFC_130 Stream Details

- Set the record length to be 300 seconds and leave time as default.
- Change to the **Configuration Manager** menu and save the configuration.
- Send the parameters to the **130-01** DAS by using the **Send to DAS** command from the **Configuration Menu**.

2.4.2 Format the Compact Flash

- Format the Compact Flash using the following menus.

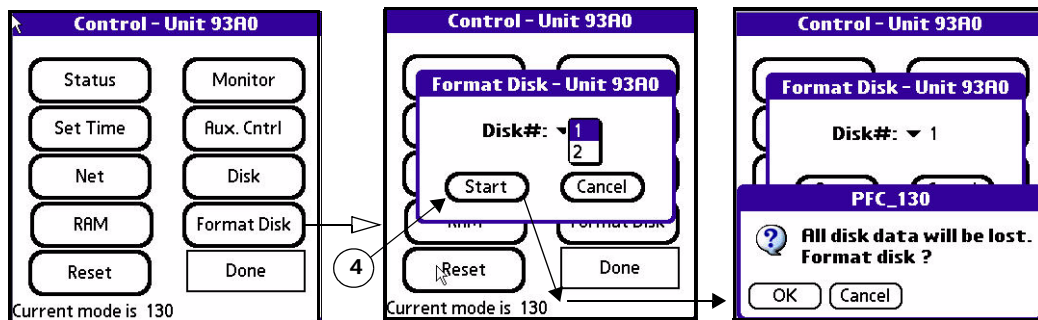


Figure 2 - 19 PFC_130 format disk menus

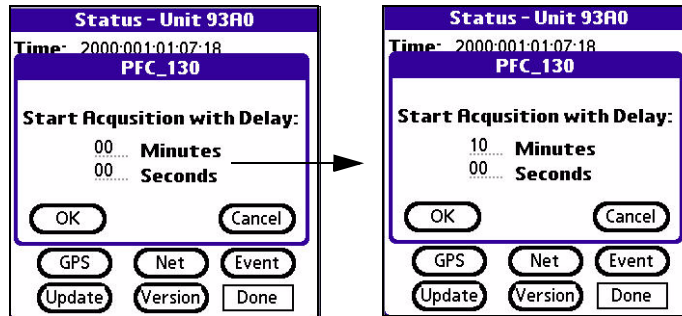
- Tap the **Format Disk** menu on the **Control** menu.
- Select the **Disk #:** to be formatted.
- Select the **Start** button to start the format or the **Cancel** button to cancel the format and return to the **Control** menu.
- Confirm the format by selecting the **OK** button.
- When the format is complete the submenu displays **Completed** or **Error** with a **Done** button to return to the **Status** menu.
- Check that the GPS has locked or the **130-01** DAS has the correct time.

8. Start acquisition of the **130-01** DAS by referring to the **Status Menu** section of the *PFC_130 Users Guide*.



[1] Turn on acquisition by tapping Start Acq next to the acquisition line on the Status menu.

[2] If a delay is desired enter a delay time or approve with the OK button.



9. After some period of time (5 minutes or more) stop acquisition on the **130-01** DAS.

2.5 Examples of 130 LCD Displays

| LCD | Display |
|---|---|
| Initial power up LCD | <p>Firmware Version Firmware Date Unit ID</p> <p>Ref: Tek 130 9047 cmf019 2002:122</p> |
| RAM Used Kb out of Total | <p>Used Kb Total Available RAM</p> <p>RAM: Used/Total Kb 200/1792</p> |
| Compact Flash Used MB out of Total | <p>Used MB Total Available Mb</p> <p>Ok1: *Used/Total Mb 0.039/975</p> |
| Date, Time and Temperature | <p>Date Time</p> <p>00:001:00:09:32 Temp +24.4C</p> <p>Internal temperature</p> |
| GPS status | <p>GPS Status</p> <p>GPS: Sleep MinSLL 000:00:06</p> |
| Position | <p>GPS Position</p> <p>Pos: N 00:00.000 E000:00.000</p> |
| <p>Power status of power to the 130 and battery backup power</p> <p>Acceptable Range: 10-15Volts Backup Range: 2.2-3.6 Volts</p> | <p>Battery backup power Main power</p> <p>Pwr: Main 12.20V Bkup 3.00V</p> |
| <p>Acquisition Status</p> <p>Stream Indicator:</p> <p>C = Continuous L = Level</p> <p>I = Time Interval E = Event</p> <p>T = Time List K = Cross</p> <p>X = External V = Vote</p> | <p>Requested State Actual State</p> <p>Acq: Stop Off Ev 0000 C-----</p> <p>Event Count Stream Indicator else trigger type Inactive</p> |



Section 3 Serial PPP Communication

3.1 Overview

Communication between a DAS and a PC can be accomplished by using either:

- Direct PPP connection over a direct serial link with a serial cable or serial radio.
- Modem PPP connection over a serial link with the 130 DAS Modem or by using the Modem connector on the 130-SM. An optional external modem can also be used with the 130 NET connector for serial communication.

3.2 Direct PPP Connection

3.2.1 PC Setup

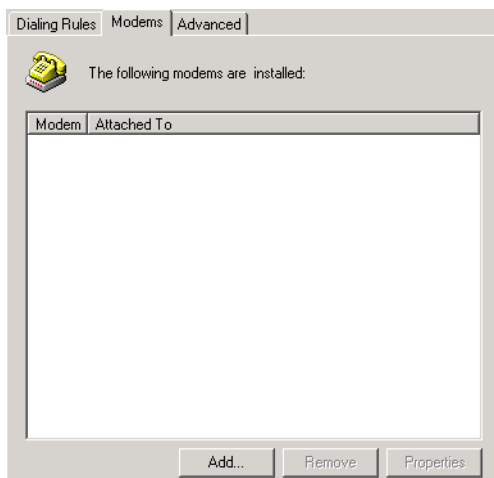
Information File (Generic Null Modem.inf)

REF TEK has supplied a modem information file (Generic Null Modem) that is located in the **C:\reftek** directory. This file must be resident on the local drive, however, there is no reason to access or make changes to it.

This information file is not needed when using a standard telephone modem. If you do not need to install the Generic Null modem skip the next section.

To add a generic null modem perform the following instructions:

1. From the **Control Panel** select the **Phone and Modems** icon.
2. Select the **Modems** tab.
3. Click **Add**.



4. Select the "Don't detect my modem" option if installing a Generic Null Modem.



Figure 3 - 1 Install New Modem

5. Select the **Next>** to select the modem from a list.
6. In **Install New Modem** click **Have Disk**(Figure 3 - 2).

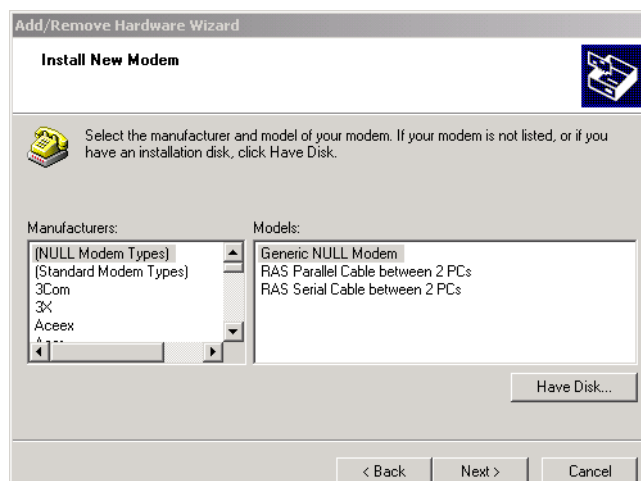


Figure 3 - 2 Have Disk in Install New Modem window



Figure 3 - 3 Install From Disk

7. At the **Install From Disk** window in the **Copy Manufacturer's files from:** text box type **C:\reftek**
8. Click **OK** when ready (Figure 3 - 3).
9. At the **Install New Modem** window under **Models** select **Generic NULL Modem**.
10. Click **Next >** when ready (Figure 3 - 4).

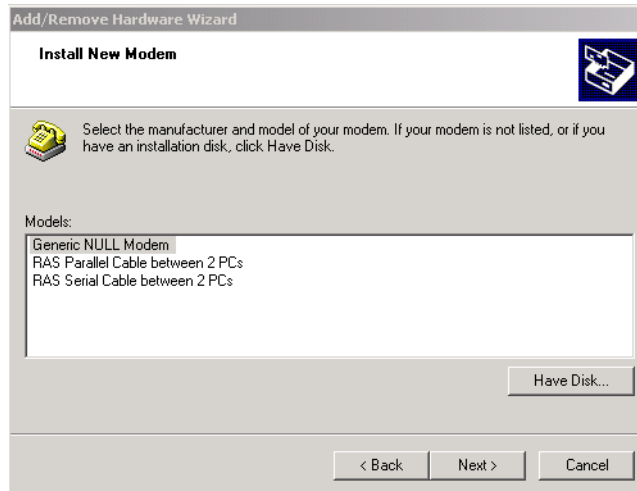


Figure 3 - 4 Select Generic NULL Modem window

11. At the next **Install New Modem** window select an available port to use for the modem
12. Click **Next >** when ready (Figure 3 - 5).

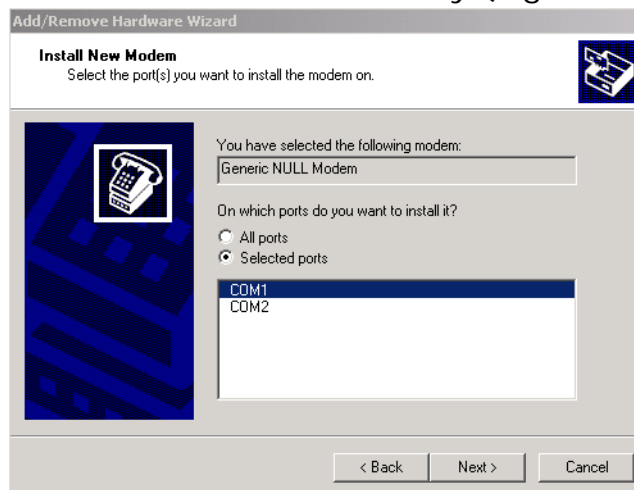


Figure 3 - 5 Select Communication Port



Note: If the "Digital Signature Not Found" warning appears, select the Yes button and proceed.

13. The **Install New Modem** window will display **Your modem has been set up successfully**
14. Click the **Finish** button (Figure 3 - 6).



Figure 3 - 6 Modem set up successful

15. At the **Phone and Modems Options** window select the **Properties** button.

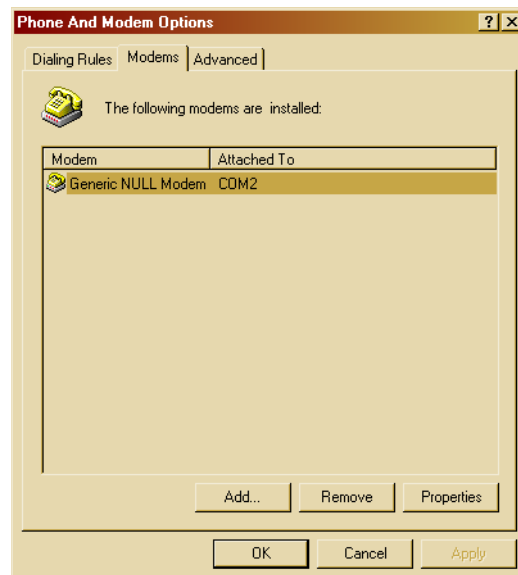


Figure 3 - 7 Phone and Modem options

16. In the **Generic NULL Modem Properties** window on the **General** tab – click the **Maximum Port Speed** drop-down menu and select the maximum baud rate setting (Figure 3 - 8).



Note: The baud rate settings **MUST** match the configuration of the connected equipment.

- [1] For direct connection to the 130, the baud rate the 130 is configured to.
- [2] For direct connection to a 72A with the RT422 board, the RT422 board is configured at the factory to 9600 but can be changed. Reference the *RT422 Asynchronous Serial Communications Card* (Board Document) for additional information on the jumper configurations that support the baud rate setting.
- [3] For connection to a DAS thru a radio or other equipment, consult their operations manual.

17. Click **OK** when ready.

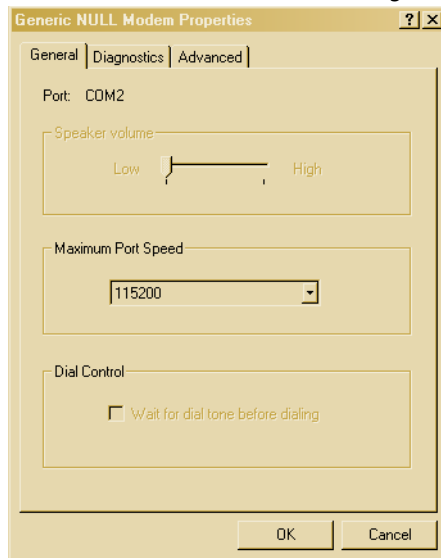


Figure 3 - 8 Set modem properties

18. In the **Phone and Modems Options** window click the **OK** button.
19. At this point the PC needs to be **restarted**. Using standard operations **restart** the PC.

