



CONNECTION TECHNOLOGY CENTER, INC.

LEVEL 3 – LESSON 1

PRACTICAL TIPS FOR IDENTIFYING AND TROUBLESHOOTING PORTABLE MEASUREMENT CABLES FOR VIBRATION ANALYSIS



INTRODUCTION

Welcome to **Level 3, Lesson 1** of CTC's free online vibration analysis training. We're glad you have taken the time to view this self-paced lesson on identifying and troubleshooting portable measurement cables for vibration analysis. We hope you enjoy the training and will continue to build your vibration analysis knowledge as you progress through Level 3.

'Practical Tips for Identifying and Troubleshooting Portable Measurement Cables for Vibration Analysis' is created and presented by CTC for complimentary educational use only. This training presentation may not be edited or used for any other purposes without express written consent from CTC.

Thanks to Joe Dominick of Weirton Steel and Bob Simpson of VibraNostics for this technical information and field data.



OBJECTIVES

Troubleshooting vibration analysis hardware is an important tool in the vibration analysts' toolbox.

Knowing what to look for and how to isolate the problem with vibration analysis cables contributes to the prevention of other problems in the future.

This lesson focuses on cabling problems in portable systems.

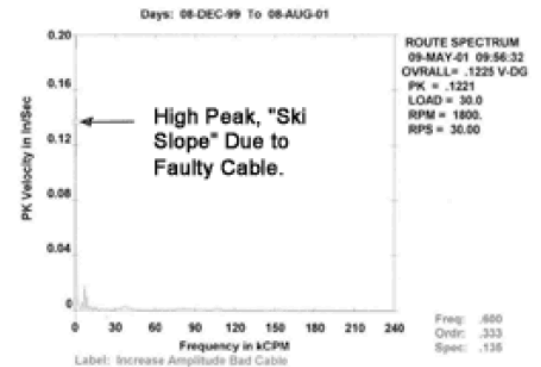
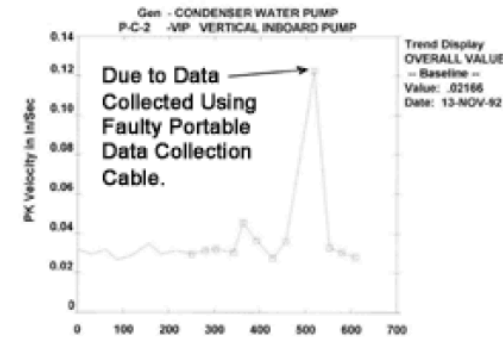


HARDWARE PROBLEMS

Problems with vibration analysis hardware can be very frustrating.

Some examples of typical issues are:

- ❑ Collecting measurement points all day, and downloading the information only to find that the data cannot be used
- ❑ Downloading the data into a database and not being able to remove the measurement point because of a suspect reading (see diagram)
- ❑ Trying to collect data with one cable while the system is showing erroneous readings with the spare cable miles away



This training will provide tips and insights into what could be wrong with your cabling and how to correct the problem.

