TECHNICAL NOTE 2

Tuning a Model 183150 CTA Module

TSI strives to ship Thermal Anemometry systems that are ready to use by our customers. There are occasions when the system should be shipped back to TSI for service. This occurs when an additional channel is added to an IFA300, when channel boards are moved from one IFA300 to another, when a channel oscillates, or when channel boards are moved from one IFA300 slot to another. If the hardware cannot be shipped back to TSI/Shoreview, then the users will have no choice but to perform tuning of the system on their own. This is done on a channel by channel basis, using a reference flow, as described in this document.

Equipment needed:
Oscilloscope
Digital voltmeter
Steady reference flow at 80 ~ 90m/s
Screw Drivers
Pliers
Soldering iron

S e t u p - I F A

Set up the IFA300 as usual. Attach the probe and cable that you plan to use to take data, to the flow device, connected to the IFA300 channel that you will be tuning. A TSI calibrator would be a great choice for flow device. Use 80m/s velocity for wire sensors and 90m/s for film sensors. Connect a digital voltmeter and oscilloscope to the "Output Voltage" connector of the IFA300.

We will be adjusting one inductor for each sensor type and cable length, as shown in Fig. 1. If stability is not achieved an additional resistor will need to be adjusted, as shown in Fig. 2. The IFA system was designed with the intent of having one sensor type & cable length always used with the same channel. If that is done, the CTA board can be tuned specifically for that particular sensor type. If that is <u>not</u> done, and different sensor types & cable lengths are used on the same channel, then tuning becomes a compromise among all the sensor types & cable lengths.
We have a film or wire sensor, and 5m or 30m cable. These four cases will be called:

A. Wire Sensor, 5m Cable
B. Film Sensor, 5m Cable
C. Wire Sensor, 30m Cable
D. Film Sensor, 30m Cable

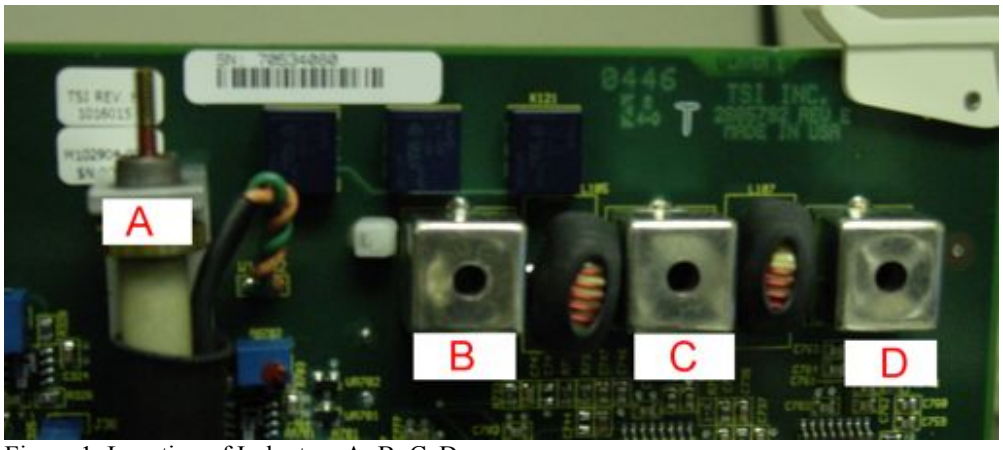

Figure 1. Location of Inductors A, B, C, D

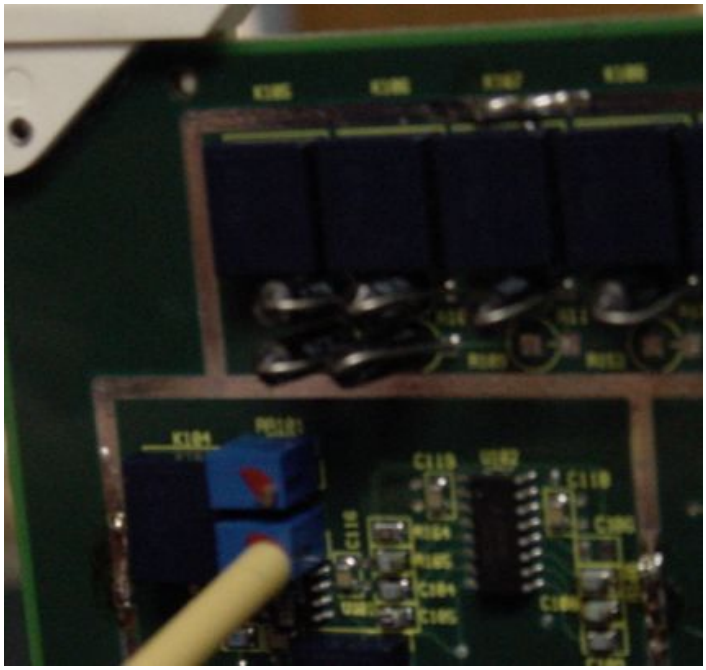

Figure 2. Location of additional tuning resistor, the lower one with the yellow driver in it. This is covered by a metal shield, which has to be removed.