Adding Remote Access Services (RAS)

Configure the Remote Access Services (RAS):

1. Using standard window operations click **Start** —> **Settings** —> **Control Panel**.

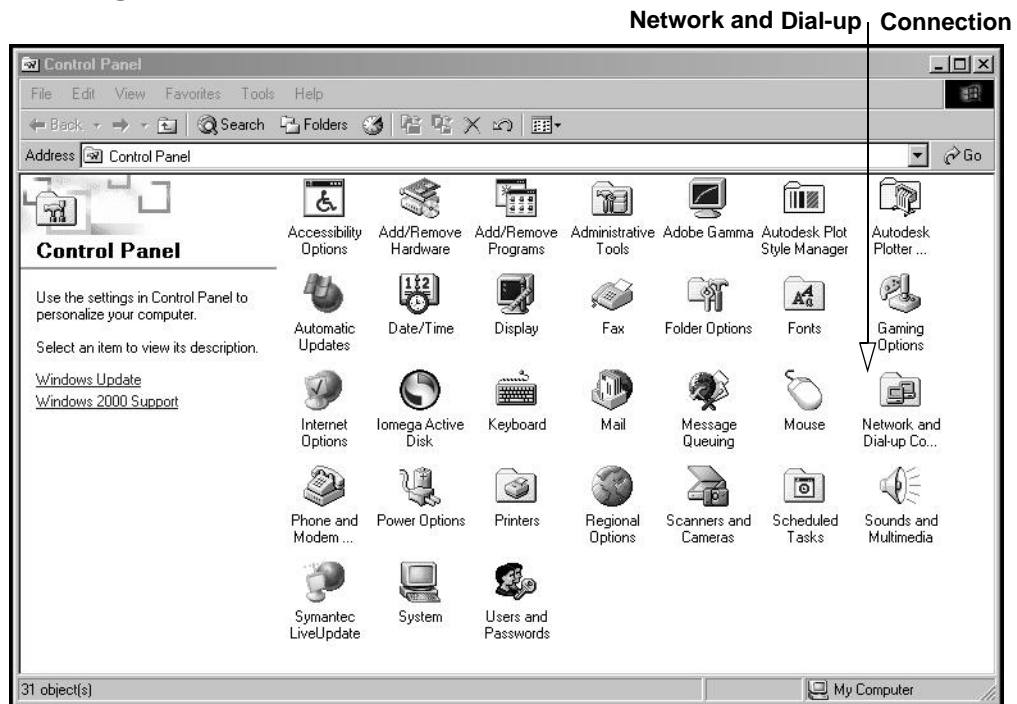


Figure 3 - 9 Control panel

2. Double-click the **Network and Dial-up Connection** Icon.

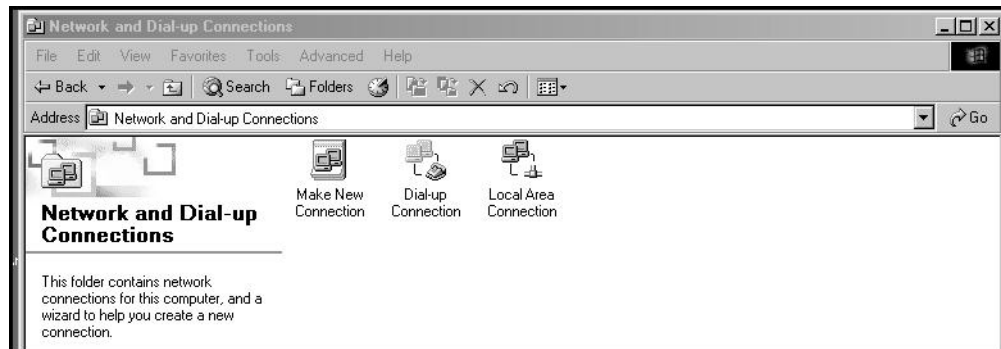


Figure 3 - 10 Network and Dial-up connection under Windows 2000



Note: Windows XP uses a "New Connection" wizard.

3. Double-click the **Make a New Connection Icon**.



Figure 3 - 11 Make a New Connection

4. Select the **Next** option screen and select **Accept incoming connections**.

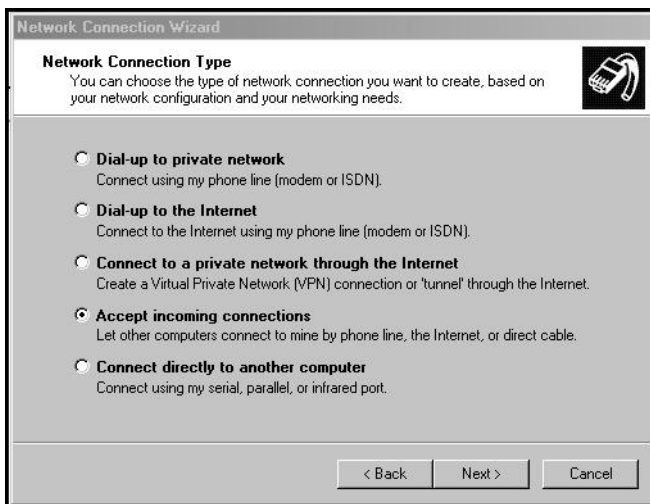


Figure 3 - 12 Accept Incoming Connections

5. Select the **Next** button and check the **Generic Null Modem** option.

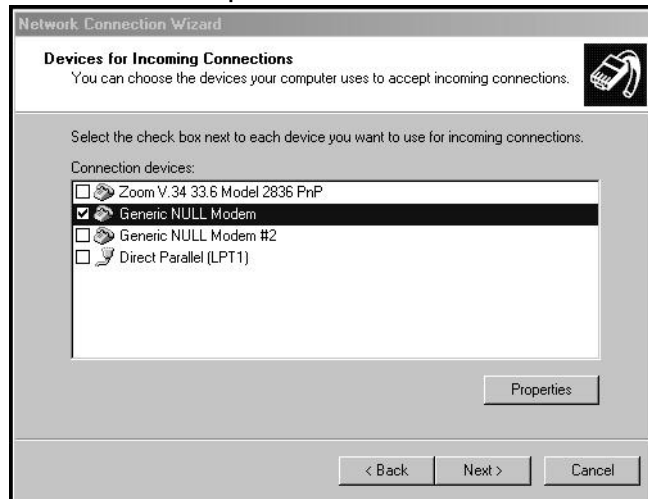


Figure 3 - 13 Device for Incoming Connection

6. Click the **Next** button when ready to continue.
7. Select the **Allow** option on the **Incoming Virtual Connection** window.

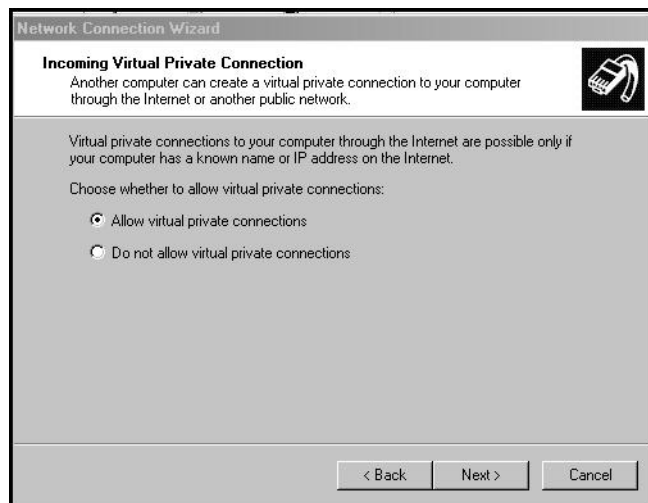


Figure 3 - 14 Select Allow Incoming Virtual Connection

8. Click the **Next** button.

9. Select the **Add** button to add a new DAS connection.

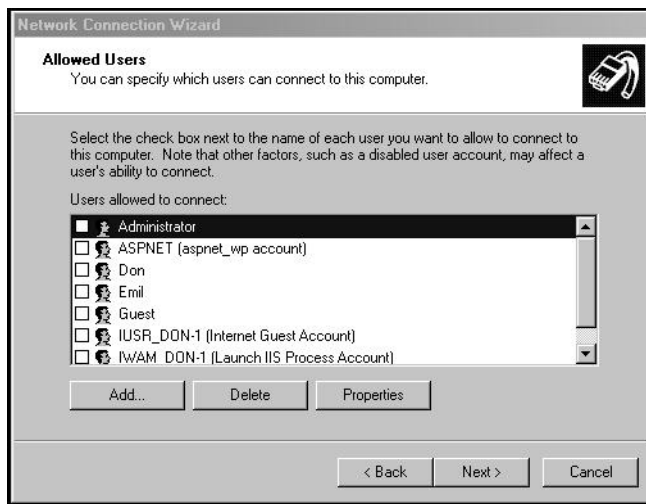


Figure 3 - 15 Add DAS user

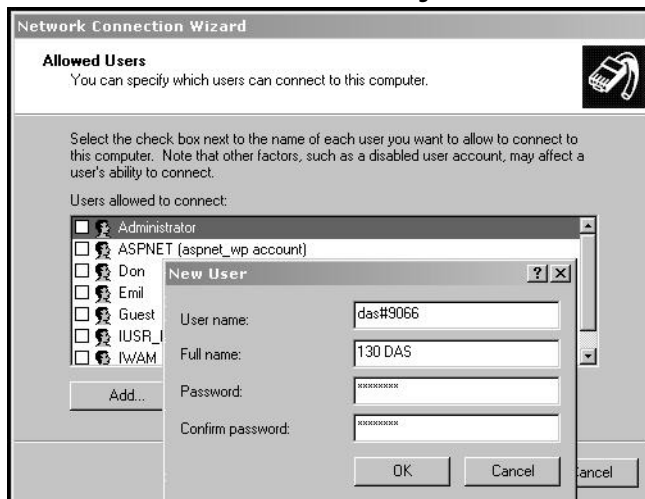


Note: When a DAS unit is setup and is connected to a PC, an account must be created and added. The account Username **MUST** be the particular DAS unit ID that is directly connected to the PC.

10. At the **New User** window in the **User name:** text box type the correct user name *das#_ _ _ _* and password *das#_ _ _ _*, **Where:**

_ is the DAS unit ID number

- If the DAS unit ID is only 3 digits use a leading zero, include the alpha characters *das* and number sign (#).
- If the DAS unit ID is hex, the letters should be in uppercase **ONLY** (i.e. 9AB2 not 9ab2).
- 8 total characters only.



11. Click in the **Full Name:** and fill-in (any name or leave blank).

12. For the **Password:** setting you *must* use the *Username* (i.e., *das#9066*).

13. Next **Confirm Password** by re-typing the password.



Note: The Password: settings are case sensitive.

14. Select the **OK** button to create the new user.

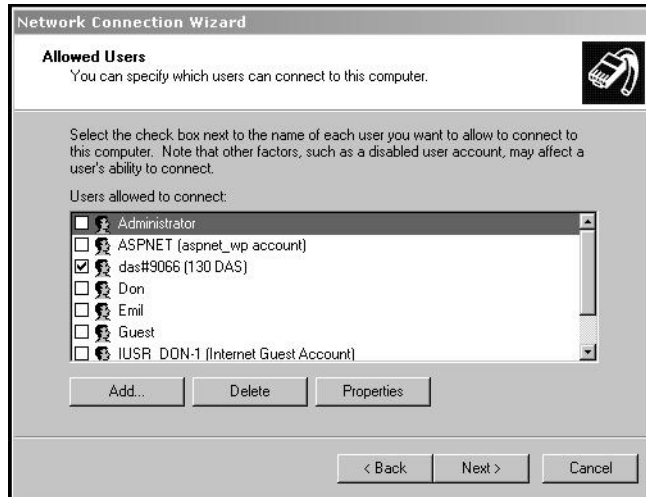


Figure 3 - 16 Added DAS user

15. Select the **Next** button.

16. In the **Network Components** window (Figure 3 - 17), under the components, highlight **Internet Protocol (TCP/IP)**.

17. Select the **Properties** button.

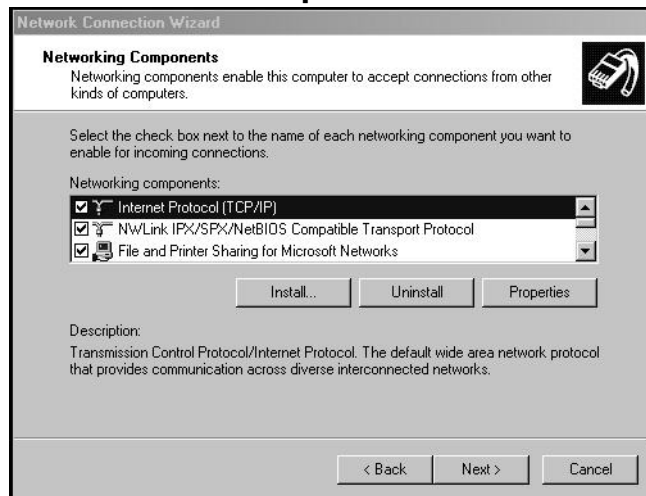


Figure 3 - 17 Networking components

18. On the **Incoming TCP/IP Properties**, enable **Allow callers to access my local area network**.

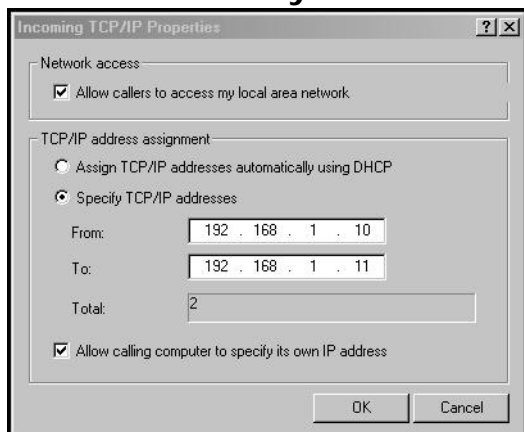


Figure 3 - 18 Incoming TCP/IP properties

19. Enable **Specify TCP/IP address**.
20. In the **From:** text box type a generic IP address where:
21. **From** IP address = PC's PPP IP address.
22. In the **To:** text box type a destination IP address where:
23. **To** IP address = Range of IP address for Serial PPP pool.
24. Click **OK** when ready.

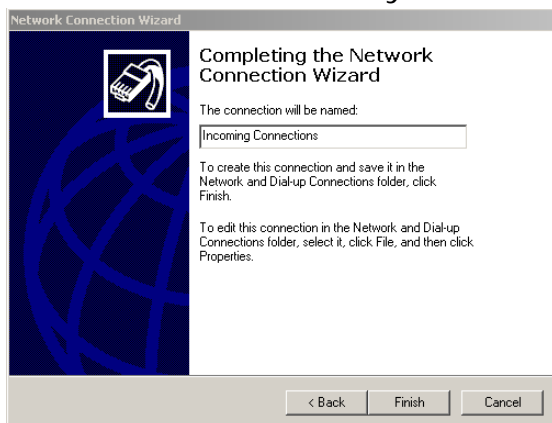


Figure 3 - 19 Remote Access Setup window

25. Click **Finish** after naming the connection.

3.2.2 Start Remote Access Service (RAS)

Windows provides a services control program. It must be used to start RAS. The control program can be accessed through the Windows Control Panel:

For Windows 2000:

Start -> Settings -> Control Panel -> Administrative Tools -> Services

For Windows XP:

Start -> Settings -> Control Panel -> Administrative Tools -> Services -> Component Services.

A shortcut to the control program has also been placed at **Start -> Programs -> Refraction Technology -> RTP Services -> Services**. The shortcut can be copied to the windows desktop by dragging it to the desktop while holding down the CTRL key.

To start RAS perform the following steps:

1. Start the Services control program.
2. Double-click the **Services** icon to open the windows services process window.

