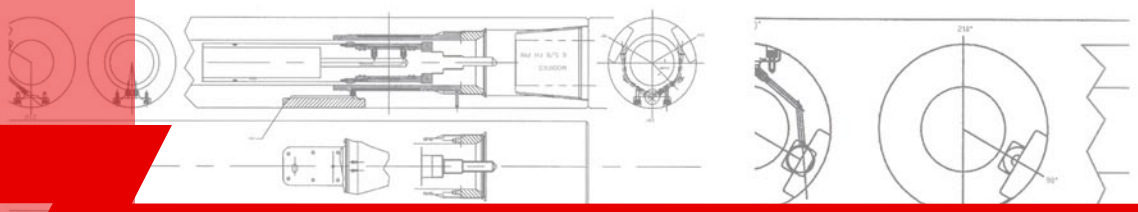
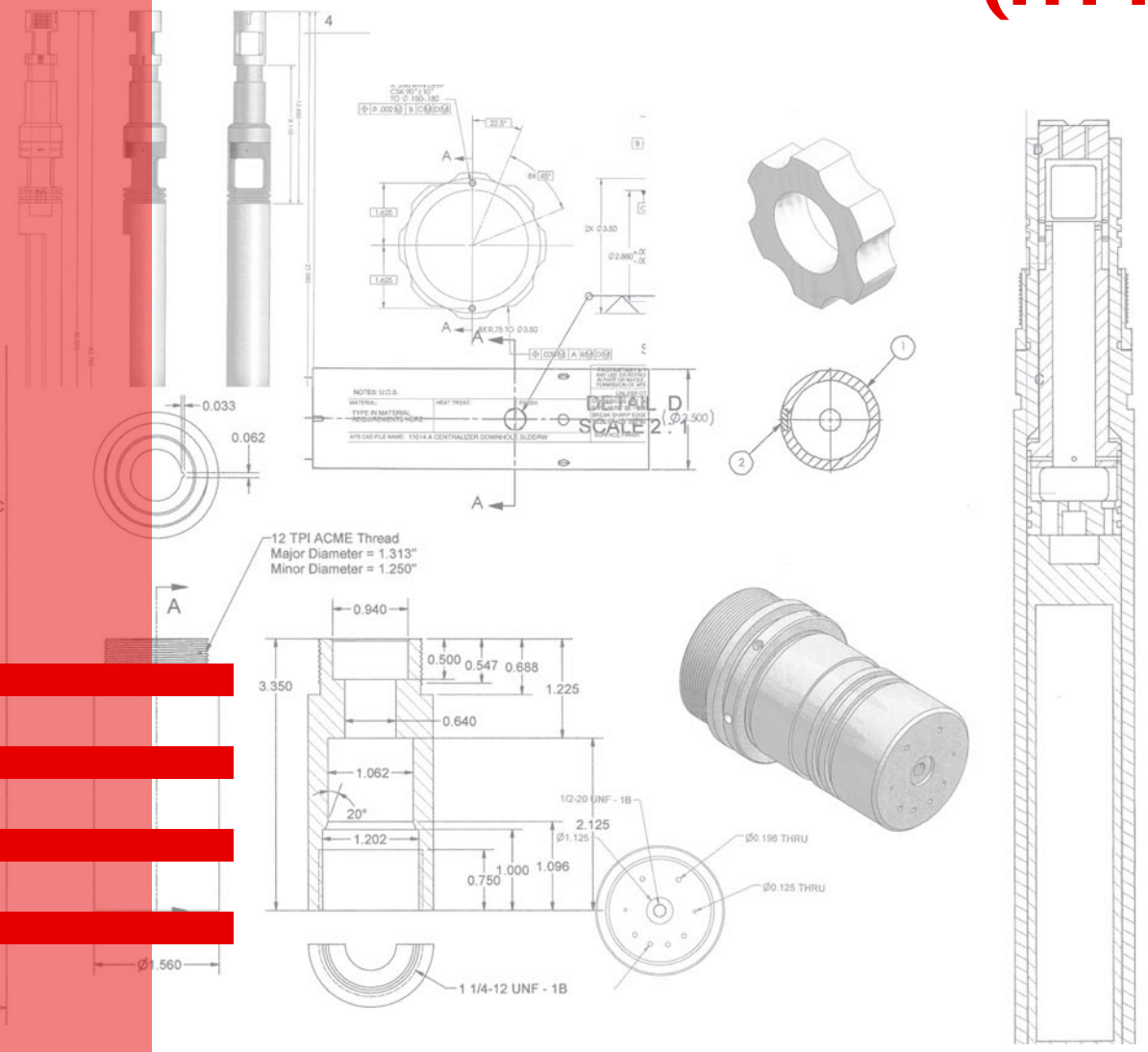


High Temperature Fluid Temperature Tool (HTT)



6/2004

High Temperature Fluid Temperature Tool (HTT)

Operation Instructions

Table Of Contents

I. OVERVIEW & SCHEMATIC 3

II. SPECIFICATIONS & COMPONENTS 4

III. SETUP FOR DOWNHOLE LOGGING 7

IV. BENCH TESTING 13

V. TOOL DISASSEMBLY 16

VI. SERVICING THE PC BOARD 19

VII. TESTING THE THERMISTOR 24

VII. TOOL REASSEMBLY 25

APPENDIX A (SERVICING THE PC BOARD) 27

APPENDIX B (SOFTWARE INSTALLATION) 29

APPENDIX C (CALIBRATION DATA) 30

Any opinions, findings, and conclusions or recommendations expressed in this document are those of the author(s) and do not necessarily reflect the views of the National Science Foundation, Joint Oceanographic Institutions, Inc., or ODP member countries.

