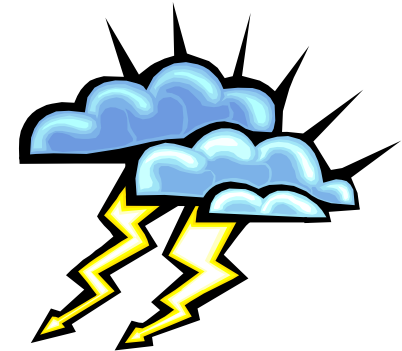




# **Line Protection Modules**

# What do Line Protection Module products do? Why are they used?

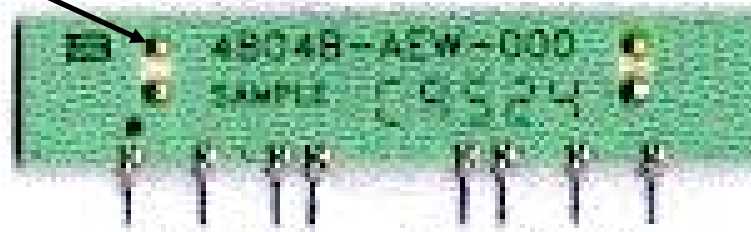
- Protect fragile telecom circuits
  - From lightning
  - From AC power-cross



# How do they work ?

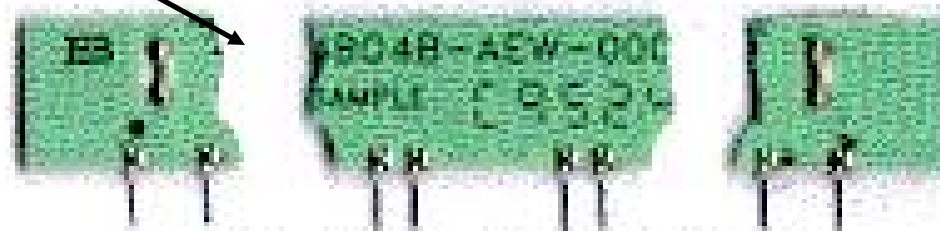


Fuse melts



Substrate Cracks

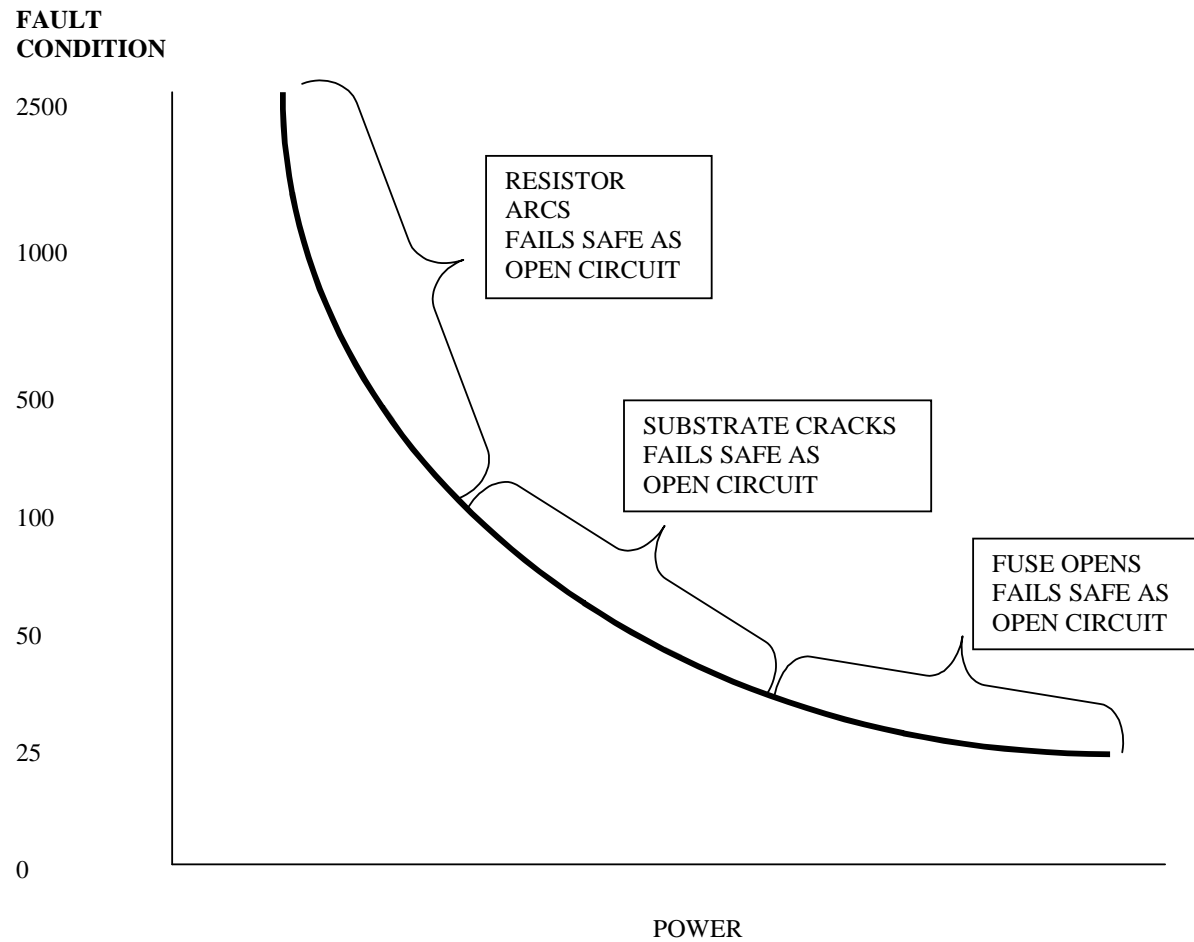
Slow Blow Fuse Action



Fast Blow Fuse Action

# Failing Safe

FAIL SAFE LFR's



# Where are they used?

- Telecommunications-Line Protection
  - Central office switches
  - Transmission switching equipment
    - ISDN-Integrated Services Digital Network
    - ADSL-Asymmetric Digital Subscriber Line
    - HDSL- High Bit Rate Digital Subscriber Line
    - POTS-Plain Old Telephone Service (CPOTS, RPOTS, PayPOTS)
    - DLC - Digital Loop Carrier Systems