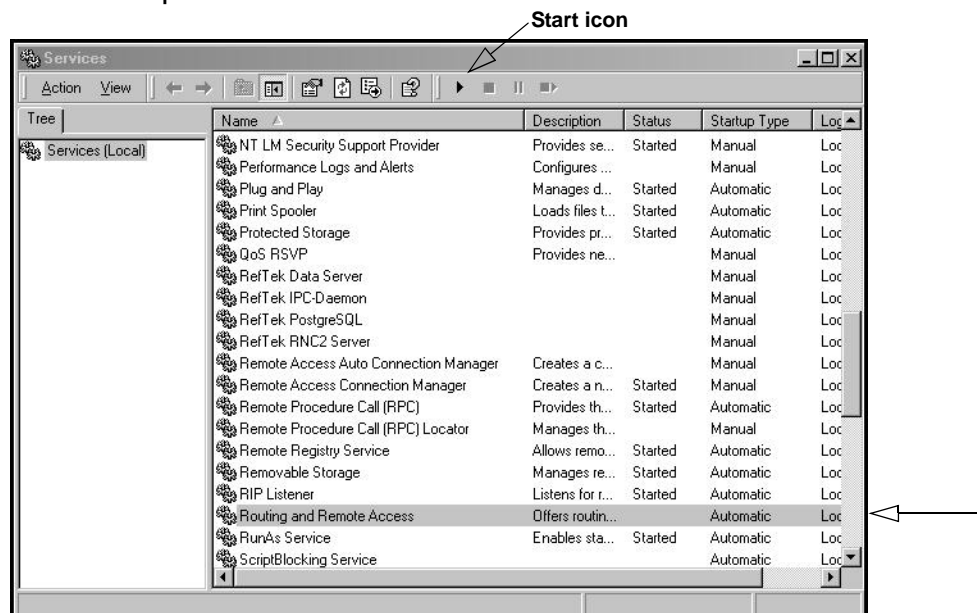


Figure 3 - 20 Services window

3. Highlight and select the **Routing and Remote Access** service.
4. Start the service by using the **Action** pull-down or using the start icon on the task bar.

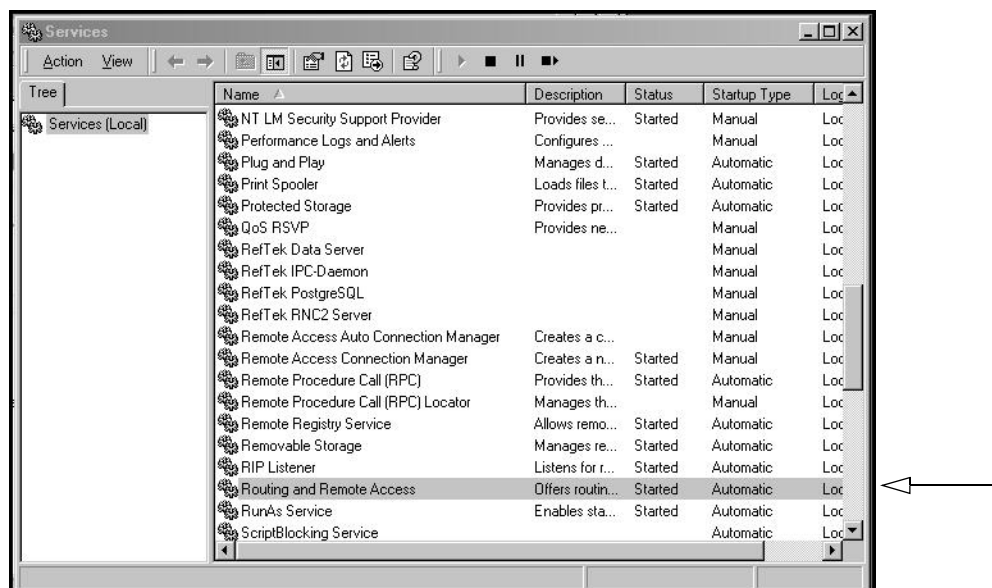


Figure 3 - 21 RAS started

5. Close the control program.

3.3 Modem PPP Connection

3.3.1 130-Modem

The **REF TEK** 130-Modem which is shown below, is capable of providing the same functions as the internal SLM2456 modem module and can be used in all of the **REF TEK** 130 Series Data Acquisition System family. The unit looks similar to the 130-GPS (as shown in Figure 3 - 22) except it has the 130-Modem label on the end of the unit and two wires connected as shown below in Figure 3 - 23.

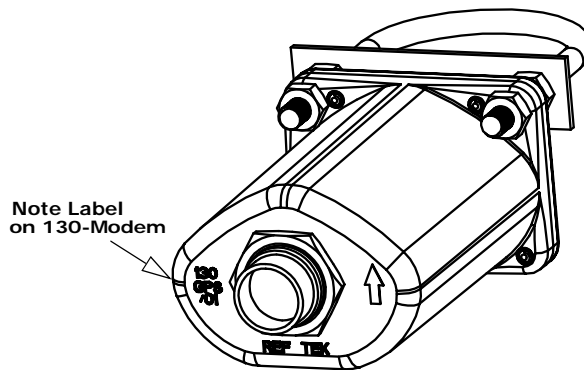


Figure 3 - 22 130-GPS



Figure 3 - 23 130-Modem

3.3.2 DAS Setup

This Section explains the **REF TEK** 130-Modem when it is used with the **REF TEK** 130 family. The 130-Modem is an optional external modem.

A user should be familiar with whatever **REF TEK** host system is in current use. Documents for other **REF TEK** products are available on request.

3.3.3 Setting up the 130 to use the 130-Modem

1. Connect the 130-Modem to the 130 DAS unit NET connector, using the standard **REF TEK** 130-8154 cable supplied with the 130-Modem unit, this cable is also available seperately (see drawing).
2. Attach the phone line connector to an available phone line connection.

The **REF TEK** 130-8154 130-Modem-to-DAS cable referred to above is wired as follows:

| Modem Connector PT06A1210P(SR) | 130 Net Connector (PT06A14-19S) | Signal | Phone Line Cable |
|-----------------------------------|------------------------------------|---------------------|------------------|
| PIN A | PIN A | RX | |
| PIN B | PIN B | TX | |
| PIN C | PIN C | RTS | |
| PIN D | PIN D | CTS | |
| PIN E | PIN E | GND | |
| PIN F | PIN F | CCD | |
| PIN G | - | Phone - TIP | Red - 2 |
| PIN H | - | Phone - RING | Green - 3 |
| PIN J | PIN G | 5V | |
| PIN K | PIN M | 12 V | |

No additional cables are needed to operate the 130-Modem and **REF TEK** 130. The user should consult applicable literature for other host devices.

3.4 SLM Modem module

The SLM2456 modem module is used in the 130-Modem and as the internal modem for the **130-01**. The SLM2456 is a complete, modem module that is based on the Si2456 chipset. The Si2456 is an ITU-V.90 compliant, 56 kbps modem chipset with integrated direct access arrangement (also called DAA it includes parallel phone detect, over-current detection and global PTT compliance). This provides a programmable line interface to meet global telephone line requirements. It is a single design that includes a DSP data pump, a modem controller, on-chip RAM and ROM, an analog front end (AFE) a DAA, and analog output.



Note: The 130-8137 modem cable is used with the 130-01 when supplied with an internal modem.

3.4.1 Modem features

The SLM2456 accepts standard modem AT commands and provides connect rates up to 56/33.6/14.4 kbps full-duplex over the Public Switched Telephone Network (PTN). It also features a complete set of modem protocols including all ITU-T standard formats up to 56 kbps.



Note: This material is part of the Silicon Laboratories® Si2456/33/14 data sheet document revision 1.0. See the *Si2456/33/14 Users Guide* (“AN70:Si245/Si2433/Si2414/Si2403 Modem Designer’s Guide”) for detailed feature explanations.

3.5 Modem configuration



Note: The internal modem (used on the 130-SM) requires the jumper installed on the RT530 lid board to assign the serial PPP port to the internal modem and therefore disable the serial PPP port coming out of the NEt connector.

3.5.1 PFC_130 Serial PPP

Use the Serial PPP settings within the PFC_130 to configure the modem.



Note: Serial PPP settings are for internal and external modem control. If a modem is connected the user MUST use these settings to configure the modem.

1. Use the **Control** menu **Net** button to assign Serial PPP parameters for the modem.

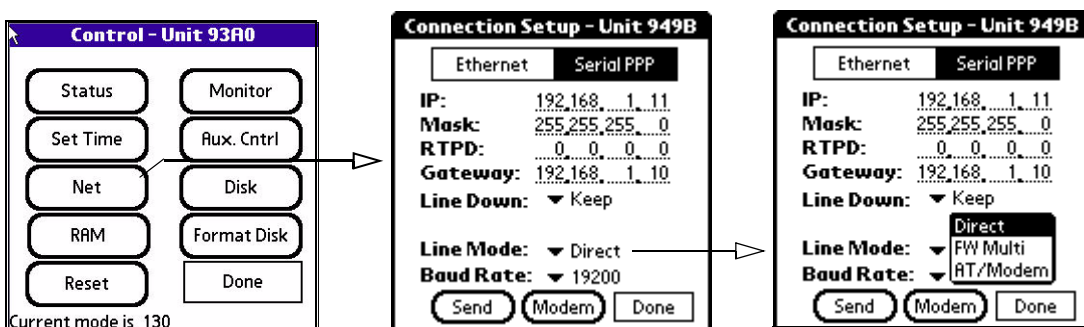


Figure 3 - 24 PFC_130 Control menu.

2. Click the **Line Mode** (type of serial connection) pull-down arrow and select the **AT/Modem** option from the pull-down.



Note: Direct - Connection to a PC or router or FW in point-to-point mode.

Note: FW Multi - Connection to a Freewave operating in multipoint mode.

Note: AT/Modem - Connection to a modem.

- Click the **Baud Rate** (serial port speed) pull-down arrow and select the **19200** baud rate.

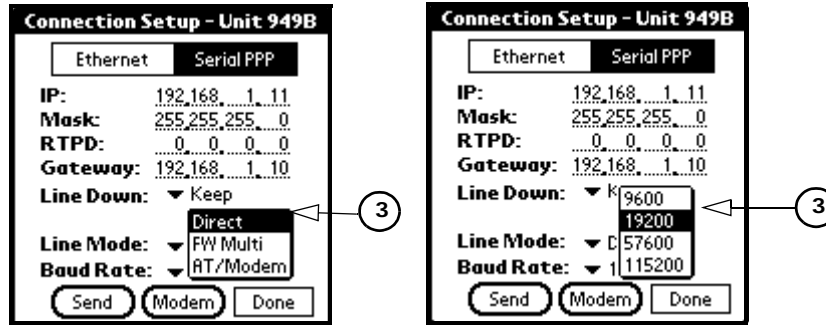


Figure 3 - 25 Assign Serial PPP Line Mode and Baud Rate



Note: It is preferred to set the port speed at 19200 to allow for phone noise and the modem buffering to keep up.

- After assigning Serial PPP parameters use the **Send** button to send them to the DAS.

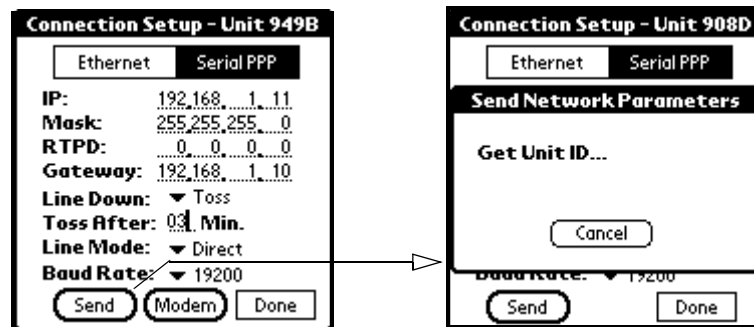
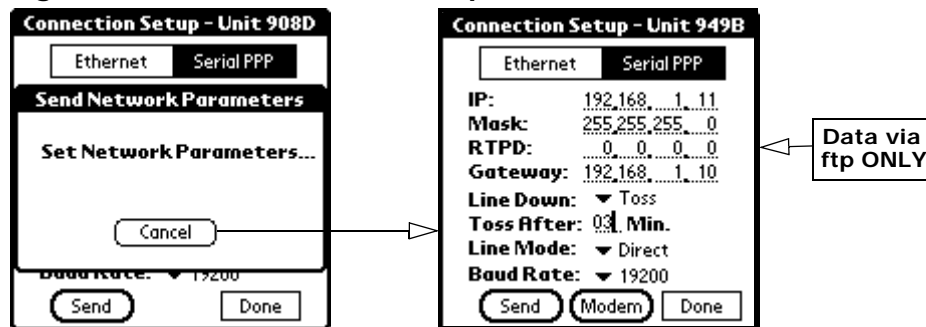


Figure 3 - 26 Send Serial PPP parameters to the DAS



Note: When the Send button is selected both Ethernet and Serial PPP IP configuration are sent to the DAS at the same time. So it is therefore possible to edit both sets of configurations at the same time and only send them to the DAS once.

Figure 3 - 27 Send Serial PPP parameters

If using AT/Modem - Line Mode:

1. Select the **Modem** button to adjust the modem settings.

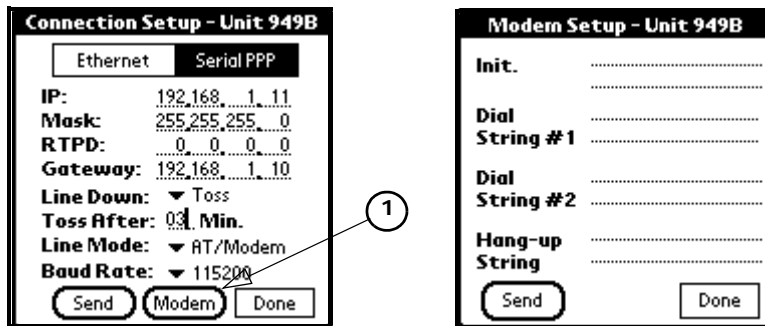


Figure 3 - 28 Modem setup screen

2. Tap after the **Init.** field and provide the modem initialization parameters as shown below (**ATEOS0=1**).

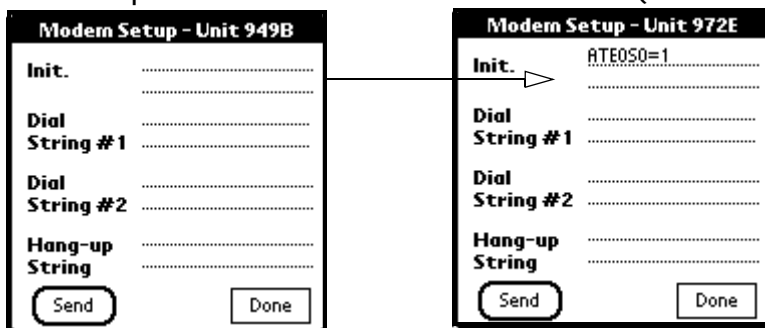


Figure 3 - 29 Modem Init string



Note: Type the init string exactly as shown above. The init string is the **ONLY** string that works. It is sent to the modem on both boot up of the 130-01 and/or if sent from the above window using the *Send* button.