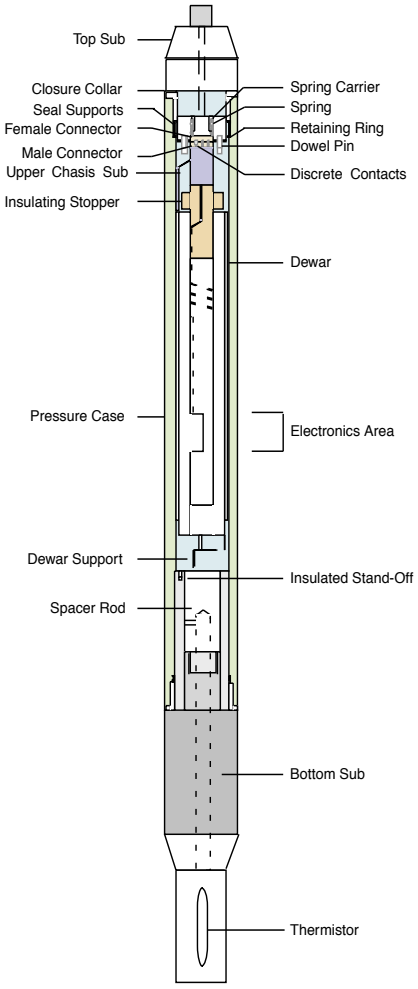
Section I

Overview and Schematic

In high-temperature environments (i.e. hydrothermal systems or lower crustal settings), temperature logs can be recorded using the wireline slim-hole Hi-T Temperature Tool (HTT) developed at LDEO. The HTT can be used in fluid temperature conditions up to 275°C.

Logging cable with Teflon insulation will begin to degrade once the fluid temperature exceeds 232°C, but the HTT system can still transmit reliable measurements even after the cable has been considerably degraded.

The HTT is a wireline tool without internal batteries; therefore, it is dependent on the wireline for tool power and data transmission.



Section II

Specifications and Components

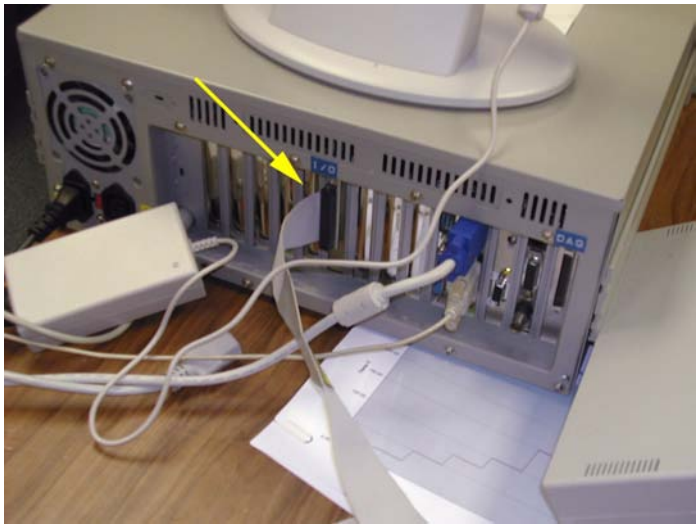
Length:	3 m (9.84 ft)
Weight:	250 lbs (113.4 kg)
Diameter:	3.5 inches
Temperature resolution:	0.5°C
Maximum temperature:	275°C
Cable head:	Schlumberger
Ideal logging speed:	10 ft/min

The primary components needed to run the HTT are:

A. Downhole tool

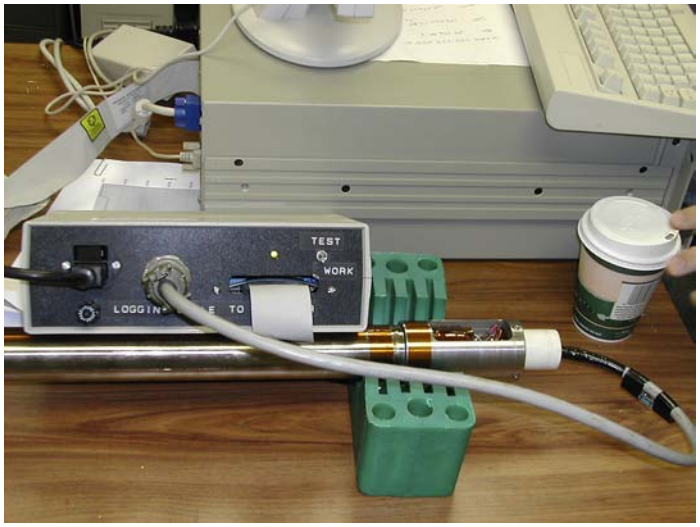
B. Surface panel

C. Digital I/O card. Most likely this is already installed in the DHML data acquisition system (DAS) PC. If it is not, installation instructions can be found in Appendix A.