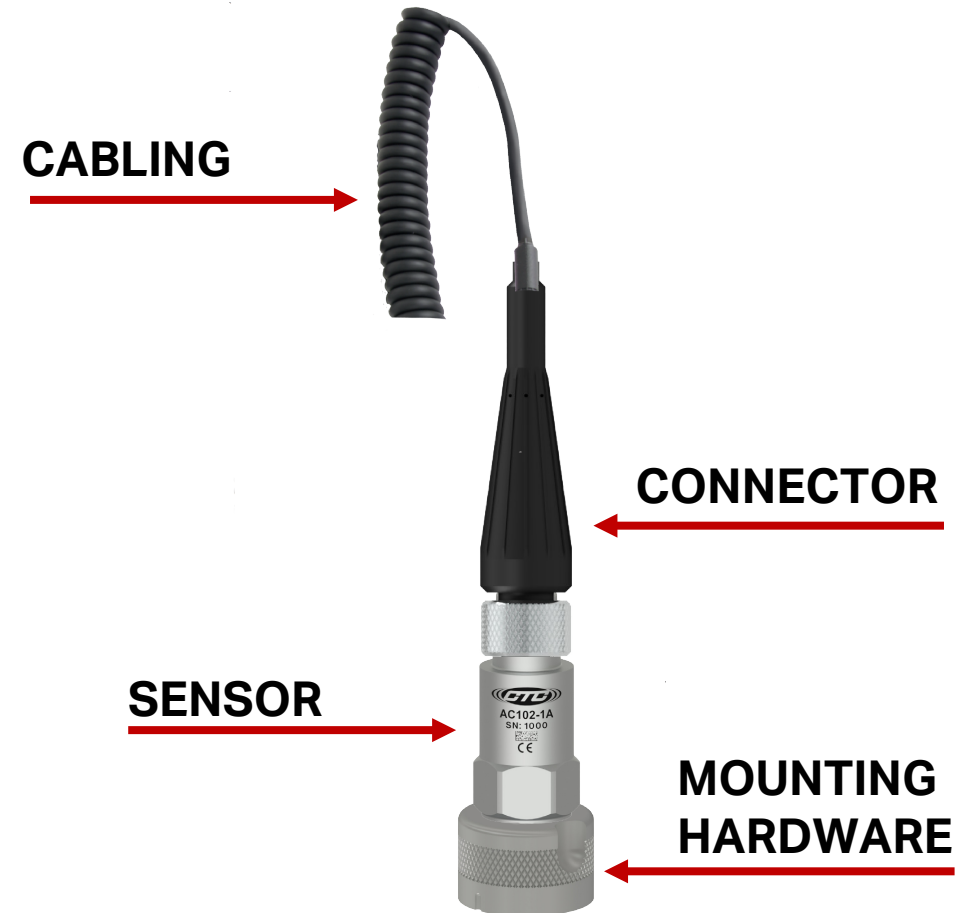


PORTABLE DATA CABLES

The **cabling** provides the path for the accelerometer output to the data collector.

It is also the path for powering the accelerometer.

Connectors attach the cable from the accelerometer to the data collector or a junction box.



TROUBLESHOOTING TIPS / TECHNIQUES

Here are some troubleshooting tips on how to determine where to start and what to look for, as well as some corrective actions / solutions and tips on how to extend cable life.

Identify the problem using **Fault ID / visual inspection** of the cables:

It is very important to understand what the problem is, and to identify what exactly the fault is.

A few **questions to consider**:

- What types of error(s)** are being observed?
- Are there any nicks, cuts, scratches, or burn marks** anywhere on the cable?
- Is there any corrosion** on the connector sockets?



TROUBLESHOOTING CHART

The **troubleshooting chart** on the following pages was developed to help an analyst determine a fault by matching the situation to what is being observed in the field.

Note: **You will see the importance of using both the spectrum and the time waveform to help understand the full picture.**



TROUBLESHOOTING CHART

SITUATION	CAUSE(S)	CORRECTIVE ACTIONS	NOTES / REMARKS
Normal operation (Baseline, reference)	N/A	N/A	Taken from a HP Feed Water Pump, 50 Hz.
Sensor not present	Problem with electronics of accelerometer or cable not attached to sensor.	Check cable for continuity and ensure cable is attached to sensor. If yes, suspect sensor and contact manufacturer.	Data collectors will not collect data if a sensor cannot be detected.
High peak reading / ski slope	Cut / burnt outer jacket of cable. Loose internal solder joint in connector. Broken / damaged insert of accelerometer connector.	If it is a loose connector or broken insert, repairing the cable by replacing the damaged end may be the only required action. For damaged cable, entire cable must be replaced.	Ski slope can vary in degree. Note: other possible causes could be accelerometer shock / overload if a magnet mount is being used and not enough time was allowed for the sensor to stabilize.



TROUBLESHOOTING CHART

SITUATION	CAUSE(S)	CORRECTIVE ACTIONS	NOTES / REMARKS
Flat frequency response	Flat frequency response is due to the extreme scaling of the data due to the ski slope effect. Same causes as high Peak reading / ski slope apply here.	If it is a loose connector or broken insert, repairing the cable by replacing the damaged end may be the only required action. For damaged cable, entire cable must be replaced.	Due to the resolution of the graph to due to the high ski slope, it appears that there is no higher frequency influences, they are still there, they just can't be resolved due to the auto ranging of the data collector.
High overall readings	The high overall readings can be attributed to a damaged or loose connector or damaged cable.	If it is a loose connector or broken insert, repairing the cable by replacing the damaged end may be the only required action. For damaged cable, entire cable must be replaced.	See notes section from high peak reading / ski slope and / or flat frequency response, if applicable.
Fluctuation observed in overall readings	Damaged or loose connector or damaged cable.	Repair or replace connector(s) or entire cable assembly.	Indication of cable problem, of which time waveform or spectrum data (below) would indicate if not caught prior to storing data.



TROUBLESHOOTING CHART

SITUATION	CAUSE(S)	CORRECTIVE ACTIONS	NOTES / REMARKS
High single-point trend observed during trend analysis	Faulty cable (damaged connector insert) caused false high vibration reading that was still under the set alarm limits of the analyst.	If you suspect a problem, re-take the measurement point, or observe for any increase in vibration amplitude by using the real-time function of the data collector, if available. If you are still experiencing a problem, or if is at a higher rate, repair or replace the cable.	Because it was under the set alarm limits, the analyst was not alerted that it could have been a problem, so the data was stored. Upon the following reading, (after the cable has been replaced) the data went back to 'normal.'



