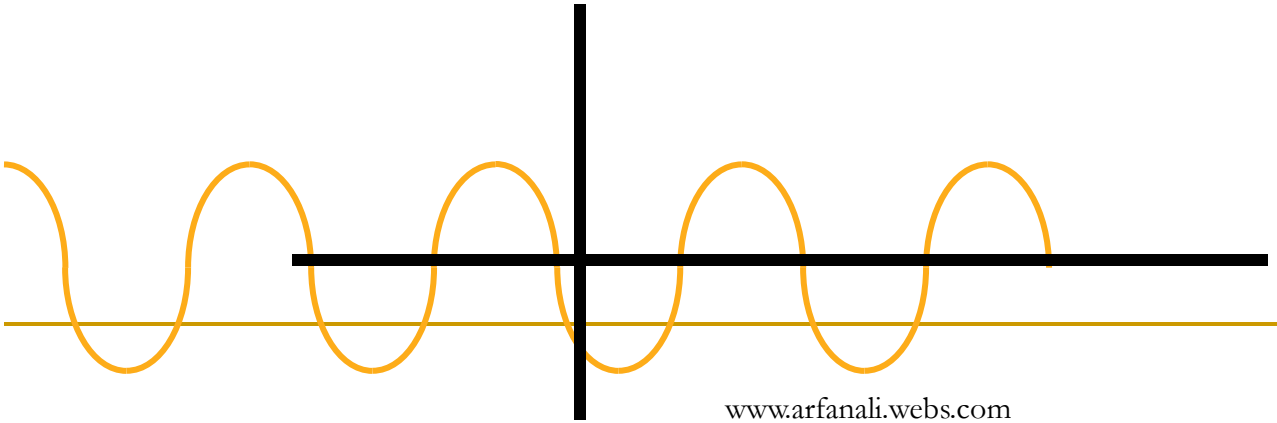
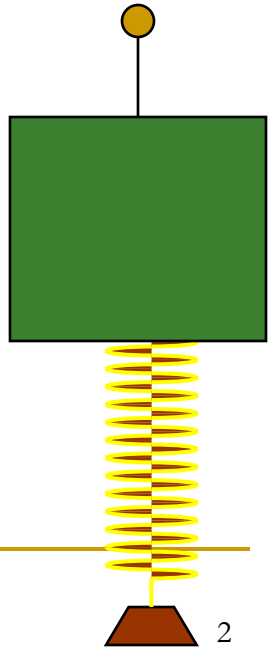
Bentley Nevada 3500 System Architecture and Rack Configuration

Presented by:
Arfan Ali

Introduction to Vibration

- The Oscillatory (back and forth) motion of a machine from its normal position of rest.
- Any motion that repeats itself after a specific interval of time .
- **Vibration Example** :

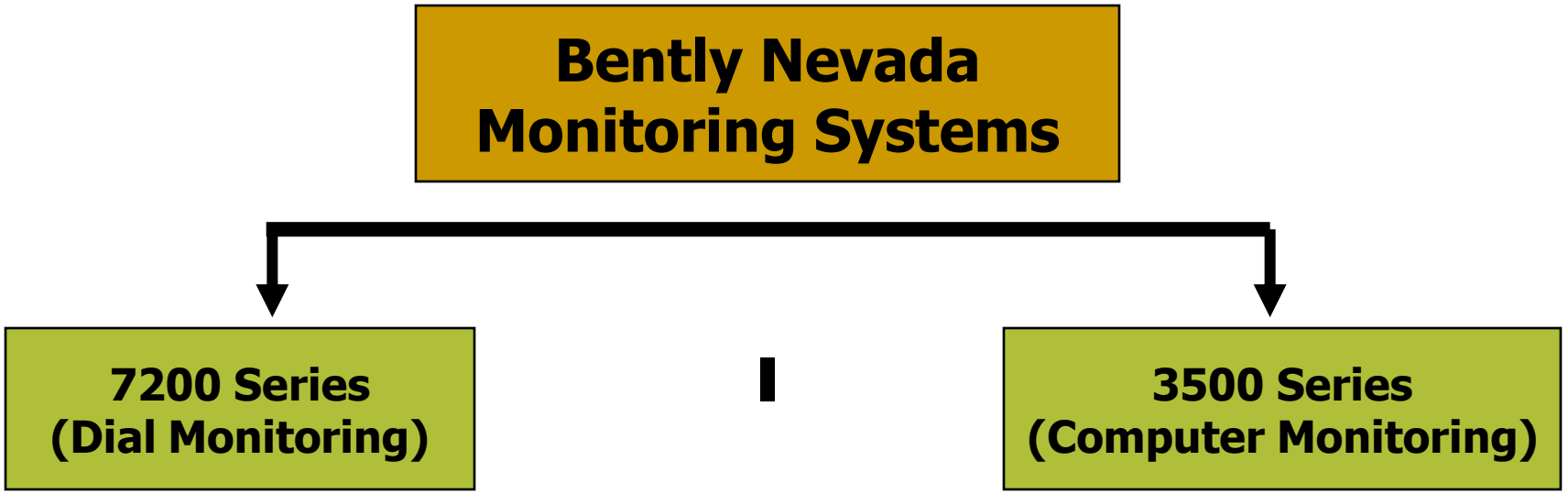




Importance of Vibration Monitoring System

- Essential for
  - Protection against machinery faults
  - Predict and diagnose crucial machinery Problems
    - Imbalance
    - Misalignment
    - Shaft crack
    - Bearing Failures and etc.
- Parameters to measure
  - Thrust
  - Vibration
  - Speed
  - Temperature

Monitoring Systems



we have two types of vibration monitoring system the Bently nevada 7200 series vibration monitoring system. It is a dial monitoring analog system installed at our plant on Air Compressor partially and on Most of the TPs etc.

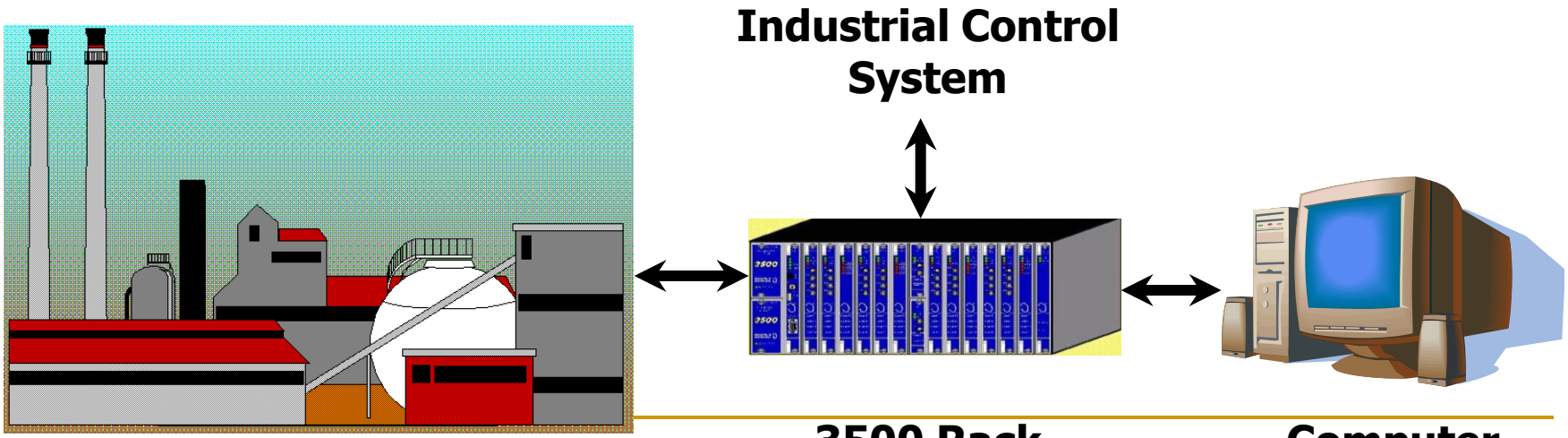
The second one is bently nevada 3500 series vibration monitoring system it is computer based digitized system installed at Syn compressor, Ammonia commpressor, CO2 compressor and on Air compressor partially. The scope of presentation my presentation is limited to 3500 system only.