3. Tap the **Send** button to send the modem parameters to the DAS.
4. Tap the **Done** button to return to the Connection setup menu.

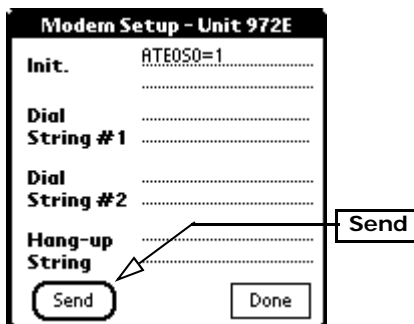


Figure 3 - 30 Send the modem parameters

3.5.2 Data transfer through PPP real-time

If you want data to be transferred real-time through PPP then it must be marked in the data stream parameters and the RTPD host IP entered in the PPP menu.

- If the remote cannot find RTPD when carrier detect goes high, at the IP address entered for RTPD, it will hang up the line.
- The remote does not call out automatically when using a modem. It will drop the line if it does not negotiate with an RTPD host address other than 0.0.0.0.
- If the data is streamed over PPP and the link is getting saturated, at some point the 130 will close the RTPD connection, reset the DAS and take the link down.
- FTP cannot be used if the PPP link is talking or connecting to an RTPD.



Note: If the user wants the option of real-time and ftp, they must stop acq first and allow the serial data buffer to clear before doing ftp or the unit will lock up and will be reset by the watchdog after 60 seconds.

3.6 PC Setup

3.6.1 130 DAS modem communication



Note: The modem at the 130-01 DAS end of the line should be pre-configured to automatically answer before trying to dial to the DAS.

The following steps are an example of the steps necessary to configure the 130-01 DAS modem to automatically answer.

1. Be sure the modem is connected an open COM port on the PC.
2. Open a Hyper Terminal window using: **Start --> Program --> Accessories --> Communications --> Hyper Terminal**
3. Create a new **130-01** DAS connection session.
4. Enter the **Connect using** option as **COM** for the connection.
5. Set the **Port Settings** to the port settings of the 130 modem.
i.e. Bits per second to the baud rate of the 130 modem.
6. Once connected enter AT commands necessary for the specific modem installed to automatically allow auto-answer.
i.e. **AT S0=1**

3.6.2 Install modem



Note: This section only applies if a modem has not already been installed on the PC.

This section describes requirements for dialup into a **130-01** Recorder on a computer running Windows 2000.

1. Connect the modem to an open COM port of the PC.
2. Open the **Start --> Settings --> Control Panel -->** window to add a modem.
3. Double-click the **Phone and Modem** Icon.

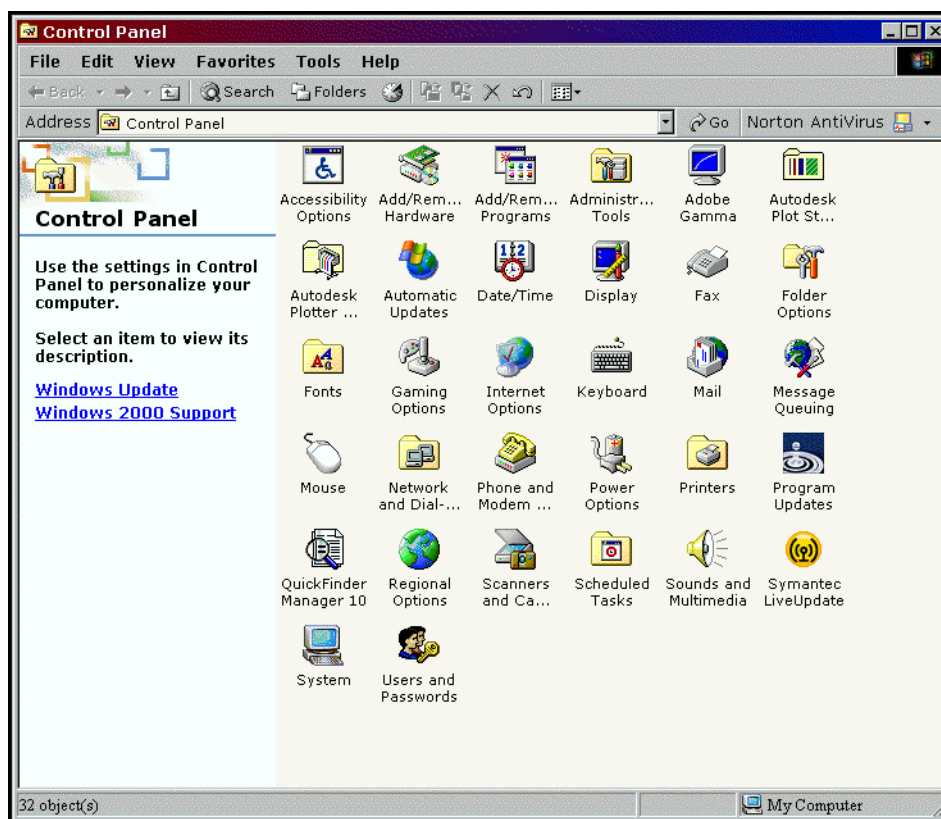


Figure 3 - 31 Add a modem

4. Select the **Modem** option tab to continue the setup.

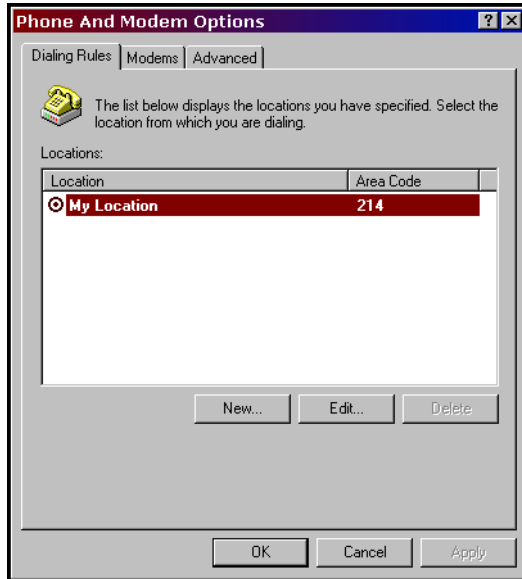


Figure 3 - 32 Phone and Modem options

5. Select the **Add** option to detect and install a modem.

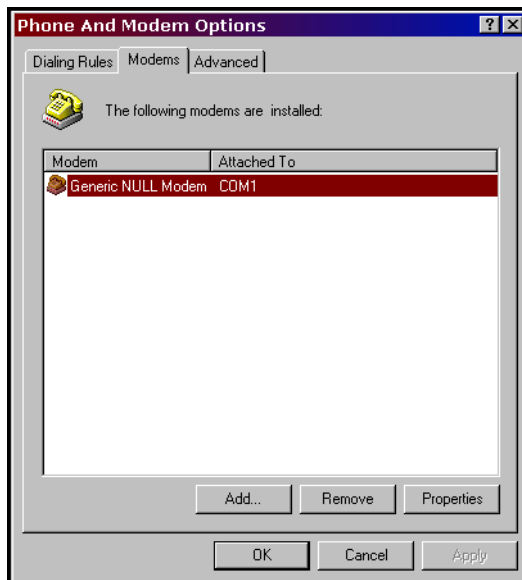


Figure 3 - 33 Chose Modems option

6. The Install New Modem window opens and installs.

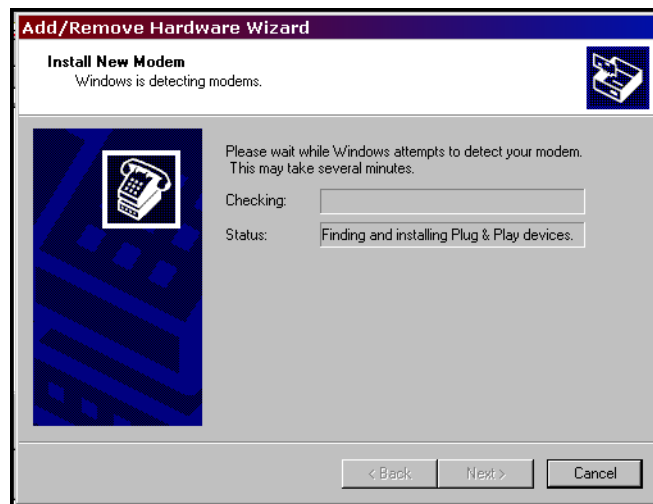


Figure 3 - 34 Detect a new modem

7. Select the **Finish** button to accept the new device and finish the installation.

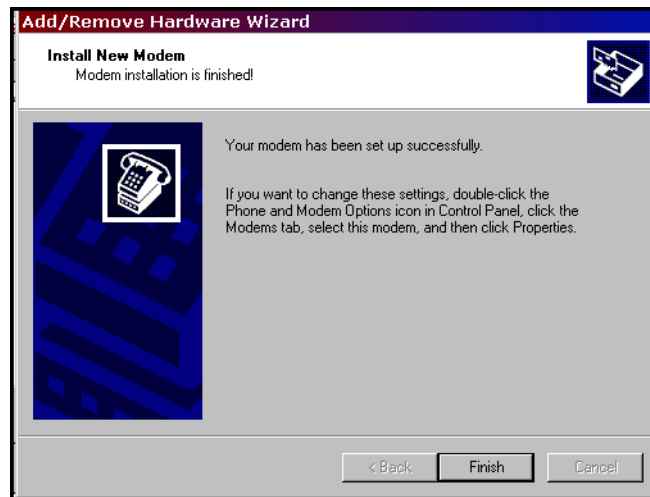


Figure 3 - 35 Detected new modem and installed

- The **Phone and Modem Options** window displays to show the new modem.

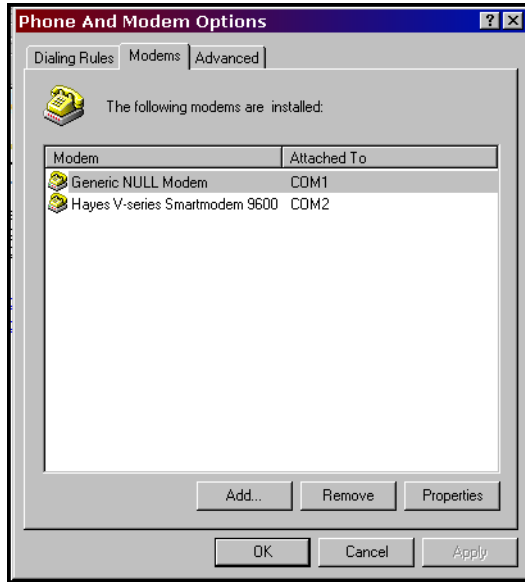


Figure 3 - 36 New hardware detected

- Highlight the new modem.

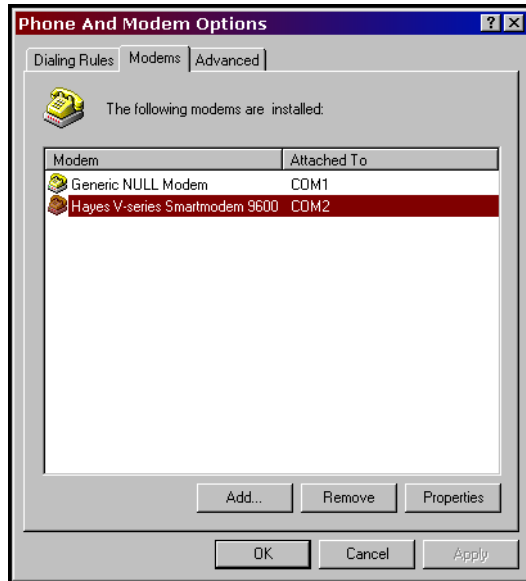


Figure 3 - 37 Highlight new modem

- Select the **Properties** button to set the baud rate for the modem.

11. Set the Baud rate from the drop-down menu and Select the **OK** button.

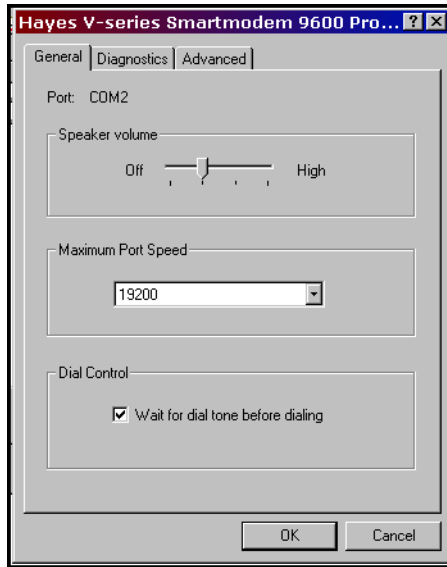


Figure 3 - 38 General modem properties



Section 4 Periodic Maintenance Operations

4.1 Introduction

This section provides maintenance information for the 130-01/3 and 130-01/6 on the following topics:

| Description |
|---|
| See "Replacing the Compact Flash" on page 4-70. |
| See "Connector Assembly & Maintenance" on page 4-74. |
| See "Periodic Maintenance checks" on page 4-76. |
| See "Replace CPU Battery (130-01/3 and 130-01/6)" on page 4-77. |
| See "Disassembly of the 130 for service" on page 4-78. |
| See "Sealing and pressure testing a 130-01 DAS" on page 4-83. |
| See "Adding or replacing an RT527" on page 4-88. |
| See "To Test the 130 DAS Memory" on page 4-87. |

This section provides general maintenance procedures that increases the effectiveness and useful life of your recorder unit(s).

4.2 Replacing the Compact Flash

If the Compact Flash needs to be changed do the following

1. Remove the cap off the **130-01** DAS.



Figure 4 - 1 Remove cap from the well

2. If the LED, in the disk well assembly (**Item 3**) next to where the Compact Flash is installed, shows "Green", it can be replaced with an empty formatted drive.



Note: If the LED shows Red the drive is reading data; DO NOT REMOVE THE DRIVE UNTIL THE LED CHANGES TO GREEN.

The following conditions could result if a drive is replaced while the LED is Red:

- Loss of data on the drive.
- The drive may have to be reformatted.
- The 130 DAS may have to be power-cycled.



Note: DO NOT TOUCH THE DRIVE, except when replacing the tape.