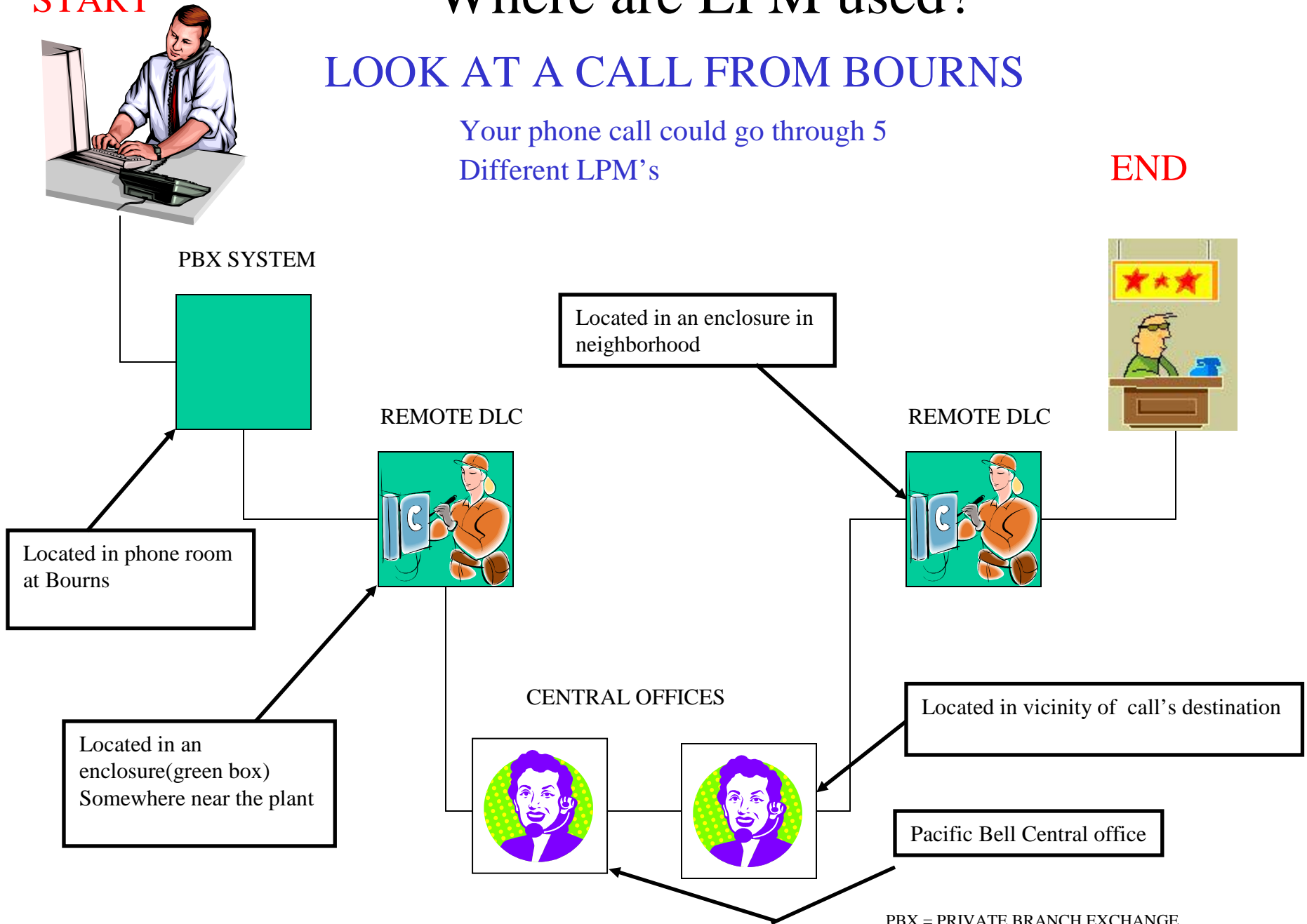
START

# Where are LPM used?

## LOOK AT A CALL FROM BOURNS

Your phone call could go through 5  
Different LPM's

END