Features of 3500 Monitoring System

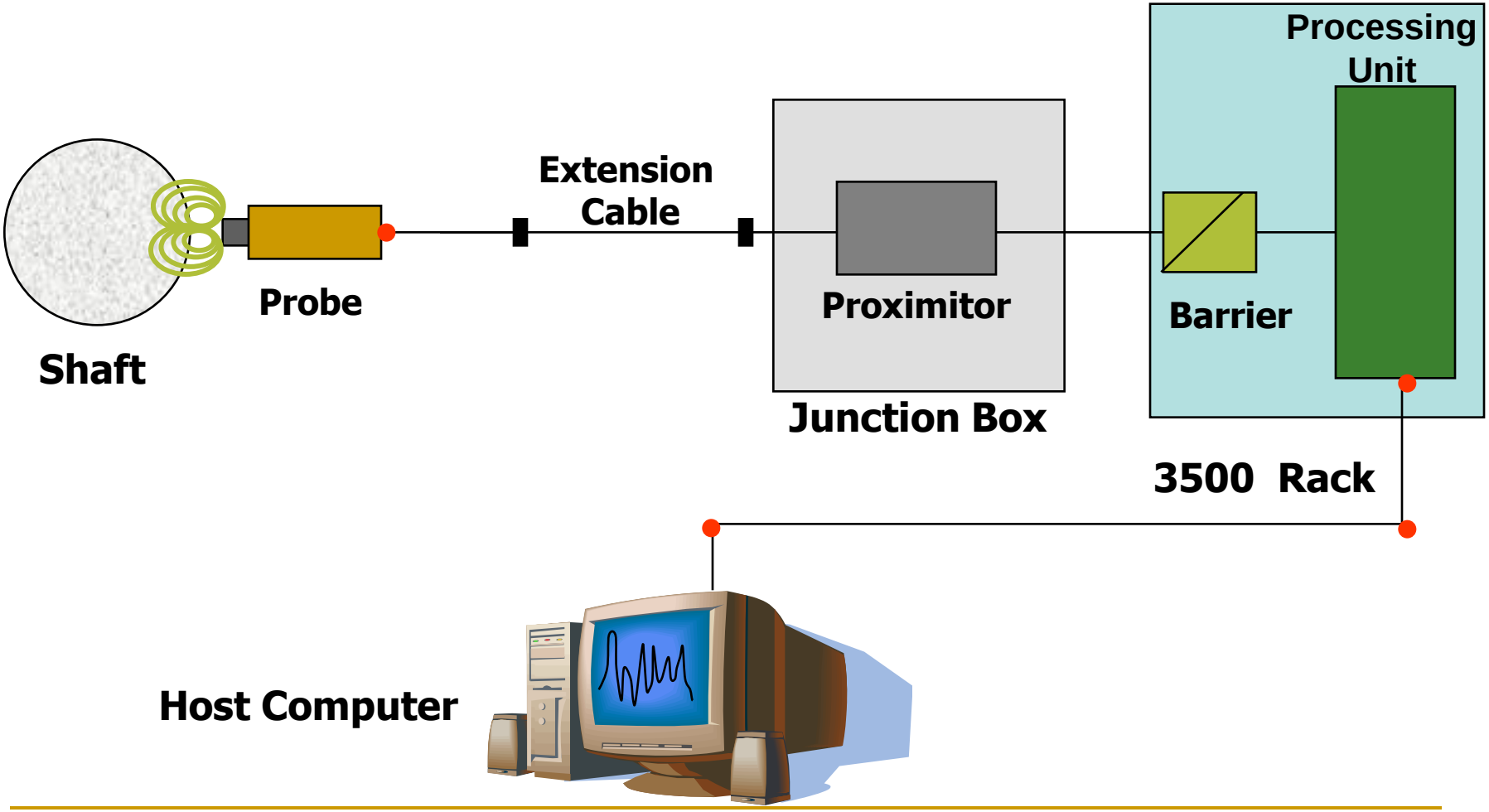
- State of art vibration monitoring system
- Processor based system
- Modular & Flexible Architecture
- Tight integration with DCS using Industry Standards Interfaces
- Hot Insertion or Removal of Modules
- Provides Enhanced Operator Information
  - Windows based operator display
  - Data can be displayed at multiple locations
- Improved Reliability due to
  - Redundant power supply and distribution network
  - Triple Modular Redundant Relay Modules