Notice that every inductor is locked in place with red locking compound. This prevents adjustments going off during shipment. Please be aware that extreme care and caution must be taken when breaking these adjustments loose the first time, or you will break the inductor or resistor. You may want to scrape as much of the red locking compound off with a sharp detail knife. Another useful hint is to use pliers on inductor A. Inductors B, C, and D should be accessed with a screw-driver from both sides to break them loose. See Figure 3 for the location. The IFA300 has 8 slots. Slot 8 is closest to the power supply. Slots 1~4 require less tuning than slots 5~8, so please use the lower number slots whenever possible.

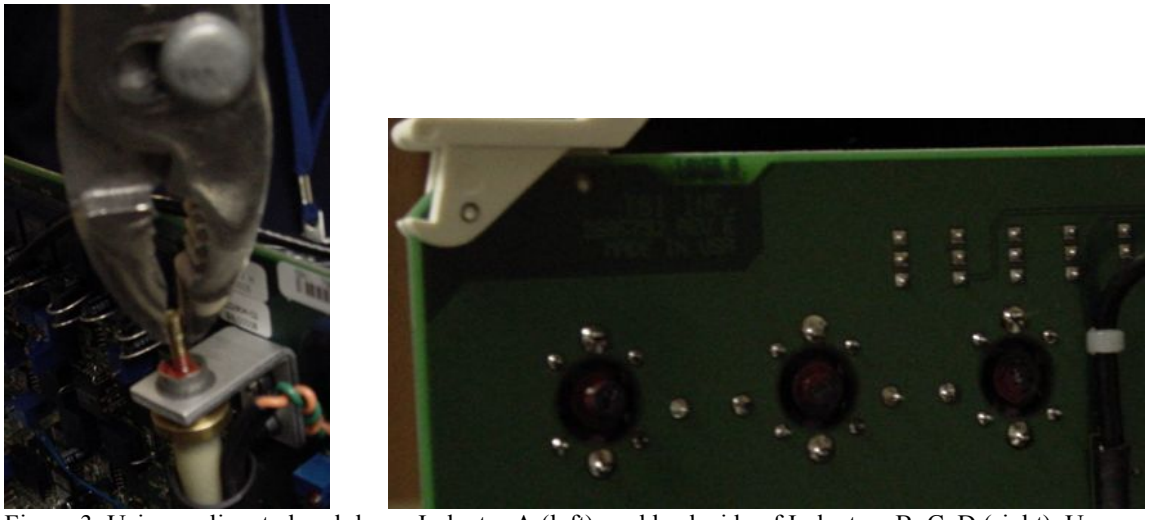

Figure 3. Using a pliers to break loose Inductor A (left), and back side of Inductors B, C, D (right). Use a screwdriver from both sides to break these loose.

Setup - ThermalPro

Start ThermalPro, then click IFA300 → Communications screen. Click the "up" then "down" arrow on these settings: Channel, Offset, Gain. Notice the display area shows confirmation that the settings were applied. Select the sensor type. Set the cable resistance, or you can measure it using the button in the lower right. See the ThermalPro manual for more details. Click the "up" then "down" arrow on Cable Length or select the correct one. Clicking the "up" then "down" arrow resets that parameter. This has to be done for all the parameters initially, and also again if the IFA is switched off during the tuning procedure.

Now select "Probe Res" in the lower right corner. The display window will show a number, like 5.82. Multiply this number by 1.8 (Wire Sensor) or 1.5 (Film Sensor). Enter the result in "Operate Res" field. Change the "System" selector from "Stby" to "Run" and click "Yes" to the following warning msg. Now the IFA300 is activated, the bridge is on, and you are measuring the velocity. The output voltage should be ~1.65V DC.