D. Schlumberger cablehead

E. Test cable (only needed for bench testing)



F. Depth signal from Schlumberger

G. HiTemp software (Installation instructions in Appendix B.)

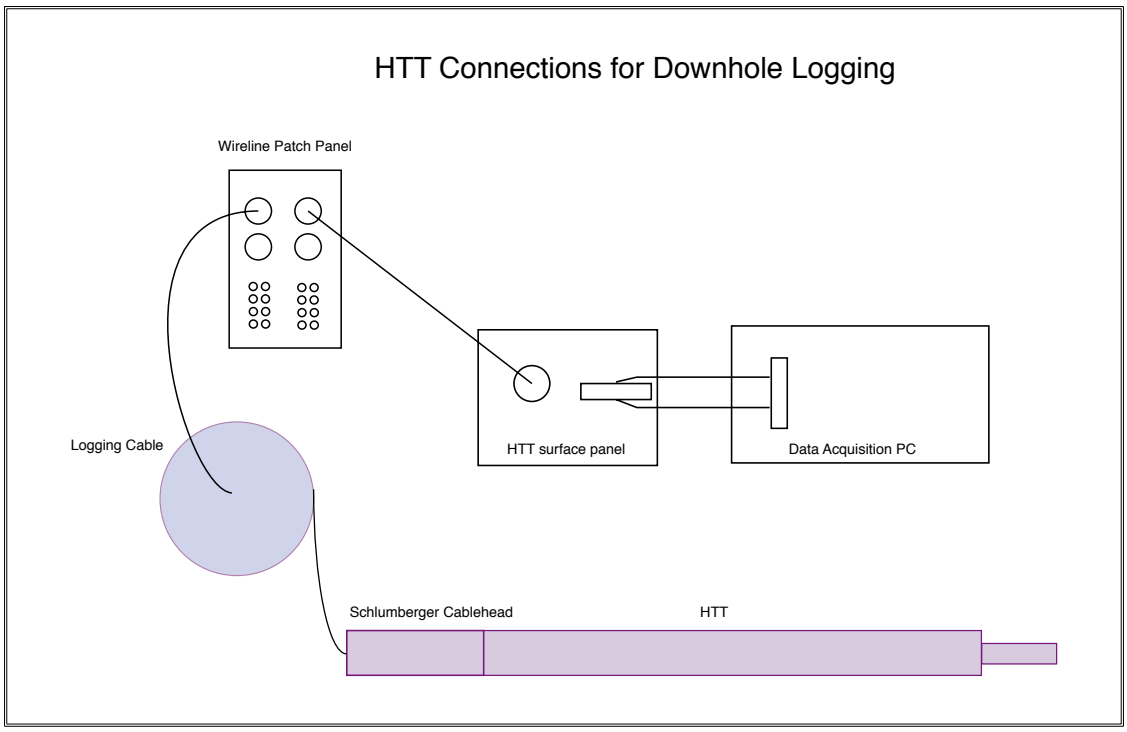
Section III

Setup for Downhole Logging

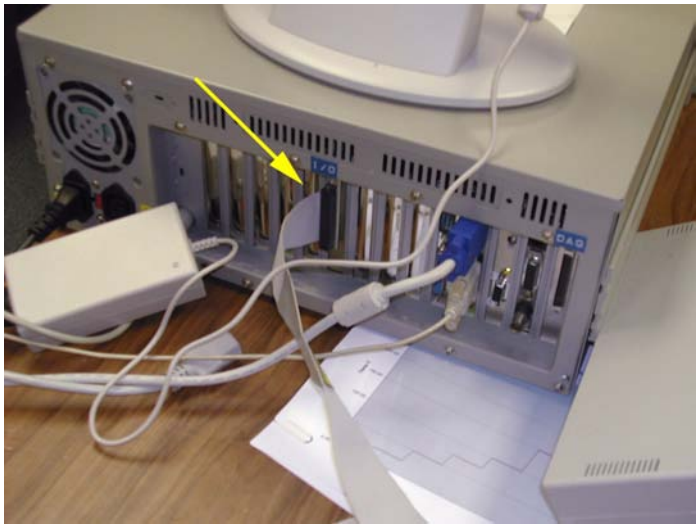
The following are instructions for configuring the HTT tool for normal logging operations:

Connections:

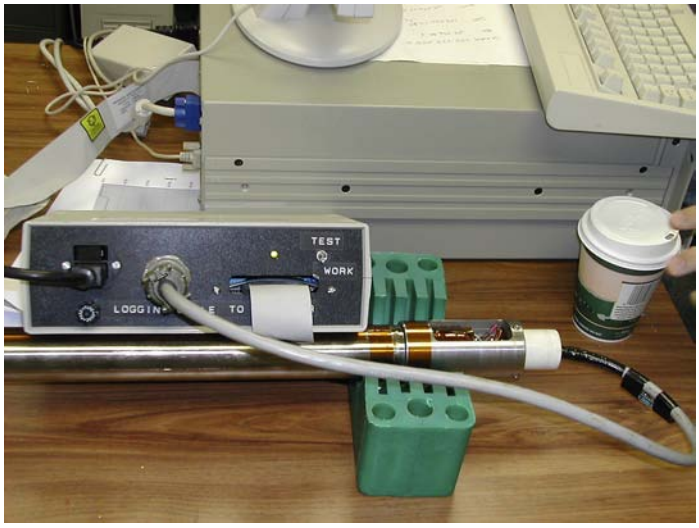
Connect the wiring as shown in the following figure:



A. Connect the surface panel to the Digital I/O card at the back of the DAS PC computer. (See picture, next page.) Note that there may be an analog DAQ card in the PC as well, and it uses the same connector. Don't get them confused!



B. Connect power to the surface panel and set the "Test/Work" switch on the surface panel to "Work":



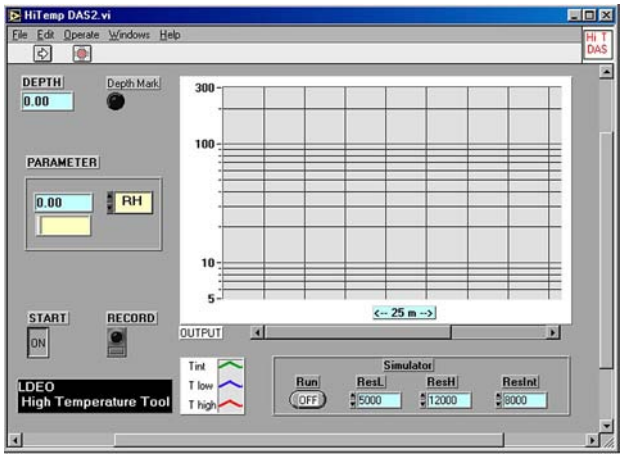
C. Connect the surface panel to the wireline patch panel located on the portside wall of the DHML and shown in the picure below:

D. Connect the wireline patch to the logging cable.

Important: Problems have occurred in the past while making the connections between the tool, surface panel and PC. The main board on the tool was destroyed, so EXTREME care must be taken to make the correct connections. A new test cable has been prepared for IODP Expedition 301 that should simplify the connections. The cable can be seen next to the tool chassis in the picture on the next page.

