



130-01 Operations

Startup

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This REF TEK manual provides startup and basic operating procedures for the 130-01 and its related family of products. Internal cable drawings are also provided along with guidelines for initial communication and installation.

Refraction Technology
1600 Tenth Street
Suite A
Plano, Texas 75074
Tel: 214-440-1265
Fax: 972-578-0045
www.reftek.com

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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.
FPn	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:

130-01/3 System Documents	PDF file
130-01 System Startup	130_startup_01.pdf
PFC_130 Users Guide	Pfc_130.pdf
Data Utilities Users Guide	130_utilities.pdf
Archive Utilities	arcutil.pdf
130 Theory of Operations	130_theory.pdf
130 PFC Release Notes	130_PFCRN.pdf
130 CPU Release Notes	130_CPURN.pdf
130 Command Reference	130_command.pdf
130 Recording Format	130_record.pdf
130-GPS Manual	130_gps.pdf
130-01 Boards	
RT505 – OR – RT649 A/D Board	
RT506 - CPU Board	
RT520 - Lid Interconnect Board	
RT526 – Micro Drive/Flash Board	
RT527 - Sensor Control Board (Optional)	
RT535 - Mass Memory Board (Optional)	
Optional Manuals	PDF file
RTPD Installation and Users Guide	RTPD.pdf
RTP Protocol	RTP.pdf
RT_View Users Guide	RTView.pdf
RTCC Command and Control Users Guide*	RTCC.pdf
130 RTCC Release Notes	130_RTCCRN.pdf
RT_Display Users Guide	RTDisplay.pdf
RTPMonitor Installation and Users Guide	RTPM.pdf
131A-02/3 3G Triaxial Accelerometer	131A023.pdf
131A-01/3 4G Triaxial Accelerometer	131A013.pdf
131B-01/1 4G Uniaxial Accelerometer	131B011.pdf

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 REF TEK customer support team.

To register enter your company information through the [Register](http://support.reftek.com) link on our website at <http://support.reftek.com>.

Our support team will send you a unique Username and Password allowing secured access to all product documentation and software sold to your company.

Once we register your contact we will only send necessary notifications via email. The same notifications will be shown on our website <http://support.reftek.com> notification page.

Thanks,

Your REF TEK support team

CF Card Replacement:

Due to the large variability of CF cards available on the world market and the resulting problems with compatibility due to memory layout, signal structuring and power requirements, Refraction Technology cannot guarantee a CF card will work in a REFTEK data recorder unless it is sold through REFTEK itself. REFTEK ensures compatibility through communications with CF manufacturers and rigorous in-house testing. Some CF manufacturers refuse to provide adequate information or factory controls to ensure that the product being sold today is the same as the product sold earlier under the same part number. CF cards not purchased from REFTEK may work at one temperature but not at another, or may fail all together.

ATTENTION: For optimal performance in a REF TEK 130 recorder, CF disks should ALWAYS be formatted BY THE 130 RECORDER.

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.
 - c. Re-programs the internal flash memory.

Note: DO NOT DISTURB THE UNIT DURING THIS PROCESS.

Note: User parameters stored in SPROM using the WP command will be erased when a firmware update is performed.

NOTE: DAS power must be above 11.5V for a firmware update.

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:

1. Issue a Reset command from a PDA running PFC_130
-OR-
Physically disconnect and reconnect power to the unit.
2. Observe the LCD for the following messages:

READING DISK DO NOT DISTURB
WRITING FLASH DO NOT DISTURB

3. The 130 DAS resets and returns to normal messaging.

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

1. If you are connecting remotely by a TCP connection:
 - a. **First connect**
 - b. **Discover the unit**
 - c. **Acquire status**
2. Issue a reset command from the Status screen.
3. Delete the unit from the Station List screen.
4. Wait at least 5 minutes.
5. 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.

Contents

1	Overview	1
1.1	Introduction	1
1.2	Specifications	3
1.3	Mating Connectors	4
1.4	Purpose of the 130 Broadband Seismic Recorder	5
1.5	Standard Faceplate Connections	6
1.5.1	Power connector	6
1.5.2	Control Connector (Serial)	7
1.5.3	GPS Connector	7
1.5.4	Net Connector	8
1.5.5	Channel Input Connectors.....	10
	Channels 1-3 connector signals	11
1.5.6	Channels 4-6 connector signals	12
1.6	General Recorder Control Considerations	13
1.6.1	General Recorder operation.....	13
1.6.2	Power Considerations	15
1.7	Port Settings & Modem Communications	16
1.7.1	Control (Serial) Port	16
1.7.2	Serial PPP Port.....	17
1.7.3	NET Port	17
1.8	Hardware Modularity	18
1.9	Frequently Asked Questions	20
1.10	Warranty Statement.....	22
1.11	Warranty/Non-Warranty Service	23
1.12	Static sensitive device protection	24
2	Startup	25
2.1	Getting started with your 130-01 DAS	25
2.2	Establishing Minimal Hardware Connections	26
2.2.1	Install the Compact Flash.....	27
2.2.2	Power up the 130-01 DAS.....	28
2.3	General GPS Operations	29
2.4	Using a PDA for configuration	30
2.5	Check the GPS Status:	31
2.6	Example configuration Steps	33
2.6.1	Create a configuration with PFC	33
2.6.2	Format the Compact Flash	35
2.6.3	Start Acquisition	36
2.6.4	Write Parameters to SPROM (WP)	37
2.6.5	Load Parameters from SPROM (LP)	38
2.7	Examples of 130 LCD Displays.....	39

3	Serial PPP Communication.....	41
3.1	Overview	41
3.2	Direct PPP Connection	42
3.2.1	PC Setup	42
3.2.2	Adding Remote Access Services (RAS).....	46
3.2.3	Start Remote Access Service (RAS).....	51
3.3	Modem PPP Connection.....	53
3.3.1	130-Modem.....	53
3.3.2	DAS Setup	53
3.3.3	Setting up the 130 to use the 130-Modem	54
3.4	SLM Modem module	55
3.4.1	Modem features.....	55
3.5	Modem configuration.....	56
3.5.1	PFC_130 Serial PPP	56
3.5.2	Data transfer through PPP real-time	59
3.6	PC Communication Setup.....	60
3.6.1	130 DAS modem communication	60
3.6.2	Install modem	61
4	Periodic Maintenance Operations	65
4.1	Introduction	65
4.2	Replacing the Compact Flash.....	66
4.3	Connector Assembly & Maintenance	69
4.4	Periodic Maintenance checks	71
4.5	Replace CPU Battery (130-01/3 and 130-01/6).....	72
4.6	Disassembly of the 130 for service.....	73
4.6.1	130-01 Bill of Materials.....	74
4.7	Assembly of the 130	78
4.8	Sealing and pressure testing a 130-01 DAS.....	79
4.9	Firmware update options	80
4.9.1	Download firmware from the FTP site	80
4.9.2	Firmware update process	80
4.9.3	Updating firmware from a Compact Flash™	80
4.9.4	Updating firmware using ftp	81
4.9.5	Updating firmware at the 130-01	81
4.9.6	Updating firmware via telemetry mode	82
4.10	To Test the 130 DAS Memory	83
4.10.1	Overview	83
4.10.2	Memory test process	83
5	Adding or replacing an RT527	85
5.1	Overview	85
5.2	Installation.....	86

5.2.1	Upgrade	88
5.2.2	For a new installation:	88
5.3	RT527 Scope	90
5.3.1	Channel Connector Signals.....	90
5.3.2	Sensor Test Signals.....	91
5.3.3	Auxiliary Channels	91
6	Logfile Example	93
6.1	Timing examples.....	93
6.2	System information.....	97
6.3	Acquisition Information.....	100
6.4	Disk Access Information	102
7	Index.....	103

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List of Figures:

Figure 1—1 Pinout.....	2
Figure 1—2 130 Connectors.....	6
Figure 2—1 Compact Flash	27
Figure 2—2 LCD Display	28
Figure 2—3 PFC_130 Start	30
Figure 2—4 PFC Control	30
Figure 2—5 PFC Status	30
Figure 2—6 PFC Load Status.....	30
Figure 2—7 GPS Mode	32
Figure 2—8 PFC New Configuration.....	33
Figure 2—9 New Configuration.....	33
Figure 2—10 PFC Channels.....	34
Figure 2—11 Channel Details	34
Figure 2—12 Stream Details	34
Figure 2—13 Format Disk.....	35
Figure 2—14 Set Acq Delay	36
Figure 2—15 Write (WP)	37
Figure 2—16 Load (LP)	38
Figure 3—1 Add Modem	42
Figure 3—2 Have Disk - Modem	43
Figure 3—3 Select Generic	43
Figure 3—4 Select Port	44
Figure 3—5 Modem Success	44
Figure 3—6 Phone and Modem Options	44
Figure 3—7 Modem Properties	45
Figure 3—8 Control Panel.....	46
Figure 3—9 Make New	46
Figure 3—10 Incoming Connect	47
Figure 3—11 Allow Incoming Virtual	48
Figure 3—12 Add DAS User	48
Figure 3—13 Add User	49
Figure 3—14 Networking.....	50
Figure 3—15 Remote Access.....	50
Figure 3—16 Services	52
Figure 3—17 RAS started	52
Figure 3—18 130 Modem	53
Figure 3—19 PFC Control.....	56
Figure 3—20 Assign Baud.....	56

Figure 3—21 Send Serial.....	57
Figure 3—22 Modem Setup.....	58
Figure 3—23 Send.....	58
Figure 3—24 Add Modem	61
Figure 3—25 Phone and Modem Options	61
Figure 3—26 Modem Option	62
Figure 3—27 Detect Modem.....	62
Figure 3—28 Installed Modem.....	62
Figure 3—29 New Modem.....	63
Figure 3—30 Modem Properties.....	63
Figure 4—1 Handle drive	67
Figure 4—2 Install Drive.....	67
Figure 4—3 Compact Flash	68
Figure 4—4 PTO Connector	70
Figure 4—5 130-01 Boards Stack	71
Figure 4—6 130-01 Bill of Materials	74
Figure 4—7 Tighten Pattern	78
Figure 5—1 RT527 SCB	85
Figure 5—2 Unbolt 130 Case.....	86
Figure 5—3 Remove 130 Top	87
Figure 5—4 Stack Screws	87
Figure 5—5 Install O-Ring	88
Figure 5—6 130-Exploded View.....	89
Figure 5—7 Bolt Pattern	89



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, pin-out, 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.