3. Use only the provided tab, attached to the Compact Flash, as shown in Figure 4 - 2 and Figure 4 - 3.

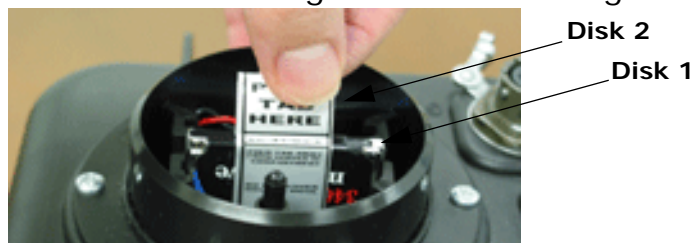
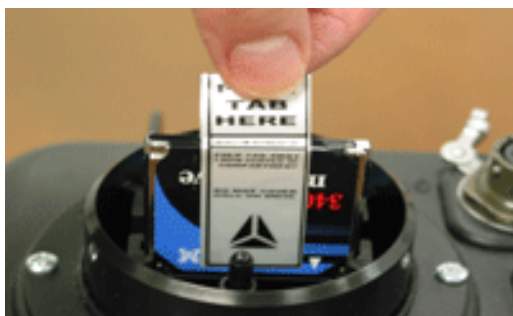


Figure 4 - 2 Use the provided tab to remove the Compact Flash



Note: DO NOT HOLD the drive in the middle as it may damage the drive.

Figure 4 - 3 Gently remove by pulling straight up from the well

4. Handle the drive by grasping the sides of the drive with the other hand.



Figure 4 - 4 Only handle the drive by its side

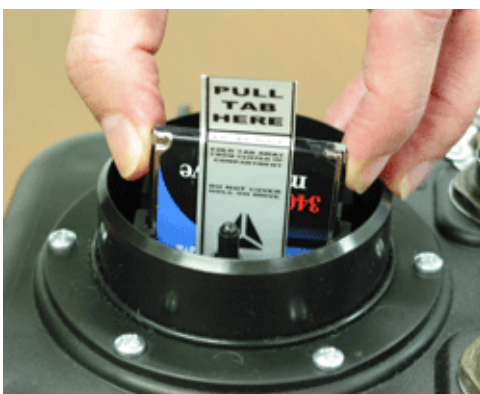


Figure 4 - 5 Install a new drive

5. Install a newly formatted drive in either slot by holding (ONLY) onto the sides of the Compact Flash and inserting into the well or reader (as shown in Figure 4 - 2).
6. The LED, for the well slot, should turn "Green".

When using the Compact Flash with a Compact Flash Reader:

1. Grasp only the edges while inserting the drive into the CompactFlash Reader.



Figure 4 - 6 Compact Flash reader

2. Grasp only by edges or tab to install or remove the drive.

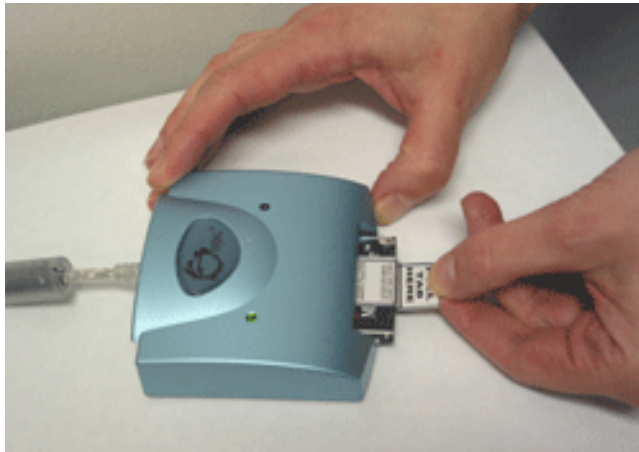


Figure 4 - 7 Compact Flash removal from a CompactFlash Reader

4.3 To replace or install a sticker on a drive

Use the following guide to install a sticker on the Compact Flash

1. FOLD THE STICKER INWARD AT THE THREE LINES POINTED OUT WITH ARROWS. (fig. 1)
2. PEEL OFF THE ADHESIVE MASKING PAPER ON THE BACK EXPOSING THE ADHESIVE ON THE STICKER.
3. ALIGN THE STICKER WITH THE MIDDLE OF THE MICRODIVE AND REFERENCE ONE OF THE FOLDED CREASE WITH THE EDGE OF THE MICRODRIVE'S TOP BE CAREFUL NOT TO COVER THE HOLE ON THE MICRODRIVE. (fig. 2)
4. REPEAT THE PROCESS TO THE OTHER SIDE. (fig. 3)
5. PINCH THE STICKER WHERE THE TAP SAYS "PULL HERE" TO MATE THE TAPS TOGETHER TO ONE ANOTHER.
6. PRESS ON THE TOP OF THE MICRODRIVE TO ADHERE THE REST OF THE STICKER TO THE TOP OF THE DRIVE. (fig. 4)

| | | | | | |
|--|-------------|-------|---------------------------|---------------------------------|----|
| UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES + 1/32 .XX ± .01 - 1/32 .XXX ± .005 | APPLICATION | | REFRACTION TECHNOLOGY INC | | |
| | APPROVALS | DATE | | | |
| MATERIAL DRIVE STICKER FAB 130-8102 | DRAWN | JWS | 10/9/02 | MICRODRIVE STICKER INSTRUCTIONS | |
| FINISH | REVISIONS | SIZE | CODE IDENT NO. | DRAWING NO. | |
| | | B | | 130-8102 | |
| DO NOT SCALE DRAWING | | SCALE | | SHEET | OF |

4.4 Connector Assembly & Maintenance

To allow you to choose the particular peripherals to use (such as power supply, modem, and external clock), and suitably locate them, **REF TEK** typically does not always supply complete cables with your recorder. Instead, **REF TEK** supplies a kit that contains the mating connectors that you need to construct the cables required by your particular peripherals and system configuration. Upon order, **REF TEK** will supply any or all of our standard connector cables (as described later). Also, **REF TEK** will construct any custom cables your system needs. For some of the more standard connector/cable drawings of commonly used assemblies see "Standard Faceplate Connections" on page 1-3.

Pin connections are supplied in your recorder manual (Starting in Chapter 1, "Overview" on page 1-1). When making the connections follow industry standard practices in dressing the cable end, soldering the connections and applying shrink tubing. The use of self-vulcanizing tape is preferred to potting the connector since with potting, the connector is no longer field serviceable.



Note: For additional moisture protection, apply DL-111 inside the top shell to seal against the rubber grommet. Bottom shell must rotate freely after the top shell has been firmly tightened into the connector body.

The recommended periodic connector maintenance and usage is as follows:

1. Plugs labeled "PT06" have a superintending outer locking collar with a machined inner groove that locks onto the pegs in the side of the panel mount mate receptacle. When removing a PT06 connector, move it out of the locked position by first applying a downward force on the outer collar and then twisting it free in a counter-clockwise direction.
2. Be careful with tools when gripping connectors - use tools with nylon fittings in the jaws if you can, and do not apply excessive force.
3. The connectors have a machined groove inside. To avoid damaging this groove, you must apply a downward force while turning. Because connectors for the 130 DAS units are constructed of an alloy, excessive force on the locking groove can cause burrs which make subsequent installation and removal of the connectors more difficult.
4. Do not attempt to remove a plug with pliers.

5. Assemble new connectors correctly as shown below.

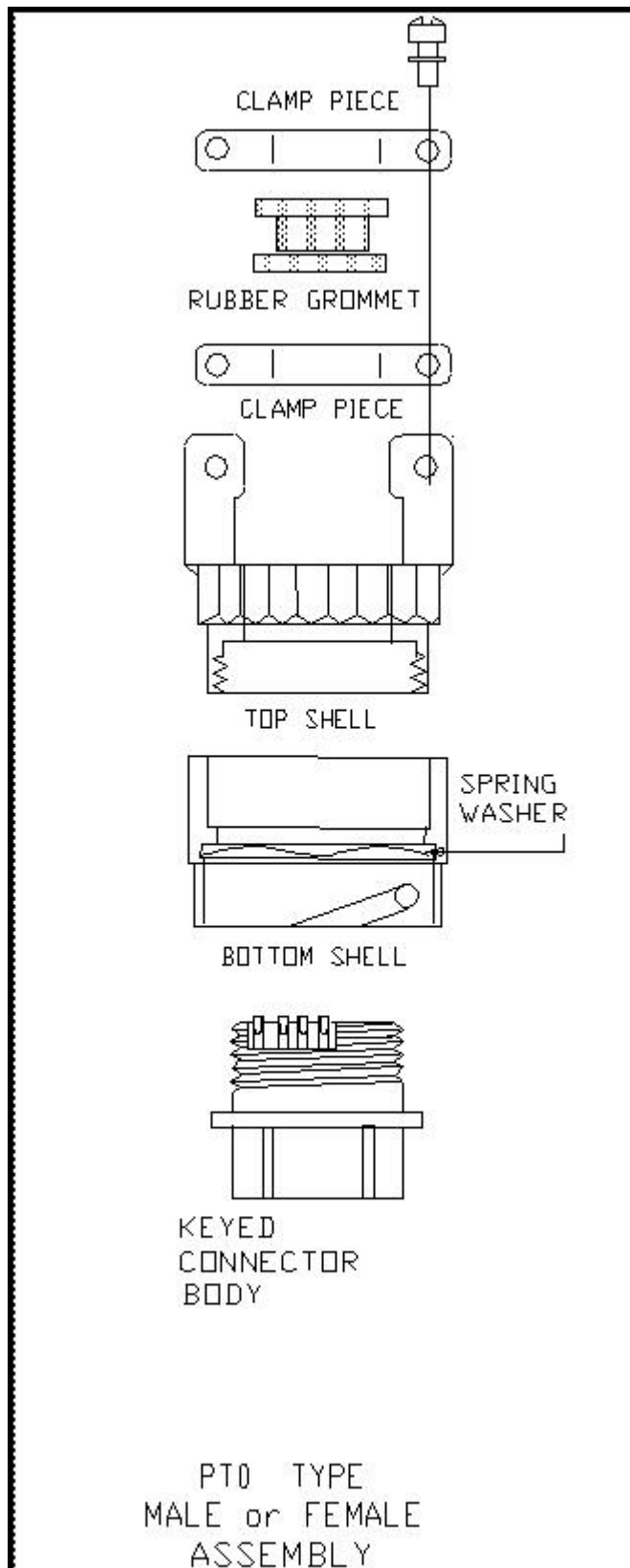


Figure 4 - 8 PTO Connector breakout

4.5 Periodic Maintenance checks

In theory, no maintenance is needed - in practice it is to the user's advantage to inspect a unit at least every year or before and after any long-term field deployment. Shock, vibration and effects the user has no control over (vandalism for example) may occur and cause leaks in the case that result in dust or moisture accumulating inside and damaging components. For these reasons it is best to perform an annual inspection, clean off the boards, ensure that all components are in good condition and that socketed chips are properly seated and that all boards and connectors are firmly mated. If you encounter a recurrent problem, please advise Refraction Technology.

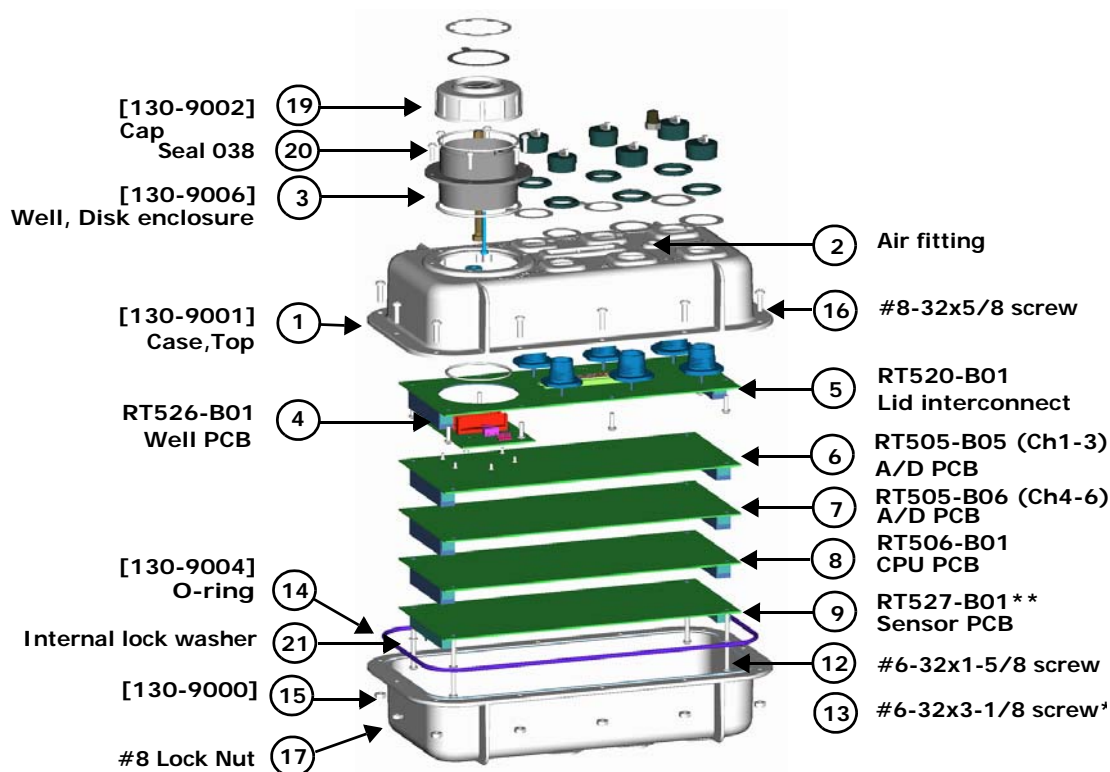


Figure 4 - 9 130-01/3 and 130-01/6 board stack



Note: For some DAS units an EMI protective shield has been added to make the unit CE compliant. Care should be taken in removal when servicing the unit.



Note: ** Optional board

Note: RT505-B06 A/D PCB is for 130-01/6 and 130-02/6 6 Channel 130 DAS units.

4.6 Replace CPU Battery (130-01/3 and 130-01/6)

The CPU board has a 3.6 volt back-up battery, located in the well area, to retain CPU RAM when the recorder is powered off or asleep. If the LCD display shows less than 2.2 volts for the battery it should be replaced.

Refer to Figure 4 - 9 on page 4-76.