Operation:

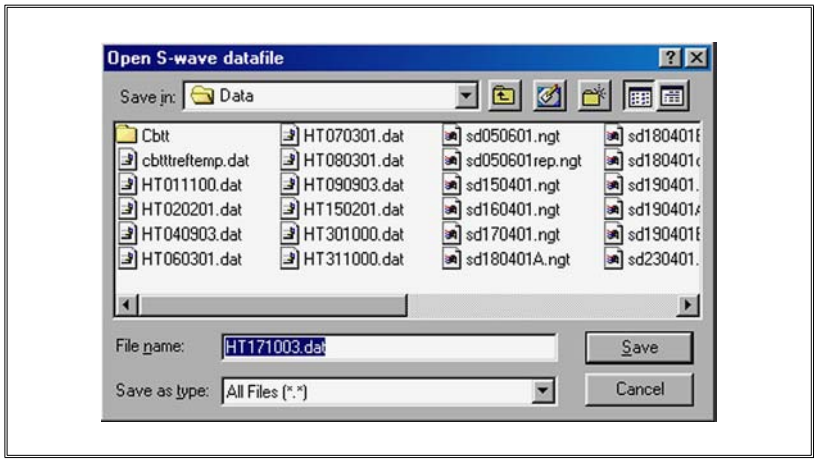
A. To log with the HTT tool, start HiTemp.exe. This will open HiTemp DAS2.vi, shown below:

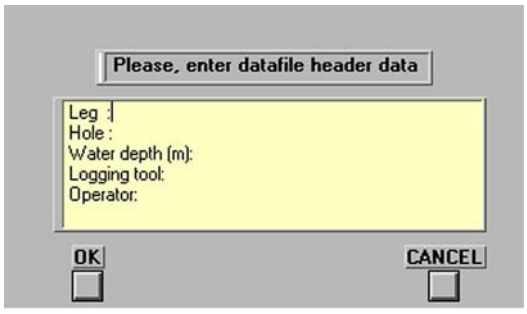


B. Make sure the "Start" button is ON.

C. Make sure the "Run" button is OFF and that Schlumberger turns on the depth module in the MCM. (The "Run" button controls whether the program uses simulated depth data - ON - or waits for real depth data from the Schlumberger depth system - OFF.)

D. Click the run arrow at top left to start the program. When prompted, select an appropriate datafile name and enter header info:





E. When the 'Record' button is green, data will be logged to disk. When it is black, data is not logged. This data file should appear in C:\Data. The program records data every 15 cm with a high (higher time constant) and a low (lower time constant) thermistor. Note: For temperatures up to approximately 100 °C use the data from T_{low} and after surpassing the 100 °C mark use the data from T_{high}. (See Appendix C.)

F. When you are finished, click the "Start" button. (Yes, really.)

Troubleshooting

If the following error box appears, the software is trying to access depth data on serial port COM3, but COM3 doesn't exist. Make sure the computer has a COM3 port and that it isn't being used by something else. Unfortunately, the software doesn't allow this to be changed.

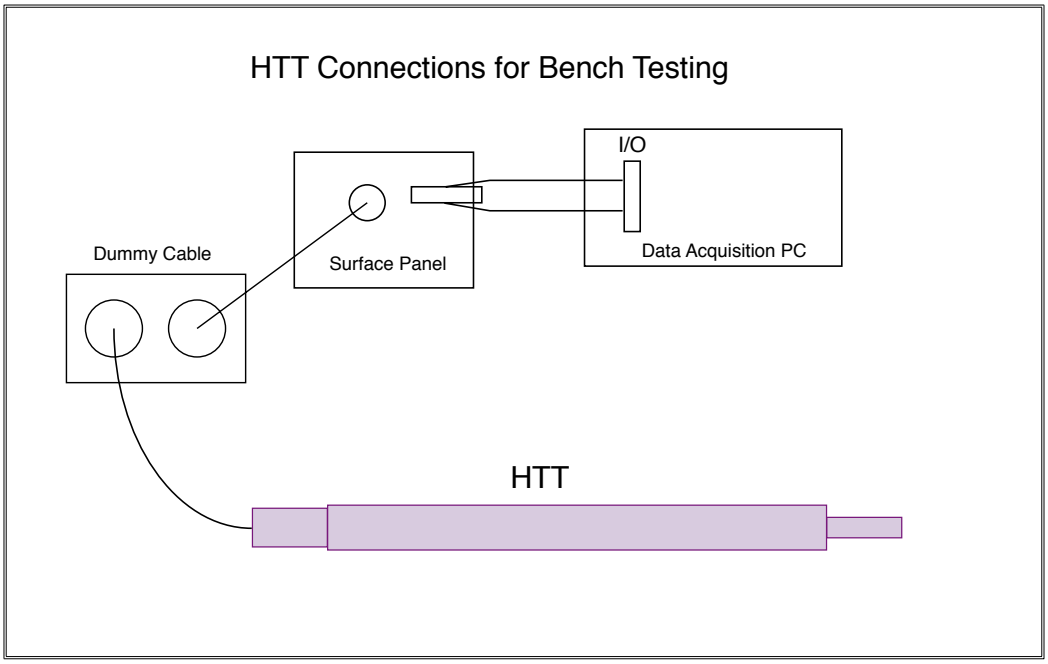
Section IV

Bench Testing

To test the tool in its fully assembled state (inside the pressure casing), follow the procedure below.