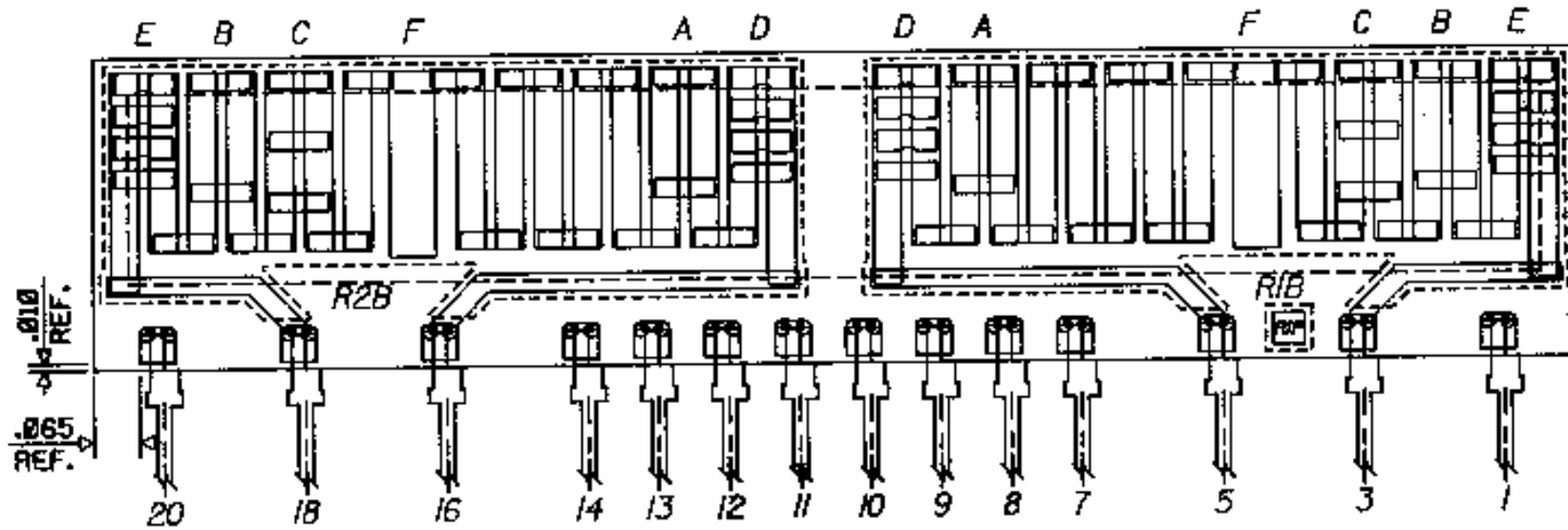


PBX = PRIVATE BRANCH EXCHANGE  
DLC = DIGITAL LOOP CARRIER

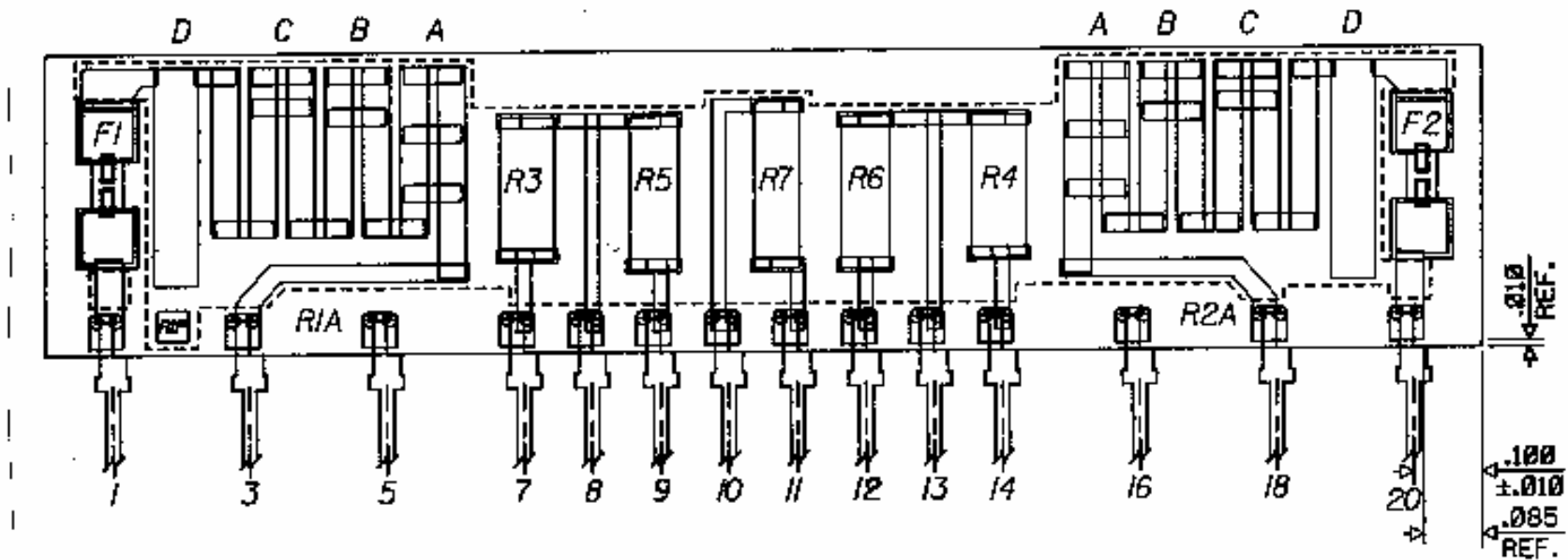
# What are they called?

