Case Studies of Electrical Protection Issues in the Field

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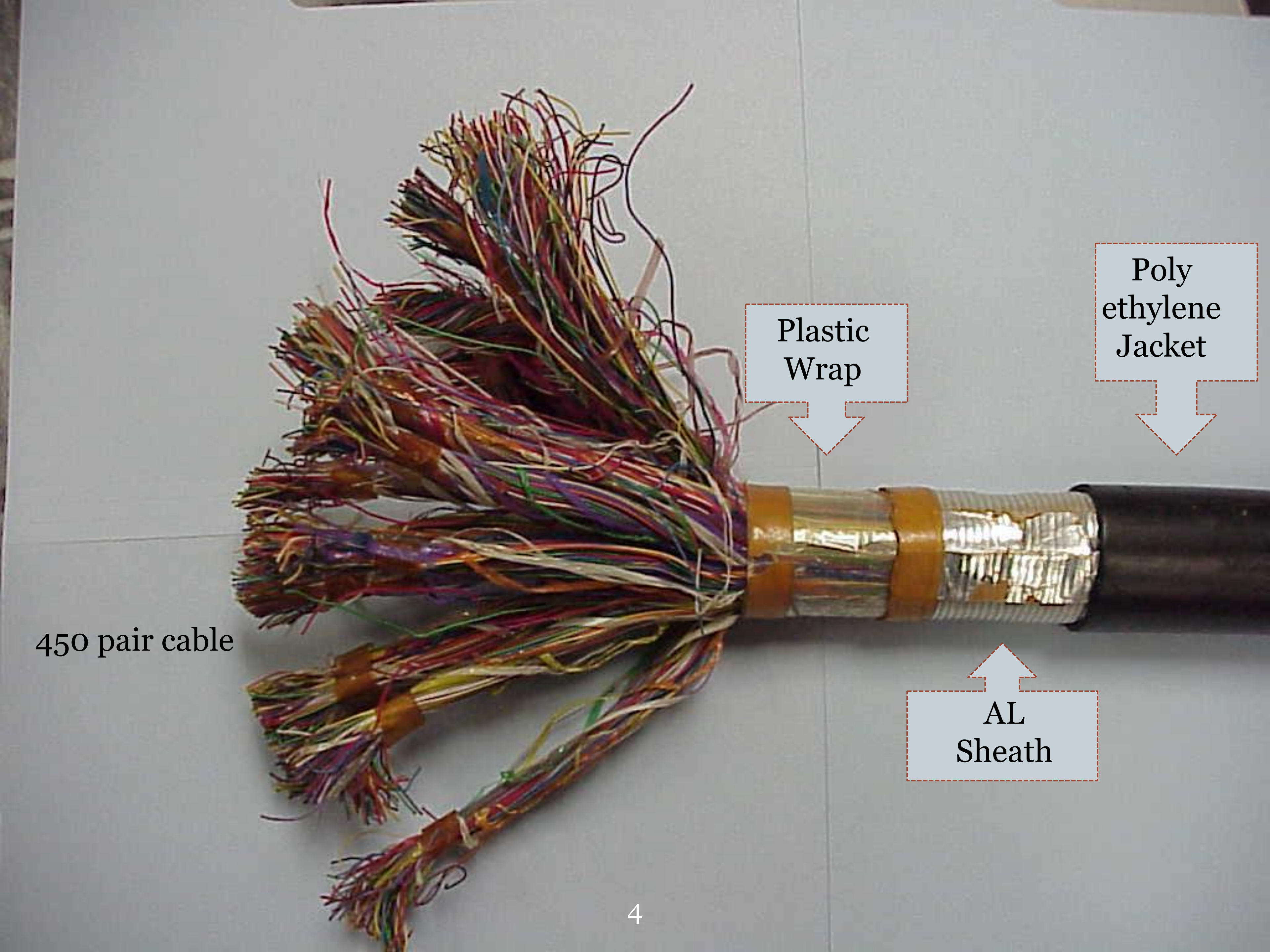
PEG GENERAL MEETING - 2013

Stage Coach Current

Dale Stegmaier


PLACENTIA
ANAHEIM
ANAHEIM HILLS
ORANGE
VILLA PARK
ORANGE PARK ACRES
RIVERSIDE
Area of Interest
Central Office


