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TecNote 6001 – Loop Detector General Discussion

Detector Tuning

What is Detector "Tuning"?

Detector “tuning” is the period in which the detector is establishing its initial reference value.

How long should tuning take?

The time period that is required for tuning is dependent upon the sensitivity setting. The more sensitive the setting, the longer the unit will take to tune up. The time is determined by the most sensitively set channel. On a perfect loop, with at least one channel set to the highest sensitivity, the detector should not take more than 20 seconds to tune up. With all channels set to the lowest sensitivity, on an ideal loop the detector should never take more than 3 seconds to tune up. When a detector requires an extended length of time to tune up, that is an indication that the loop frequency is not stable. The instability of the loop is proportional to the length of time required for tuning.

How stringent are the tuning requirements?

Like tune up times, the strictness of a tune up test is also dependent upon channel sensitivity. However, unlike time, the stringency is independent of other channels. The higher the sensitivity setting on the channel, the more stable the loop must be. The stringency of the tune up requirement also contributes to the required length of tune up time. Once again, a longer tune up time indicates instability with the loop frequency

Can a detector lose its reference?

Yes, a loop detector can occasionally lose its reference because of erratic loop behavior. However, once the loop stabilizes, it quickly regains its reference. Temperature tracking algorithms are responsible for maintaining reference integrity. These algorithms slowly compensate for environmental changes. Detector fault conditions sense and recalibrate for situations such as opens, shorts, and 25% inductance changes. The detector also has a default time value that will limit the length of a continuous call, for situations where loop frequency has made a rapid shift, or a vehicle or debris has come to rest on the loop.

Can a detector re-tune itself?

The tracking algorithms are constantly re-tuning the detector. However, after restoration from a fault condition the detector goes through a “hard tune” sequence. The detector will allows the loop to oscillate for 10 seconds to ensure that the condition has been removed, then it will proceed with a full re-tune. This re-tune is identical to a reset or power up re-tune.

Cross Talk

What is cross talk?

Cross talk occurs when a signal from one loop is induced upon another loop.

What are the symptoms of cross talk?

Cross talk is easily confused with a variety of other problems. The two most common problems that arise from cross talk are false detects, and loop instability. As stated before, loop instability is recognized by long tune up times, or frequent faults (especially 25% change fault). Cross talk is caused by a signal from adjacent loops being induced on one another. A scanning loop detector can not cause cross talk on other loops that are connected to the card, but one card may interfere with another card. The best way to protect against cross talk is by carefully following these suggestions.

1. Use twisted lead-in wire on all loops

2. Use shielded wire and ground at the cabinet

3. Do not run lead-in near other signals (AC Line, etc.)

4. Put adjacent loops on the same detector card

5. Make sure adjacent loops have opposing turns

What can be done to eliminate cross talk?

The best guard against cross talk is properly installed and terminated loop lead-ins. The next best choice is to change the frequency of the loop causing the problems. The loop frequency may be slightly change by engaging or disengaging additional capacitors with the oscillator. This is done via the ‘A’ and ‘B’ switches. Turning the switch to the on position engages a capacitor, while the off position disengages (A = .022 uF, B = .047 uF). There is always a .1 uF capacitor engaged.

Setting Sensitivity

What is sensitivity?