1. The power to the **130-01** may be left on so data in memory will not be lost.
2. Remove the cap (130-9002) (**Item 19**) from the well disk enclosure (**Item 3**).
3. Disconnect the connector for the battery from the pins located next to the fin clip inside the well.
4. Gently remove the battery assembly (130-9007) (**Item 18**) from the fin clip inside.
5. Insert the new battery assembly (130-9007) (**Item 18**) into the fin clip inside the well disk enclosure (**Item 3**).
6. Attach the connector off the new battery assembly (130-9007) (**Item 18**) to the pins located next to the fin clip inside the well disk enclosure (**Item 3**).
7. Check the LCD display to be sure the voltage is now close to 3.6 volts.



Figure 4 - 10 Backup battery voltage on LCD display

8. Screw the cap (130-9002) (**Item 19**) onto the well enclosure (**Item 4**).
9. Once the cap bottoms out to the flange turn the cap ONLY A HALF TURN to seal the well.

4.7 Disassembly of the 130 for service

To disassemble a 130-01 (Refer to Figure 4 - 9 on page 4-76 and Figure 4 - 11 on page 4-79) follow these steps:

1. Power off the **130-01**.
2. Check and make sure the cap (**130-9002**) is installed on the well disk enclosure (**Item 3**).
3. Flip the **130-01** DAS upside-down on the top of the top case (**Item 1**).
4. Unbolt the bottom base case (**Item 15**) of the recorder by removal of twelve #8-32x5/8 screws (**Items 16**) and the twelve #8 lock nuts (**Item 17**).



Note: The order of removal is not important until the 130 DAS needs to be assembled.

5. Remove the bottom half of the case (**130-9000**) (**Item 15**).



Note: Make sure the O-ring (**Item 14**) (**130-9004**) stays on the bottom half of the 130-01 DAS assembly.

6. If the DAS has a protective EMI shield, remove the cover (form-fitting plastic).
7. If boards need to be removed, loosen and remove the six #6-32 screws (**Item 12**) or (**Item 13**) from the stack.



Note: Retain the lock washers (**Item 21**) with the screws so they do not get misplaced.

8. Disconnect the CPU ribbon cables (**Item 10**) and (**Item 11**) from the CPU board (**Item 9**) by spreading the ears on the connections of the CPU board (**Item 9**).
9. At this point the individual boards may be gently lifted off the stack.
10. The **130-01** DAS configuration can be changed, at this time, by:
 - (1) Adding a memory expansion board to the top of the CPU board (**Item 9**). Make sure the board notches match where the cable connectors for the ribbon cables (**Item 10**) and (**Item 11**) are located on the board.
 - (2) Adding a sensor control board (**Item 8**) after removing the CPU board (**Item 9**).
 - (3) Upgrade the 130-1/3 to a 130-1/6 6-Channel recorder.

11. Refer to "Assembly of the 130" on page 4-82 to assemble the 130 DAS.

| Assembly ID: 130-01/3 Recorder, 3rd Generation, 3 Channel | | | | | |
|--|----------------|------|------|---|-----------|
| 1 | 130-8000 | | | Assembly, Final, 130-01/3, 3rd Generation DAS | 1.0000 EA |
| .2 | 130-8001 | | | Assembly, Top, 130-01, 3rd Generation DAS | 1.0000 EA |
| ..3 | 130-8009 | 0130 | | Assembly, Well, Disk Drive, 130-01 | 1.0000 EA |
| ...4 | FAB1309006 | 3 | 0010 | Well, Disk Drive, 3rd Generation DAS | 1.0000 EA |
| ...4 | FAB1309007 | | 0020 | Shaft, Switch Actuator, 3rd Generation DAS | 1.0000 EA |
| ...4 | FAB1309008 | 18 | 0030 | Battery, 3.6V, .95Ah, 1/2AA, w/ Connector, for 1: | 1.0000 EA |
| ...4 | HNB1/4-20X14 | | 0040 | Bolt, Hex Head, 1/4-20x7/8, Nylon | 1.0000 EA |
| ...4 | HNN1/4-20 | | 0050 | Nut, 1/4-20, 7/32 Length, 5/16 OD, Small | 1.0000 EA |
| ...4 | HST4-26X10 | | 0130 | Screw, Plastic Self Tapping, 4-26X5/16, | 6.0000 EA |
| ...4 | HST6-20X8 | | 0120 | Screw, Plastic Self Tapping, 6-20x1/2, P | 6.0000 EA |
| ...4 | SEAL034/50DURO | | 0080 | O-Ring, 2-034, 50 Durometer, EPR | 1.0000 EA |
| ...4 | SEAL038/50DURO | | 0110 | O-Ring, 2-038, 50 Durometer, EPR | 1.0000 EA |
| ...4 | SEAL147/50DURO | | 0090 | O-Ring, 2-147, 50 Durometer, EPR | 1.0000 EA |
| ..3 | 130-8012 | | 0140 | Assembly, Lens, LCD, 130-01 | 1.0000 EA |
| ...4 | FAB1309004 | | 0010 | Bezel, Lexan, 130-01, 3rd Generation DAS | 1.0000 EA |

Figure 4 - 11 130-01/3 Bill of Materials (Page 1 of 3)

| | | | | | | |
|-------|------------------|---|------|--|---------|----|
| ... 4 | HPHM2.5X4 | | 0020 | Screw, M2.5x4, PPH, SS | 6.0000 | EA |
| .. 3 | FAB1309001 | ① | 0150 | Case, Top, 130-01, 3rd Generation DAS, CE | 1.0000 | EA |
| .. 3 | FAB1309175 | | 0200 | Shield, Upper, .030, PVC, WAVE ZERO | 1.0000 | EA |
| .. 3 | H9166-0060 | ② | 0120 | Valve, Air, Schrader, 1/8~ Pipe Tap, 916 | 1.0000 | EA |
| .. 3 | HCW-06 | | | Washer, Spring (Crescent), #6, SS | 16.0000 | EA |
| .. 3 | HST6-20X8 | | 0080 | Screw, Plastic Self Tapping, 6-20x1/2, P | 8.0000 | EA |
| .. 3 | PMS318112N | | 0060 | Connector, Cap, Dust, for Shell Size 12 | 3.0000 | EA |
| .. 3 | PMS318114N | | 0070 | Connector, Cap, Dust, for Shell Size 14 | 3.0000 | EA |
| . 2 | 130-8005 | ⑩ | | Assembly, Cable, Disk Internal, 50 pin | 1.0000 | EA |
| .. 3 | PAWP-50-8240-200 | | 0010 | Connector, IDC-Socket, 2mm, Ribbon, 50-p | 2.0000 | EA |
| .. 3 | W2mmRIBBON50 | | 0020 | Cable, 2mm Ribbon, 50 conductor | 0.3300 | FT |
| . 2 | 130-8006 | ⑪ | | Assembly, Cable, Interconnect, Test/Status, 20 p | 1.0000 | EA |
| .. 3 | PAWP-20-8240-200 | | 0010 | Connector, IDC-Socket, 2mm, Ribbon, 20-p | 2.0000 | EA |
| .. 3 | W2mmRIBBON26 | | 0020 | Cable, 2mm Ribbon, 26 conductor | 0.3300 | FT |
| . 2 | 130-8007 | | | Kit, Completion, for 3-Card Stack, 3rd Generatio | 1.0000 | EA |

Figure 4 - 12 130-01/3 Bill of Materials (Page 2 of 3)

| | | | | | | |
|------|------------|----|------|--|---------|----|
| .. 3 | 130-HANDLE | | 0130 | Handle, Black, for use w/130 | 1.0000 | EA |
| .. 3 | FAB1309000 | 15 | 0010 | Case, Bottom, 3rd Generation DAS | 1.0000 | EA |
| .. 3 | FAB1309003 | 14 | 0020 | Seal, Black, 3rd Generation DAS | 1.0000 | EA |
| .. 3 | FAB1309176 | | 0150 | Shield, Lower, .030, PVC, WAVE ZERO | 1.0000 | EA |
| .. 3 | HCW-06 | | | Washer, Spring (Crescent), #6, SS | 6.0000 | EA |
| .. 3 | HKHN-08 | | 0080 | Nut, Hex with Star Washer, 8-32, SS | 12.0000 | EA |
| .. 3 | HPH6-32X26 | 12 | 0030 | Screw, 6-32x1-5/8, PPH, SS | 6.0000 | EA |
| .. 3 | HPH8-32X10 | | 0140 | Screw, 8-32x5/8, PPH, SS | 2.0000 | EA |
| .. 3 | HPH8-32X8 | | 0100 | Screw, 8-32x1/2, PPH, SS | 10.0000 | EA |
| . 2 | 130-8013 | | | Assembly, Cap, Disk Drive Well, 130-01 | 1.0000 | EA |
| .. 3 | FAB1309002 | 19 | 0010 | Cap, 130-01, 3rd Generation DAS | 1.0000 | EA |
| 1 | RT505F-B05 | 6 | 0170 | Assembly, PCB, A/D Board, CH1-3, x1 or x32 G | 1.0000 | EA |
| 1 | RT506G-B01 | 8 | 0150 | Assembly, PCB, CPU Board, 3rd Generation | 1.0000 | EA |
| 1 | RT520G-B01 | 5 | | Assembly, PCB, Lid Interconnect, 3rd Gen | 1.0000 | EA |
| . 2 | RT526F | 4 | 0250 | PCB, Microdisk/Compact Flash Board, 3rd | 1.0000 | EA |

Figure 4 - 13 130-01/3 Bill of Materials (Page 3 of 3)

4.8 Assembly of the 130

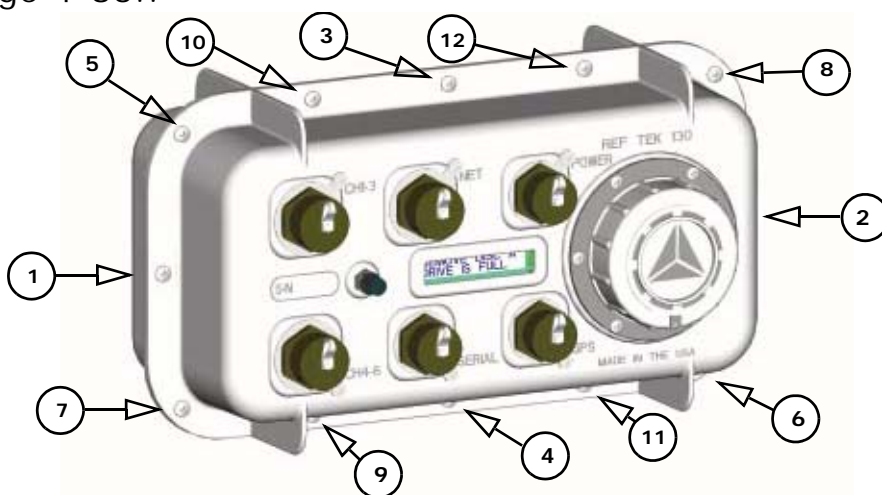
Assemble the 130 DAS (Figure 4 - 9 on page 4-76) as follows:

1. Gently re-stack the boards in the order shown in Figure 4 - 9 on page 4-76.



Note: If new boards are added remember the CPU board is always last unless a memory expansion board is added, in this case the memory board is mounted last.

2. If the DAS has an EMI protective shield, either close the flaps re-install the cover (plastic).
3. Insert the six removed #6-32 screws (**Item 12**) or (**Item 13**) with the lock washers (**Item 21**).
4. Tighten the stack of boards with a screwdriver.
5. Connect the loose end of the ribbon cables (**Item 10**) and (**Item 11**) by locating the first pin on the connector and applying pressure until the ears of the connector close.
6. Place the O-ring in the bottom half of the case (**Item 15**).
7. Place the completed flipped case assembly (**Item 1**) onto the case bottom base (**Item 15**) making sure the O-ring sits in the groove of the top case as well.
8. Bolt the two halves of the **130-01** DAS together using twelve #8-21x5/8 SS screws (**Item 16**) and #8 lock nuts (**Item 17**).
9. Seal and pressure test the **130-01** DAS. Refer to Step 7 on "Sealing and pressure testing a 130-01 DAS" on page 4-83..



Note: Follow the pattern shown below in Figure 4 - 14 to install and hand tighten the nuts to the screws. Then tighten all twelve screws in the same pattern

Figure 4 - 14 Bolt pattern for halves of 130

4.9 Sealing and pressure testing a 130-01 DAS

Recorder units in the plastic cases must be reassembled correctly so that they remain properly sealed and moisture proof. The top and bottom case incorporates an O-ring that forms the seal. The O-ring is very lightly lubricated with a hydrocarbon based silicone and it must be correctly seated before the recorder is reassembled. **REF TEK** provides a spares kit that includes an O-ring and other assembly hardware for each recorder. Extra O-rings can be ordered under part number **130-8003** as part of the spares kit.

Each recorder also contains two desiccant packets that should be replaced when the recorder is opened. Desiccant packs can be reactivated by following the instructions on the packs. Alternately, a pair of desiccant packs can be 'microwaved' at half power for three to five minutes to re-activate them.

Following reassembly (See "Assembly of the 130" on page 4-82.) it is advisable to pressure test a recorder before use, as described below. After a successful test the recorder should be returned to atmospheric pressure. The test should show no significant pressure drop (at constant temperature) over a 24-hour period.

To reassemble and pressure test, a 130 DAS, refer to Figure 4 - 9 on page 4-76 and proceed as follows:

1. Clean the O-ring groove in the bottom base case (**Item 25**).
2. Clean the O-ring groove in the case top case (**Item 1**).
3. Flip over the top case assembly with the board stack.



Note: Make sure the cap is on the disk well.

4. Carefully slide the O-ring into position into the groove of the flipped top case assembly (Item 1).



Note: Try to avoid stretching the O-ring unduly.

5. If the DAS has a protective EMI shield, either close the flaps install the cover (plastic).
6. Carefully lower the recorder bottom base case (**Item 25**) onto the top case assembly half of the **130-01**. Observe the O-ring and check that the corners do not get caught and displaced or gouged as the unit is seated on the top.
7. Install the retaining screws, using twelve #8-21x5/8 SS screws (**Item 16**) and #8 lock nuts (**Item 17**), and tighten them to seal the unit as shown in Figure 4 - 14 on page 4-82.
8. Pressurize the unit to about 1 psi with air and note the precise reading. This value should remain constant for at least 24 hours. Alternately, a 5-minute water immersion test may be used if the person doing the test keeps a close watch (for bubbles).

4.10 To update firmware from the FTP site

1. Login to our FTP site at: ftp.reftek.com/pub as:
User name: Anonymous
Password: Your E-mail address
2. Find the **130-01** firmware at ftp.reftek.com/pub/130/cpu/prom.
3. Download the zip file of the most recently released firmware version.

Update firmware:

Updating firmware in a **130-01** DAS requires the presence of a firmware file on an installed Compact Flash device.