3500 Monitoring System Components and Layout

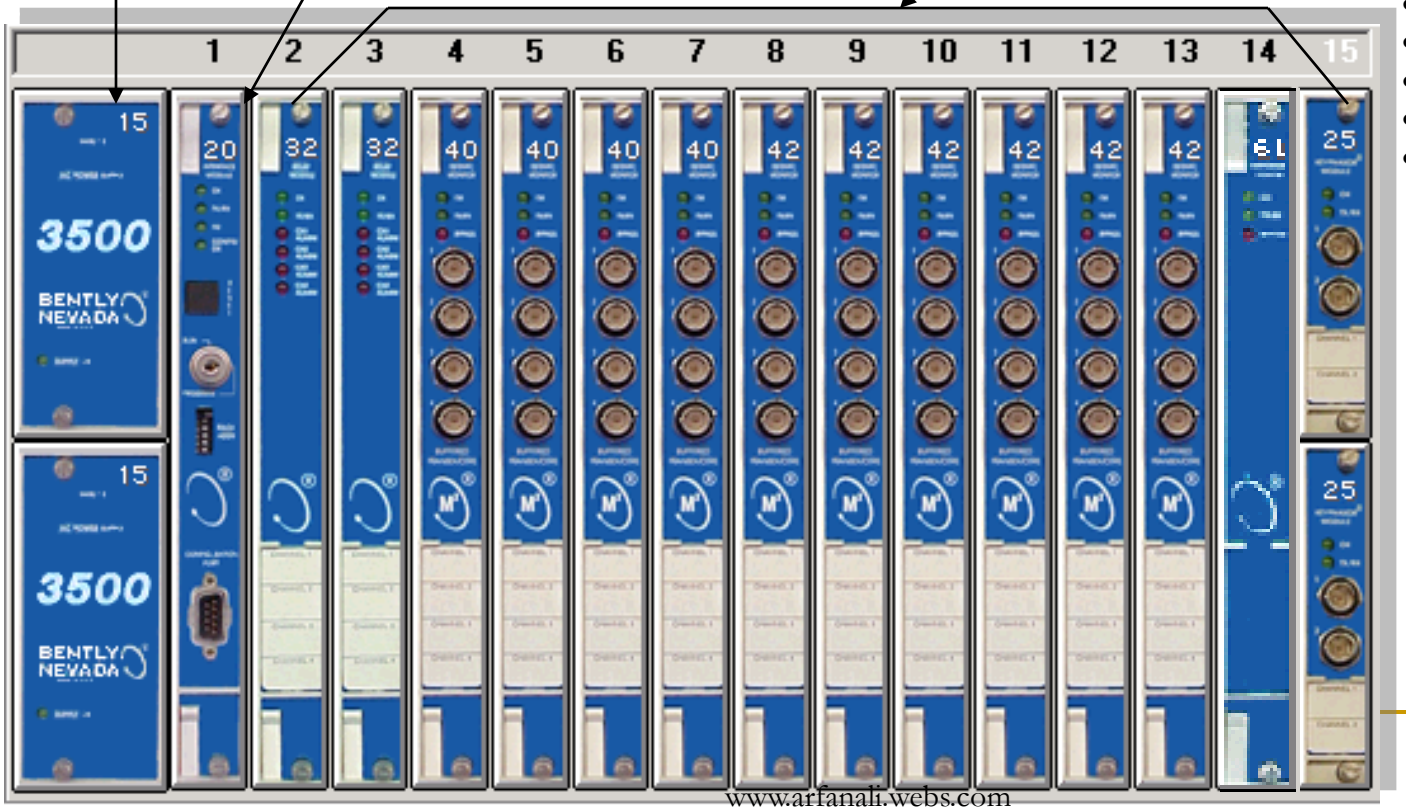
- Transducers
- 3500 Rack
- 3500 Software
- Computers