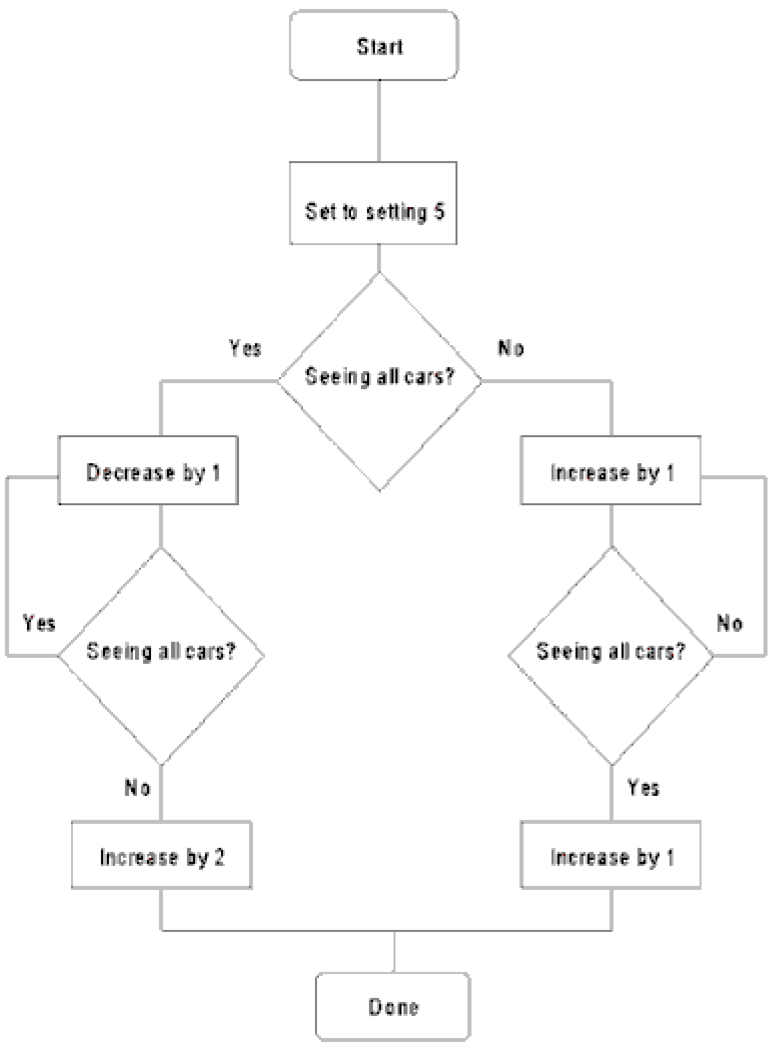
Sensitivity is the percentage of inductance change that must occur to produce a detect output.

What happens if the sensitivity if set wrong?

There are only two ways the sensitivity can be set wrong; too high, or too low. If the sensitivity is set too low the detector will "miss calls." If the sensitivity is too high, then the detector will issue "false calls." It is better to set the sensitivity too high, than too low because at an actuated intersection you would rather service a phase without a vehicle than skip a phase on which a vehicle is waiting. Therefore, after setting the sensitivity, it is generally good practice to increase the setting to one level higher.

What is the most efficient method to set the sensitivity?

The quickest way to set sensitivity is to follow a simple procedure.



What are some factors that determine sensitivity?

The largest determinant of necessary sensitivity is the inductance of the loop and the lead-in. The larger the loop is physically, then the larger the inductance will be. Therefore, a car will make a smaller relative change in the inductance of a large loop, as compared to the change made on a small loop. That means, that larger loops will require higher sensitivity settings. Acceptable loop inductance ranges from 50-1500 uH. Long lead-in on large loops will also make an impact. Lead in wire is about 20-25 uH per 100 feet. The extra inductance due to the lead-in is added to the total inductance, but does not change when a car passes over the loop; therefore, extra lead-in will desensitize a loop.

A "Good" Loop

The most critical component in inductive loop detectors is the loop itself. The majority of problems that arise with this form of detection are due to poor installation, or deterioration with time.

Inductance Range

Loops best operate with an inductance range from 50-1000 uH.

Shielding

Each twisted pair should be shielded, with shielding terminated to chassis ground in the cabinet. There also should be no shorts between the shield and the loop wires. Verify the following values using a mega-ohm meter on a disconnected loop. Shield to Each Conductor greater than 1 mega-ohm Shield to Earth Ground greater than 1 mega-ohm Each Conductor to Earth Ground greater than 1 mega-ohm

Twisted *Pair*

The lead-in wire should be twisted pair from the loop all the way to the cabinet.

Splicing

A minimum amount of splicing should be performed. If splicing is necessary it crucial that the splice is given a water tight seal, because capillary action will cause the cable to suck water between the insulation and the conductor and eventually corrode the conductor.

Resistance

When measuring from conductor to conductor the resistance of the entire loop should be less than 4 ohms.

Induced Noise

An oscilloscope should be placed across the two conductors of a disconnected loop. There should be no signal present on the loop. Verify this closely by looking at various time settings and voltage settings.

Frequency Stability

Connect an oscilloscope across an operating loop and observe the oscillations. Look for jitter or superimposed signals on the waveform.

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