- Surge Resistors
- Line Feed Resistors or “LFR”
- Line Interface Resistors
- Lightning Resistors
- Line Protection Modules or “LPM”
- Bellcore Resistors

# Serpentine Design



# Serpentine Design Fuse Side

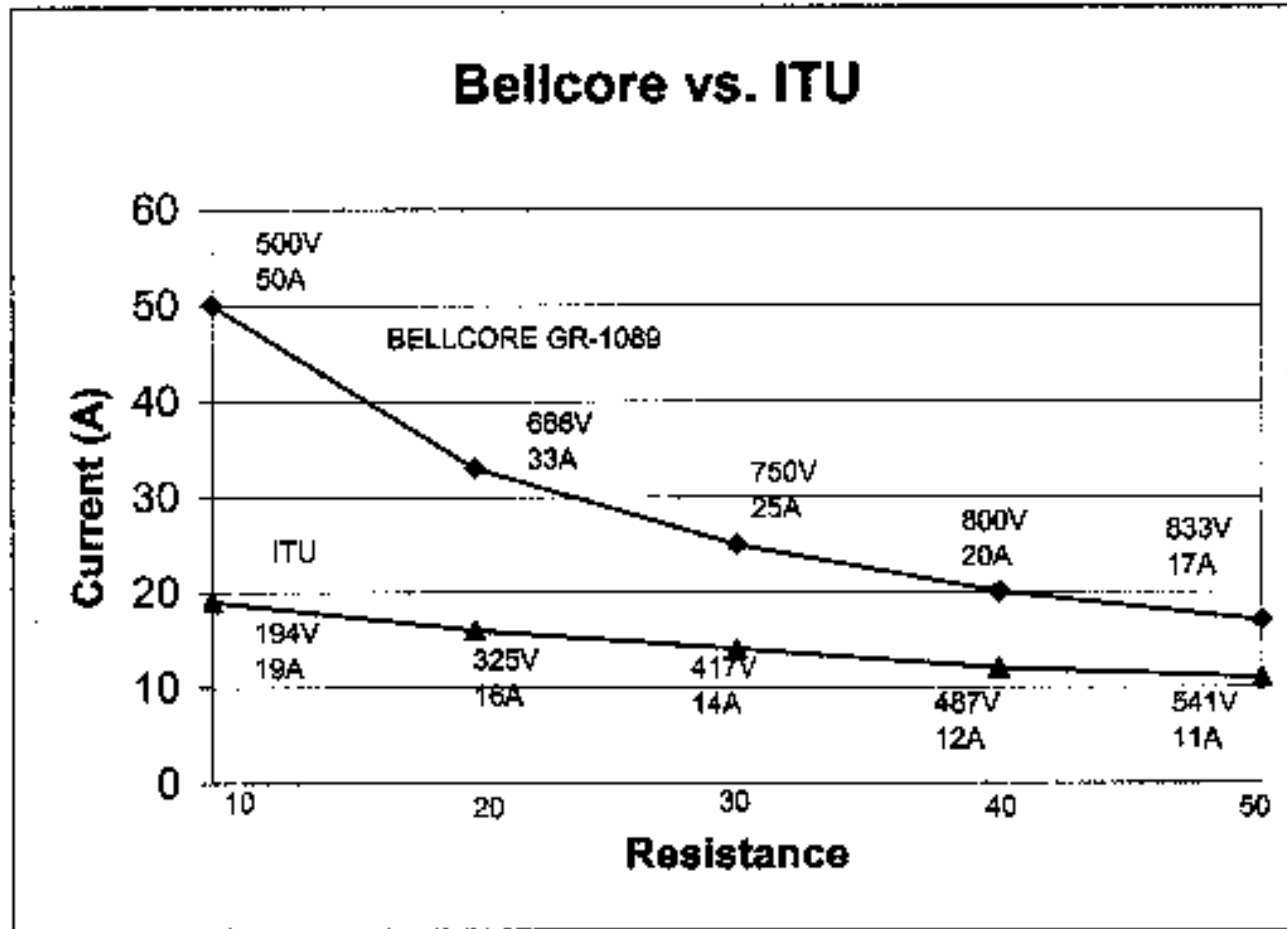


# Standards

- **BELLCORE GR1089**
- **UL 497A**
- **UL 1459**
- **UL 1950**
- **ITU K.20/K.21**

# Product Comparison

## ITU vs. Telcordia



# Telcordia Issue 3

- First Level AC Power Fault Test 8  
600V, 3A., 1.1 sec.  
50 ohm LFR, V=120, Power=288  
  
10 ohm LFR, V=28, Power=78

# Channel Diagram

Manufacturing

- Thick Film
- SIP Lead Attach
- SMD lead attach
- Twin Pack Assy
- Final Test
- Package
- Qual test lab