Plastic Wrap
Poly ethylene Jacket
450 pair cable
AL Sheath


MEASURE SHEATH CURRENT
On Cable 17

MANHOLE GROUND ROD


NO
PARKING
ANY
TIME

s 2 Ground rods

.75

.5

2.25

2.25

cable 27

v to ground 10.4

t to ground 16.9

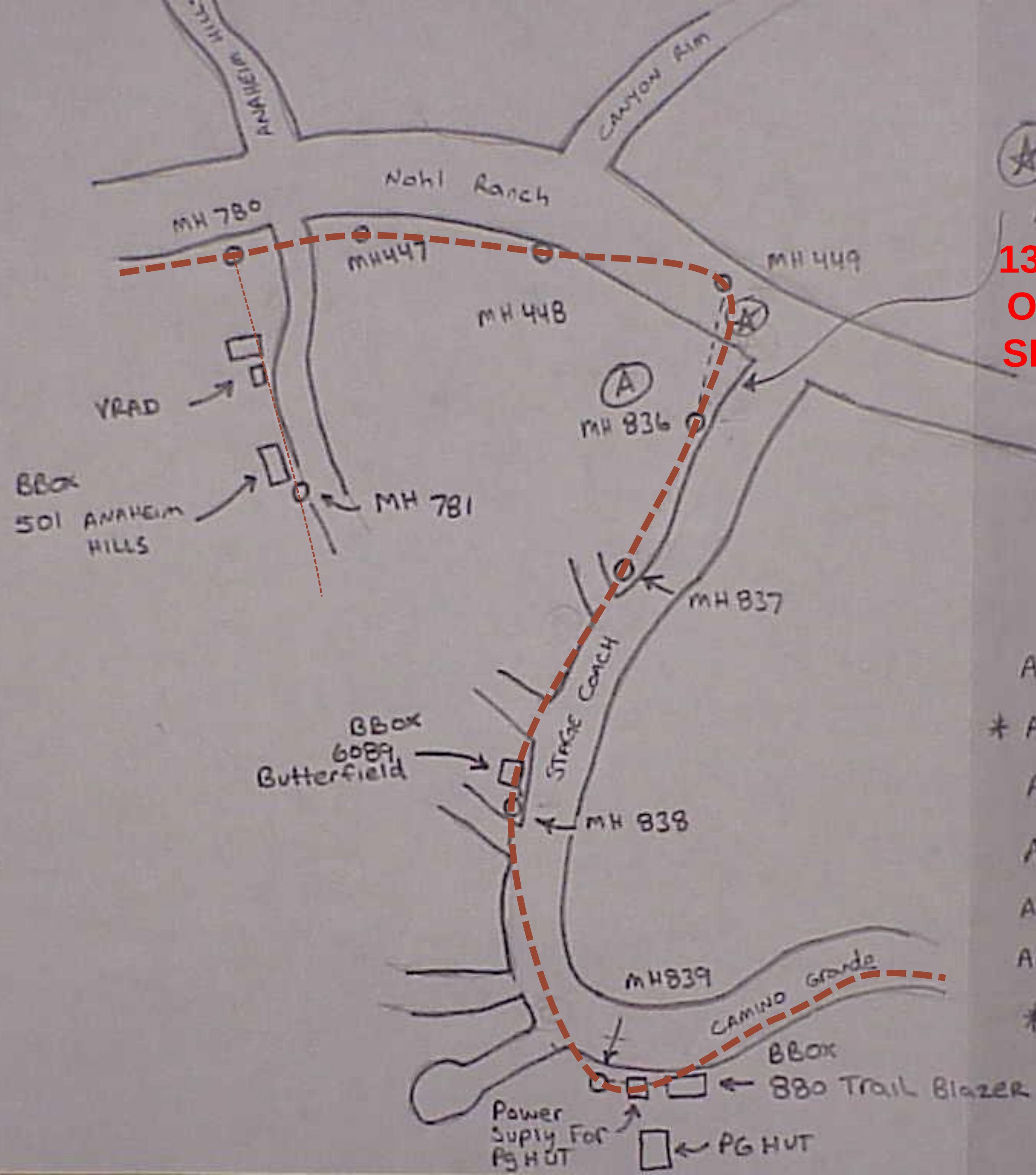
Butter Field

1.25

.25

1.0

o Ground 13.25



★ : This sect
The higest
Flow 13.7

13 AMPS ON THE SHEATH

C BBox
880 T

Amps F1 IN

* Amps F2 OUT

Amps to Groun

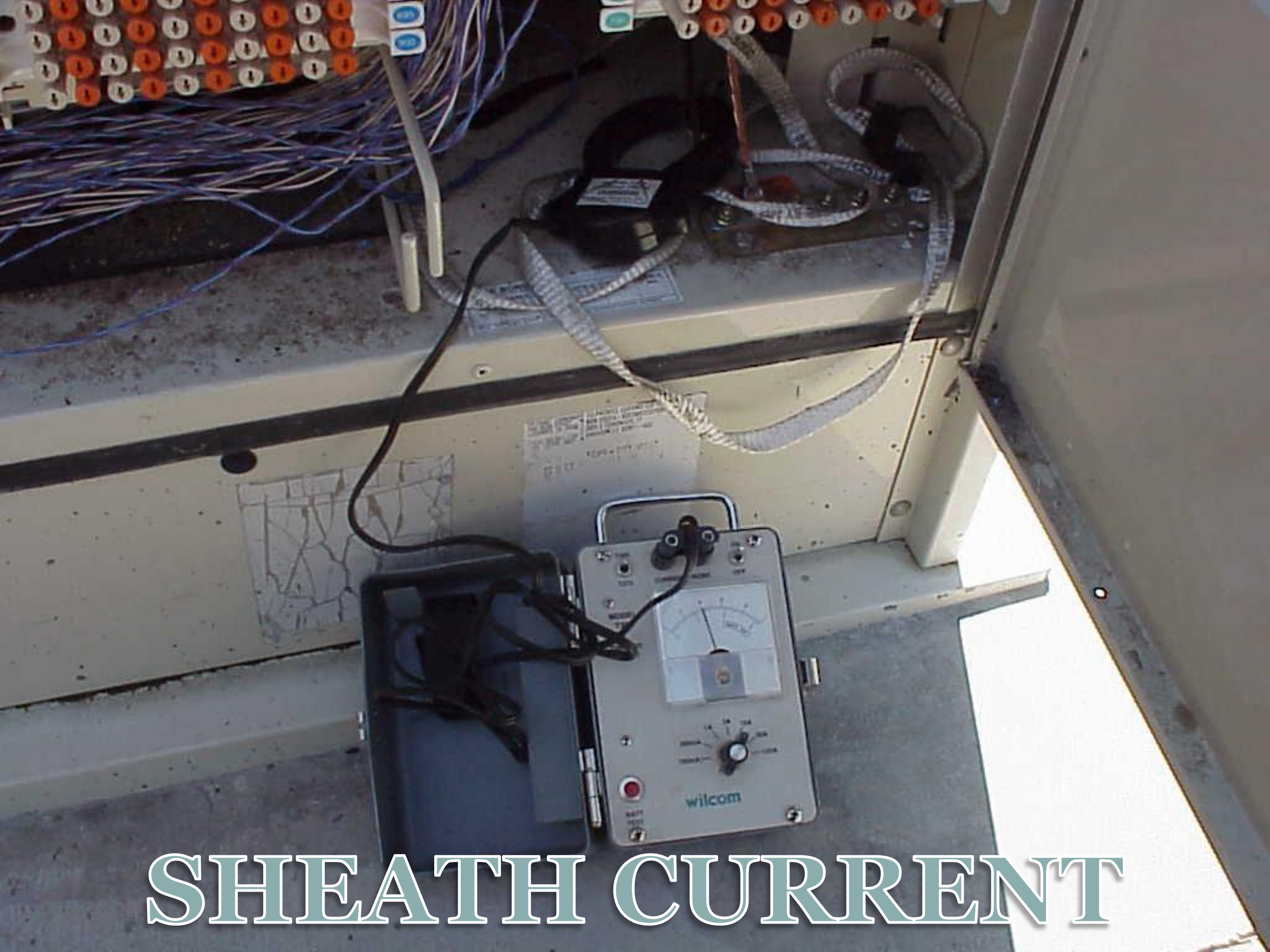
Amps to Grou

AC volts cabl

AC Volts cable

* 0.0 Amps D
Shield on F
MH 839. Sh
IN a Pressu
will Not Be


CAUTION
88o BOX



SHEATH CURRENT


T305
T272
ON
OFF
0
.2
.4
.6
.8
1
0
1
2
3
BATT. OK
1A
3A
10A
300mA
30A
100mA
100A
wilcom
BATT
TEST

21 States

1. Cable must have a continuous shield
2. Bonds to the MGN and at both ends
3. Normally carry from 500 mA to 5000 mA

California

A. No bonds to MGN
B. Cable bond to ground bed every ¼ mile
C. Normally carry from 50 mA to 5000 mA

Readings less than 50 mA indicates an open shield
Readings more than 7000 mA *suggest* power system issues

PI (Power Influence) 80 – 90 dBrnC is Marginal
PI over 100 dBrnC *suggest* power system issues
Noise = Less than 20 dBrnC