1. On power-up, the **130-01** checks the Compact Flash for the presence of 'main.s3' in the root directory.
2. If the 'main.s3' file is present on the Compact Flash, the **130-01**:
 - (a) Reads the file
 - (b) DELETES the file, and
 - (c) Re-programs the internal flash memory.

Note: DO NOT DISTURB THE UNIT DURING THIS PROCESS.

Follow these steps to update the firmware of a 130-01 DAS:

1. Unzip the 'main.s3' file from the downloaded zip file of the most recently released firmware.
2. Copy the desired firmware image to the root of the Compact Flash as 'main.s3' using a PC with a Compact Flash reader or ftp into the **130-01** DAS, with a Compact Flash installed, in binary mode.
3. With the Compact Flash with the main.s3 image installed in the **130-01** DAS, issue a reset command.

(a) If you are at the 130 DAS:

- (a) Issue a Reset command from a PDA running PFC_130 or Physically disconnect and reconnect power to the unit.
- (b) Observe the LCD for the following messages:

READING DISK DO NOT DISTURB
WRITING FLASH DO NOT DISTURB

- (c) The 130-01 DAS resets and returns to normal messaging.

(b) If you are remotely connected to a 130-01 DAS via telemetry mode:

- (i) If you are connecting remotely by a TCP connection:
 - **(a) First connect**
 - **(b) Discover the unit**
 - **(c) Acquire status**
- (ii) Issue a reset command from the Status screen.
- (iii) Delete the unit from the Station List screen:
 - **(a) Wait at least 5 minutes**
 - **(b) At the Connections screen (reconnect id using a TCP connection) issue a Station Discovery again to discover the 130 DAS station.**

Note: DO NOT DISTURB THE UNIT until the start-up LCD message reappears.

4.11 To Test the 130 DAS Memory

4.11.1 Overview

This Section explains the how the Memory Test (MT) command is handled in the **REF TEK 130-01** DAS.

4.11.2 Memory test process

The Memory Test Command causes the **REF TEK 130-01** to perform a memory test on data and buffer memory. Since the test overwrites any existing data, the DAS performs several actions prior to starting the actual test. Acquisition is stopped (if currently active), the DAS attempts to dump all recorded data and processes not required to perform the memory test are stopped.

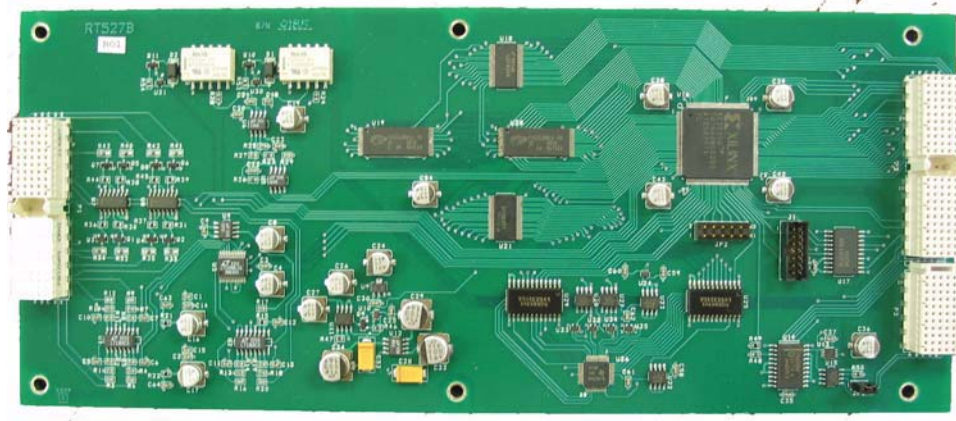
- Memory is checked using 0xAA, 0x55 and incremental data patterns.
- If an error is detected, the test is stopped immediately and the DAS responds with the FAIL result code and failing address.
- Upon successful completion of the test, the DAS responses with the PASS result code and 0x00000000 as the failing address.



Note: The test status and the PASS/FAIL results are also available on the LCD display.

- After a 20 second delay the system automatically reboots.
- All configuration parameters are restored to the conditions prior to the MT command being issued. This includes starting acquisition, if it was running prior to receipt of the command.

4.12 Adding or replacing an RT527



4.12.1 Overview

This document provides installation information to add or replace the Sensor Control board (RT527) in the 130 DAS family systems. Refer to the RT527 board technical reference information for the RT527.



Note: Please read all instructions carefully before proceeding. If you have any questions please call or E-mail REF TEK.

4.12.2 Installation

To install the RT527 in the 130-01 DAS follow these steps:

1. Upgrade the **130-01** to a minimum firmware version of 2.1.0 or later (see the "Update Firmware" section in the System Operations Manual).
2. Power off the **130-01**.
3. Check and make sure the cap (**130-9002**) is installed on the well disk enclosure (**Item 3**) as shown on Figure 4 - 22 on page 4-92.
4. Flip the **130-01** DAS upside-down on the top of the top case (**Item 1**)..



Figure 4 - 15 Top of 130

5. Unbolt the bottom base case (**Item 15**) of the recorder by removal of twelve #8-32x5/8 screws (**Items 16**) and the twelve #8 lock nuts (**Item 17**).



Figure 4 - 16 Unbolt 130 case



Note: The order of screw removal is not important.

6. Remove the bottom half of the case (**130-9000**) (**Item 15**).
7. Make sure the O-ring (**Item 14**) (**130-9004**) stays on the bottom half of the **130-01** DAS assembly.



Figure 4 - 17 Figure 1-3 Remove case top

8. Loosen and remove the six #6-32 screws (**Item 12**) or (**Item 13**) from the stack.



Figure 4 - 18 Loosen stack screws

9. Retain the lock washers (**Item 21** on Figure 4 - 22 on page 4-92) with the screws so they do not get misplaced.

For a new installation of the RT527 go to Step 12. If an upgrade of an RT527 go to Step 10.

10. If an **upgrade** or **replacement** of the RT527 (**Item 9** on Figure 4 - 22 on page 4-92) is desired, gently lift and remove the old sensor control board (RT527) (**Item 9**).
11. Install the six original #6-32 screws to secure the board stack and go to Step 14.



Figure 4 - 19 Install six original screws

For a new installation:

12. If adding (**installation**) of an RT527 (**Item 9**) is desired, gently attach the new board to connector making sure the board connectors line up and fit correctly.
13. For a new (**installation**) install the 6 (longer) #6-32 screws supplied with the RT527 board.
14. Place the O-ring in the bottom half of the case (**Item 15**).



Figure 4 - 20 Re-install O-ring

15. Place the completed flipped case assembly (**Item 1**) onto the case bottom base (**Item 15** on Figure 4 - 22) making sure the O-ring sits in the groove of the top case as well.



Figure 4 - 21 Figure 1 -7 Place 130 top on bottom assembly

16. Bolt the two halves of the 130 DAS together using twelve #8-21x5/8 SS screws (Item 16) and #8 lock nuts (Item 17).



Note: Follow the pattern shown in Figure 4-20 to install and hand tighten the nuts to the screws. Then tighten all twelve screws in the same pattern.

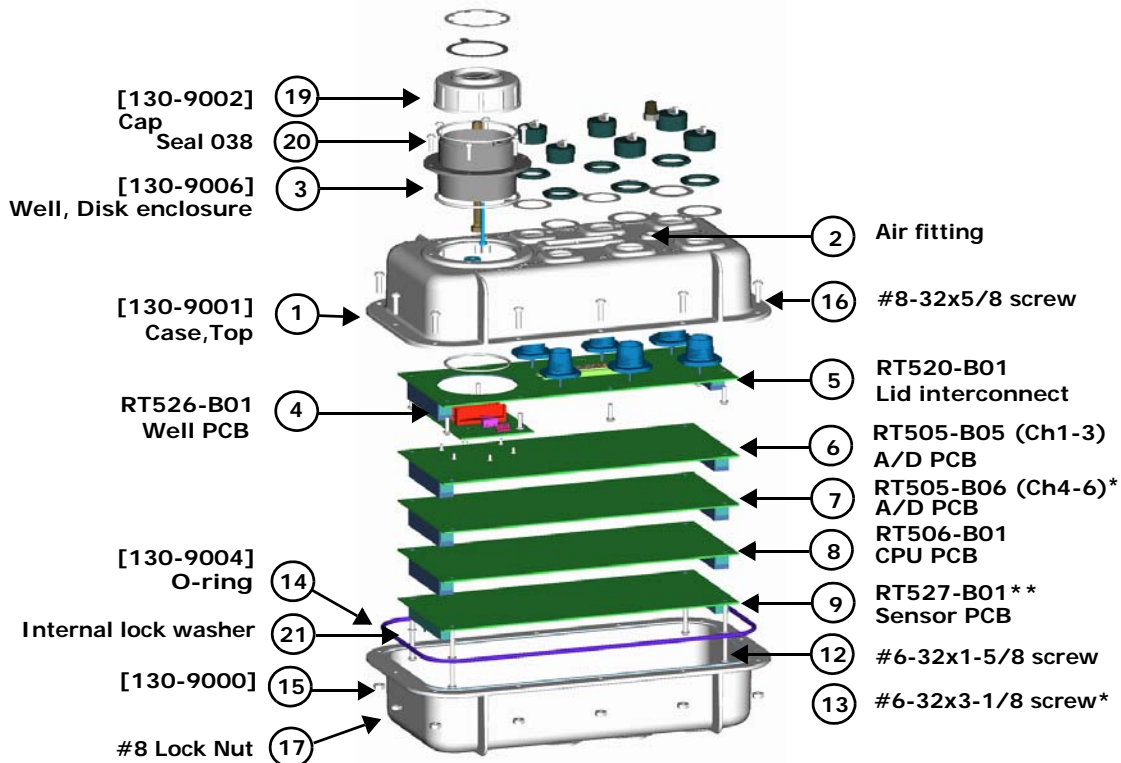


Figure 4 - 22 130-Exploded view

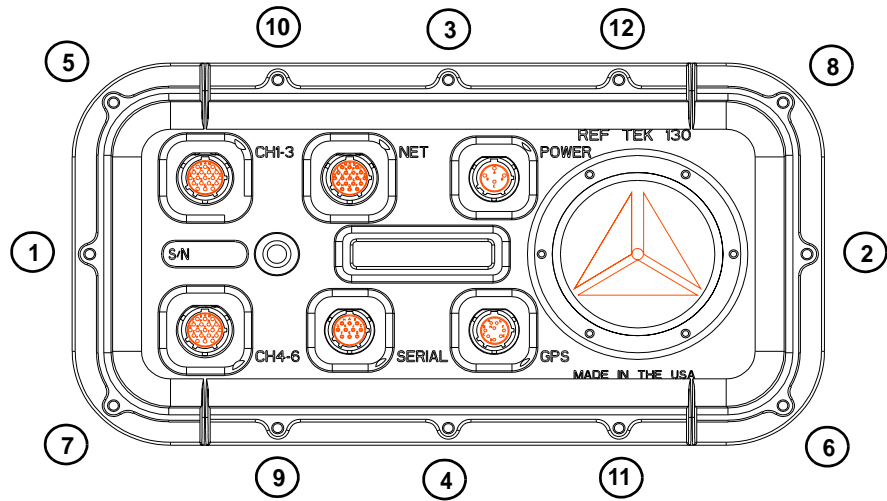


Figure 4 - 23 Bolt Pattern for 130 cover attachment

4.12.3 RT527 Scope

This document describes the handling of calibration issues using the RT527 Sensor Control Board (SCB). This board is an optional board which contains circuitry to support the reporting of auxiliary channel data, mass re-centering and calibration signal output for two sensors. For more information on sensor control see Section 8 in the *130 Theory of Operations*.

4.12.4 Channel Connector Signals

Each channel connector of the **REF TEK 130-01** has the following pin-out:

| Pin | Name | Direction | Description |
|-----|----------|-----------|--|
| A | Ch1 + | In | Channel 1 Input + |
| B | Ch1 | In | Channel 1 Input |
| C | Ch2 + | In | Channel 2 Input + |
| D | Ch2 | In | Channel 2 Input |
| E | Ch3 + | In | Channel 3 Input + |
| F | Ch3 | In | Channel 3 Input |
| G | AGnd | - | - Analog Ground |
| H | Pwr Out | - | Sensor Power (+12V) |
| J | PGND | - | - Power Ground |
| K | CalEn - | Out | Calibration Enable - active low (GND) (CMG sensors) |
| L | CalEn + | Out | Calibration Enable - active high (+5v) (STS sensors) |
| M | Center - | Out | Center Enable - active low (+5v) (CMG sensors) |
| N | CalSig | Out | Calibration Signal (+/- 5v) |
| P | Aux 1 | In | Aux (Mass Position) Channel 1 |
| R | Aux 2 | In | Aux (Mass Position) Channel 2 |
| S | Aux 3 | In | Aux (Mass Position) Channel 3 |
| T | DGND | - | - Digital Ground |
| U | Center + | Out | Center Enable - Active High (+5V) (STS sensors) |
| V | SID | In/Out | Sensor ID |



Note: The CalEn and Center pins are tri-state under normal operation conditions. These pins are driven to their stated output level when in active use.

4.12.5 Sensor Test Signals

Sensors vary in the number and type of signals they support. The following table shows some common sensors used with the **REF TEK 130-01**:

| Sensor | Mass | Center | CalSig | CalEn | Notes |
|-----------------|---------|---------|--------|---------|--|
| | Outputs | Inputs | Inputs | Inputs | |
| 131A | - | - | - | 1 (+5v) | Self-test output while enabled |
| LE3Dlite | - | - | - | 1 (GND) | Fixed self-test starts on falling edge |
| L4C | - | - | 1 | - | |
| S13 | - | - | 1 | - | |
| | | | | | |
| CMG-3ESP | 3 | 1 (GND) | 1 | 3 (GND) | Center enable > 0.2 S |
| CMG-3T | 3 | 1 (GND) | 1 | 3 (GND) | Center enable > 0.2 S |
| CMG-40T | 3 | - | 1 | 3 (GND) | |
| STS | 3 | 1 (+5v) | 3 | 1 (+5v) | Center enable > 0.5 S |

4.12.6 Auxiliary Channels

Three auxiliary channels are provided on each sensor connector. Each channel connects to a 12-bit A/D converter with an input range of +/- 10v. These channels are read once per second and stored as left-justified, 2's-compliment, 16-bit values. This equates to a bit-weight of 305.2 uV. These channels can be used to measure mass position or other auxiliary input data, such as temperature and wind speed. The current readings of the auxiliary channels are available on demand using the Auxiliary Data status response (SS:AD).