Bourns  
Costa Rica

Customers

Disty

CEM

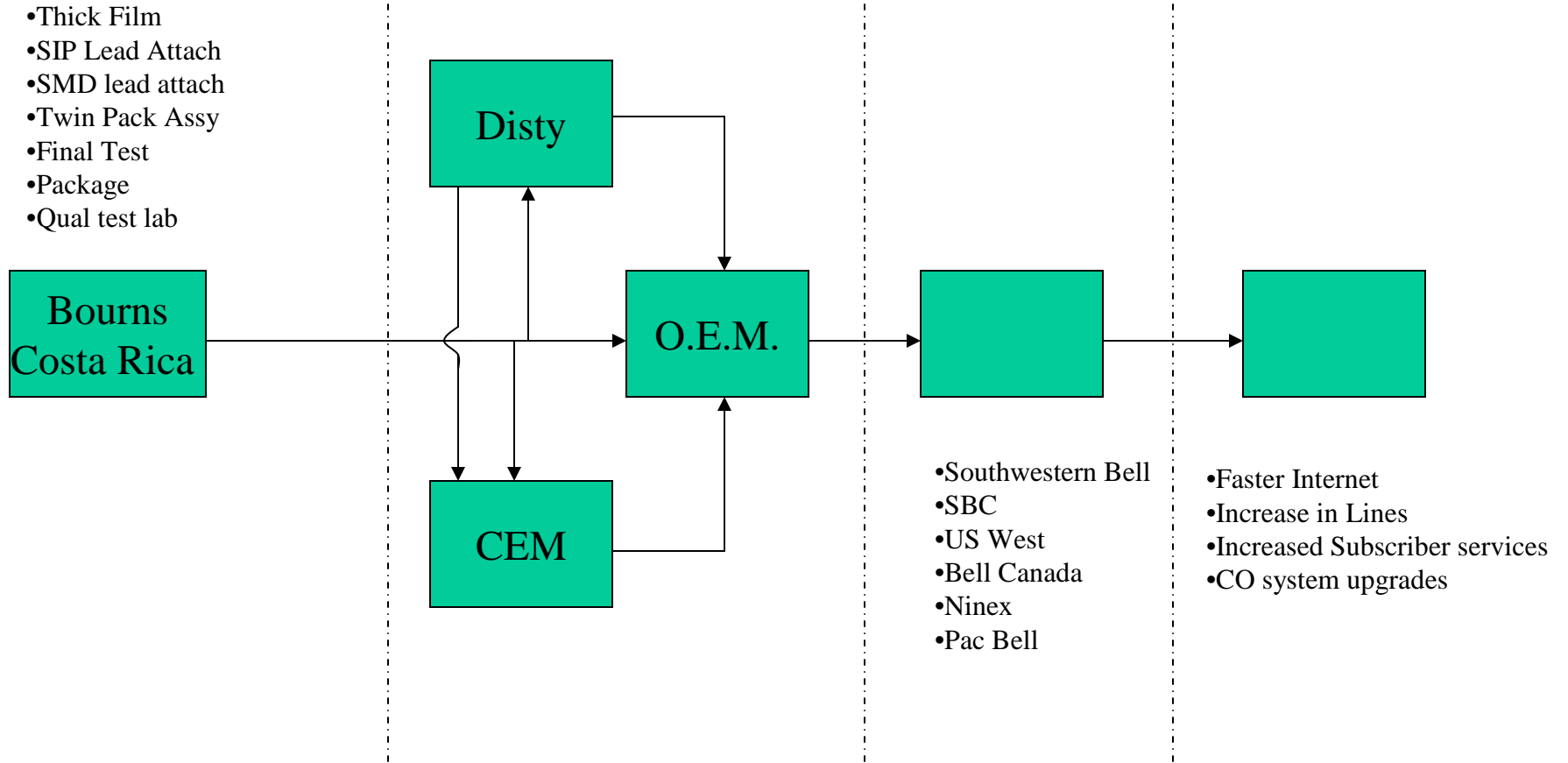
O.E.M.

End  
Customers

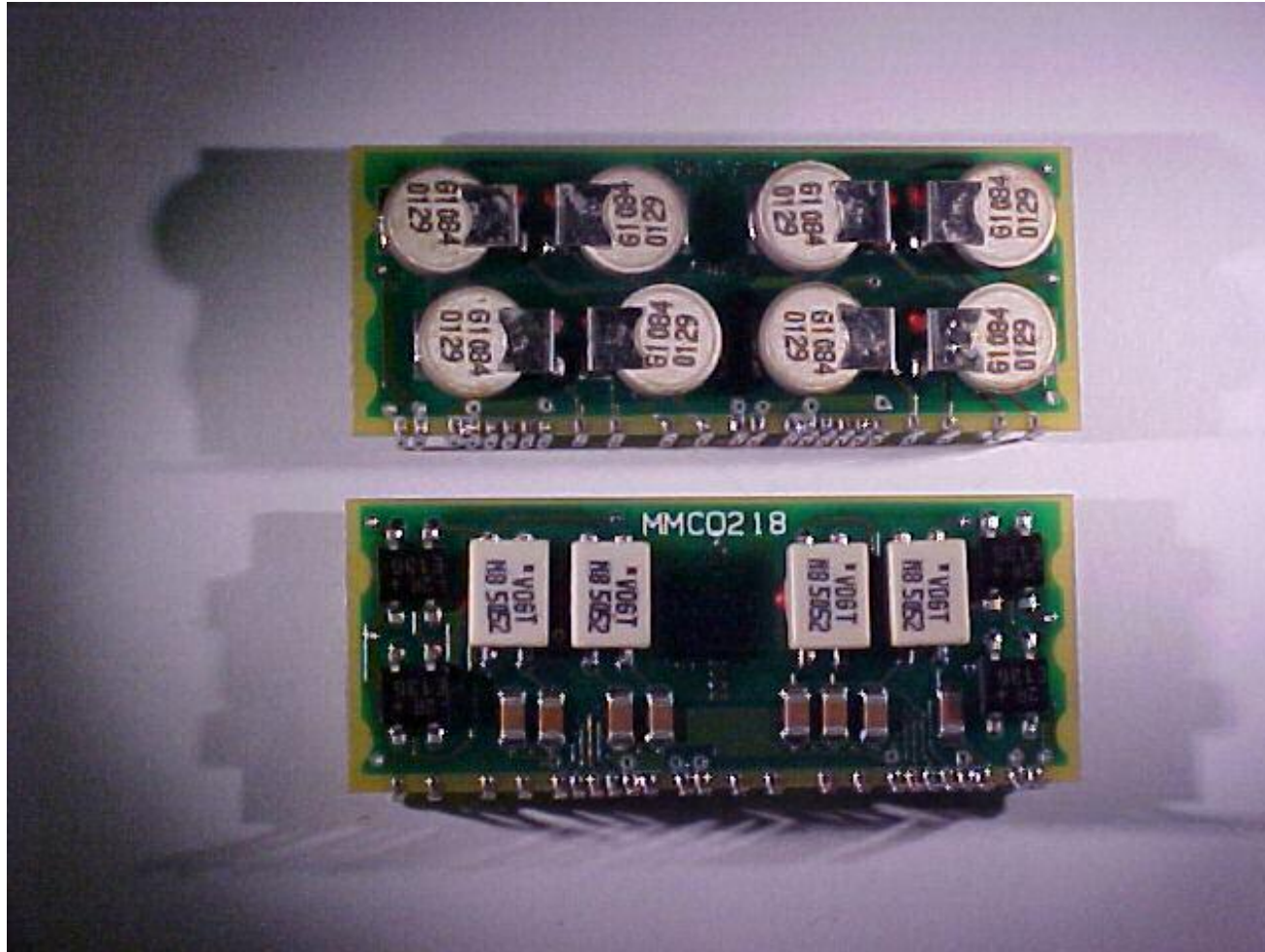
- Southwestern Bell
- SBC
- US West
- Bell Canada
- Ninex
- Pac Bell