Vibration Monitoring System Overview



3500 System Monitor



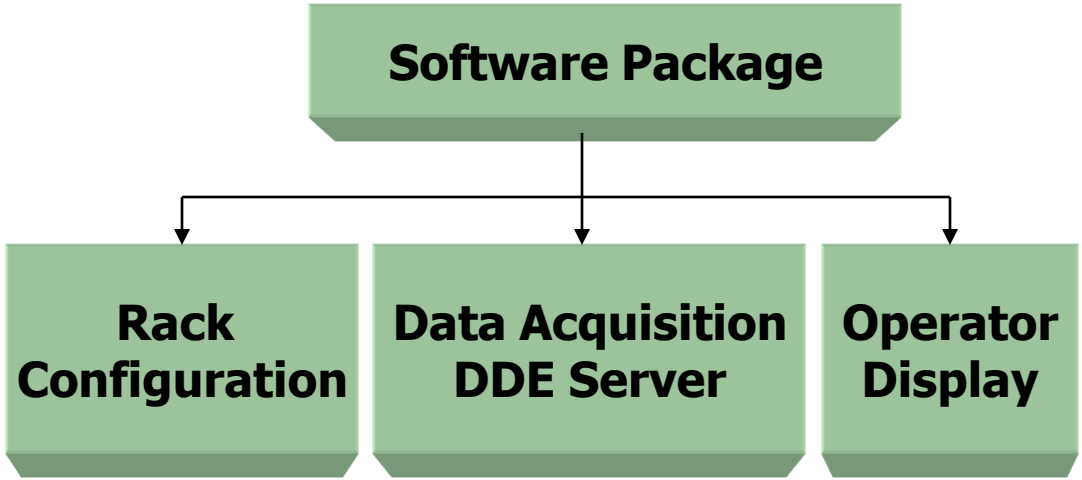
One or two Power Supplies

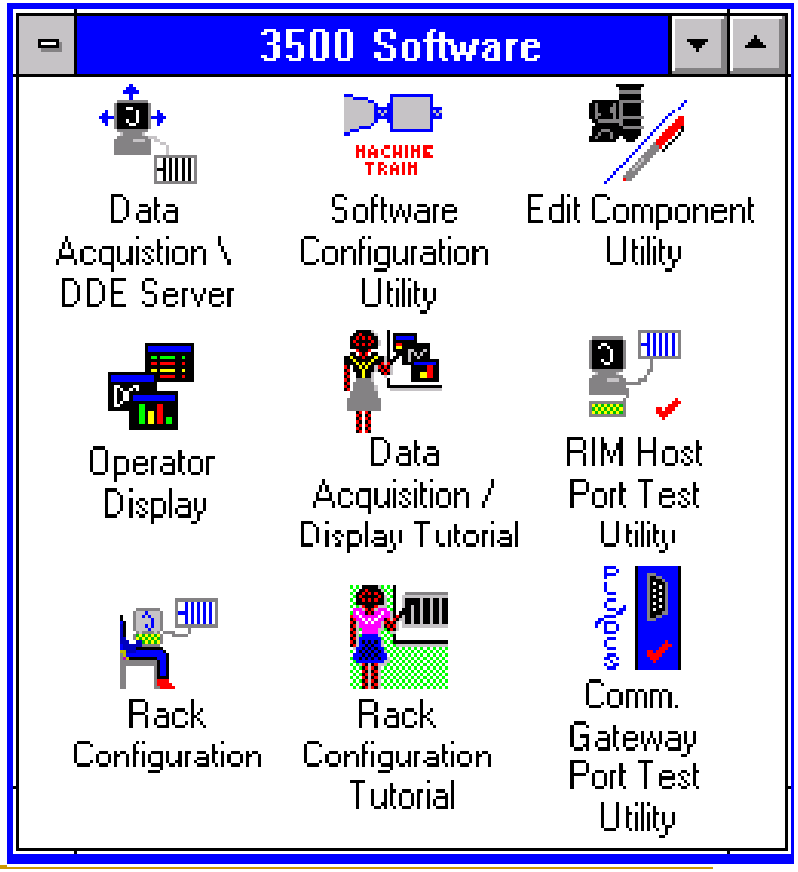
Rack Interface Modules

Any combination of the following 14 slot positions

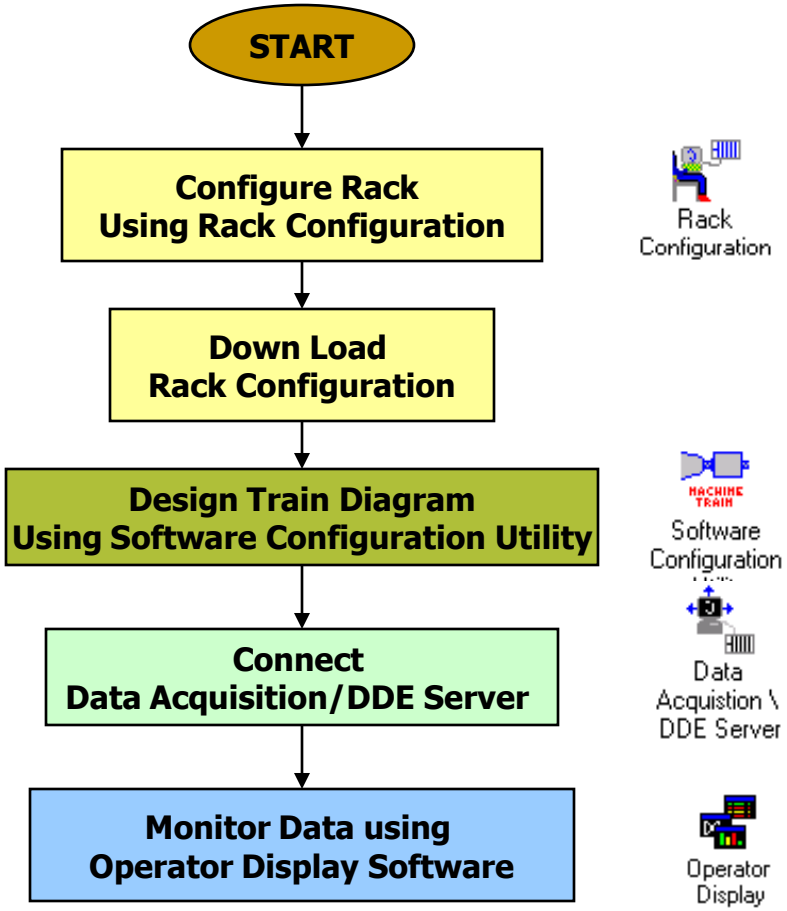
- **Monitor Module**
- **Key Phasor Module**
- **Relay Module**
- **Temperature Modules**
- **Communication Gateway Module**

3500 Software Packages





3500 Software Sequence



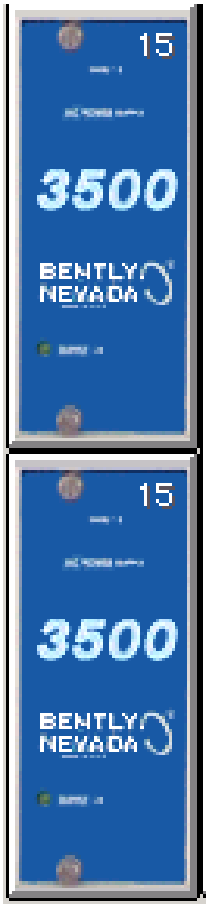
Common Pitfalls

- Not Ok
- By Pass
- Internal Faults

Question & Answers

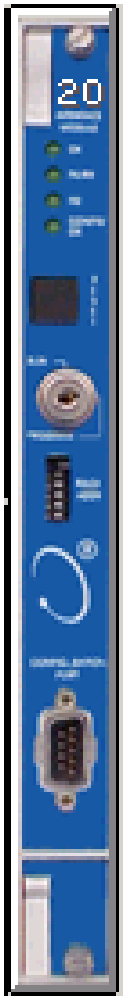
3500/15 AC & DC Power Supplies

- Half Height Modules
- Always Installed in the left most slot
- Upper Module.. Primary Supply
- Lower Module.. Backup Supply
- Removing & insertion of one Supply at one time will not disrupt operation.



3500/20 Rack Interface Module (RIM)

- Must be located in the 1st Slot
- Interface card between the rack & monitoring computer
- Works as a communication server

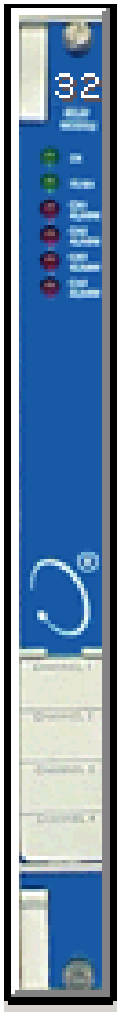


3500/42 Proximitor/Seismic Monitor

- Four Channel Monitor
- Accepts input from proximity and seismic transducers
- Monitor acceleration, velocity and absolute shaft measurement as well

3500/32 The 4 Channel Relay Module

- Full Height Module
- Provides Four Relay outputs
- Provide Alarm on Alert & tripping on Danger situations
- Programmable for AND/OR voting of trip Relays



3500/40 Proximitor Monitor

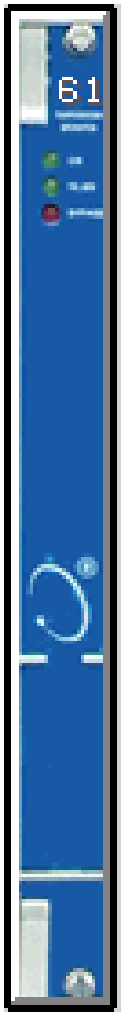
- Four Channel Monitor
- Accepts input from proximity transducers
- Monitors Radial Vibration and Thrust Position
  - Vibration 0- 500µm or 0- 20 mil Max.
  - Thrust 40-0-40mil Max.
- Hold Alarm set points (Alert & Danger)
- Compare monitored values with Alarm set points
- Provide Input signal to Relay module, when the monitored value exceed from the set point

3500/25 Key Phasor Modules

- Half Height module with 2-channels
- Measure RPM of the observed shaft
- View either Notch or Projection on the Shaft
- Association of key Phasor signal with peak to peak vibration is used to determine Vibration spectrum
- Range 1 to 99,999 RPM
- Maximum 4 key Phasor signals are possible in 3500 System
- Front View
  1. **OK** and **TX/RX**
  2. Buffered O/P

3500/61 Temperature Monitoring

- Full Height module
- Six channel Monitor
- Accepts both Thermocouple & RTD type inputs
- Provide 4 to 20 mA recorder outputs
- Not in use at FFC-MM



Rack Configuration Software

- Configuration radial Vibration Channel
- Configuration Axial vibration channel
- Configuration of Keyphasor
- Configuration of Relay module

Configuration of Radial Vibration Channel

- Transducer field installation
- Range
- Set points
- Key phasor
- Alert latching / non latching

Configuration of Axial vibration channel

- Transducer field installation
- Towards / away
- Zero position
- Range
- Set points
- Key phasor
- Alert latching / non latching
- Time delay
- 1X, 2X and not 1X