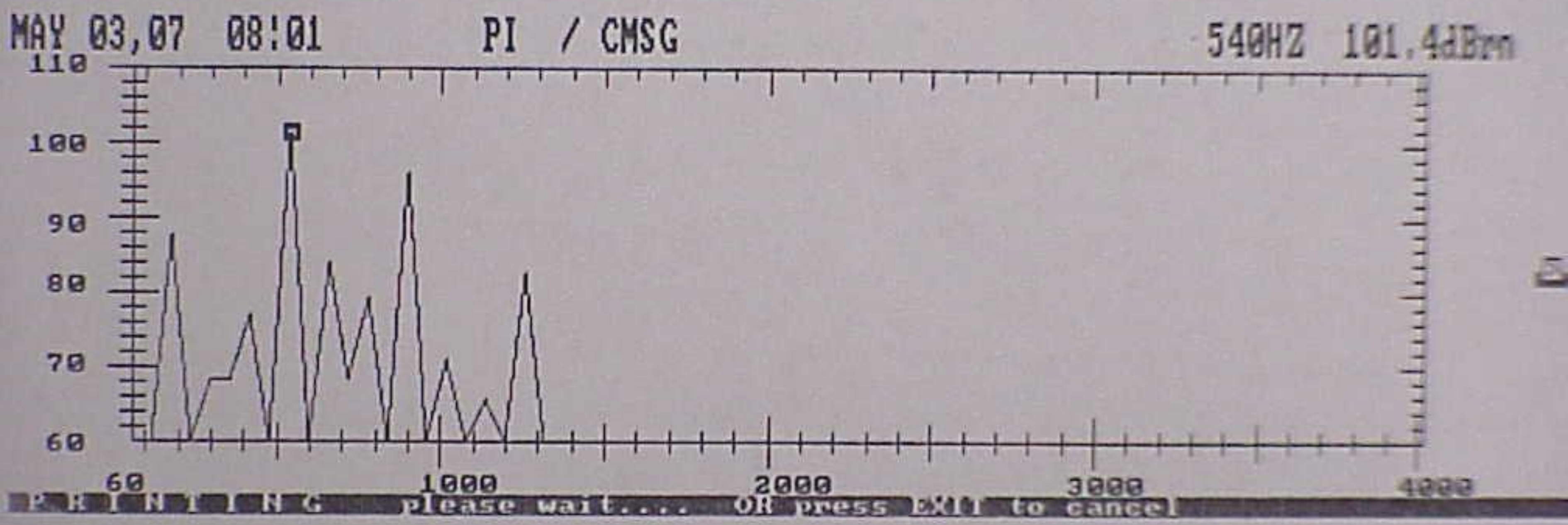
Location	Date 5/3/07		Current mA (21)	Loss dBM (8.5)	Noise dBrn Cmsg <20	Noise dBrn Flat	Power Influence Cmsg <85	Power Influence Flat	T-R Voltage AC Volts	Dominant Frequency
880 Box 880 Trail Blazer	Cable 17	Dynatel	26.8	5.4	30		7106		T-R 0	PLOT 1
	Pair 416 BP 416	Wilcom 132EZ	600 Termination Bridge						R-G 16.75V T-G 16.75V	PLOT 2 PLOT 3
B Box 501 Anaheim Hills	Cable 17	Dynatel	28.8	4.9	19		94		T-R 0	PLOT 4
	Pair 551 BP 701	Wilcom 132EZ	600 Termination Bridge				540HZ 96		R-G 2.0 T-G 2.0	PLOT 5
	Cable 17	Dynatel	28.9	5.0	30		95		T-R 0	PLOT 6
	Pair 501 BP 201	Wilcom 132EZ	600 Termination Bridge				540HZ 91		R-G 2.0 T-G 2.0	PLOT 7
	Cable	Dynatel							T-R	
	Pair	Wilcom 132EZ	600 Termination Bridge						R-G T-G	
	Cable	Dynatel							T-R	
	Pair	Wilcom 132EZ	600 Termination Bridge						R-G T-G	
	Cable	Dynatel							T-R	
	Pair	Wilcom 132EZ	600 Termination Bridge						R-G T-G	