Demand Drivers

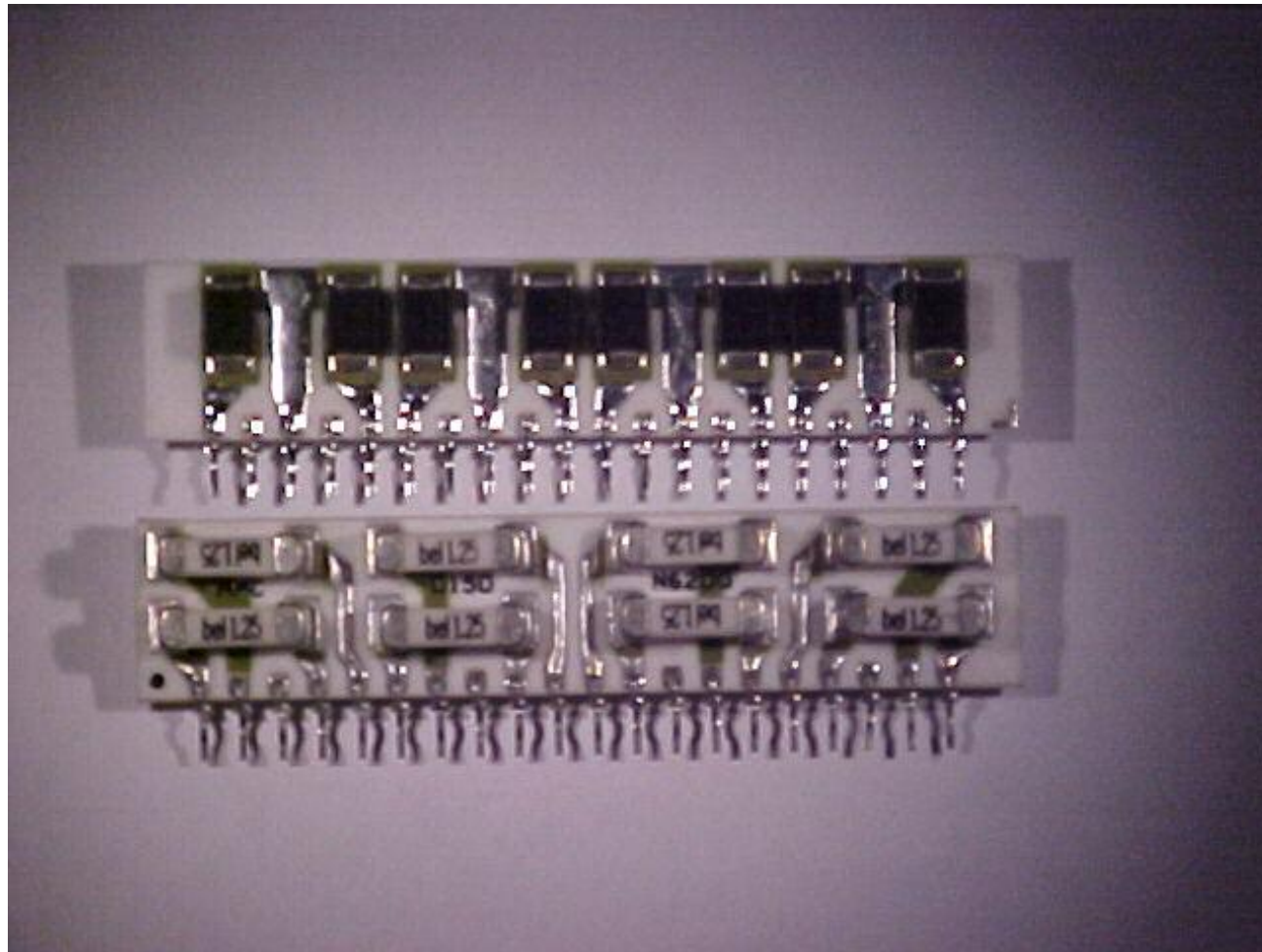
- Faster Internet
- Increase in Lines
- Increased Subscriber services
- CO system upgrades