Connections:

To bench test the HTT, connect as shown in the following figure:



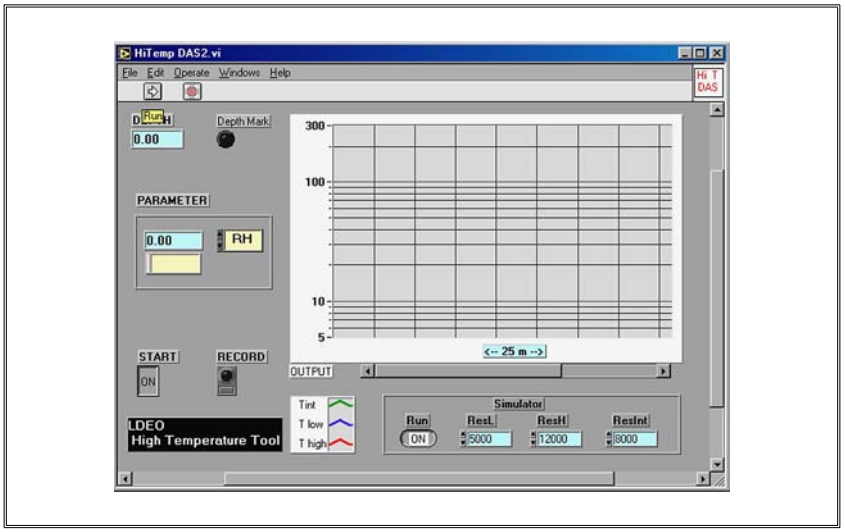
B. Connect the surface panel to the DAS PC (as described previously in Section III).

C. Connect the surface panel to the dummy cable box.

D. Connect the dummy cable box to the HTT.

Software:

To test the HTT tool, start the normal logging program – HiTemp.exe. This will open HiTemp DAS2.vi, shown below:



Notes:

- To use simulated depth data, rather than waiting for real depth data from the Schlumberger depth system, set the "Run" button to ON. (Although this control is in the same box as ResL, ResH, ResInt, its function is unrelated.)
- You will have to select a datafile name and header info, but these are unimportant when bench testing.
- When you are finished, click the "Start" button to stop. (Yes, really.)

Testing the Surface Panel Alone:

The HiTemp program allows you to test the surface panel electronics alone (i.e. without involving the actual tool at all). It does this by sending signals out from the Digital I/O card that simulate the signals that would be coming in from a properly functioning tool. The "Test/Work" switch on the front of the surface panel selects whether the surface panel processes the simulated signals or the real signals from the tool.

To test the surface panel, set the "Test/Work" switch on the surface panel to "Test" and run HiTemp.exe. The program should show steady values for TH, TL, and Ti. The values entered into

ResL, ResH, and ResInt (bottom right on screen) determine the simulated temperature signals. For the thermistor coefficients in use at 2004-06-09, the corresponding temperatures are:

ResL = 5000	⇒	TL = 90.90 C
ResH = 12000	⇒	TH = 106.79 C
ResINT = 8000	⇒	Ti = 73.17 C

Testing the HTT Tool:

To test the whole tool setup, set the "Test/Work" switch on the surface panel to "Work" and run HiTemp. The program should show sensible values for TH, TL, and Ti.

If the tool has been inside for more than 10 minutes or so, TL should show room temperature. Apply some heat to the sensor tip. TH and TL should change, but Ti should not.

Section V

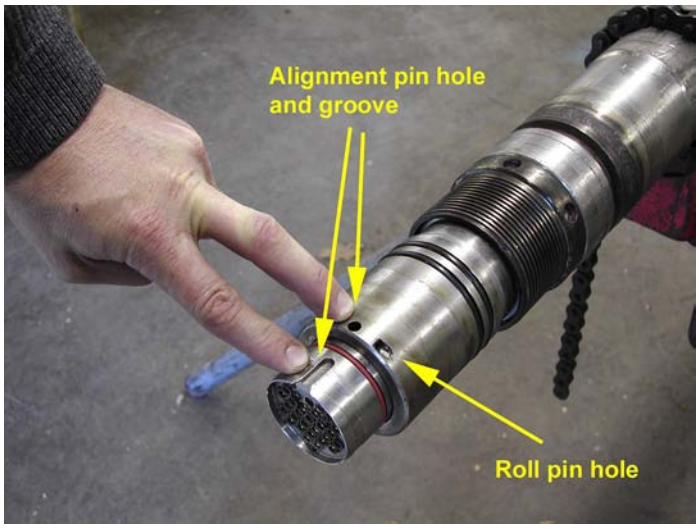
Tool Disassembly

The inside of the HTT is comprised of a small PC board, a dewar in which the PC board is housed, a thermistor, and supporting wires. These components are all solid state and do not require servicing. In the unlikely event that it becomes necessary to service or repair the HTT, the inside chassis of the tool must be removed. The chassis is fragile and is difficult to reassemble without breaking wires; therefore, this procedure should only be completed if the tool has failed electronically or mechanically. In the past, failures have occurred by not setting the wireline patch panel correctly, which created an over-voltage situation that destroyed the electronics.

In the event that the tool must be disassembled and/or reassembled, the procedures described in this section must be adhered to in the prescribed sequence or certain tool damage will occur.

The internal chassis is comprised of an upper and lower section. The upper section is removed through the top of the tool, and the lower section is removed through the bottom of the tool.

A. Begin by locating the upper end of the HTT housing:



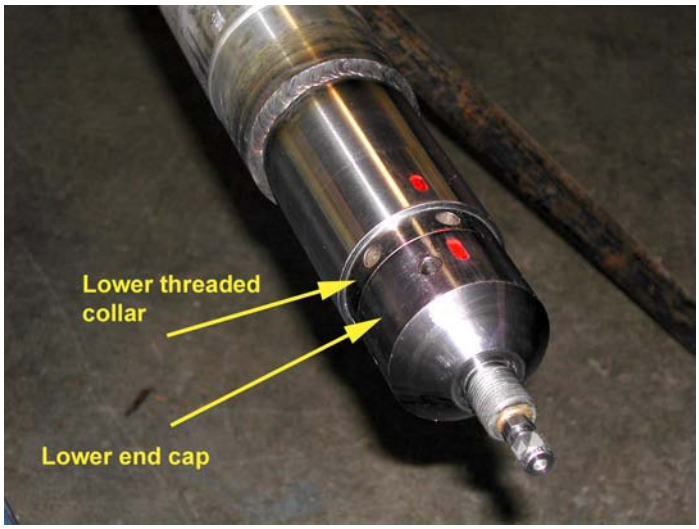
The upper chassis, which is simply a through-wired chassis, is removed by pulling it through the upper end of the housing. To release the upper chassis from the housing, drive the roll pin out of the roll pin hole using the correct role pin punch and remove the alignment pin from the alignment pin hole. Note the alignment groove in the upper chassis.