880 trail Blazer

C-Message

Plot 1

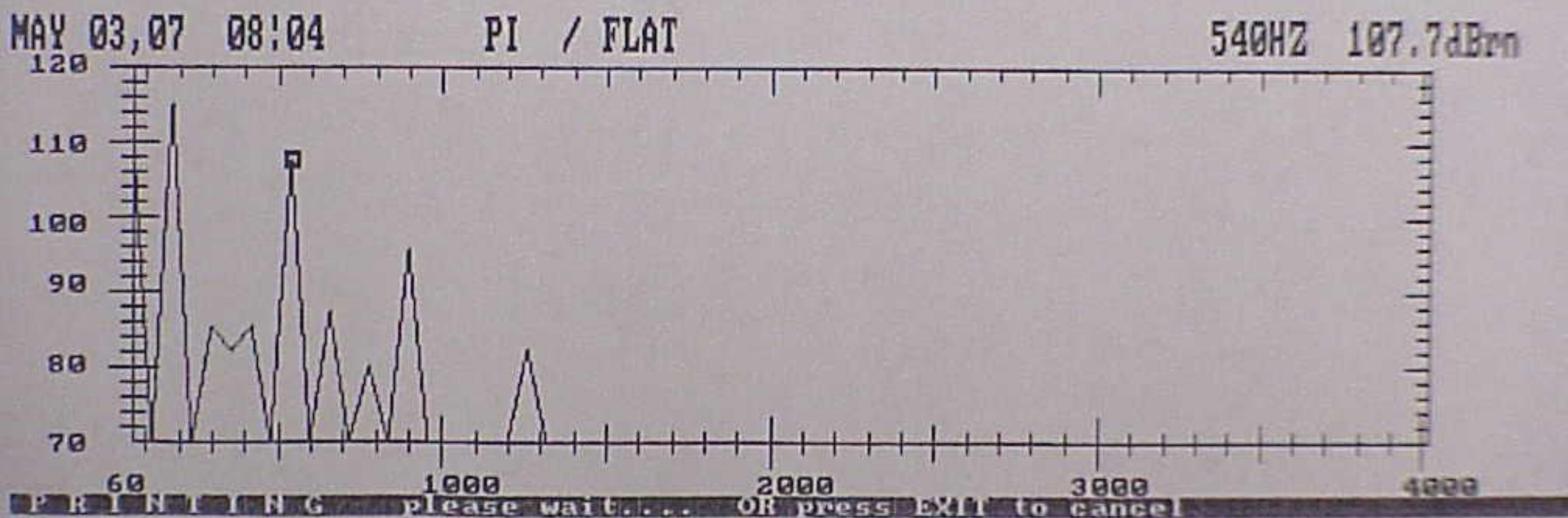
Cable 17
Pair 416



Flat

Plot 2

Cable 17
Pair 416




500 KV


134
BBOX/SAI


880 Box

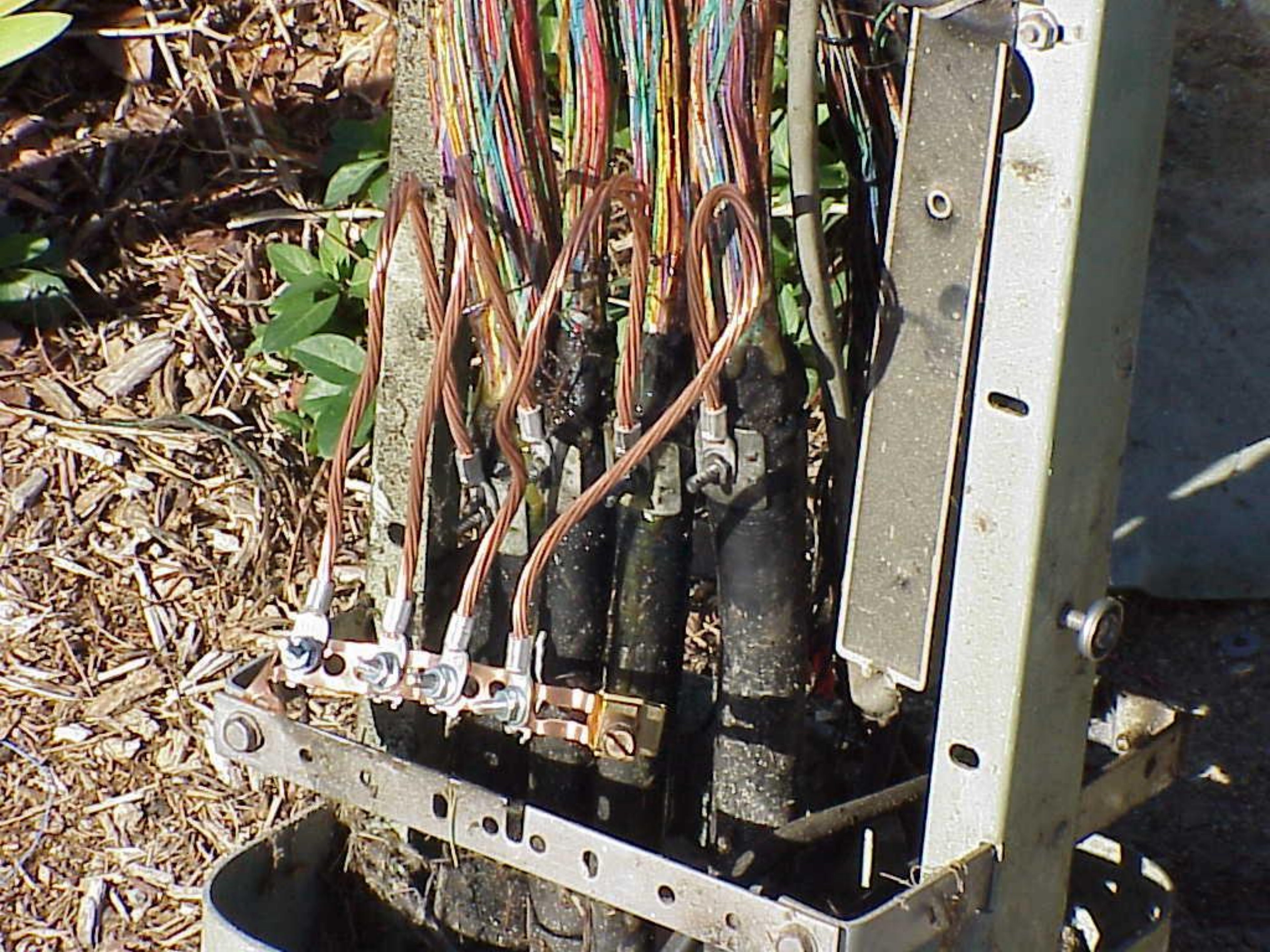

SD 880


6120
PAIRGAIN

Bond To Ground Ring


START LOOKING UP
THE HILL

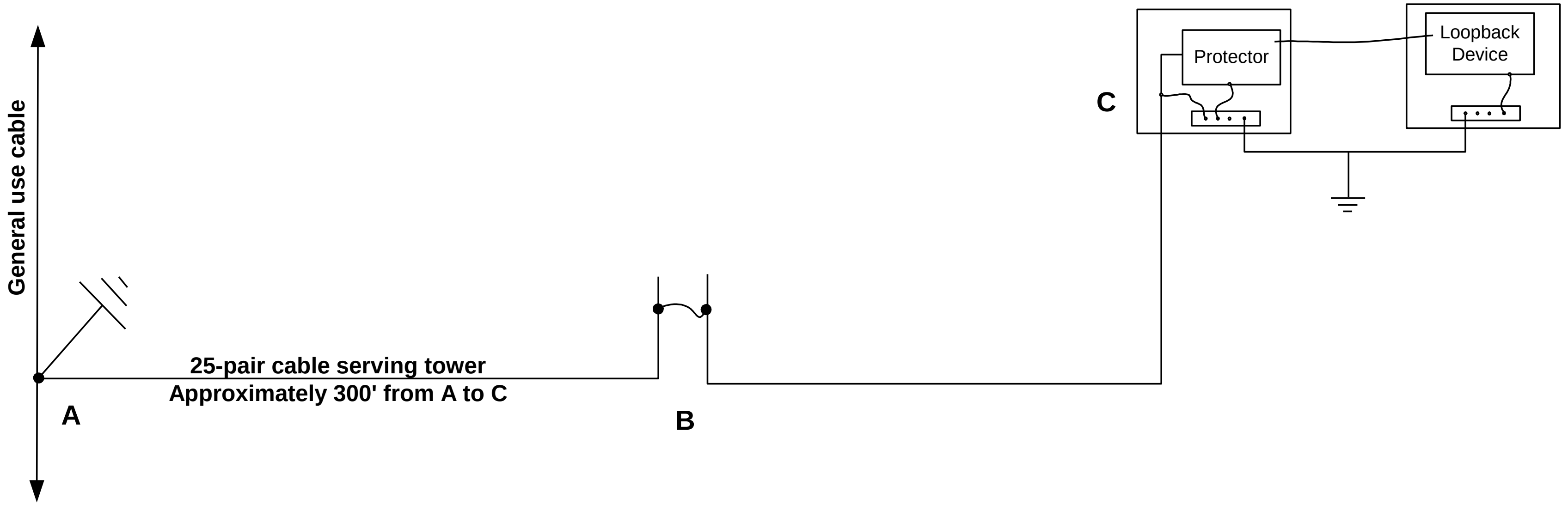
Stagecoach Rd
Tourmaline Ct
S Tourmaline
E Camino Grande
E Garnet Circle
S Ruby Ln
S Amethyst Ln
E Quartz Ln
E Onyx Ln
S Sapphire Ln
Peridot Pl
E Coral Circle
TRANSFORMER
PLOT 1
PLOT 2
PLOT 3
PLOT 4




MH 839
Back To Box 880


STOP
NOISE REDUCED FROM 30 dBrnC TO 14 dBrnC

TENTION
CAUTION!