# Re-settable Line Protection Module

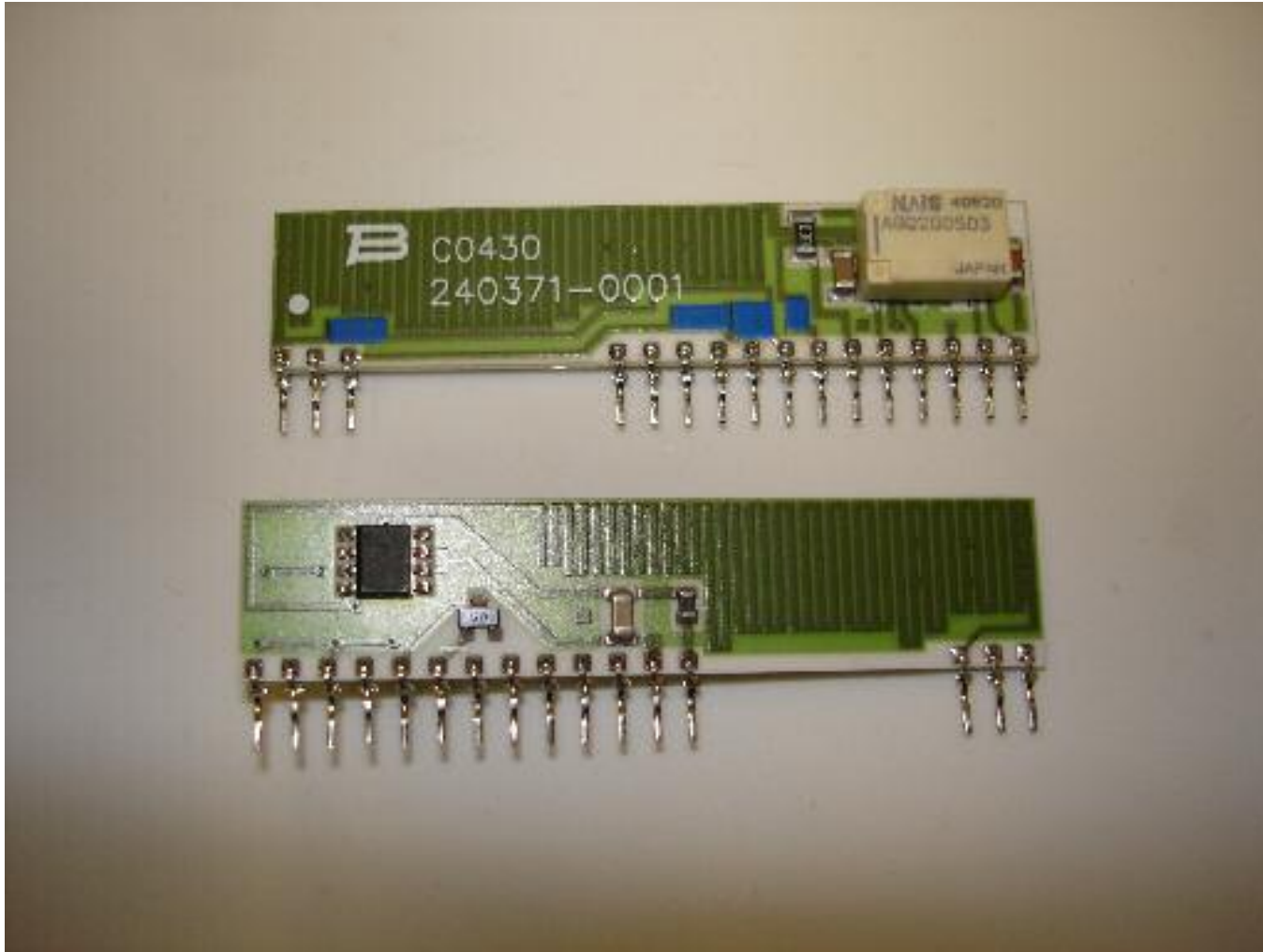


# Telecom Fuse + Thyristor

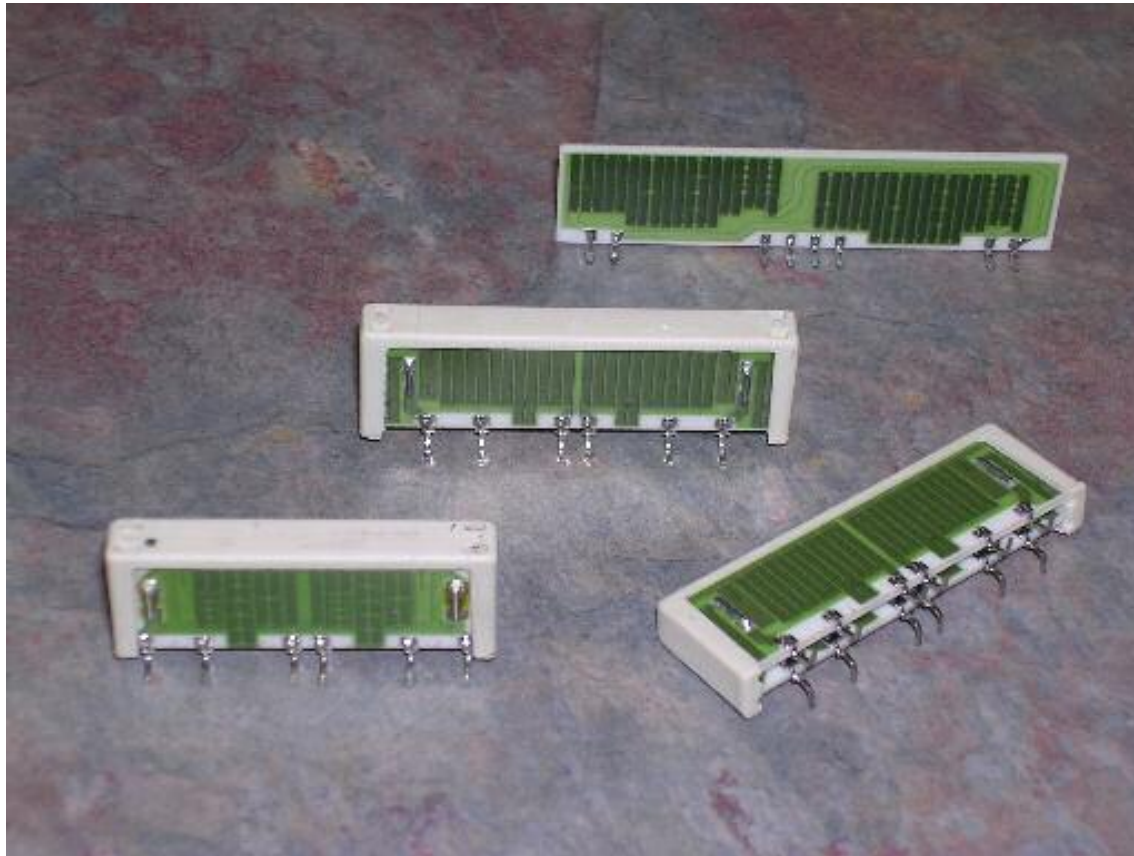