Configuration of Key phasor

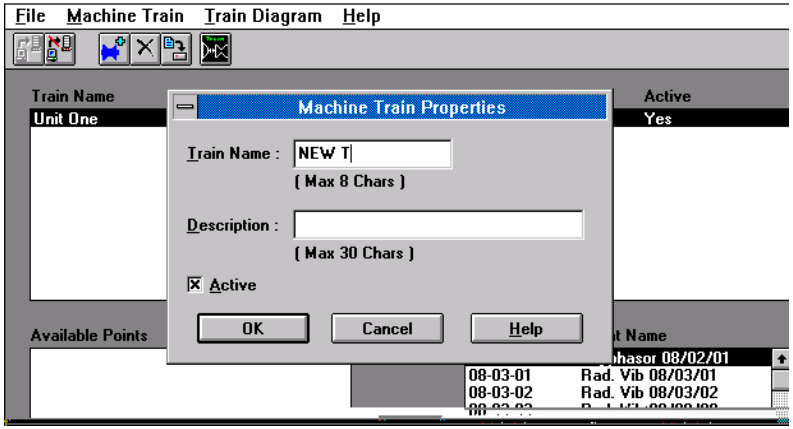
- Association
- Range
- Notch

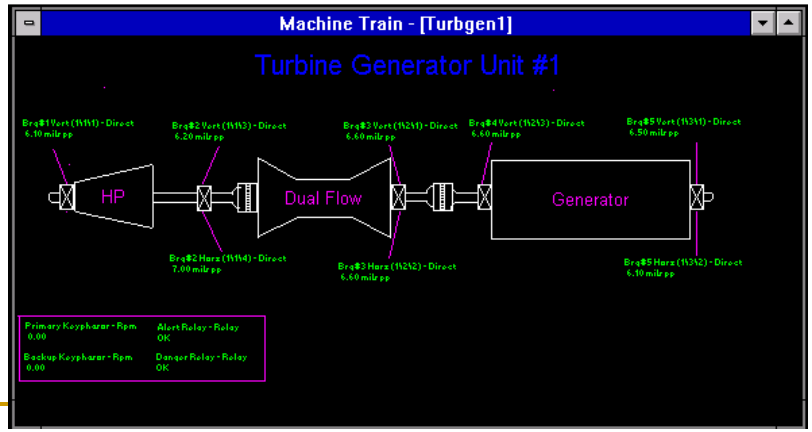
Configuration of Relay Card

- Identify the XTs and VTs required for alarms and danger
- Type of voting

Software Configuration Utility

- Used to create Machine Train Displays
- Specify Historic trend parameters
  - Enabling/Disabling
  - Time B/W two consecutive points
  - Memory Size
- Generate Report on Machine Train Displays





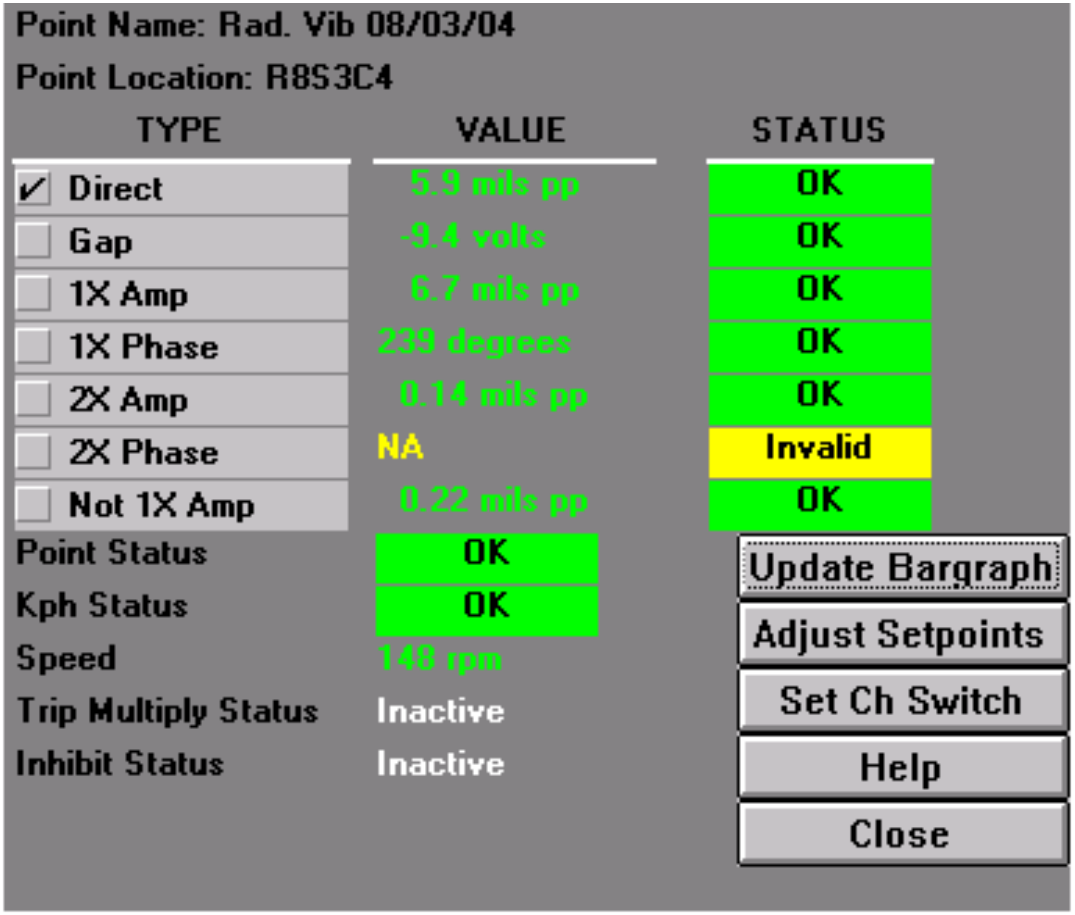
Data Acquisition/DDE Server

- Collects machinery monitoring Data, Alarm, and System Events data
- Provides data to Operator Display Software
- Stores historical and real-time trend data

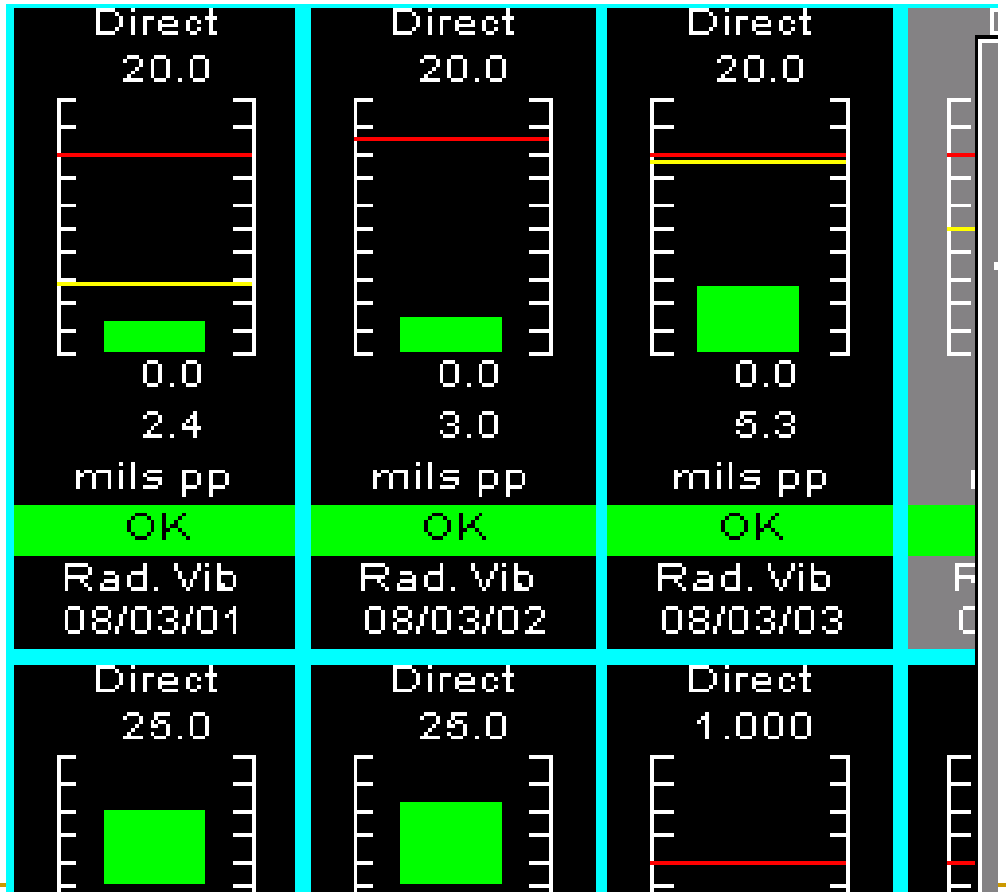
Operator Display Software

- Displays machine monitoring data using
  - Current values
  - Bargraphs
  - Trends (Historical/Real)
  - Machine Train Diagrams
- Used to view
  - System Event List
  - Alarm Event List