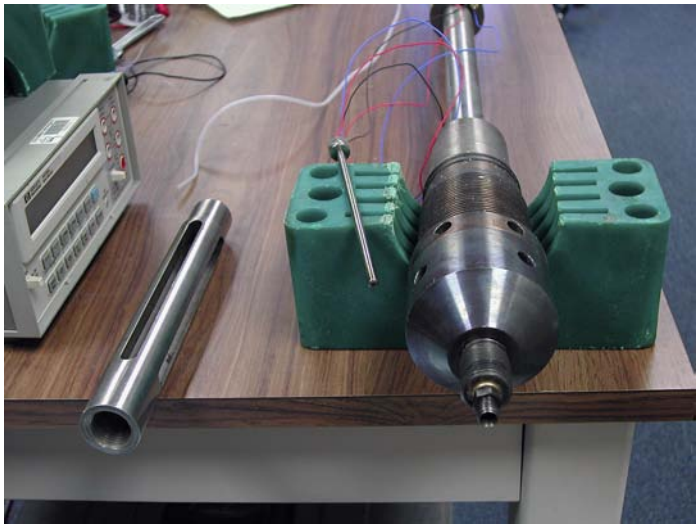
Now simply pull the upper chassis straight out. **Do not rotate** the upper chassis.

B. Next, locate the lower end of the HTT housing. The lower chassis, which contains the electronics, is pulled into the housing via a bronze threaded collar:

Below is a picture of the lower housing with the lower chassis attached. To remove the lower chassis, use a pin spanner wrench to loosen the threaded collar at the lower end of the HTT housing. The collar is located between the housing and lower end cap, which are both indicated with red alignment grooves.

When removing the lower threaded collar, it is very import to spin **only** the threaded collar. Make sure the red index marks remain aligned while removing the chassis or the wires at the top of this section will be ripped off.





The lower chassis and associated parts.

Section VI

Servicing the PC Board

Servicing of the PC board should only be attempted if the tool has failed. All components within the tool are solid state and thus do not require routine servicing. Most electronic problems can be avoided by ensuring proper connections to the tool.

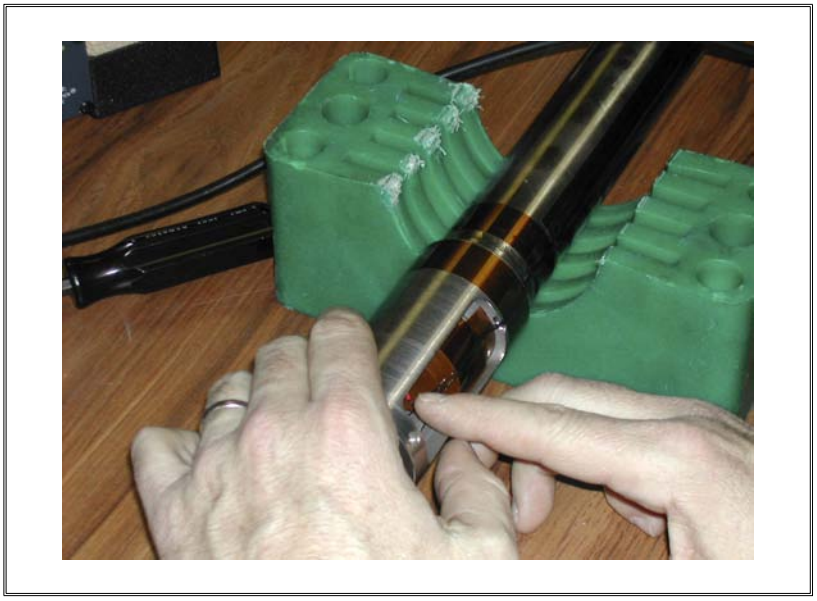
To service the PC board:

A. Lay out the lower chassis on a sturdy bench and remove the three screws that hold the upper vespel connector:

B. Unsolder the conductors from the connectors (see figure, next page):

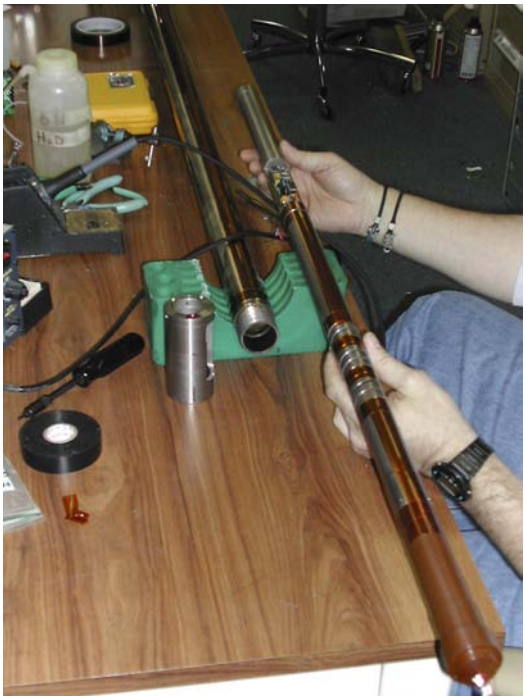
C. Remove the tape that is on the conductors and unsolder the wires:

D. Pull back the three black wires:

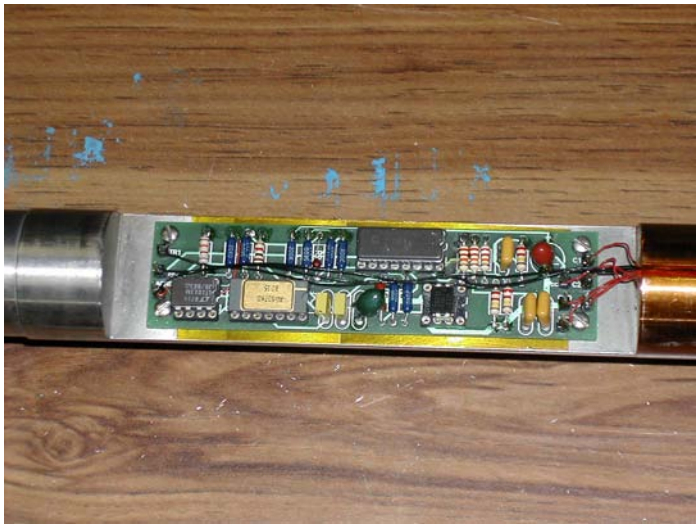


E. Now unscrew the upper connector holder. This should be a two person operation, ideally. Use a pin wrench on the lower portion of the tool and a standard wrench on the upper connector holder. **Do not use a wrench on the chassis body.** There are two small drops of Loctite 242 to keep the connector from easily spinning, so you will need to break that seal when unscrewing the upper connector:

F. Pull the vespel connector straight out. The entire internal chassis is connected to the vespel connector:



G. Remove the PC board by unscrewing the four screws and unsoldering the wires. Install the new board and re-solder each wire as before:



Section VII

Testing the Thermistor

A. Pull the chassis out of the tool, as described in the previous section.

B. Unsolder the wires on the wire posts at the lower end of the chassis to make sure there is no influence by the PC board.

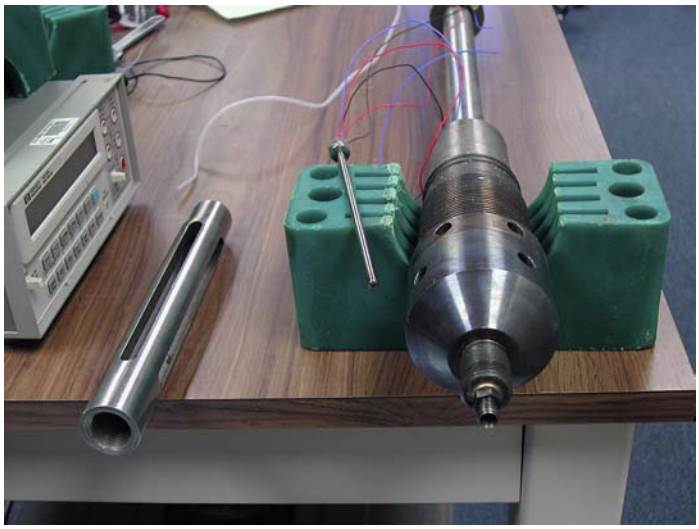
C. Using a multimeter attach the leads to the following wires:

Black is common
Red is for higher temperature
Blue is for lower temperature

You should get readings in the following ranges:

Black to Blue: Approx 70K ohm ± 50K
Black to Red: Approx 300K ohm ± 100K

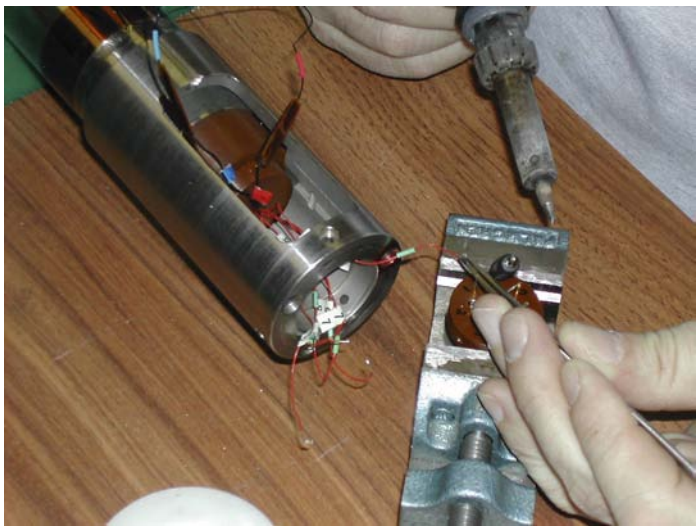
D. The thermistor can now easily be changed by unscrewing the retaining nut and then pulling the thermistor out. To install a new thermistor, feed the wires into the center hole. It may be easier to feed a fishing wire from the upper end of the hole through the lower opening, and then pull the wires in (see figure below).



Section VIII

Tool Reassembly

A. First solder the three black wires to the connector wires and tape them with Kapton to prevent them from shorting out:



B. Re-solder the seven wires to the upper vespel connector. The vespel disk has 8 pins. Although it is unlikely you will need the following information, here is the convention for wiring logging tool connections:

1=brown wire
2=red wire
3=orange wire
4=yellow wire
5=green wire
6=blue wire
7=violet wire
8=black (armor, this corresponds to #10 on the Schlumberger connector)

C. Insert the upper vespel connector into the lower HTT section. Make sure the #1 pin is aligned with the red mark on the top of the chassis.

D. Insert the three retaining screws and make sure you do not overtighten. Remember, you are putting these screws into plastic!

E. Now tape the exposed threads at the top of the chassis to prevent wire chaffing. Then place the 3 black wires in the top groove and tape them down:

F. Now tuck the wires neatly in the connector and tape them down.

Appendix A

PC Board Installation

The HTT tool requires a digital I/O card (a National Instruments PCI-6601) to be installed in the DAS PC. The following are instructions for installing the card:

A. Make sure that National Instruments Labview, NI-DAQ, and Measurement and Automation Explorer are installed. If not, install them from the Labview CDs. This must be done *before* plugging the card in or the wrong drivers might get installed.