# Line Protection Module

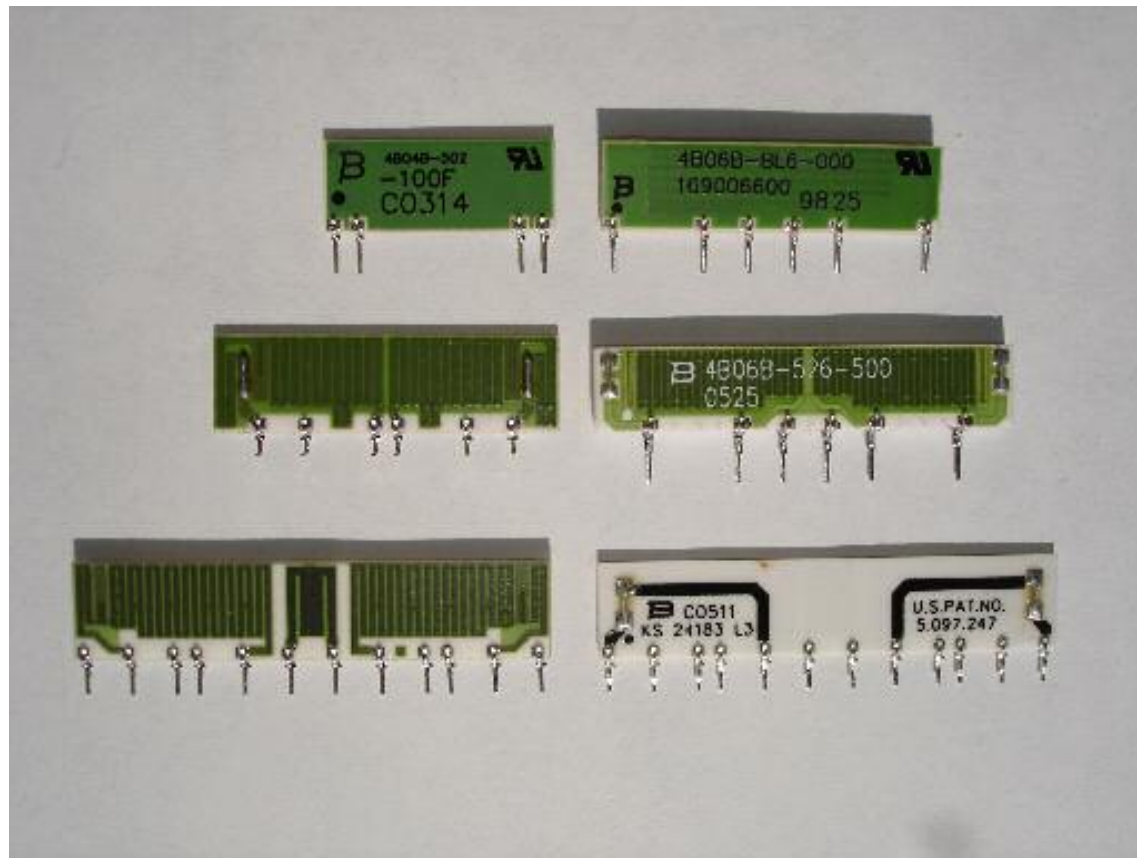
## Overvoltage/Overcurrent with relay



# Surface Mount Product



# Standard and Custom LPM's



# Hybrid LPM's