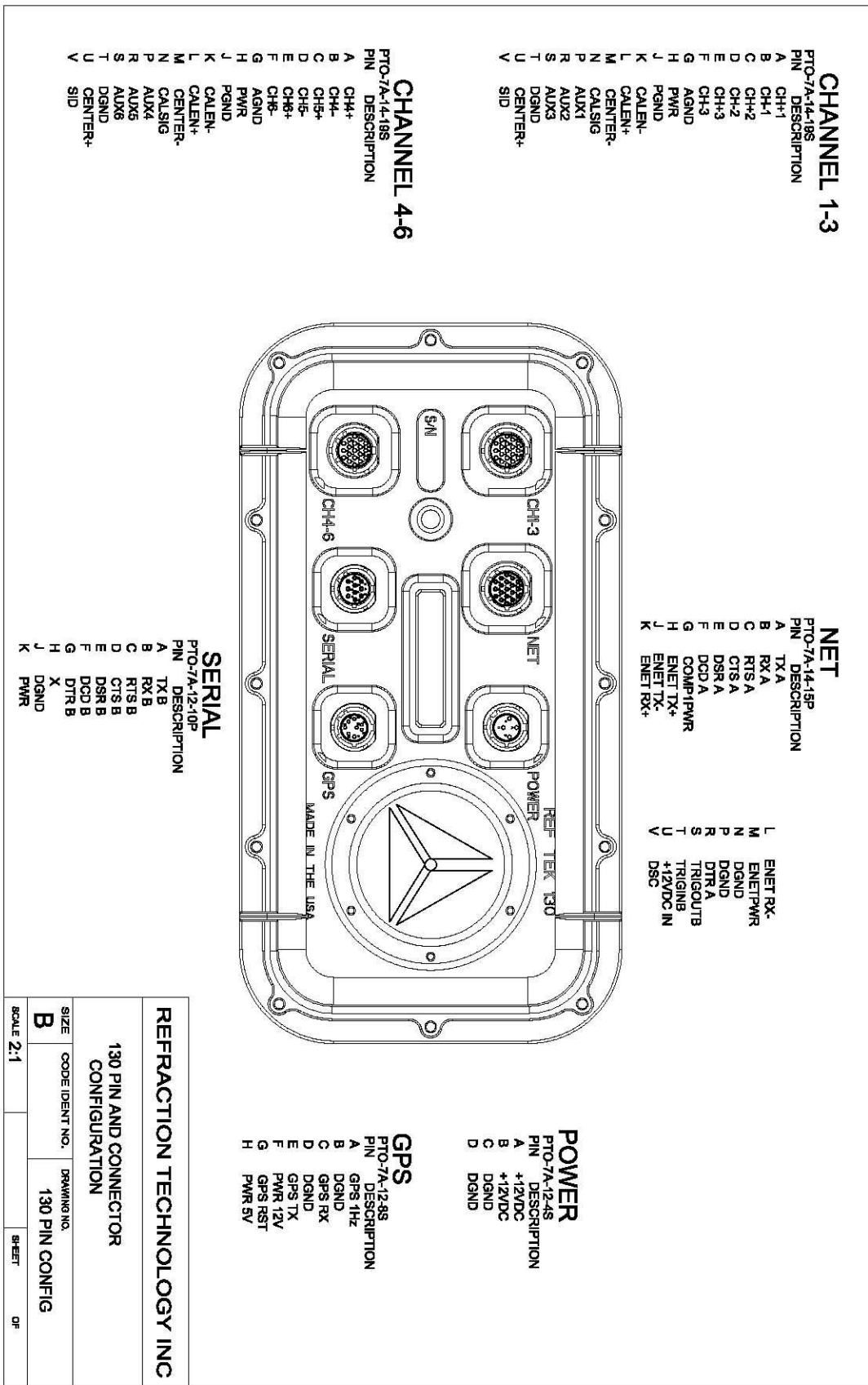


Figure 1—1 Pinout

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:	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 \pm 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:	\pm 10 μ sec after validated 3-D fix and locked
Free-Running Accuracy:	0.1 ppm over the temperature range of 0 $^{\circ}$ C to 60 $^{\circ}$ C
	0.2 ppm from -20 $^{\circ}$ C to 0 $^{\circ}$ 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 Trigger:	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:	
	CE

1.3 Mating Connectors

Function	Mating Connector
Serial	PT06SE1210S
Power	PT06SE124P
GPS	PT06SE128P
NET	PT06SE1419S
Channel	PT06SE1419P

1.4 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

1.5 Standard Faceplate Connections

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

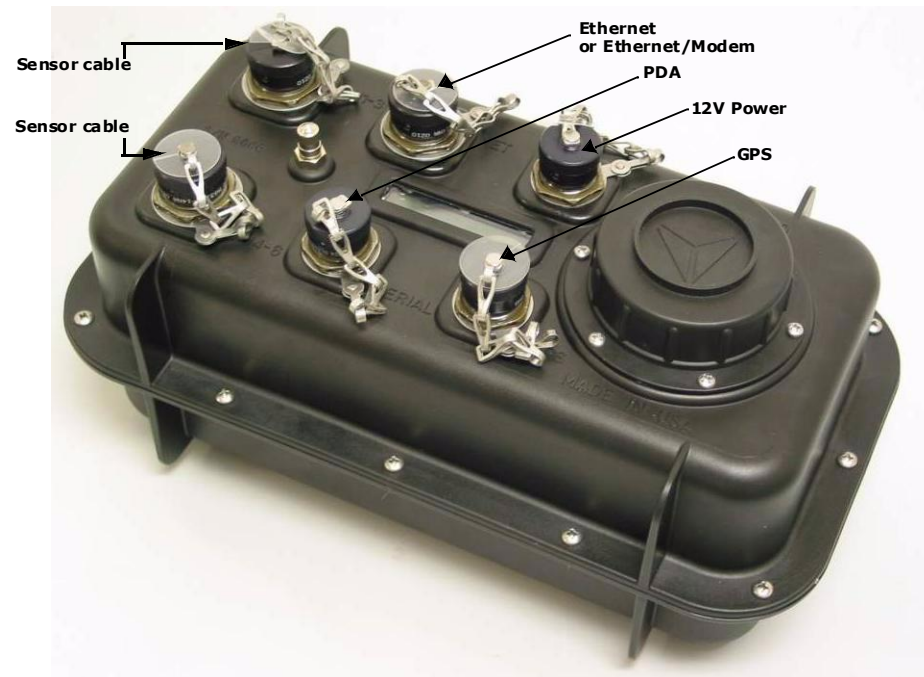


Figure 1—2 130 Connectors

1.5.1 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	

Note: Disk operations are suspended when the input voltage drops below 11.1V and are re-enabled when the voltage goes above 11.5V (Version 2.9.6 or later – See 130-CPU 3.0.0 Release Notes).

1.5.2 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	PT07A12-10P	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 ³

1.5.3 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 ⁴
		G	GPS RST	Output Pulse	0-3.3 Volts
		H	PWR 5V	5 Volts ⁵	Default

¹ Volts = Controlled by Software

² Output = Protected by self resetting fuse

³ Volts = Controlled by Software

⁴ Volts = Controlled by software and protected by a self resetting fuse

⁵ Volts = Controlled by software and protected by a self resetting fuse

1.5.4 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.

- 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.
- 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 Communications	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 ⁴	
		K	ENET RX+	Input Ethernet ⁵	
		L	ENET RX-	Input Ethernet ⁶	
		M	ENETPWR	PWR Ethernet ⁷	+12 Volts ⁸
		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 ⁹
		V	OSC	Output, Tristate ¹⁰	0-5 Volts

¹ VDC = Controlled by software

² Volts = Protected by self resetting fuse

³ Ethernet = Transformer coupled

⁴ Ethernet = Transformer coupled

⁵ Ethernet = Transformer coupled

⁶ Ethernet = Transformer coupled

⁷ Ethernet = Controlled by software and protected by self resetting fuse

⁸ Volts = Tracks main input voltage

⁹ VDC = Alternate main power input

¹⁰ Tristate = Controlled by software

1.5.5 Channel Input Connectors

Both three 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 a 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.

Channels 1-3 connector signals

Recorder Faceplate Connector	Pin	Name	Dir	Electrical Desc	Voltage Range	Note
Channels 1-3	A	Ch1+	In	Channel 1 input +	±10 Volts	
On All models	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

1.5.6 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

1.6 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, microprocessor 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 "Firmware update options". 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.

1.6.1 General Recorder operation

Refraction Technology provides PFC_130 and RTCC interface software. Refer to the Command Format Specification part of the 130 Command Specifications 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 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.

1.6.2 Power Considerations

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

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.

1.7 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 section 2 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 power up.

1.7.1 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

1.7.2 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

1.7.3 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:

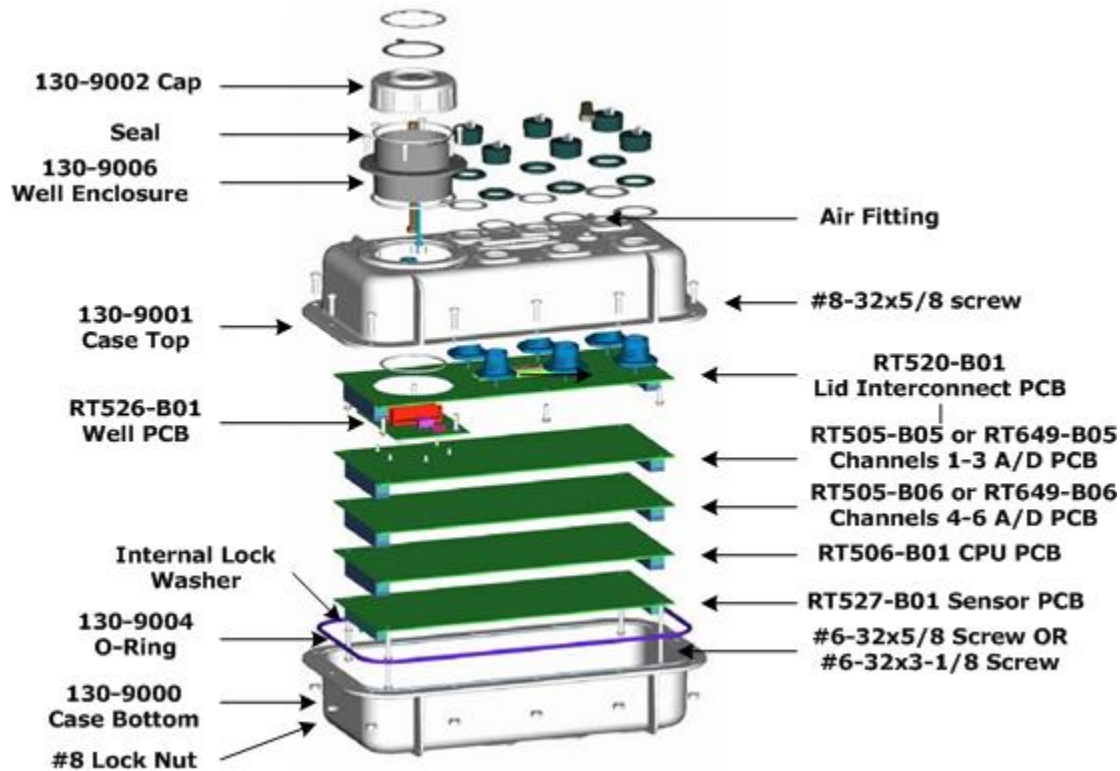
Function	Characteristics
Primary Function	This port performs high-speed transfer of data and status information. It can be used with RTCC to configure the 130-01 DAS, RTPD for data connection and FTP for file transfer.
Configuration	The 130 Ethernet port address and mask can be configured using the PFC_130 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

1.8 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	340 Mbytes to 2 Gybtes
		For 130-01/3 and 130-01/6 models ONLY!	(RT526-B01) Interface Board (located in the well)
			Dual Compact Flash
*	3	A/D Converter - (RT505-B05) -OR- (RT649-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) -OR- (RT649-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
			Serial Port
			Ethernet Controller
			EIDE

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.



Note: *130-01/3 - same as figure above without RT505-B06 or RT649-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.

1.9 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 17.

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 65.

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: Can I format the Compact Flash on the PC for use in the 130 recorder?

For optimal performance in a REF TEK 130 recorder, Compact Flash disks should ALWAYS be formatted BY THE RECORDER.

6. 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.

It 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 power up (i.e. 130-Modem).

1.10 Warranty Statement

Refraction Technology instruments are warranted free from defects of manufacture for one year from date of shipment. 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.

1.11 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**

1.12 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. REK TEK can supply these if requested.
3. Failure to protect against static increases the chance of boards being damaged and may void REF TEK warranty.



2 Startup

This section provides information on the following topics:

- Getting started with the 130-01 DAS and quick power up.
- Minimum hardware configuration.
- Quick start 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.

2.2.1 Install the Compact Flash

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



Figure 2—1 Compact Flash

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

Note: Remember to hold the Compact Flash only by its edge as shown below.



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



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.

2.2.2 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 2–2 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.

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

1. Compares the 130 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.

At initial power-up the 130 leaves the GPS on for approximately 20 minutes to do phase-locking and oscillator adjustment.

In Cycled mode the 130-01:

Powers down the GPS and awakens the GPS and repeats the above phase locking algorithm each hour at 40 minutes after the hour.