FURTHER EXPLANATION OF CAUSES

CONNECTOR PROBLEMS

- ❑ A broken connector insert is very common for two socket connectors using a hard plastic isolation insert. Constant handling of cables and sensors weakens the inserts, leading to cracks or inserts completely falling out. Once the insert is damaged or gone, interference can show on either of the pins from the accelerometer, causing very high overall readings and suspect data.
- ❑ Looseness in solder joints are harder to pinpoint. The indicator is generally the presence of erratic or intermittent readings while moving the cable or wire. Since the solder joints for some connectors are potted with adhesive, the solder joint cannot be observed or reviewed without destroying the connector.



FURTHER EXPLANATION OF CAUSES

DAMAGED CABLE

- ❑ Cut or burnt cable causes the shielding of the cable to become exposed, and could cut or burn one of the twisted-shielded pair of wires inside the cable. This in turn causes contamination of the signal, which can cause fluctuations of the signal observed by the data collector. These fluctuations commonly create the ski-slope effect seen in spectrums.



EXTENDING CABLE LIFE – TIPS ON PREPARING FOR CABLE FAULTS

Corrective actions / solutions for problem cables in the field almost invariably comes down to repairing or replacing the cable.

The following are some factors and tips on extending the life of any cable assembly.



EXTENDING CABLE LIFE – TIPS ON PREPARING FOR CABLE FAULTS

HAVE SPARE CABLES ON HAND

- Ensure you have some spare cables on hand in order to switch out cables that may be faulty or failing, and for troubleshooting purposes

MAINTENANCE / INSPECTION OF CABLE AND CONNECTORS

- Keep the condition of the cable assemblies free of dirt, oils, greases, or other types of contaminant build up
- Clean out connector contacts and ensure contacts / pins are not showing signs of corrosion
- Ensure connectors are not damaged or inserts are not cracked periodically prior to use
- Ensure cables are not cut, nicked, or burnt
- Ensure elongation of coiled cables is also kept to a minimum



EXTENDING CABLE LIFE – TIPS ON PREPARING FOR CABLE FAULTS

CARE DURING USE

- Take care not to have cables lay on or near hot surfaces, such as steam pipes or hot equipment with surface temperature $>250^{\circ}$ (temperature rating of the cable)
- Note: if data will be collected around hot equipment, contact your supplier for a special high temperature cable assembly

CABLE MANUFACTURER WARRANTY

- The manufacturers' warranty is important in ensuring that a good cable is used during data collection
- A lifetime warranty cable will protect you from having to purchase a repair or replacement if your cable begins to fail
- Choose a manufacturer that has high quality cables that are built for extended life and that have a warranty to back them up, like CTC's cables



EXTENDING CABLE LIFE – TIPS ON PREPARING FOR CABLE FAULTS

PROACTIVE CONNECTOR DEVELOPMENT

- ❑ Proper strain relief and connector reinforcements are very important to the extension of the cable life. Custom strain reliefs for connectors are available that relieve the stresses on the solder joints of the connector and the cable. Filling the rear cavity of a connector with an adhesive helps structurally reinforce the connectors, preventing exposure to the environment and potential damage.
- ❑ Material changes are also important to consider. To help alleviate problems with broken two socket inserts, a soft neoprene isolation material (insert) can be used instead of the hard plastic isolation material that cracks and breaks easily.



CONCLUSION

The condition of your cabling has a direct impact on the quality of the data collected. Many false alarms and / or time spent trying to track down a machine fault that really isn't there can be avoided if you know what to look for when observing data that seems out of the ordinary. A good first step to any problem or observed inconsistency is to isolate the problem and start looking at possible causes and solutions.

TYPICAL OBSERVED DATA

- High overall vibrations for measurements
- Significant changes in recorded vibration
- 'Ski Sloping' of data in the spectrum at points < 1 Hz (60 CPM) and / or intermittent signals as indicated by the data collector

TYPICAL CAUSES

- Damaged cable (burnt or cut cable)
- Damaged connector (2 socket isolation material / insert)
- Looseness of solder joints

TYPICAL SOLUTIONS

- Repair or replace the cables



SUMMARY

Thank you for taking the time to review this training lesson. We hope that you learned something that will help you to collect more accurate and quicker data, to allow you to make better "calls."

CTC prides itself on the industry's best customer service and technical support. CTC is proud to employ Vibration Institute Certified Analysts as part of our commitment to providing the industry's best service and support.

For more technical information, additional white papers, and training materials, we invite you to visit our website at www.ctconline.com.



SUMMARY

CTC offers a full range of vibration analysis hardware and process and protection instruments for industrial use. Our customers choose us time and time again based on:

- ❑ **Superior durability**
- ❑ **Accuracy and performance**
- ❑ **Quick service (shipping most orders in 3 days)**
- ❑ **Knowledgeable support staff**
- ❑ **Industry's only UNCONDITIONAL LIFETIME WARRANTY
on all CTC Line products**

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