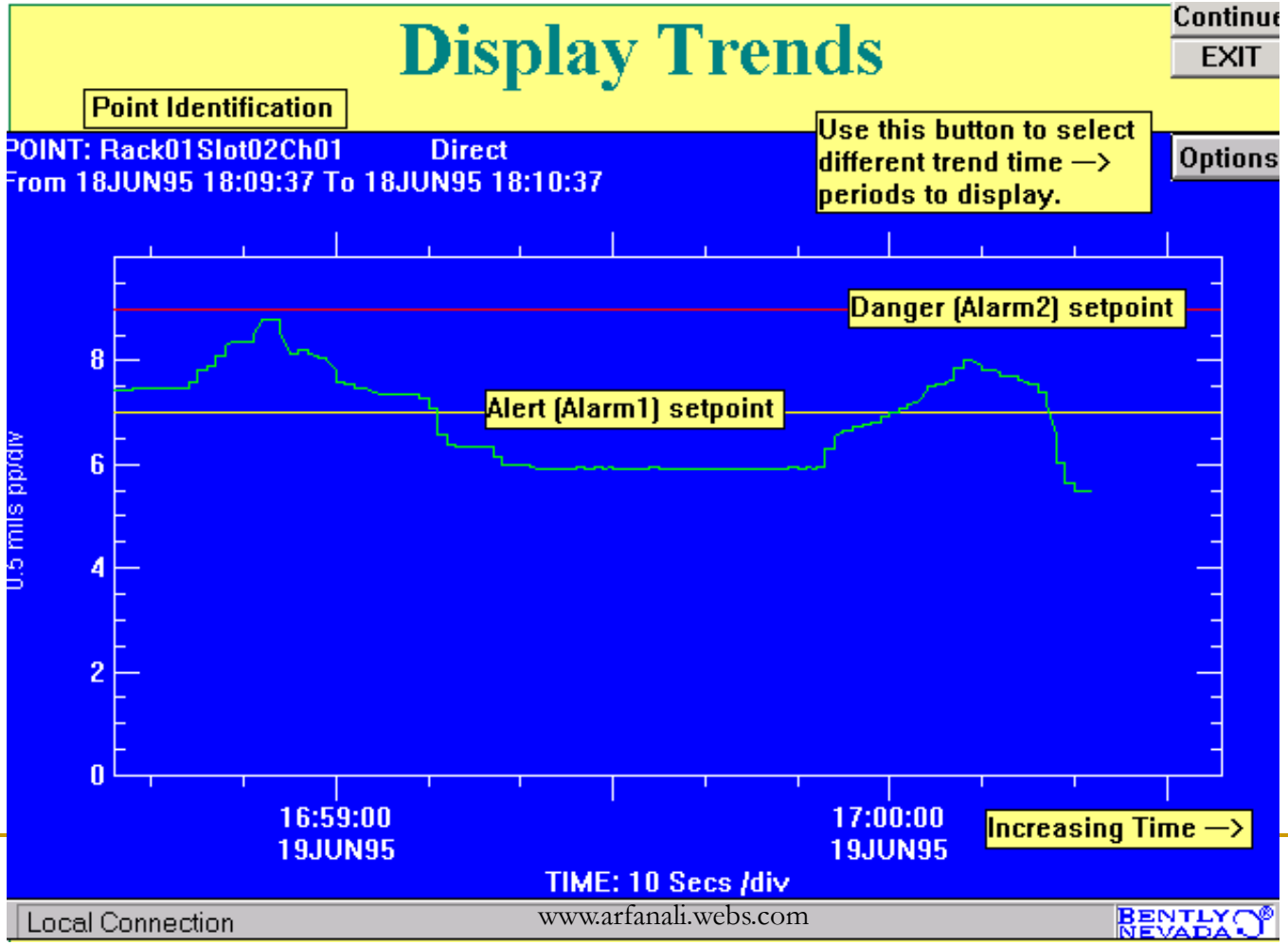
Current Values



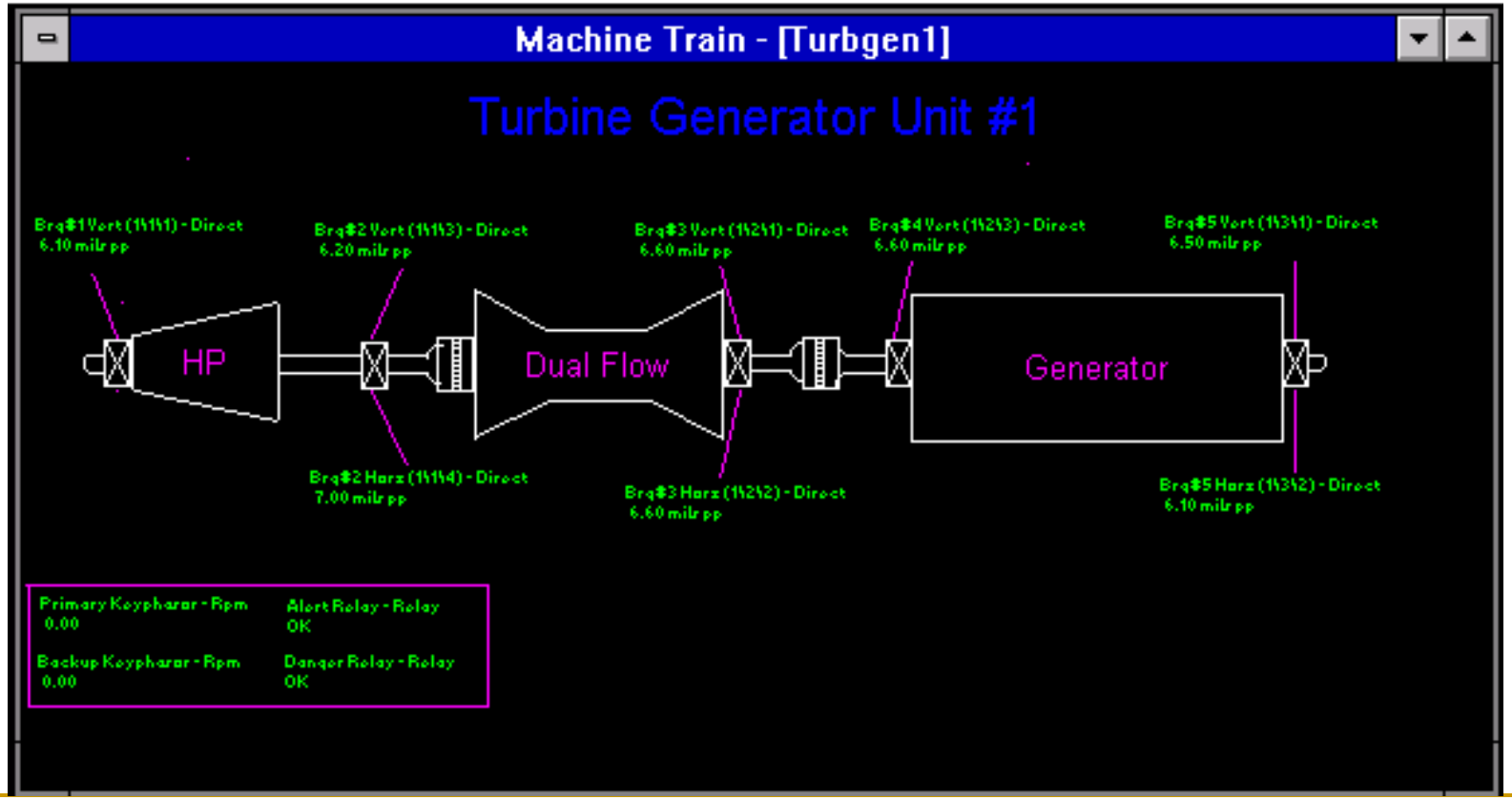
Bargraphs


Direct
20.0
0.0
2.4
mils pp
OK
Rad. Vib
08/03/01
Direct
20.0
0.0
3.0
mils pp
OK
Rad. Vib
08/03/02
Direct
20.0
0.0
5.3
mils pp
OK
Rad. Vib
08/03/03
Direct
25.0
Direct
25.0
Direct
1.000

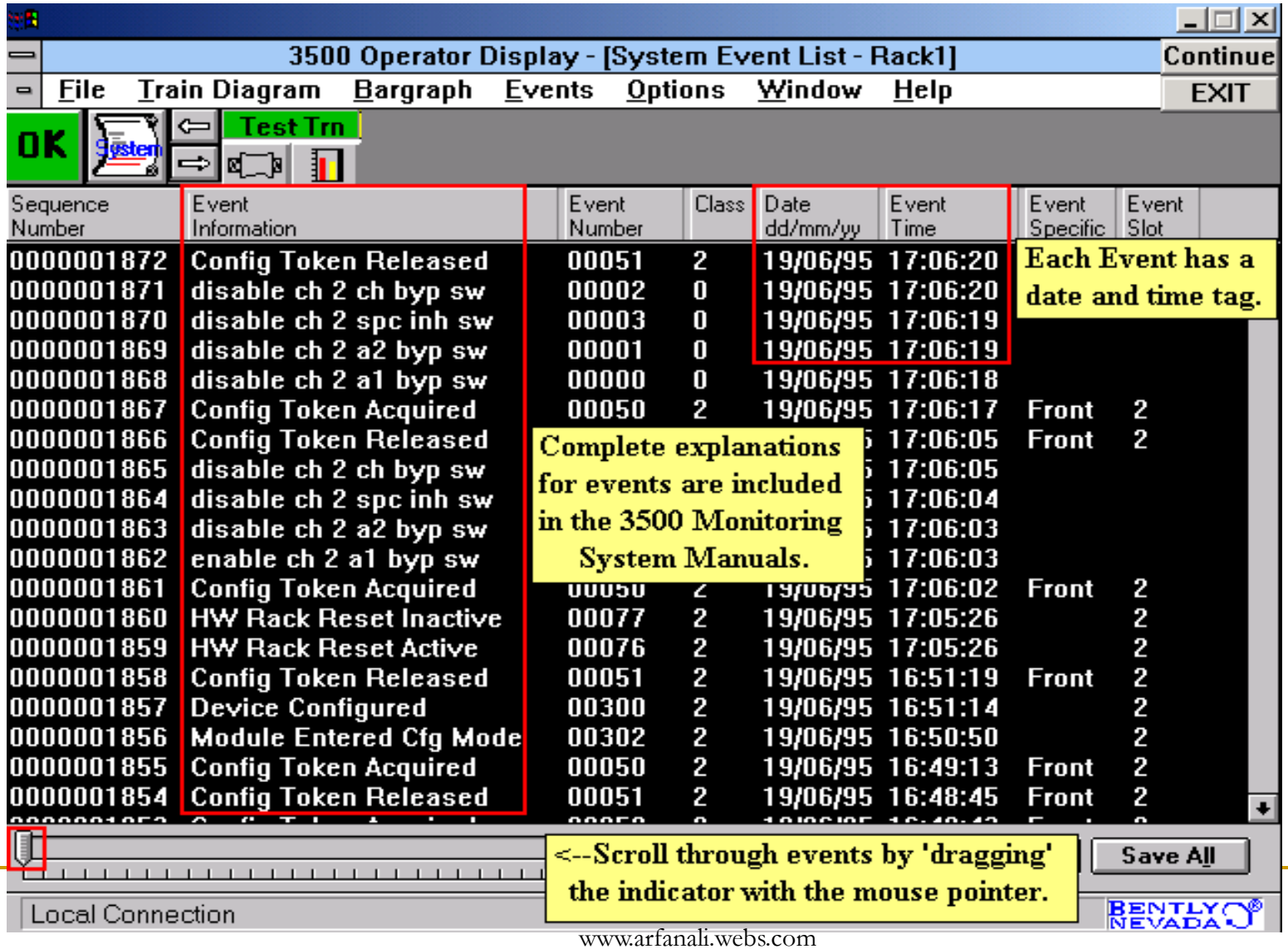
Trends


Display Trends
Continue
EXIT
Point Identification
POINT: Rack01Slot02Ch01 Direct
From 18JUN95 18:09:37 To 18JUN95 18:10:37
Use this button to select different trend time periods to display.
Options
Danger (Alarm2) setpoint
Alert (Alarm1) setpoint
0.5 mils pp/div
8
6
4
2
0
16:59:00
19JUN95
17:00:00
19JUN95
Increasing Time
TIME: 10 Secs /div
Local Connection
BENTLY NEVADA