In Continuous mode the 130-01:

Leaves the GPS powered on continuously.

In Off mode the 130-01:

Powers down the GPS and does not turn the GPS power back on.

2.4 Using a PDA for configuration

- Using the PDA device, open the PFC_130 program.

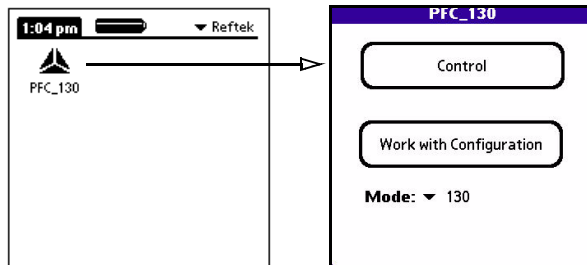


Figure 2-3 PFC_130 Start

- Select 130 as the **Mode** from the pull-down menu.
- At the Main PFC menu tap the **Control** window to establish a connection.
- A connect to DAS menu will display initializing the connection to the DAS.

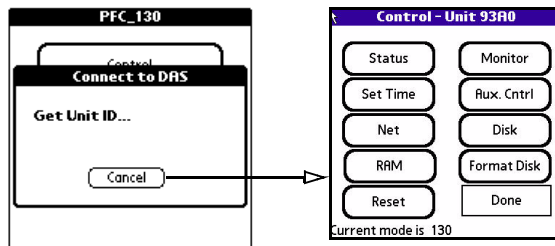


Figure 2-4 PFC Control

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

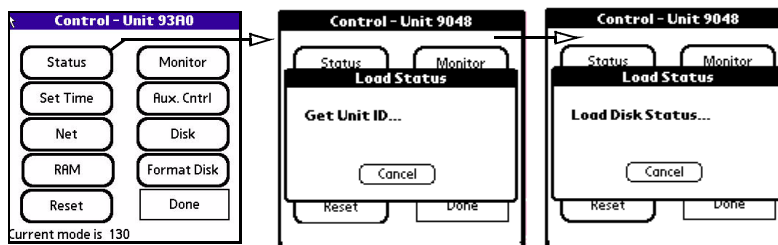


Figure 2-5 PFC Status

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

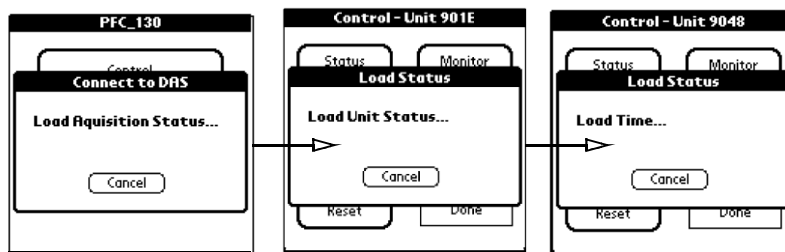
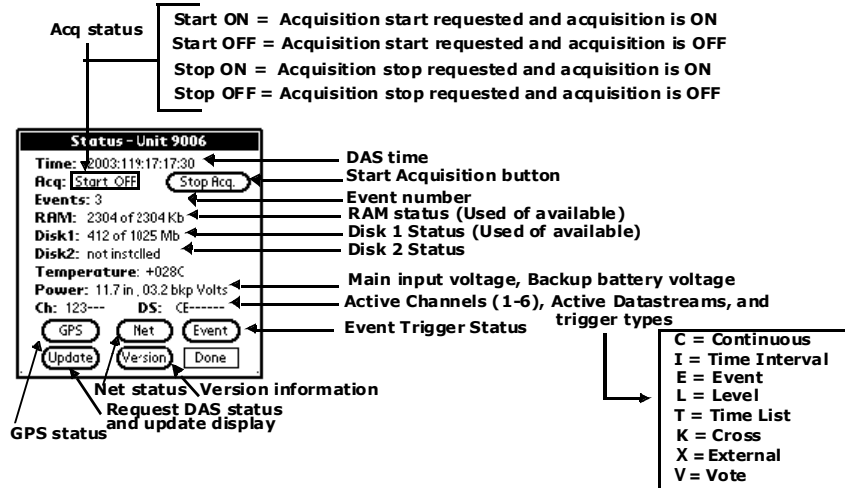


Figure 2-6 PFC Load Status

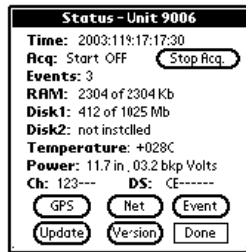
- The **Status** screen will open to show status information for the 130-01 connection.



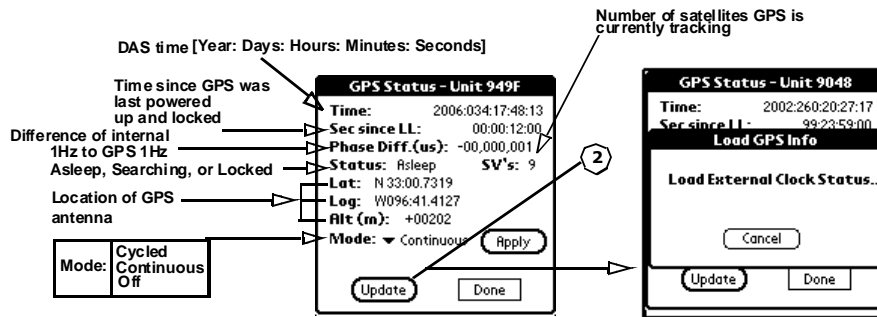
Note: If gradual performance degradation is noticed while working with the PFC_130 application simply exit and restart the PFC_130 application.

2.5 Check the GPS Status:

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



- Click the **Update** button to update the GPS display



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 Phase Lock cycles continuously.
Cycled	During each GPS wake cycle, the GPS is powered ON for 20 minutes. The GPS is then powered OFF until 40 minutes after the hour. If the end of the first GPS wake cycle occurs between 40 minutes after the hour and the top of the hour, the next GPS wake cycle starts at 40 minutes past the hour.
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.

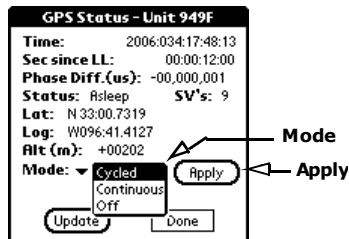


Figure 2—7 GPS Mode

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

2.6 Example configuration Steps

2.6.1 Create a configuration with PFC

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.

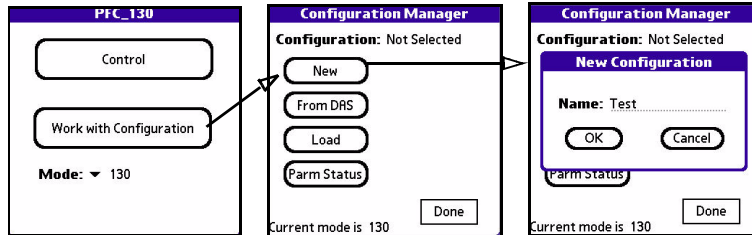


Figure 2—8 PFC New Configuration

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

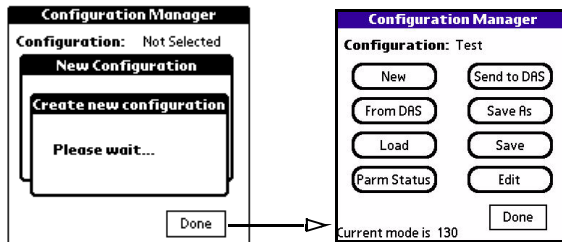


Figure 2—9 New Configuration

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.

Note: Entering an experiment name will cause it to appear in the Status/Control banner in PFC versions 1.3.2.01 or later.

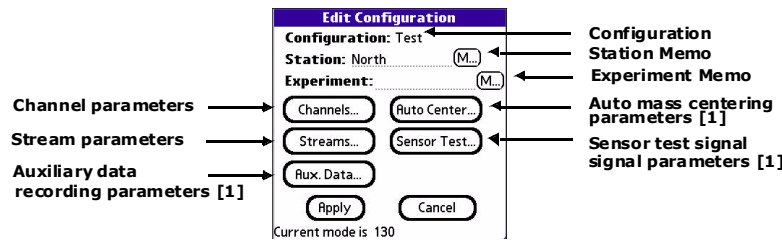


Figure 2—10 PFC Channels

Channel Configuration Details

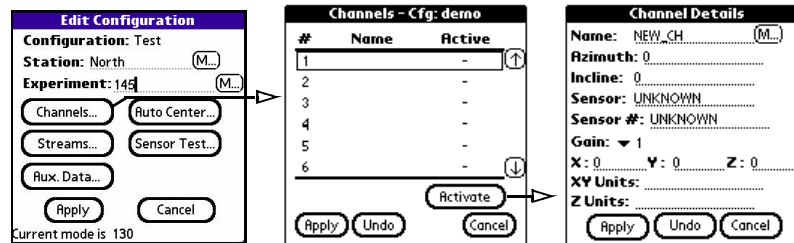
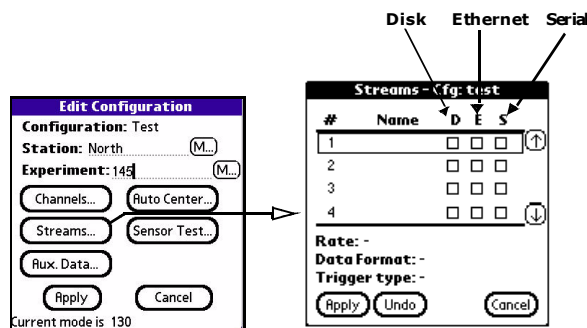


Figure 2—11 Channel Details

Edit Streams



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

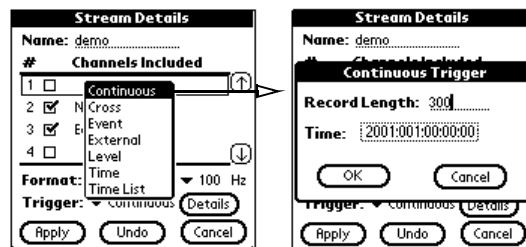


Figure 2—12 Stream Details

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

2.6.2 Format the Compact Flash

1. Format the Compact Flash using the following menus.

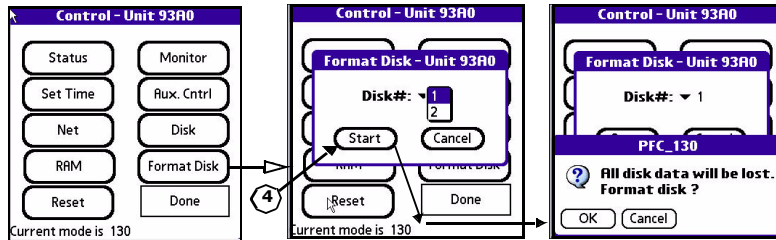


Figure 2—13 Format Disk

2. Tap the **Format Disk** menu on the **Control** menu.
3. Select the **Disk #**: to be formatted.
4. Select the **Start** button to start the format or the **Cancel** button to cancel the format and return to the **Control** menu.
5. Confirm the format by selecting the **OK** button.
6. When the format is complete the submenu displays Completed or Error.
7. Select the **Done** button to return to the **Status** menu.

NOTE: For optimal performance in a REF TEK 130 recorder, Compact Flash disks should ALWAYS be formatted BY THE RECORDER.

2.6.3 Start Acquisition

1. Check that the GPS has locked or the 130-01 DAS has the correct time.
2. Turn on acquisition by tapping **Start Acq** next to the acquisition line on the PFC Status menu.
3. If a delay is desired enter a delay time or approve with the **OK** button.