B. Take the computer off the rack by sliding it forward. You may have to disconnect some of the cables from the back - avoid this if possible - but if it becomes necessary, make sure that they are clearly labeled so they can be properly connected after you are done. Also, you may not have to completely take the computer off the rack as you may have enough space to maneuver once you have enough slack from the cables.

C. Remove ONLY the top screws that are located at both sides of the computer case. The bottom screws will hold the computer components in place.

D. Slide the top panel towards the back.

E. Remove the hold-down bar that runs across the tops of the boards.

F. Install the PC board in any open PCI slot in the Industrial PC.

G. Turn the computer on. You will probably see the "found new hardware" wizard. If so, accept its default choices.

H. Check for potential conflicts with the network card by doing the following:

   i) Select the "Measurement and Automation" icon in the National Instruments Program Folder
   ii) Click on "Devices and Interfaces"

iii) You should see "PCI-6601"
iv) If you do not see "PCI-6601," turn the computer off and disconnect the network card
v) If you do see "PCI-6601" then right click (right mouse button) on the icon and select "Properties"
vi) Click on "Test Resources." It will tell you if the card is working properly.
vii) Alternatively, open the Control Panel in Windows, select "System," then "Device Manager", and look under "Data Acquisition Devices" for the PCI-6601 card.

Appendix B

Software Installation

The HTT software should already be installed on the data acquisition PC. The following procedure should be undertaken only if there is a need for installing data acquisition software for the HTT.

A. Insert the software floppy and select *setup.exe* from the floppy.

B. Click on "Finish" to finalize installation after the setup is finished.

C. Ignore Labview run time engine by clicking on "Cancel" button and place the HTT application icon on the desktop.

D. Shut down and restart the computer and click "Cancel" when the computer asks for password.

E. Go to the program folder where the Hi-Temp applications are stored.

F. Open the folder, make a copy of the file *hitemp.cfg*, and place the copy in the root directory of the C drive (C:\hitemp.cfg). [The file *hitemp.cfg* contains the thermistor coefficients. These coefficients need to be changed only if there is a need to change the thermistor.]

Appendix C

Calibration Data

Cold Side Calibration Constants	
R0	100.470
Alpha	0.0038675
Delta	1.3953
Beta	0.1110
Proportional Band	5.0

Test Data: Cold Side

Set-point °C	Actual °C	Error °C	Calibration Tolerance	Pass/Fail
-8.00	-7.98	0.02	±0.20	P
0.00	0.00	0.00	±0.20	P
25.00	25.00	0.00	±0.20	P
50.00	49.98	-0.02	±0.20	P
75.00	75.01	0.01	±0.20	P
100.00	100.00	0.00	±0.20	P
110.00	110.03	0.03	±0.20	P

Hot Side Calibration Constants	
R0	100.813
Alpha	0.0038397
Delta	1.5202
Proportional Band	4.0

Test Data: Hot Side

Set-point °C	Actual °C	Error °C	Calibration Tolerance	Pass/Fail
50.00	50.14	0.14	±0.60	P
100.00	99.97	-0.03	±0.60	P
150.00	149.96	-0.04	±0.60	P
200.00	200.01	0.01	±0.60	P
250.00	250.01	0.01	±0.60	P
300.00	300.05	0.05	±0.60	P
350.00	350.00	0.00	±0.60	P

HTT Calibration Report Generated 24 February 2004

TempH	TempL	Calibrator
0.00	0.43	0.00
-0.01	0.43	0.01
0.00	0.43	0.00
0.01	0.43	0.00
0.01	0.43	0.00
0.00	0.43	0.00
0.01	0.43	0.00
0.03	0.43	0.00
0.00	0.43	0.00

TempH	TempL	Calibrator
0.01	0.43	0.01
25.10	25.48	24.99
25.10	25.48	24.99
25.11	25.48	24.99
25.11	25.48	24.99
25.10	25.48	24.99
25.10	25.48	24.98
25.10	25.48	25.00
25.10	25.48	25.00
25.10	25.48	25.00
25.11	25.48	25.00
50.16	50.49	50.00
50.15	50.50	50.00
50.15	50.49	50.00
50.15	50.49	50.00
50.15	50.49	50.00
50.15	50.49	50.00
50.15	50.49	50.00
50.15	50.50	50.00
50.15	50.49	50.00
50.15	50.49	50.00
75.16	75.43	75.00
75.15	75.43	75.00
75.15	75.43	75.01
75.15	75.43	75.01
75.16	75.43	75.00
75.15	75.43	75.01
75.15	75.43	75.01
75.15	75.43	75.00
75.15	75.44	75.00
75.15	75.43	75.01
99.56	99.35	100.01
99.56	99.34	100.01
99.56	99.34	100.01
99.56	99.35	100.00
99.56	99.35	100.00
99.56	99.34	100.01

TempH	TempL	Calibrator
99.57	99.34	100.01
99.57	99.34	100.00
99.57	99.35	100.00
99.57	99.36	100.00
149.12	148.59	150.01
149.12	148.62	150.00
149.11	148.59	149.99
149.11	148.59	149.99
149.12	148.58	149.99
149.11	148.58	149.99
149.12	148.61	149.99
149.11	148.59	149.99
149.11	148.58	149.99
149.10	148.59	149.99
198.79	197.93	199.98
198.76	197.85	199.99
198.79	197.90	199.98
198.77	197.87	199.98
198.78	197.97	199.99
198.80	198.00	200.00
198.75	197.88	200.00
198.79	197.91	200.00
198.77	197.84	200.01
198.77	197.94	200.01
248.36	246.67	250.03
248.33	246.74	250.03
248.39	246.57	250.03
248.33	246.68	250.03
248.39	246.65	250.02
248.30	246.40	250.02
248.39	246.75	250.02
248.37	246.59	250.02
248.34	246.61	250.02
248.41	246.95	250.02

HTT Calibration Report Generated 8 June 2004

TempH	TempL	Calibrator
-	48.36	50
99.92	96.6	100
149.7	144.85	150
199.65	193.15	200
249.33	240.62	250