Mass re-center

Mass re-centering can be performed on-demand. The Sensor Calibration – Mass re-center (SK:M) command forces activation of the Center pins of a specified sensor for 1-2 seconds. Automatic re-centering is enabled using the PQ parameters. This assumes that the auxiliary input channels are connected to the mass position outputs of a sensor.

Pseudo-code (some error and border conditions not covered):

```
count limit = ((Time * 3600) / Rate)
if (Attempts == 0)

Attempts = 1
retry = Attempts
.....
if (Rate seconds has passed)

{

if (reading < Level)
{
if (counter > 0)

counter = counter - 1
}
else /* reading >= Level */
{
counter = counter + 1

if (counter >= count limit)

{
activate center signal
retry = retry - 1
if ((retry != 0) AND (Interval != 0))

counter = counter - ((Interval * 60) / Rate)
else
counter = 0
}
}

if (counter == 0)
retry = Attempts
}
```



Appendix A Logfile example

A.1 Timing examples

289:22:14:42 EXTERNAL CLOCK WAKEUP



The DAS issues a command to turn on the power to the 130 GPS.

323:06:03:10 EXTERNAL CLOCK POWER IS TURNED ON



The DAS gets a confirmation message from the 130-GPS that it has powered up.

289:22:15:58 EXTERNAL CLOCK IS UNLOCKED



The DAS receives messages from the 130-GPS that it is not locked. The 130-GPS is powered up and searching for satellites to lock onto but does not have enough satellites to declare a lock.

289:22:16:58 EXTERNAL CLOCK IS LOCKED



The DAS receives a locked message from the 130-GPS. The DAS will then use the 130-GPS to correct its internal oscillator.

018:09:06:44 INTERNAL CLOCK TIME JERK ENABLED



The DAS compares the 130-GPS time to its internal oscillator time at the first GPS lock since the 130 power-up or reset. If a change is required to equal the 130-GPS time, it enables the timing algorithm that makes the change, Time Jerk. It gives the time it was enabled and will jerk the DAS internal clock with the next 1PPS or 1 Hz rise from the 130-GPS.

018:09:06:44 INTERNAL CLOCK TIME JERK # 1 OCCURRED AT 09:06:44.553

The DAS internal clock was changed according to the 130-GPS time pulse, 1 PPS. It will be only correct to the next 1 Hz pulse and therefore no more than a 1 second correction occurred.

018:09:06:44 DSP CLOCK SET: OLD=04:018:09:06:44.553, NEW=04:018:09:06:44.000

The DAS internal clock change message that tells the operator:

- [1] Time the internal clock was changed (DSP)
- [2] Time the internal clock was at the time of the change
- [3] Time it was changed to

(The first change is always less than a second to line the internal 1 Hz to the 1 Hz of the 130-GPS.)

018:09:06:44 DSP CLOCK DIFFERENCE: 0 SECS AND -553 MSECS

Indicates the difference, in milliseconds, between internal 1 Hz and the 130-GPS 1 Hz before the DSP clock set or internal oscillator change.

018:09:06:44 DSP CLOCK HAS CHANGED 1 TIMES

Indicates the DAS has made one change to its internal clock since power up or reset.

018:09:06:48 INTERNAL CLOCK TIME SET

The DAS again compares its internal clock with the 130-GPS time to correct the seconds value now that both 1 Hz pulses are lined up.

018:09:06:48 DSP CLOCK SET: OLD = 04:018:09:06:48.000, NEW= 04:018:09:06:45.000

The DAS internal clock has changed from the old value to the new value. This second internal clock change will always be in multiples of seconds.

018:09:06:45 DSP CLOCK DIFFERENCE: -3 SECS AND 0 MSECS

Indicates what the difference, in seconds, is between the internal 1 Hz and 130-GPS 1 Hz before the DSP clock set (internal clock set).

018:09:06:45 DSP CLOCK HAS CHANGED 2 TIMES

Indicates the DAS has made two changes to the internal clock since power up.

018:09:06:45 INTERNAL CLOCK TIME SET

During the first GPS power-on cycle the DAS waits 20 minutes, after initial LOCK, in case the GPS reports an additional 1 second shift due to a difference in its pages.

This shift can be +/- 1 second from the current reported time.

This shift only occurs once and is rare.

If acquisition was started as soon as the GPS declared LOCK and this shift occurs within the 20 minutes of GPS LOCK then the data prior to this shift will off by the +/- second, as reported in the example below.

018:09:21:50 DSP CLOCK SET: OLD = 04:018:09:21:50.000, NEW= 04:018:09:21:51.000

The DAS internal clock has changed from the old value to the new value. This third time set will either be +/- 1 second.

018:09:21:51 DSP CLOCK DIFFERENCE: +1 SECS AND 0 MSECS

Indicates there was a difference of +1 second and any data recorded between the second DSP clock set needs to be corrected by +1 second.

018:09:06:45 DSP CLOCK HAS CHANGED 3 TIMES

Indicates the DAS has made three changes to the internal clock since power up.

018:09:07:22 INTERNAL CLOCK PHASE ERROR OF -1 USECONDS

The DAS internal clock or 1 Hz is compared to the 130-GPS 1 Hz periodically and the difference is noted. In this case: -1 μ S

For the first cycle of DAS/130-GPS power the phase error will be checked every minute for 15 minutes. Each additional lock will have only one phase error check/message.

301:07:30:58 INTERNAL CLOCK PHASE ERROR OF 18 USECONDS

The DAS internal clock or 1 Hz is compared to the 130-GPS 1 Hz periodically and the difference is noted.

In this case: 18 μ S

301:10:13:47 INTERNAL CLOCK PHASE ERROR OF 223 MSECONDS

The DAS internal clock or 1 Hz is compared to the 130-GPS 1 Hz periodically and the difference is noted.

In this case: 223 mS

357:09:44:53 GPS: POSITION: N23:18:20.04 E101:23:29.58 +01610M

The DAS prints the 130-GPS position information given by this 130-GPS after lock.

305:02:37:56 SIRF: JERK

The DAS compares the 130-GPS time to its internal oscillator time at the first GPS lock since 130 power-up or reset. If a change is required to equal the 130-GPS time, enables the timing algorithm that makes the change, Time Jerk. It gives the time it was enabled and will jerk the DAS internal clock with the next IPPS or 1 Hz rise from the 130-GPS.

(Message used in early development code).

305:02:37:57 SIRF: TIME SET

The DAS internal clock was changed according to the 130-GPS time pulse.

It will be only correct to the next 1 Hz pulse and therefore no more than 1 second.

(Message used in early development code).

305:09:45:50 EXTERNAL CLOCK ERROR – UNABLE TO CORRECT DRIFT

This message indicates the DAS gave up trying to correct drift of its internal oscillator due to not enough information coming from the 130-GPS serial time message and/or 1PPS.

018:09:28:31 EXTERNAL CLOCK ERROR - MISSING 1PPS

This message indicates the DAS does not see the 130-GPS 1 Hz - Hardware problem.

289:22:16:00 EXTERNAL CLOCK SLEEP

This message indicates DAS has told the 130-GPS to sleep.

This occurs after each GPS cycle - 5 minutes/1 hour.

A.2 System information

290:00:09:07 Using Ethernet RTP Link



The DAS reports datastream parameters require data to be sent via Ethernet to an RTP host setup in the network parameters.

018:08:58:54 Serial Link K/T MODE: Keep STATE: Keep, LINE MODE: Direct



Reporting Serial PPP parameters. If the link goes down data will be kept locally in RAM or disk.

018:08:58:54 Serial Link LINE SPEED: 19200



Indicates a PPP Serial link will attempt to connect at 19200. This is a set baud rate for this link.

018:08:58:54 Ethernet Link K/T MODE: Keep STATE: Keep, LINE MODE: Direct



Reports Ethernet setup parameters. If the Link goes down the data will be kept locally in RAM or Disk.

018:08:58:54 Ref Tek 130 v2.1.4R (2003:268)



Reports the DAS firmware version being used.

018:08:58:54 IP: 194.226.112.142 192.168.1.11



Reports the DAS IP address from network parameters. Ethernet is reported first and Serial PPP second.

018:08:58:54 Mask: 255.255.255.0 255.255.255.0



Reports the DAS Mask from network parameters. Ethernet is reported first and Serial PPP second.

018:08:58:54 Host: 194.226.112.210 0. 0. 0. 0



Reports the DAS RTPD or Host address from network parameters. Ethernet is reported first and Serial PPP second.

018:08:58:54 Gate: 194.226.112.125 192.168.1.10



Reports the DAS Gateway from network parameters. Ethernet is reported first and Serial PPP second.

**018:08:58:54 Channel:Offset 1:\$0001DE8A 2:\$0001DFF7
3:\$0001DDDD**



Reports the DAS A/D offset in hex counts for channels 1 - 3. This offset is user selectable. It is factory set for a terminated input to center around zero counts. RT505 A/D inherent offset is approximately 123,000 decimal counts.

**018:08:58:54 Channel:Offset 4:\$0001DF3A 5:\$0001E00F
6:\$0001DE49**



Reports the DAS A/D offset in hex counts for channels 4 - 6. This offset is user selectable. It is factory set for terminated input to center around zero counts. RT505 A/D inherent offset is approximately 123,000 decimal counts.

018:08:58:54 BOARD \$01: RT0520D S/N 0753 0 (LID) Marker OK



Reports the DAS RT520 LID board serial number.

018:08:58:54 BOARD \$02: RT0506D S/N 0817 1 (CPU) Marker OK



Reports the DAS RT506 CPU board serial number.

018:08:58:54 BOARD \$10: RT0505D S/N 0759 1 (ATD) Marker OK



Reports the DAS RT505 A/D board (Channels 1-3) serial number.

018:08:58:54 BOARD \$11: RT0505D S/N 0754 1 (ATD) Marker OK



Reports the DAS RT505 A/D board (Channels 4-6) serial number.

018:08:58:54 CPU FPGA: RT0506A1A (11FA1821) test version 1



Reports the DAS RT506 CPU SPROM version.

018:08:58:54 AD1 FPGA: RT0505A1C (11F91C03) test version 32



Reports the DAS RT505 A/D (Channels 1-3) SPROM version.

018:08:58:54 AD2 FPGA: RT0505A1C (11F91C03) test version 32



Reports the DAS RT505 A/D (Channels 4-6) SPROM version.

018:08:59:04 Network layer is UP!



Indicates the 130 DAS/RTPD network is up. Full Stack has been negotiated.

018:08:59:04 RTP: Stopped by event Open



The DAS and the RTPD server use the TCP/IP stack to sync. If the connection is broken or a re-sync is initiated the DAS reports this message. It indicates the DAS and RTPD are negotiating a link or the DAS has lost its connection to RTPD and will attempt to re-sync.

357:02:53:46 MEMORY USED=00006, AVAILABLE=02298, TOTAL=02304



Reports the RAM memory usage in the 130 DAS.

**018:08:58:54 BATTERY VOLTAGE=12.775V, TEMPERATURE=4C,
BACKUP= 03.346V**



Reports the status of battery voltages and temperature within the 130.
Battery Voltage = External Supply Voltage Value
Backup = Internal Backup Battery Voltage

323:06:03:11 POWERUP COMPLETE



Indicates the DAS has booted correctly and reports it is now ready to acquire data now that basic system power checks are complete.

018:09:06:45 ATD INTERRUPT ERROR



This message reports a DAS CPU ATD error due to having more than one A/D (RT505) board interrupt in one second. This type of error can occur if the internal clock is jerked. If this problem occurs frequently then there is a problem on the A/D board.

018:09:06:45 ATD: BI 12 BO 11 BF 0800 BW 0 IS 0 IE 1 IC 0 Ib 3:3



This message ties in with the ATD Interrupt Error above dumping the contents of some system buffers. This is for REF TEK DEBUG ONLY! and should not concern the operator.

A.3 Acquisition Information

017:10:38:08 PARAMETERS ERASED



Indicates the existing parameter set in the DAS has been erased. This is done before another parameter set is loaded.

017:10:38:08 PC1



Indicates the parameters for Channel 1 were received by the DAS.

017:10:38:09 PC2



Indicates the parameters for Channel 2 were received by the DAS.

017:10:38:10 PC3



Indicates the parameters for Channel 3 were received by the DAS.

017:10:38:10 PC4



Indicates the parameters for Channel 4 were received by the DAS.

017:10:38:11 PC5



Indicates the parameters for Channel 5 were received by the DAS.

017:10:38:12 PC6



Indicates the parameters for Channel 6 were received by the DAS.

017:10:38:13 PD1



Indicates the parameters for DataStream 1 were received by the DAS.

017:10:38:13 PS



Indicates the parameters for Station Name, etc. were received by the DAS.

017:10:38:14 PA



Indicates the parameters for Auxiliary Channel were received by the DAS.

017:10:38:15 PZ



Indicates the parameters for SCS Setup were received by the DAS.

017:10:38:16 PQ



Indicates the parameters for calibration were received by the DAS.

017:10:38:17 PK



Indicates the parameters for Auto Center were received by the DAS.

017:10:38:16 PARAMETERS IMPLEMENTED



Indicates that all new parameters were received by the DAS and have been loaded accordingly. For example gain relays for channels activated.

017:10:38:38 ACQUISITION ENABLED WITH DELAY OF 00:00



Indicates no delay of acquisition when ACQ start command was given. Operators can select a delay of up to 99 minutes and 99 seconds.

017:10:38:38 LINK PARAMETER PACKETS



Indicates the 130 CPU has pasted current parameter set into RAM for download with required data.

018:09:08:05 ACQUISITION STOP REQUESTED



Indicates the user requested acquisition to stop through an external user command.

018:09:08:05 ACQUISITION STOPPED



Reports the DAS has successfully stopped ACQ after instruction or due to data memory being full.

A.4 Disk Access Information

301:09:14:20 AUTO DUMP CALLED



Indicates that RAM has reached the operator specified used amount and the DAS enables the RAM to Disk transfer.

357:10:55:02 IDE device: IBM-DSCM-11000 S/N: KHLZ9250 fw: SC21C915



Specifies the disk device the RAM will be dumped to. (Used in early development code only).

301:10:57:45 AUTO DUMP COMPLETE



Indicates RAM memory was successfully transferred to disk.

323:05:58:41 ERTFS PENOSPC: Write failed



Indicates the disk being written to had an error. (Used in early development code only).

305:02:37:22 DISK FORMAT



Indicates the operator has requested a disk format and the DAS reports the format has happened.

305:03:25:33 AUTO DUMP FAILED



Error given when RAM was not transferred to disk when commanded to do so. The reason could be no disk is present or hardware used to transfer RAM to CPU board to disk has a problem.

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