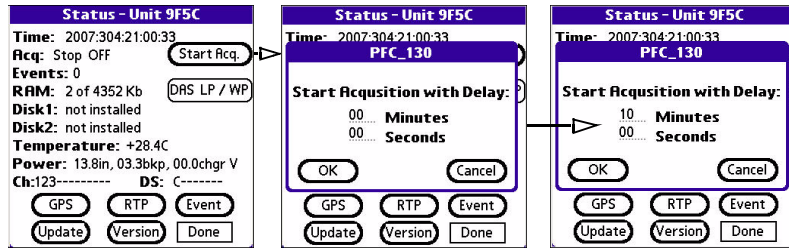
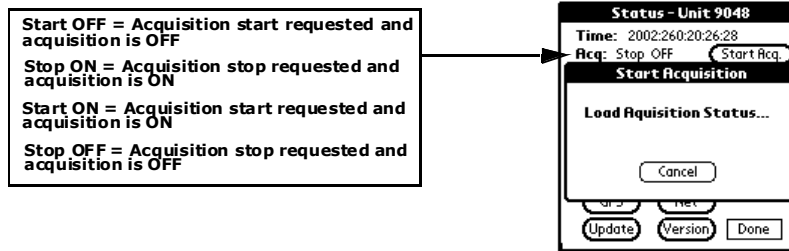
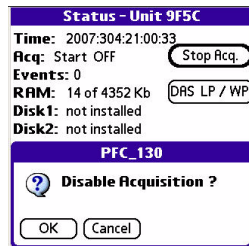


Figure 2–14 Set Acq Delay



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



2.6.4 Write Parameters to SPROM (WP)

The Write Parameter (**WP**) command causes the DAS to save the current user-accessible parameters to SPROM installed in the DAS. These parameters become the default parameters should the parameters in RAM become corrupted.

Note: User parameters stored in SPROM using the WP command will be erased when a firmware update is performed.

Note: The parameters are always saved with Acquisition ON.

To write a parameter set from the DAS to SPROM:

1. Select the **DAS LP/WP** button.
Be sure the Acquisition is ON.
2. Select the **Write** button to write the DAS parameter set.

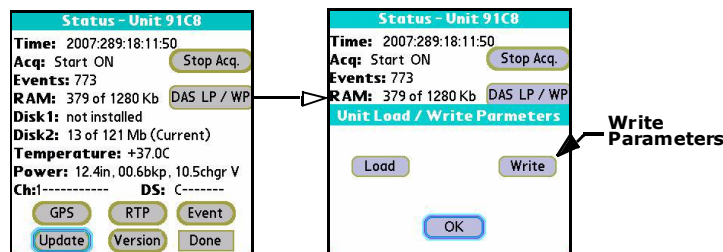
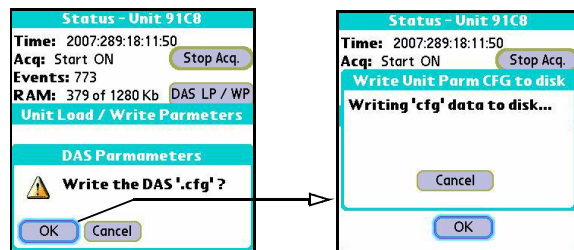


Figure 2—15 Write (WP)

3. Select the **OK** button to approve the write operation.



Note: It is also possible to Write or Load a parameter set during the DAS configuration operations by using the DAS LP/WP command on the configuration menu.

Firmware	Parameter Set Location
After CPU Firmware Version 2.8.8	Disk
After 3.2.0	SPROM

2.6.5 Load Parameters from SPROM (LP)

The Load Parameter (**LP**) command causes the DAS to load recording parameters stored in the DAS SPROM.

Note: User parameters stored in SPROM using the WP command will be erased when a firmware update is performed.

To Load a parameter set from a DAS SPROM to the DAS:

1. Select the **DAS LP/WP** button
2. Select the **Load** button to load the DAS parameters.

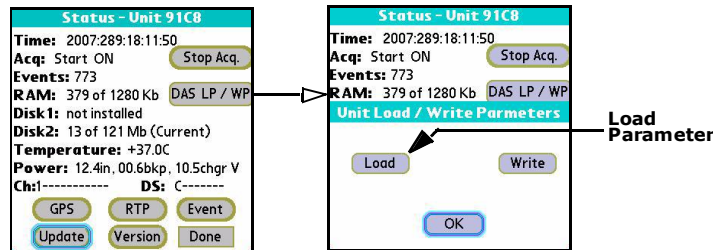
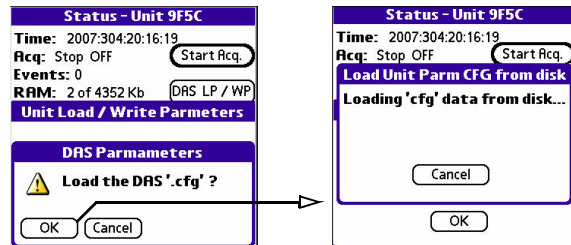


Figure 2—16 Load (LP)

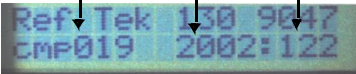





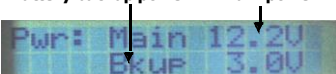
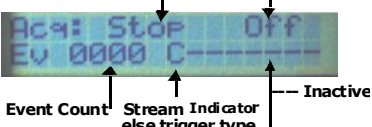
3. Select the **OK** button to approve the load operation.



Note: It is also possible to Write or Load a parameter set during the DAS configuration operations by using the DAS LP/WP command on the configuration menu.

Firmware	Parameter Set Location
After CPU Firmware Version 2.8.8	Disk
After 3.2.0	SPROM

2.7 Examples of 130 LCD Displays

LCD	Display
Initial power up LCD	 <p>Firmware Version Firmware Date Unit ID</p>
RAM Used Kb out of Total	 <p>Firmware Version Firmware Date Unit ID</p>
Compact Flash Used MB out of Total	 <p>Used MB Total Available Mb</p>
Date, Time and Temperature	 <p>Date Time</p> <p>Internal temperature</p>
GPS status	 <p>GPS Status</p>
Position	 <p>GPS Position</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>Acquisition Status</p>	
<p>Stream Indicator:</p> <p>C = Continuous L = Level I = Time Interval E = Event T = Time List K = Cross X = External V = Vote</p>	 <p>Requested State Actual State</p> <p>Event Count Stream Indicator else trigger type Inactive</p>

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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:

1. From the Control Panel select the **Phone and Modems** icon.



2. Select the **Modems** tab.
3. Select the **Add** button.

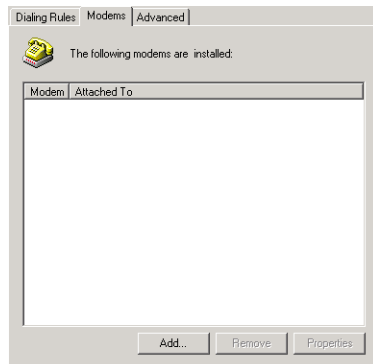


Figure 3—1 Add Modem

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



5. Select the **Next>** to select the modem from a list.
6. In Install New Modem click **Have Disk**.

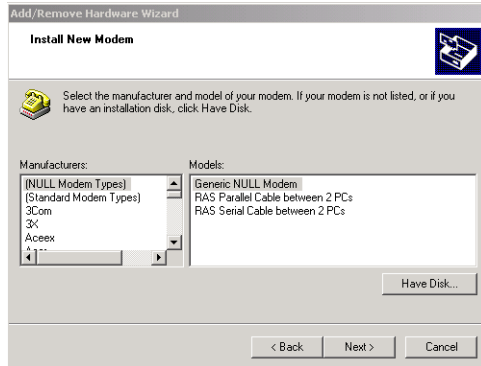


Figure 3–2 Have Disk - Modem



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

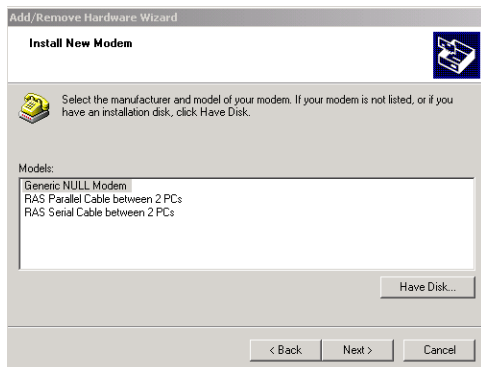


Figure 3–3 Select Generic

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

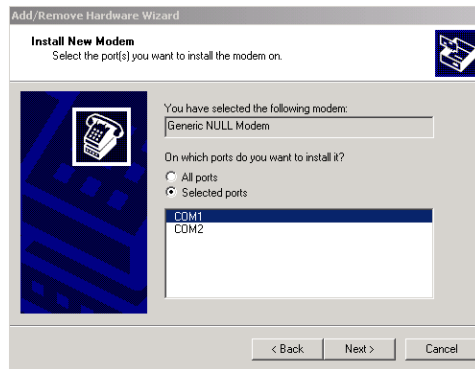


Figure 3—4 Select Port

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.

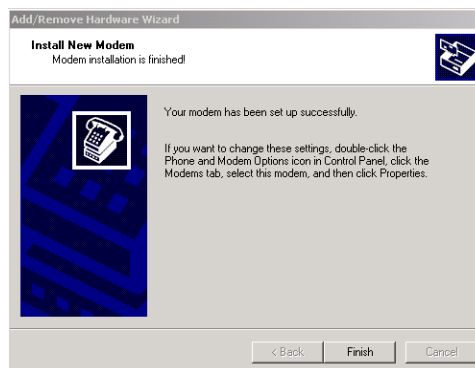


Figure 3—5 Modem Success

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

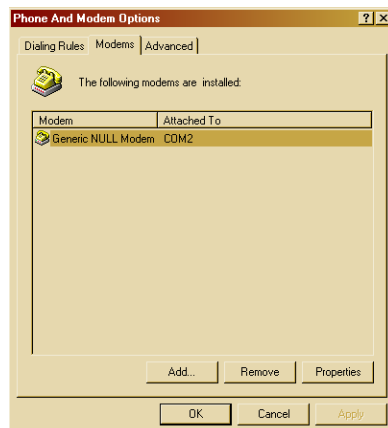


Figure 3—6 Phone and Modem Options

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.

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

- For direct connection to the 130, set the baud rate the 130 is configured to.
- 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.
- For connection to a DAS thru a radio or other equipment, consult their operations manual.

17. Click **OK** when ready.

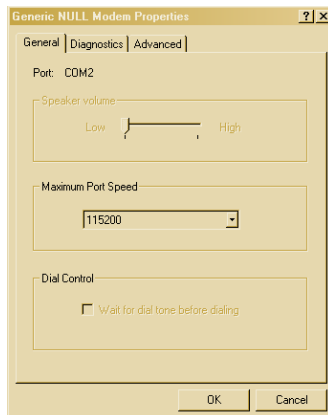


Figure 3—7 Modem Properties

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.

3.2.2 Adding Remote Access Services (RAS)

Configure the Remote Access Services (RAS):

1. Using standard window operations click **Start** —> **Settings** —> **Control Panel**.
2. Double-click the **Dial-up Connection** Icon.

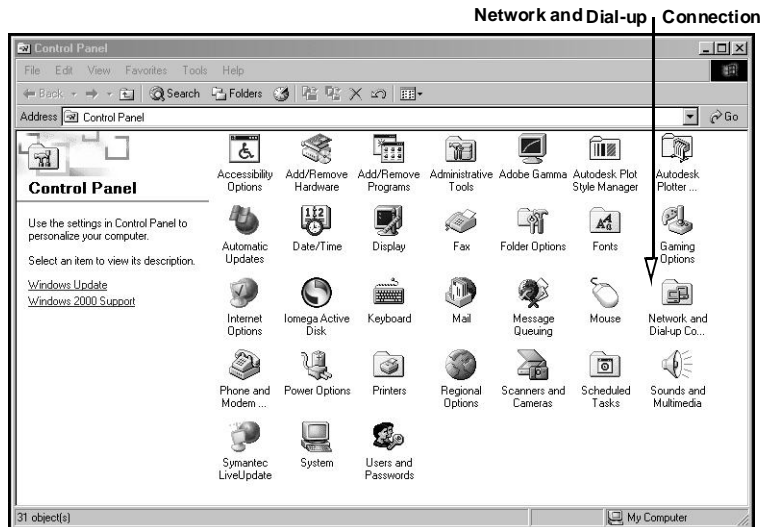


Figure 3—8 Control Panel

Note: Windows XP uses a “New Connection” wizard.