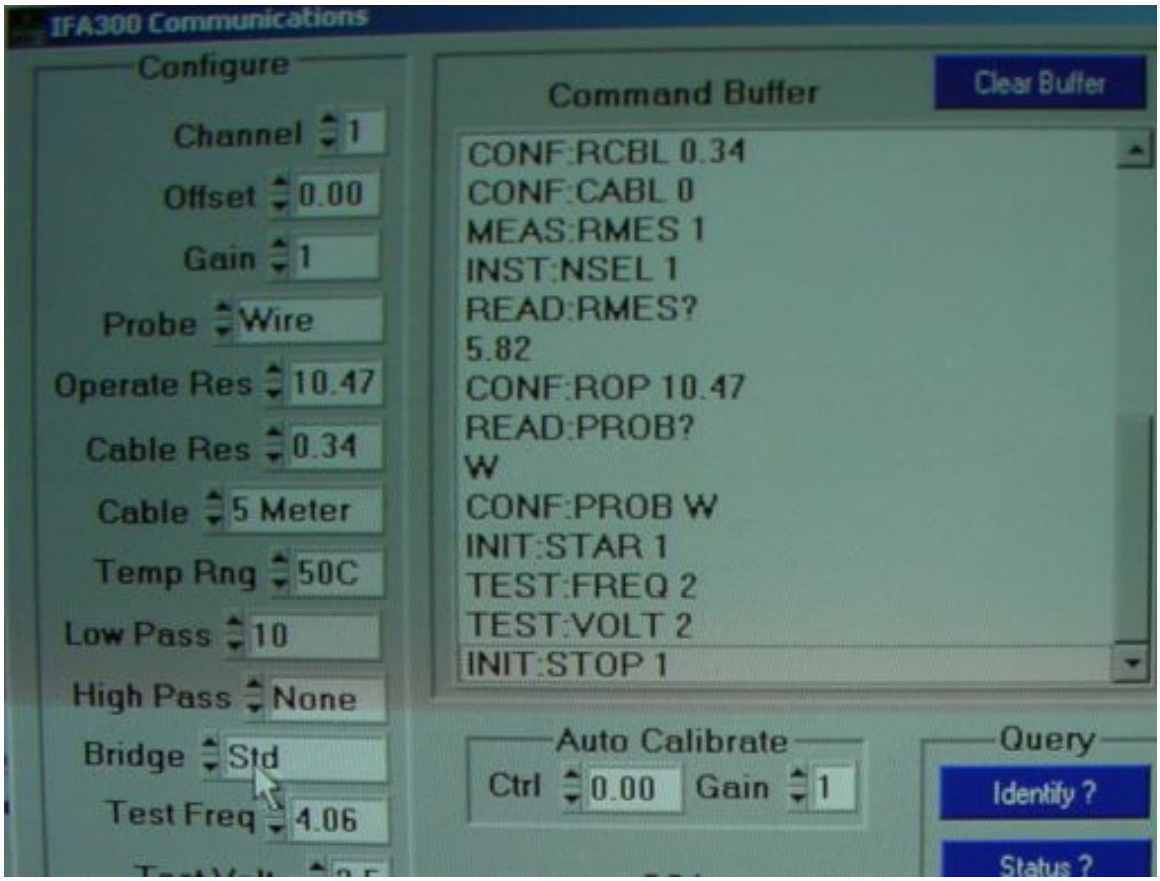

Figure 4. ThermalPro Communications screen.

Now set "Test Freq" to 4.06, and "Test Volts" to 2.5. Next you will observe the oscilloscope screen and perform tuning, if needed.

Tuning and Evaluation

Now observe the signal trace on an oscilloscope and adjust the appropriate Inductor to achieve the shortest pulse duration with the least amount of secondary oscillation or "ringing." This is a trade-off. The lowest

level of ringing will require wide and slow pulse duration. Conversely, a narrower and faster pulse time with high frequency response will cause higher level of ringing.
Set the scope to 50mV/div and 5us per div. The figures below show examples of oscilloscope traces and indicate what parameters to observe, for a wire sensor.

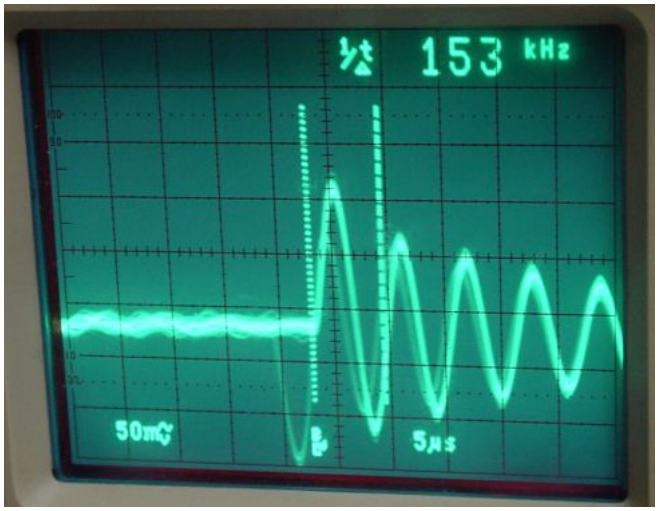

Figure 5. Signal from a wire sensor with very large amount of oscillation.