By clamping on the bond strap at location C and seeing no current flow, I was able to immediately determine the shield wasn't working properly from the ground at point A to the ground at point C. Since this is a 300' section of 25-pair cable, the resistance in the shield between point A and C should be less than 1 ohm (1000' of 25-pair cable has a shield resistance of about 1 ohm).

I then removed the bond at point C and measured the induced voltage which was 0.1 volts. This indicted the shield wasn't completely open, so I re-attached the bond and used a more sensitive clamp-on ammeter (AEMC 3731) and measured 0.007 amps. This allowed me to do the simple calculation of (V = I X R) and determine how much resistance I had in this 300' section of shield. My resistance was R = (0.1 / 0.007) = 14 ohms. Therefore, we had a high resistive splice that was adding this additional resistance and was drastically limiting the amount of current that could flow in the shield.

The bonds in the pedestal at location B was where the problem existed. When this bond was replaced, the resistance dropped from 14 ohms to less than 1 ohm and the current increased from 0.007 amps to 1.12 amps.

This section now has 1.12 amps of current flowing on the shield (99% more than before). This increased current is now creating a strong enough magnetic field around the cable to effectively cancel the magnetic fields from the power lines and we can now ground our loopback without the circuit taking errors. When we only had 0.007 amps current flowing in the shield, the magnetic field it was creating around our cable was cancelling less than 1% of the induction from the power lines and thus enough voltage existed on the pairs between the pair and earth that everytime we grounded the loopback, the induced voltage was enough to allow the protectors in the loopback card to intermittently fire to earth and thus caused continued intermittent errors on the circuit.


U.S. PAT. NO. 4,824,390
DATA HOLD
600V
40A
400A
OFF
SPERRY DSA-500
1.12
DIGISNAP
COM
V/Ω

“Special Protector”

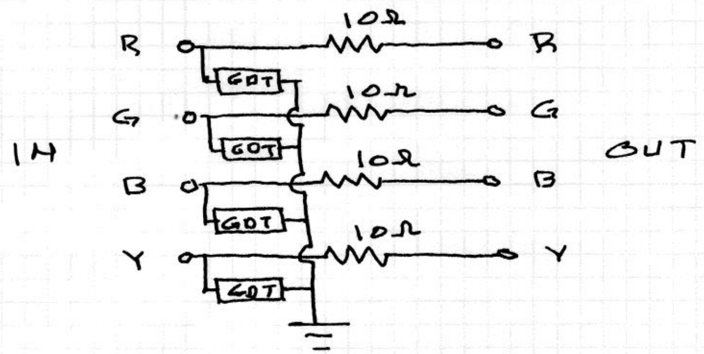
- Required by Power Company for Warranted Protection from Damage
- Placing in series and on customer side of telephone protector
- Would not pass HPNA Signal
- NEC issues
- No listing mark

GULF POWER
Premium Surge Protection Device
GULF POWER
Premium Surge Protection Device