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

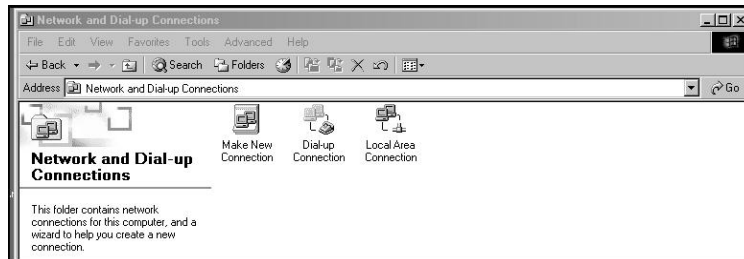
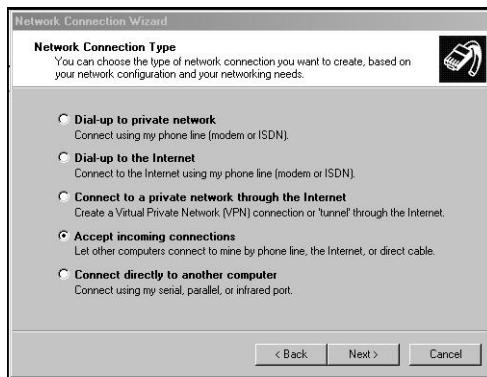


Figure 3—9 Make New

4. Select the **Next** option screen.



5. Select **Accept incoming connections** and the **Next** button.



6. Check the **Generic Null Modem** option.
7. Click the **Next** button when ready to continue.

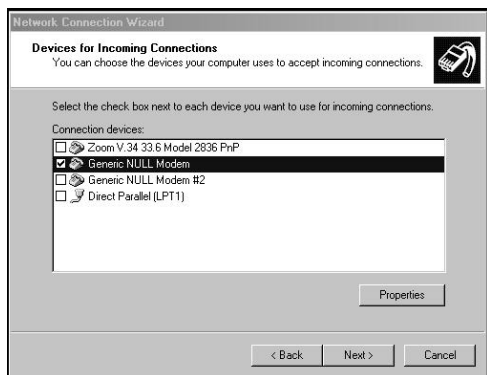


Figure 3—10 Incoming Connect

8. Select the **Allow** option on the Incoming Virtual Connection window.
9. Click the **Next** button.

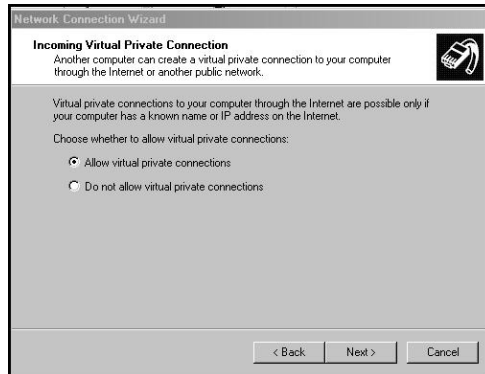


Figure 3–11 Allow Incoming Virtual

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

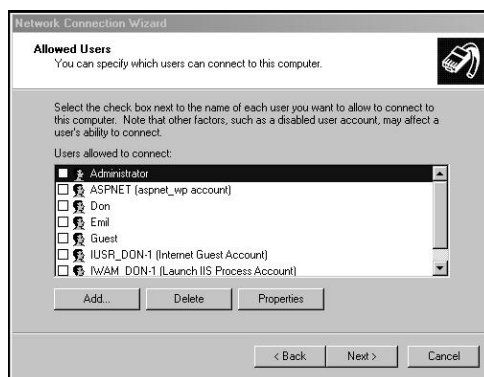


Figure 3–12 Add DAS User

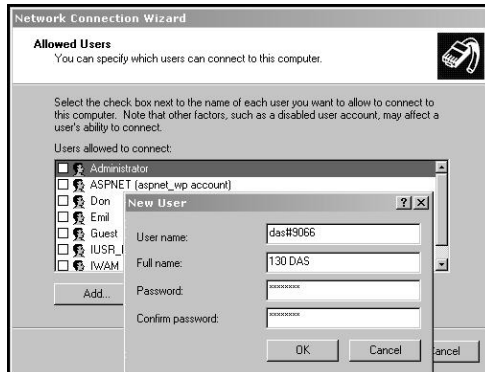
Note: When a DAS unit is setup and is connected to a PC, an account must be created and added. The account Username **MUST** be the particular DAS unit ID that is directly connected to the PC.

11. 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.



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

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

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

Note: The Password: settings are case sensitive.

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

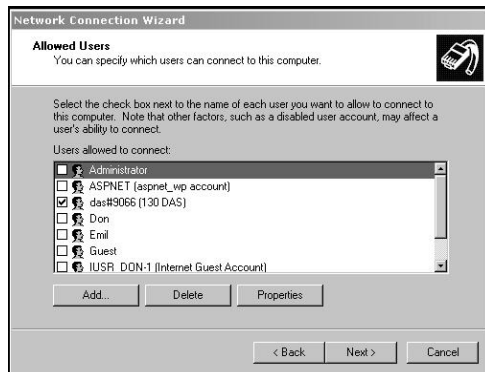


Figure 3–13 Add User

16. Select the **Next** button.

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

18. Select the **Properties** button.

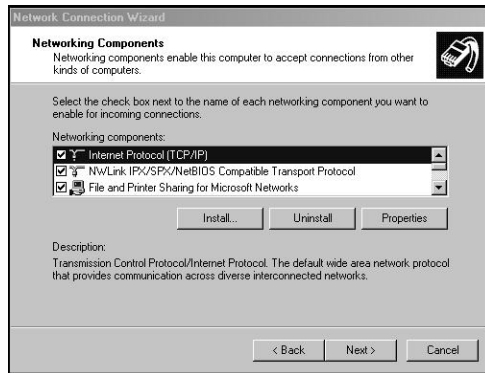


Figure 3–14 Networking

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

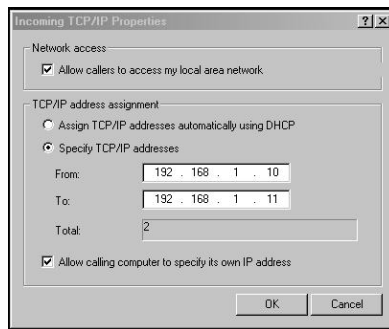


Figure 3–15 Remote Access

20. Enable **Specify TCP/IP address**.

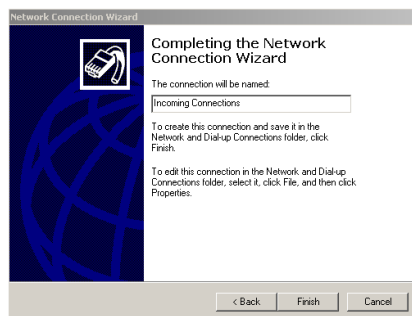
21. In the From: text box type a generic IP address where:

From IP address = PC's PPP IP address.

22. In the To: text box type a destination IP address where:

To IP address = Range of IP address for Serial PPP pool.

23. Click **OK** when ready.



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

3.2.3 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.

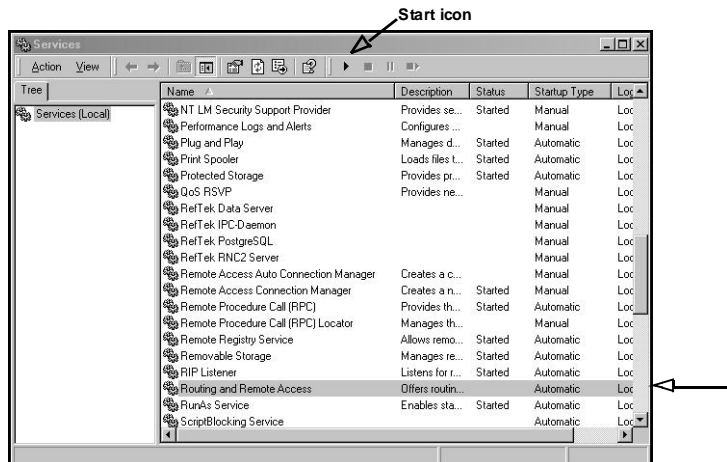


Figure 3–16 Services

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.

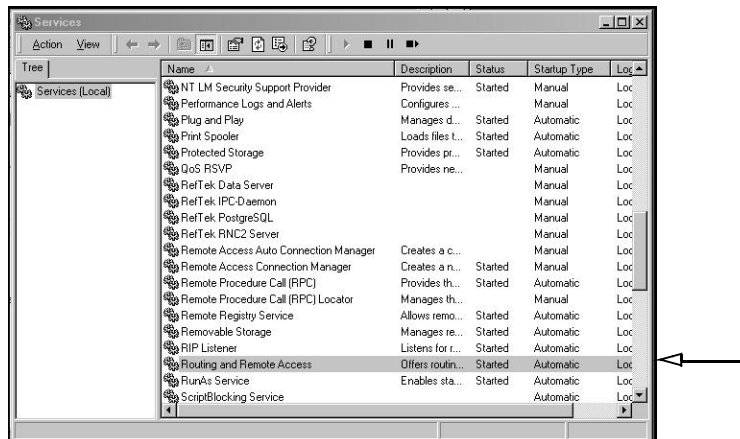


Figure 3–17 RAS started

5. Close the control program.

3.3 Modem PPP Connection

3.3.1 130-Modem

The REF TEK 130-Modem 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 except it has the 130-Modem label on the end of the unit and two wires connected as shown below.

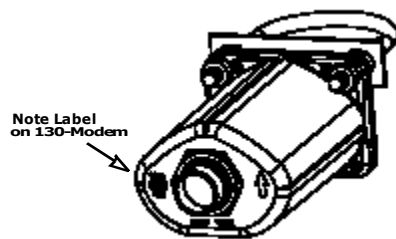


Figure 3—18 130 Modem

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 separately (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.

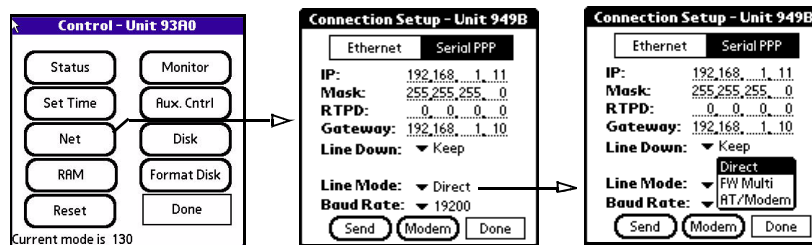


Figure 3-19 PFC Control

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.
FW Multi - Connection to a Freewave operating in multipoint mode.
AT/Modem - Connection to a modem.