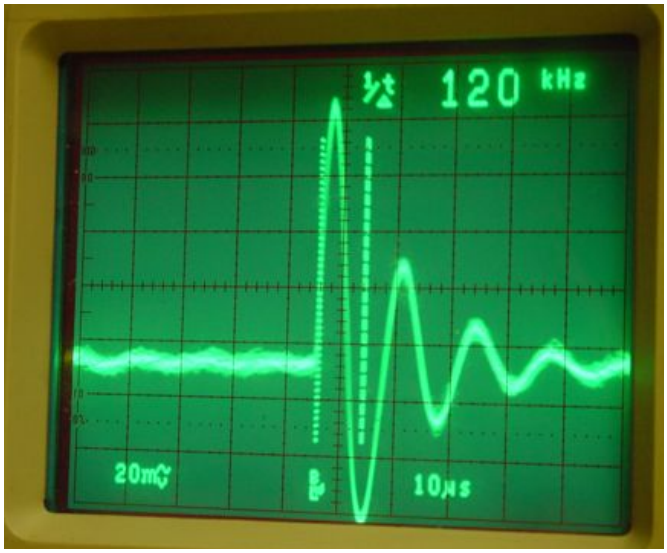

Figure 6. Signal from a wire sensor with unacceptable amount of oscillation.

Figure 7. Signal from a wire sensor with very acceptable oscillation.

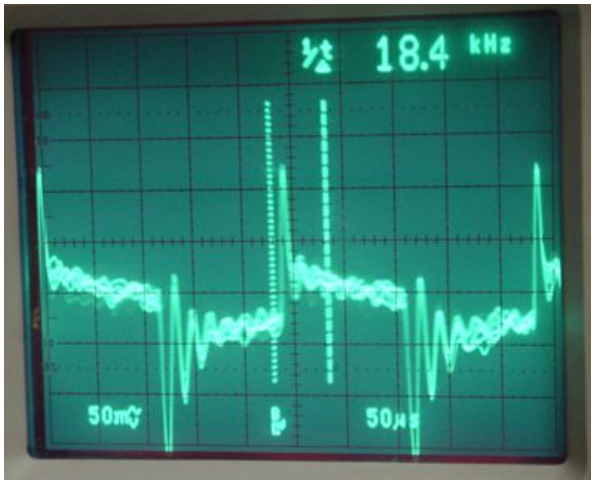

Figure 8. Signal from a film sensor, but time base is too long (50us). Please reduce the time base to 5us.

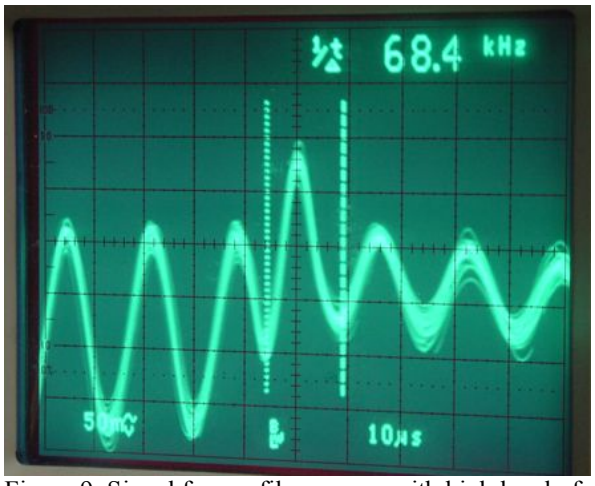

Figure 9. Signal from a film sensor, with high level of oscillation.

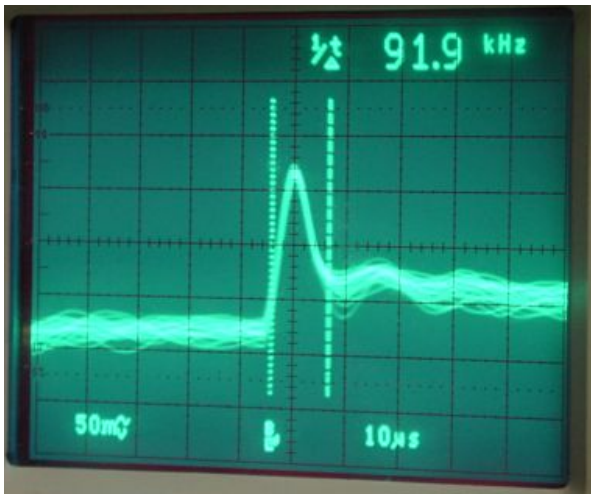

Figure 10. Signal from a film sensor, with acceptable oscillation.

C l o s i n g

When tuning is complete, set the "System" selector at the bottom of the ThermalPro Communications screen to "Stby." Now move to the next channel. Be sure to update all the related fields in the ThermalPro Communications screen, such as "Probe," "Operate Res," and "Test Freq."