G
Y
B
230 02

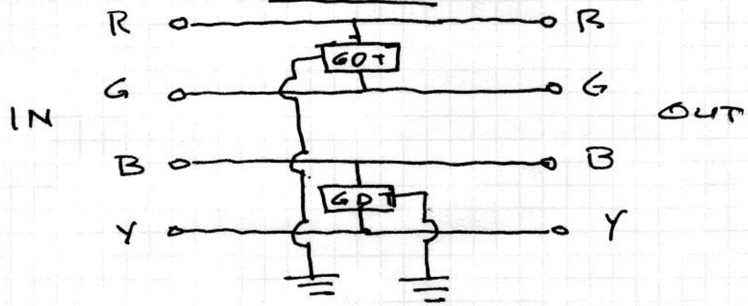
TELEPHONE LINE SURGE PROTECTOR COMPARISON

POWER CO



TWO ELEMENT GDT

AT&T



THREE ELEMENT GDT

LCP

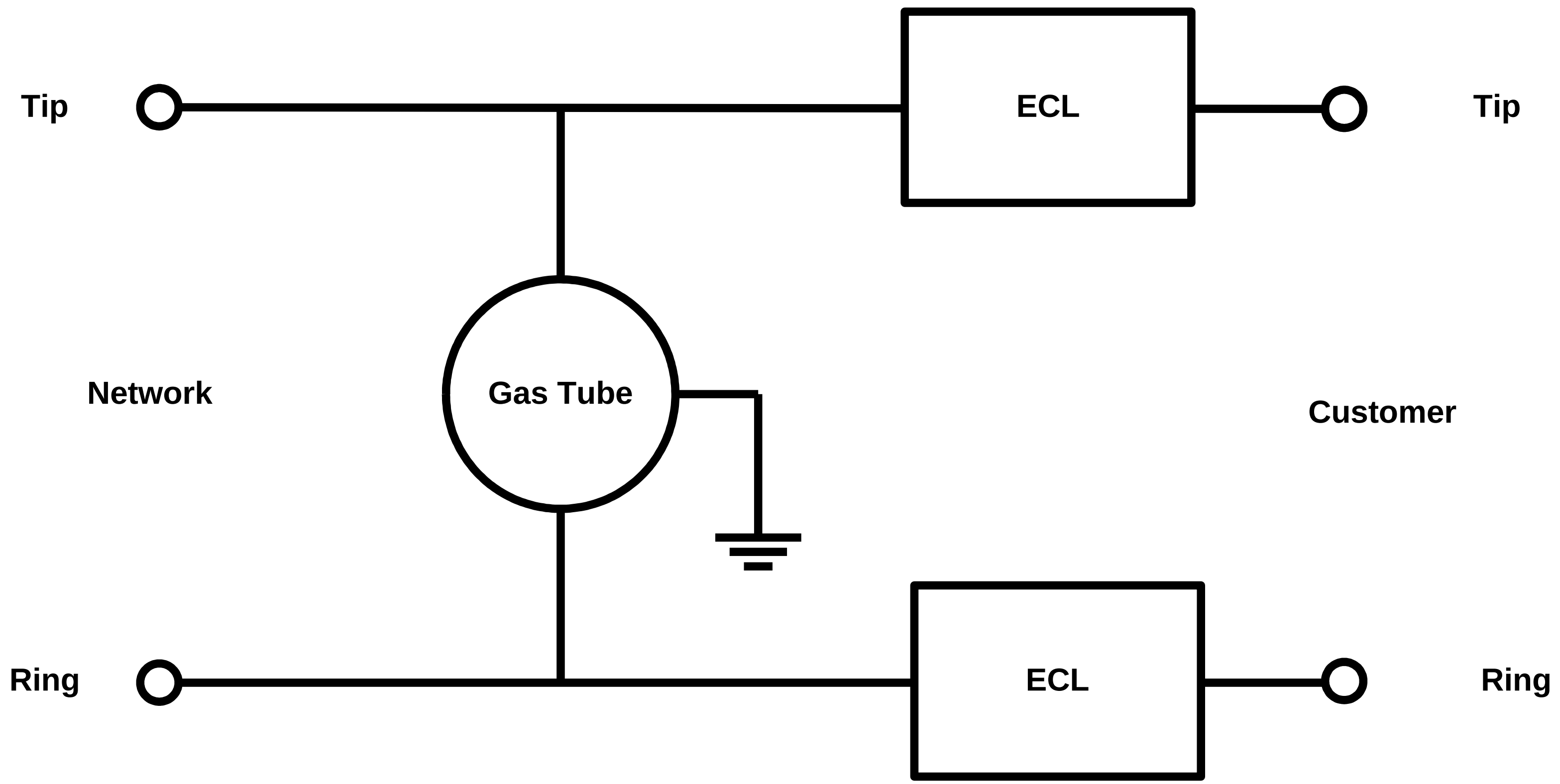
Design Question

- 10 Ohm provides coordination, but not calculated
- Two element gas tubes
  - A device for each conductor
  - Longitudinal to Metallic Conversion during a surge
- Three Element Gas Tube
  - No Longitudinal to Metallic Conversion during a surge

Electric Fence Controller Damage

- Controller for electric fence being damaged frequently by lightning storms.
- Suggested use of special protector
- Originally designed for telecommunications equipment at customer premise.
- GDT and ECL

Three Element Gas Tube with ECL Station Protector Schematic



ECL / Gas Tube Function

- Switches very quickly from a low resistance state – approximately 12Ω - to an open circuit when current threshold is exceeded
- Signal / surge path is opened until gas tube fires
- Signal / surge path is shorted to ground until surge is removed
- Lightning results – no more damage to electric fence controller

Alternative and Creative Use of an RT Site

TRUE…


Soldering Gun
NAVIGAT

LORAIN
RELIANCE COMM/TEC
LORAIN
RELIANCE COMM/TEC
Lever 2000
GAMO
POWER PELLETS
NEW!
25%
INCREASED VELOCITY


FLM 2400 HS
FRAGILE
Colgate