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

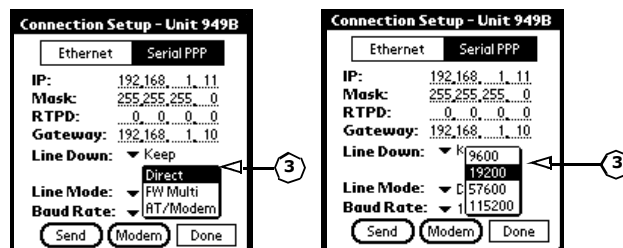


Figure 3-20 Assign Baud

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

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

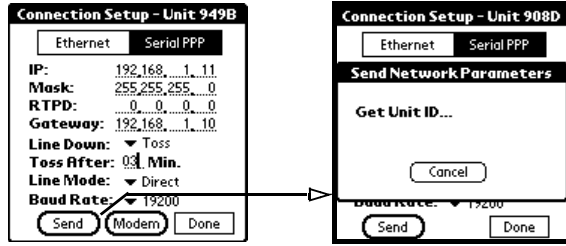
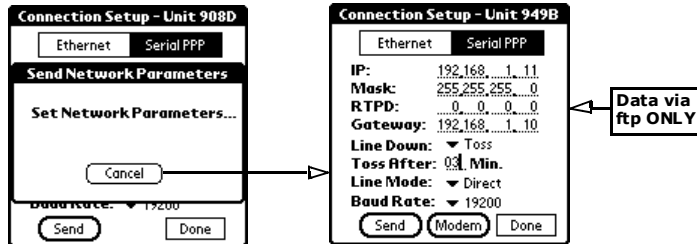


Figure 3–21 Send Serial



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.

If using AT/Modem - Line Mode:

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

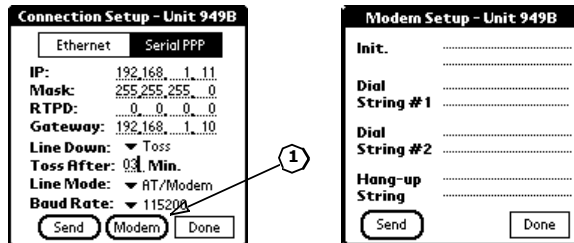
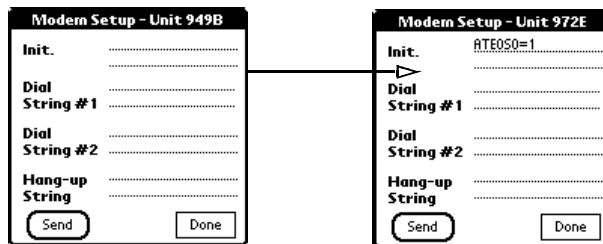


Figure 3–22 Modem Setup

2. Tap after the **Init** field and provide the modem initialization parameters as shown below (ATE0S0=1).



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.

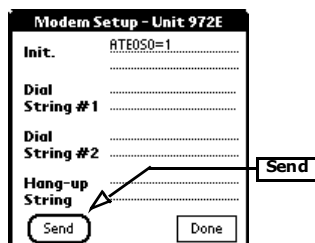


Figure 3–23 Send

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 to use the real-time and ftp option, 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 Communication 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.

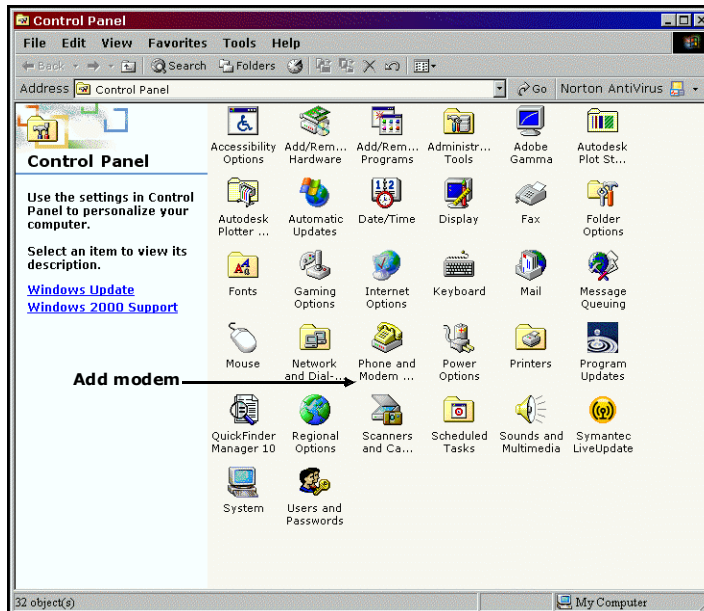


Figure 3–24 Add Modem

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

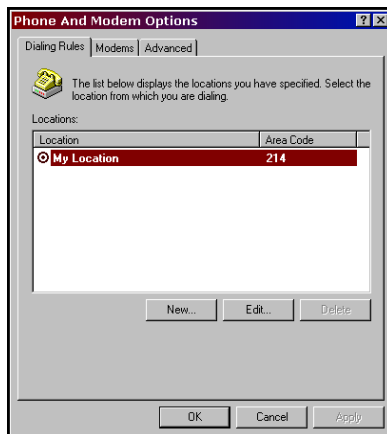


Figure 3–25 Phone and Modem Options

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

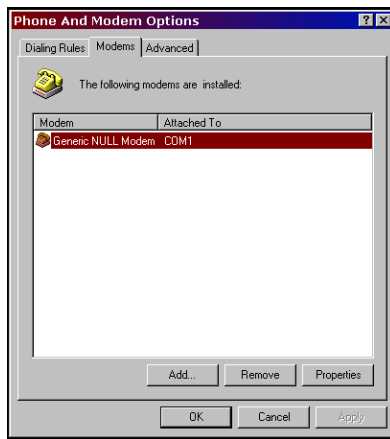


Figure 3–26 Modem Option

6. The **Install New Modem** window opens and installs.

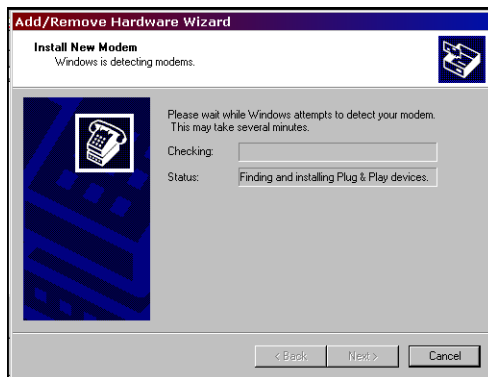


Figure 3–27 Detect Modem

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



Figure 3–28 Installed Modem

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

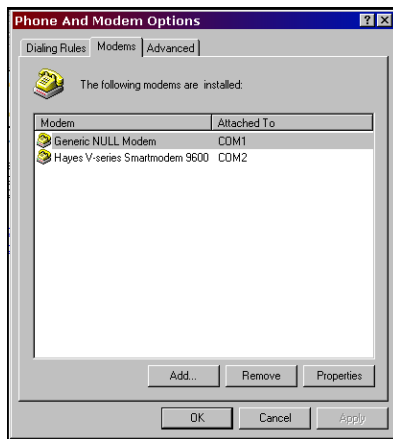
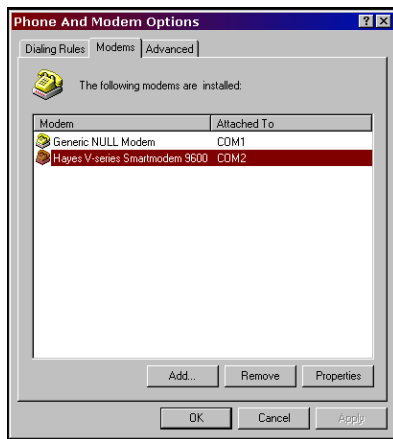


Figure 3—29 New Modem

9. Highlight the new modem.



10. 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.

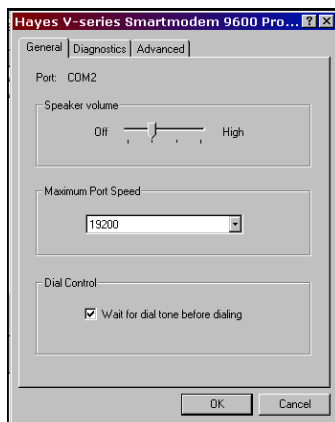


Figure 3—30 Modem Properties

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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:

- Replacing the Compact Flash
- Connector Assembly & Maintenance
- Periodic Maintenance checks
- Replace CPU Battery (130-01/3 and 130-01/6)
- Disassembly of the 130 for service
- Sealing and pressure testing a 130-01 DAS
- Adding or replacing an RT527
- Testing the 130 DAS Memory

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

WARNING: All REF TEK circuit boards are Static Sensitive and appropriate handling is required to protect each board from damage due to 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. REK TEK can supply these if requested.
3. Failure to protect against static increases the chance of boards being damaged and may void REF TEK warrantee.

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.



2. If the LED, in the disk well assembly 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.

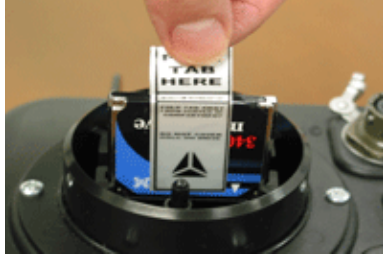
Note: DO NOT TOUCH THE DRIVE, except when replacing the tape.

3. Use only the provided tab, attached to the Compact Flash.



Use the provided tab to remove the Compact Flash

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



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

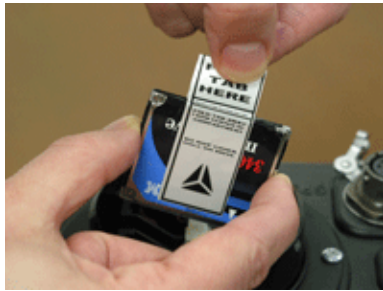


Figure 4–1 Handle drive

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.



Figure 4–2 Install Drive

6. The LED, for the well slot, should turn "Green".

When using the Compact Flash with a Compact Flash Reader:

7. Grasp only the edges while inserting the drive into the Compact Flash Reader.

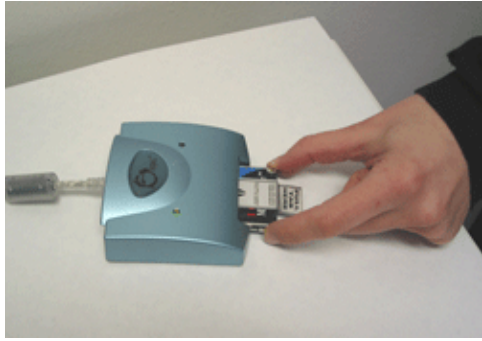


Figure 4—3 Compact Flash

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

**CF Disk Warning:**

Due to the large variability of CF cards available on the world market and the resulting problems with compatibility due to memory layout, signal structuring and power requirements, Refraction Technology cannot guarantee a CF card will work in a REF TEK data recorder unless it is sold through REF TEK itself. REF TEK ensures compatibility through communications with CF manufacturers and rigorous in-house testing. Some CF manufacturers refuse to provide adequate information or factory controls to ensure that the product being sold today is the same as the product sold earlier under the same part number. CF cards not purchased from REF TEK may work at one temperature but not at another, or may fail all together.

4.3 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".

Pin connections are supplied in your recorder manual (Starting in Chapter 1, "Overview"). 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.

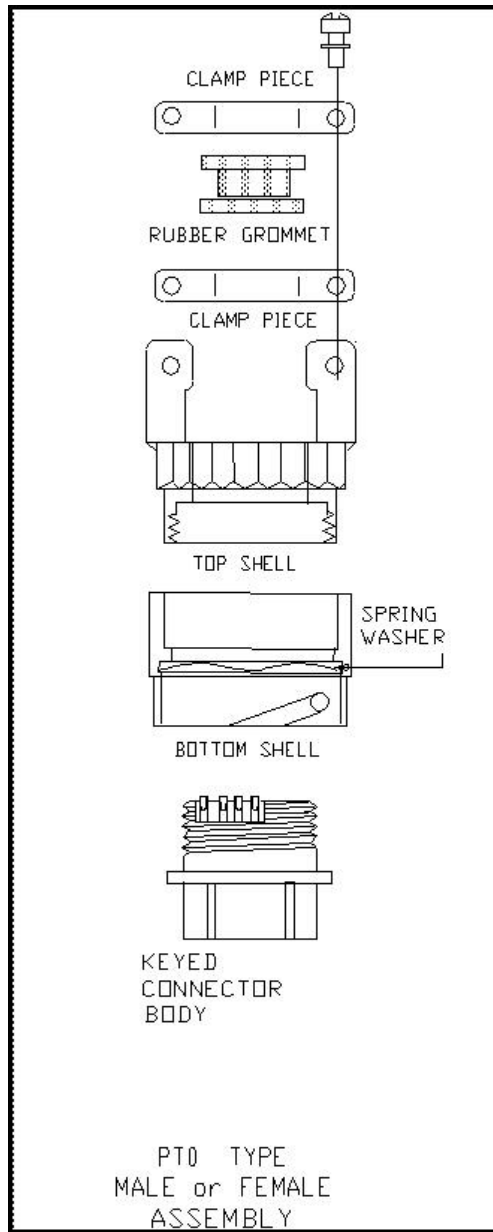


Figure 4-4 PTO Connector

- 5. Assemble new connectors correctly as shown below.

4.4 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.

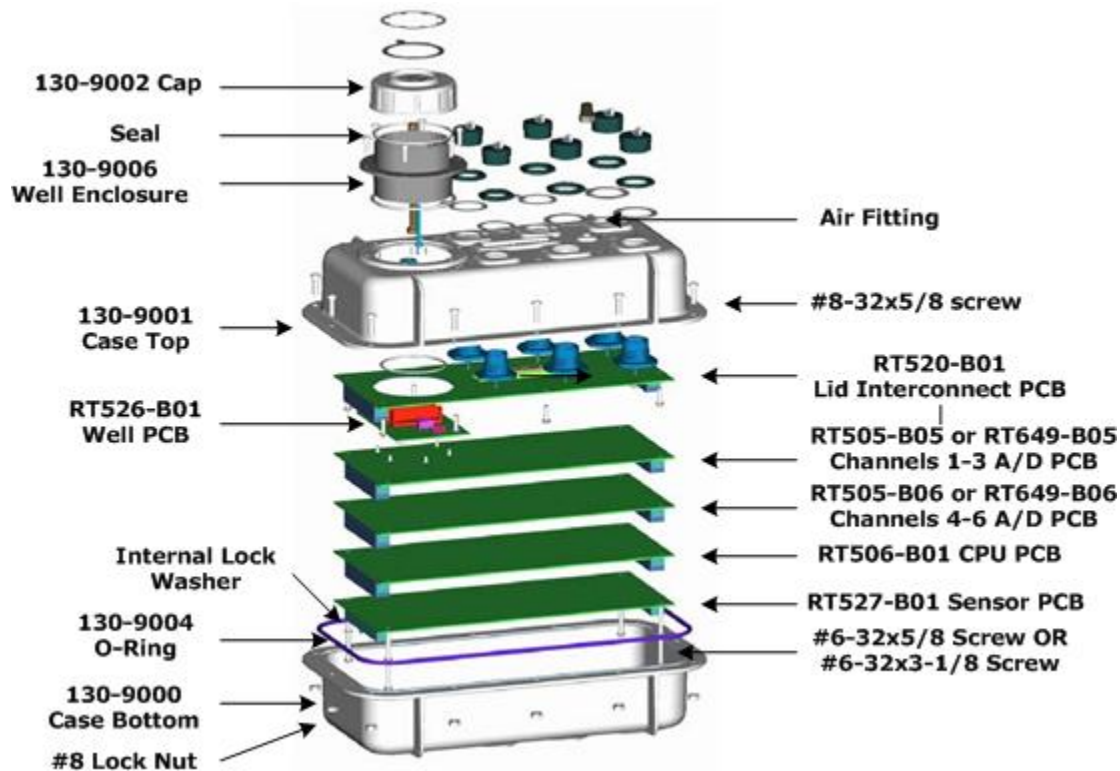


Figure 4-5 130-01 Boards Stack

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 or RT649-B06 PCB is for 130-01/6 and 130-01/6 6 Channel 130 DAS units.

4.5 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 4.5 on page 71

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.



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.

4.6 Disassembly of the 130 for service

To disassemble a 130-01 reference Figure 4.5 and 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 form-fitting plastic EMI shield remove the shield.
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:
 - 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.
 - Adding a sensor control board (Item 8) after removing the CPU board (Item 9).
 - Upgrade the 130-1/3 to a 130-1/6 6-Channel recorder.
11. Refer to "Assembly of the 130" on page 78 to assemble the 130 DAS.

4.6.1 130-01 Bill of Materials

Assembly ID: 130-01/3 Recorder, 3rd Generation, 3 Channel						Status: A	1.000000 EA
1	130-8000		Assembly, Final, 130-01/3, 3rd Generation DAS	1.0000	EA	M	
.. 2	130-8001		Assembly, Top, 130-01, 3rd Generation DAS	1.0000	EA	P	
.. 3	130-8009	0130	Assembly, Well, Disk Drive, 130-01	1.0000	EA	P	
... 4	FAB1309006	0010	Well, Disk Drive, 3rd Generation DAS	1.0000	EA	B	(3)
... 4	FAB1309007	0020	Shaft, Switch Actuator, 3rd Generation DAS	1.0000	EA	B	
... 4	FAB1309008	0030	Battery, 3.6V, .95Ah, 1/2AA, w/ Connector, for 1:	1.0000	EA	B	(18)
... 4	HNB1/4-20X14	0040	Bolt, Hex Head, 1/4-20x7/8, Nylon	1.0000	EA	B	Cap screw
... 4	HNN1/4-20	0050	Nut, 1/4-20, 7/32 Length, 5/16 OD, Small	1.0000	EA	B	Cap screw nut
... 4	HNW-04		Washer, Flat, Nylon, #4	1.0000	EA	B	
... 4	HST4-26X10	0130	Screw, Plastic Self Tapping, 4-26X5/16,	6.0000	EA	B	RT526 board mou
... 4	HST6-20X8	0120	Screw, Plastic Self Tapping, 6-20x1/2	6.0000	EA	B	Well mount to cas
... 4	SEAL034/50DURO	0080	O-Ring, 2-034, 50 Durometer, EPR	1.0000	EA	B	Well board seal
... 4	SEAL038/50DURO	0110	O-Ring, 2-038, 50 Durometer, EPR	1.0000	EA	B	Well cap seal

Figure 4—6 130-01 Bill of Materials

Assembly ID: 130-01/3 Recorder, 3rd Generation, 3 Channel					Status: A	1.000000 EA	
.. 4	SEAL147/50DURO	0090	O-Ring, 2-147, 50 Durometer, EPR	1.0000	EA	B	Well case seal
.. 3	130-8012	0140	Assembly, Lens, LCD, 130-01	1.0000	EA	P	
.. 4	FAB1309004	0010	Bezel, Lexan, 130-01, 3rd Generation DAS	1.0000	EA	B	
.. 4	H21100-142		Washer, Shakeproff, M2.5, Schroff	6.0000	EA	B	
.. 4	HPHM2.5X4	0020	Screw, M2.5 x 4, PPH, SS	6.0000	EA	B	
.. 3	FAB1309001	0150	Case, Top, 130-01, 3rd Generation DAS, CE	1.0000	EA	B	MODS, TAP AIR FITTING HOLE
.. 3	FAB1309175	0200	Shield, Upper, .030, PVC, WAVE ZERO	1.0000	EA	B	
.. 3	H9166-0060	0120	Valve, Air, Schrader, 1/8" Pipe Tap	1.0000	EA	B	
.. 3	HCW-06		Washer, Spring (Crescent), #6, SS	16.0000	EA	B	
.. 3	HNW-06		Washer, Flat, Nylon, #6	3.0000	EA	B	
.. 3	HST6-20X8	0080	Screw, Plastic Self Tapping, 6-20x1/2	8.0000	EA	B	
.. 3	PMS318112N	0060	Connector, Cap, Dust, for Shell Size 12	3.0000	EA	B	
.. 3	PMS318114N	0070	Connector, Cap, Dust, for Shell Size 14	2.0000	EA	B	

①

②

Assembly ID: 130-01/3 Recorder, 3rd Generation, 3 Channel Status: A

. 2	130-8005A 12/4/200	(10)	Assembly, Cable, Disk, Int., 50 Pin, .025 Pitch	1.0000	EA	P
.. 3	P214347		Connector, IDC, Female, 50 Pin, w/ Latches	2.0000	EA	B
.. 3	W9L30050		Cable, Ribbon, .025 Pitch, 50 Conductors	1.0000	FT	B
. 2	130-8006A 12/4/200	(11)	Assembly, Cable, Int., Test/Status, 26 Pin, .025	1.0000	EA	P
.. 3	P214346		Connector, IDC, Female, 26 Pin, w/ Latches	2.0000	EA	B
.. 3	W9L30026		Cable, Ribbon, .025 Pitch, 26 Conductors	1.0000	FT	B
. 2	130-8007		Kit, Completion, for 3-Card Stack, 3rd Generatio	1.0000	EA	P
.. 3	130-HANDLE	0130	Handle, Black, for use w/130	1.0000	EA	B
.. 3	FAB1309000	(15)	0010 Case, Bottom, 3rd Generation DAS	1.0000	EA	B
.. 3	FAB1309003	(14)	0020 Seal, Black, 3rd Generation DAS	1.0000	EA	B
.. 3	FAB1309176	0150	Shield, Lower, .030, PVC, WAVE ZERO	1.0000	EA	B
.. 3	HCW-06		Washer, Spring (Crescent), #6, SS	6.0000	EA	B
.. 3	HKHN-08	0080	Nut, Hex with Star Washer, 8-32, SS	12.0000	EA	B

Assembly ID: 130-01/3 Recorder, 3rd Generation, 3 Channel Status: A

.. 3	HPH6-32X26	12	0030	Screw, 6-32x1-5/8, PPH, SS	6.0000	EA	B
.. 3	HPH8-32X10		0140	Screw, 8-32x5/8, PPH, SS	2.0000	EA	B
.. 3	HPH8-32X8		0100	Screw, 8-32x1/2, PPH, SS	10.0000	EA	B
. 2	130-8013			Assembly, Cap, Disk Drive Well, 130-01	1.0000	EA	P
.. 3	FAB1309002	19	0010	Cap, 130-01, 3rd Generation DAS	1.0000	EA	B
1	RT505G-B05 2/18/200	6		Assembly, PCB, A/D Board, Ch 1-3, x1 or x32 G	1.0000	EA	M
1	RT506J-B01 12/4/200	8		Assembly, PCB, CPU Board, 3rd Generation, 8	1.0000	EA	M
1	RT520H-B01 3/19/200	5		Assembly, PCB, Lid Interconnect, 3rd Gen	1.0000	EA	M
1	RT526H-B01 12/4/200	4		Assembly, PCB, Microdisk/Compact Flash Boar	1.0000	EA	M

4.7 Assembly of the 130

Assemble the 130 DAS (Figure 4.5) as follows:

1. Gently re-stack the boards in the order shown in Figure 4.5.

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. Insert the six removed #6-32 screws (Item 12) or (Item 13) with the lock washers (Item 21).
3. Tighten the stack of boards with a screwdriver.
4. 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.
5. Place the O-ring in the bottom half of the case (Item 15).
6. If the DAS has a form-fitting EMI protective shield re-install the plastic EMI cover.
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".

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

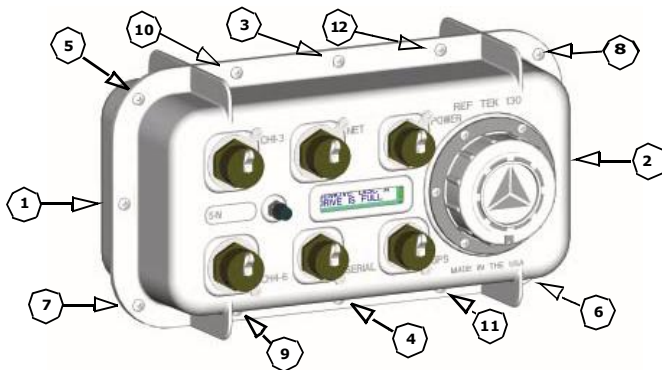


Figure 4—7 Tighten Pattern

4.8 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 put in a microwave at half power for three to five minutes to re-activate them.

Following reassembly (See "Assembly of the 130") 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 4.5 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 in the order shown (Figure 78) to seal the unit.
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).

4.9 Firmware update options

WARNING: If the firmware flash is interrupted the 130 may not boot again and the 130 must be returned to the factory for service or optional EEPROM board must be used. If you live in an area of unreliable power a UPS is recommended.

NOTE: DAS power must be above 11.5V to upgrade firmware.

4.9.1 Download 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.

4.9.2 Firmware update process

Updating firmware in a 130-01 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) Re-programs the internal flash memory.
 - (c) DELETES the file.

Note: DO NOT DISTURB THE UNIT DURING THIS PROCESS.

Note: User parameters in SPROM using the WP command will be erased when a firmware update is performed.

4.9.3 Updating firmware from a Compact Flash™

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.
3. Install the Compact Flash™ in the 130-01.

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

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

Note: DO NOT DISTURB THE UNIT DURING THIS PROCESS.

4.9.4 Updating firmware using ftp

1. ftp to the 130-01 using its IP address:

username: reftek

password: reftek

2. Use the **ls ftp** command to list the contents of the Compact Flash™.
3. Enter **bi** and **ha** to select Binary and Hash options.
4. Use the put ftp command to send the file (main.s3) to the Compact Flash™ installed on the 130-01.
5. With the Compact Flash™ with the main.s3 image installed in the 130-01 DAS, issue a reset command from the 130-01

-OR-

- **Use the RTCC command and control interface program**
 - **Use the RT130-SM GUI Reset System command**
6. On power-up, the 130-01 checks the Compact Flash™ for the presence of 'main.s3' in the root directory.
 7. If the 'main.s3' file is present on the Compact Flash™, the 130-01:
 - (a) Reads the file.
 - (b) Re-programs the internal flash memory.
 - (c) DELETES the file.

DO NOT DISTURB THE UNIT DURING THIS PROCESS.

Note: DAS power must be above 11.5V for a firmware update.

4.9.5 Updating firmware at the 130-01

1. Issue a Reset command from a PDA running PFC_130 or physically disconnect and reconnect power to the unit.
2. Observe the LCD for the following messages:

READING DISK DO NOT DISTURB

WRITING FLASH DO NOT DISTURB
3. The 130-01 DAS resets and returns to normal messaging.

4.9.6 Updating firmware via telemetry mode

1. If you are connecting remotely by a TCP connection:

First connect

Discover the unit

Acquire status

2. Issue a reset command from the Status screen.
3. Delete the unit from the Station List screen:

Wait at least 5 minutes

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.

4.10 To Test the 130 DAS Memory

4.10.1 Overview

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

4.10.2 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 responds 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.

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5 Adding or replacing an RT527

5.1 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.

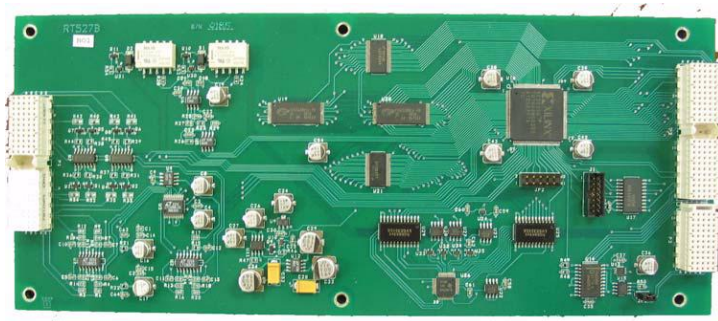


Figure 5—1 RT527 SCB

5.2 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 (Page 80) 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 page 89.
4. Flip the 130-01 DAS upside-down on the top of the top case (Item 1).



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 5–2 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 5—3 Remove 130 Top

8. If the DAS has a form-fitting EMI protective shield remove the plastic EMI cover.
9. Loosen and remove the six #6-32 screws (Item 12) or (Item 13) from the stack.



Figure 5—4 Stack Screws

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

For a new installation of the RT527 go to Step 12.

-OR-

If an upgrade of an RT527 go to Step 10.

5.2.1 Upgrade

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



5.2.2 For a new installation:

13. 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.
14. For a new (installation) install the 6 (longer) #6-32 screws supplied with the RT527 board.
15. Place the O-ring in the bottom half of the case (Item 15).



Figure 5–5 Install O-Ring

16. If the DAS has a form-fitting EMI protective shield re-install the plastic EMI cover.
17. 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.



18. 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 60 to install and hand tighten the nuts to the screws. Then tighten all twelve screws in the same pattern.

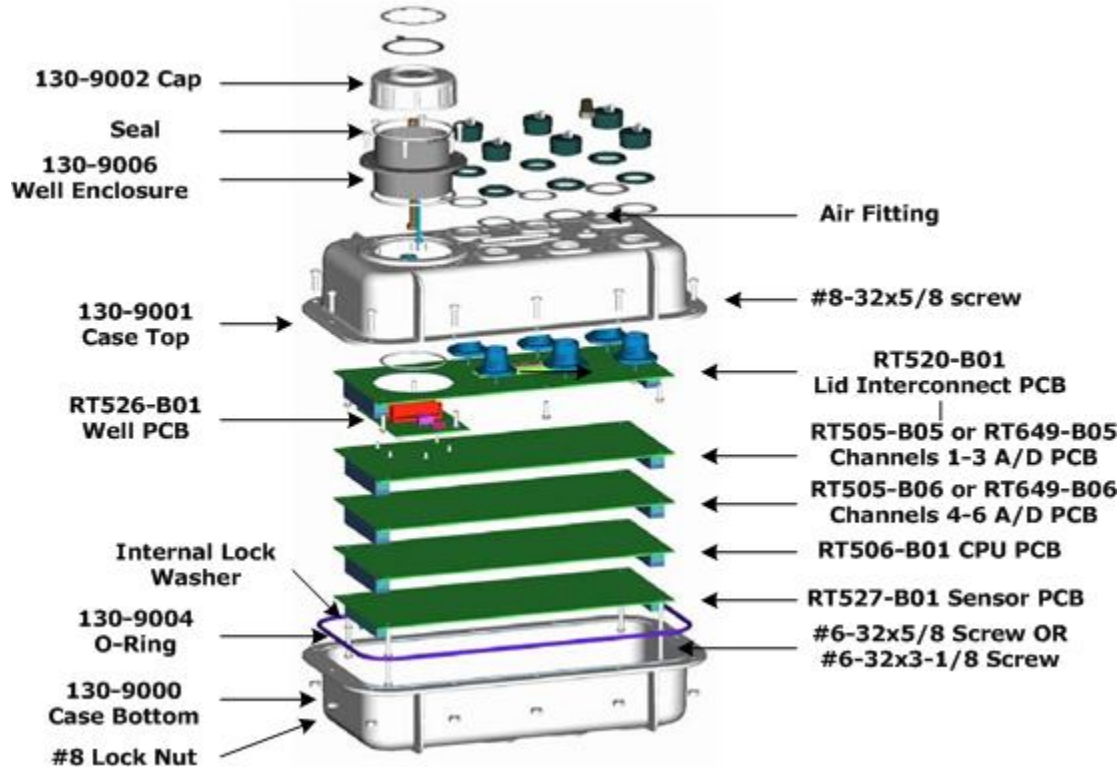


Figure 5—6 130-Exploded View

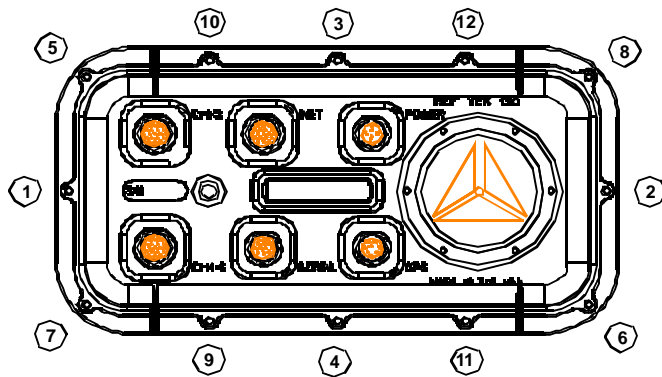


Figure 5—7 Bolt Pattern

5.3 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.

5.3.1 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.

5.3.2 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

5.3.3 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
```



6 Logfile Example

6.1 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 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.

6.2 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.

6.3 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.

6.4 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: SC2IC915

**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.



7 Index

<u>A</u>		<u>D</u>	
acquisition		data loss	20
start with PFC	36	datastream	
stop with PFC	36	sample rate of	20
assemble	78	Date	
auxiliary channels	91	LCD Display	39
		default IP	1, 8
		disassemble 130	73
		dynamic range	3
<u>B</u>		<u>E</u>	
Basic setup	26	firmware	
battery		defined	13
replace CPU	72	download	80
Bill of Material	74	flash	80
Bit Weight	3	update CF	vii
board		update DAS	vii
RT505 A/D	18	update FTP	vii
RT506 CPU	18		
RT520 Lid	18	<u>G</u>	
RT526 CF	18	GPS	
RT527 SCB	18	accuracy	3
stack diagram	19	check status with PDA	31
		connector	7
		install	26
		LCD status	39
		mating PTO	4
		modes	32
		operations	29
		PTO	3
		<u>I</u>	
		input voltage drop	6
		inspection	71
		<u>L</u>	
		LED shows RED	20, 66
		Load parameters with PFC	38
		<u>M</u>	
		main.s3	80
		Mass re-centering	91
		memory	
<u>C</u>			
cable			
130-8004	8		
130-8015	7		
130-8019	9		
130-8062	7		
130-8075	6		
130-8137 Modem	55		
CF			
format	21		
install	27		
PFC format	35		
Reader	68		
replace	vi, 66		
RT526 board	18		
Used MB on LCD	39		
WARNING	68		
channel			
activate with PDA	34		
aux	12		
connector	10		
input PTO	3		
mating PTO	4		
connector	69		
assembly	70		
connectors	6		

test83
modem
 130-Modem.....53
 generic null42

N

NET
 connector8
 Ethernet.....4, 17
 mating PTO4
 PTO3

<u>P</u>		install.....	85
parameter		SCB Sensor Control	90
LP PFC command	38	scope.....	90
WP PFC command	37	RTCC	
PDA		control software	13
cable	7	<u>S</u>	
channel display	10	sample rates.....	3
check status.....	30	groups	20
DAS configuration.....	33	Serial	
PFC_130.....	13	connector.....	4, 7
set mode.....	30	mating PTO	4
PFC_130		Modem	21, 41
control menu	30	PPP Communications	16, 41
control software	13	PTO	3
pinout	2	Sending data w/Radio	21
Power		SH3	13
average.....	3	Static Sensitivity	24, 65
connector	6	stream	
LCD	39	LCD indicator.....	39
LCD status.....	39	PDA details.....	34
mating PTO.....	4	<u>I</u>	
PDA and DAS powerup	28	Trigger	
PTO	3	Continuous.....	4
requirements.....	15	Event	4
solar.....	15	External.....	4
pressure test 130	79	Level.....	4
Purpose of DAS	5	list of supported.....	14
		Time	4
<u>R</u>		<u>W</u>	
RAM Used LCD	39	warranty.....	22
RAS.....	51	RMA	23
Recording		Write parameters with PFC	37
capacity	4		
format.....	4		
register.....	v		
RT527			

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**Refraction Technology
1600 Tenth Street
Suite A
Plano, Texas 75074**

**Tel: 214-440-1265
Fax: 972-578-0045
www.reftek.com**