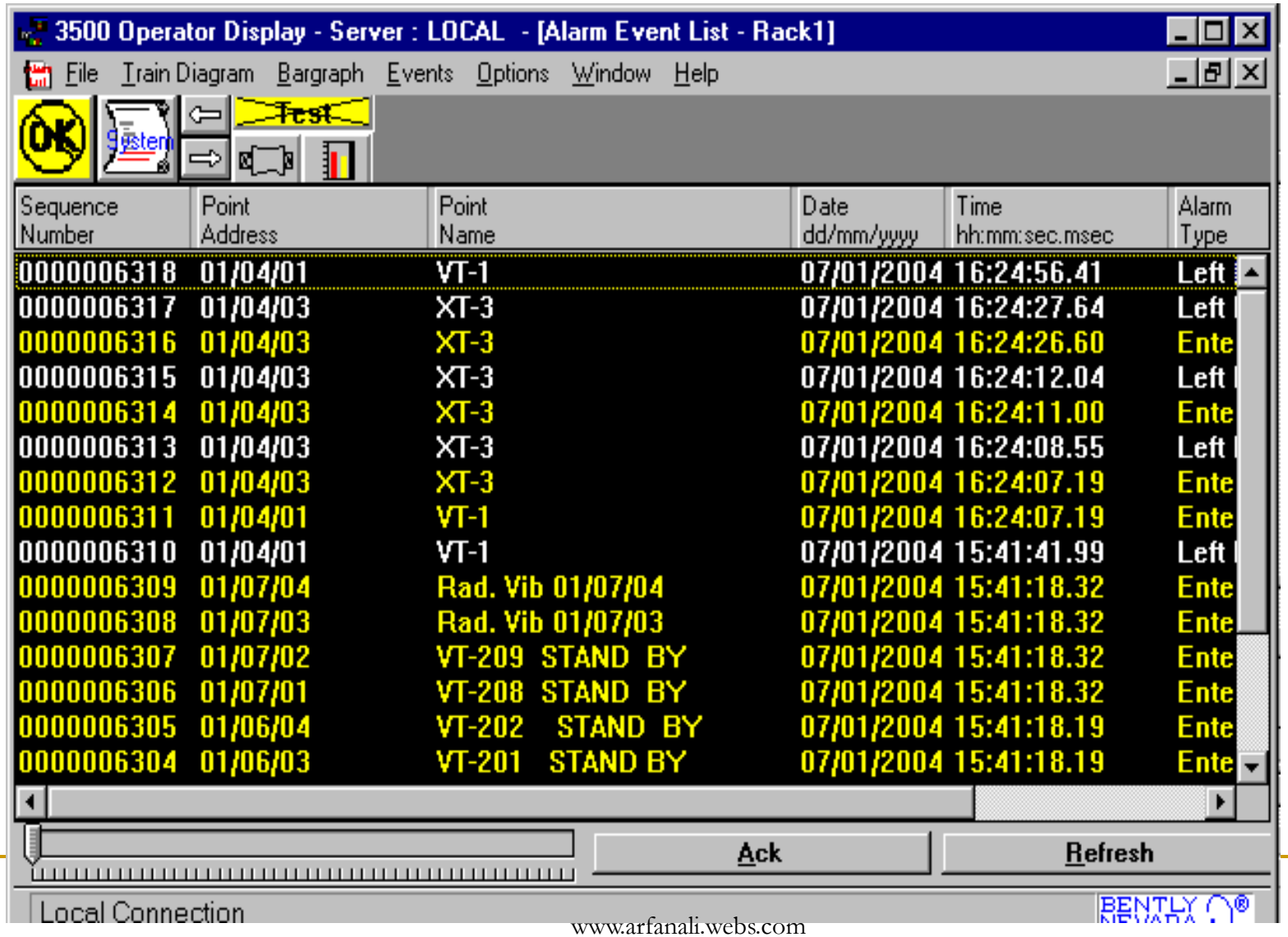
Machine Train Diagram



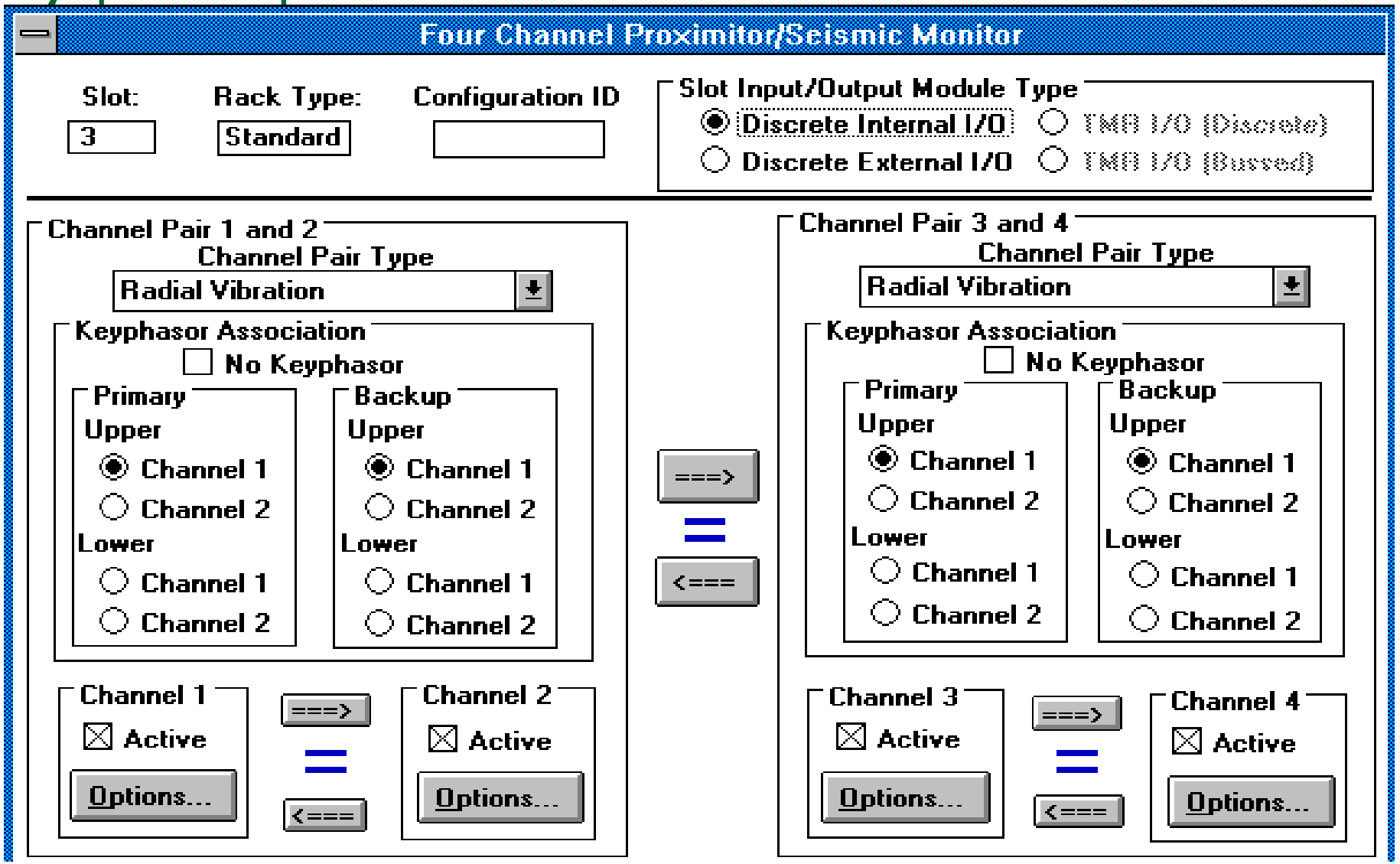
System Event List



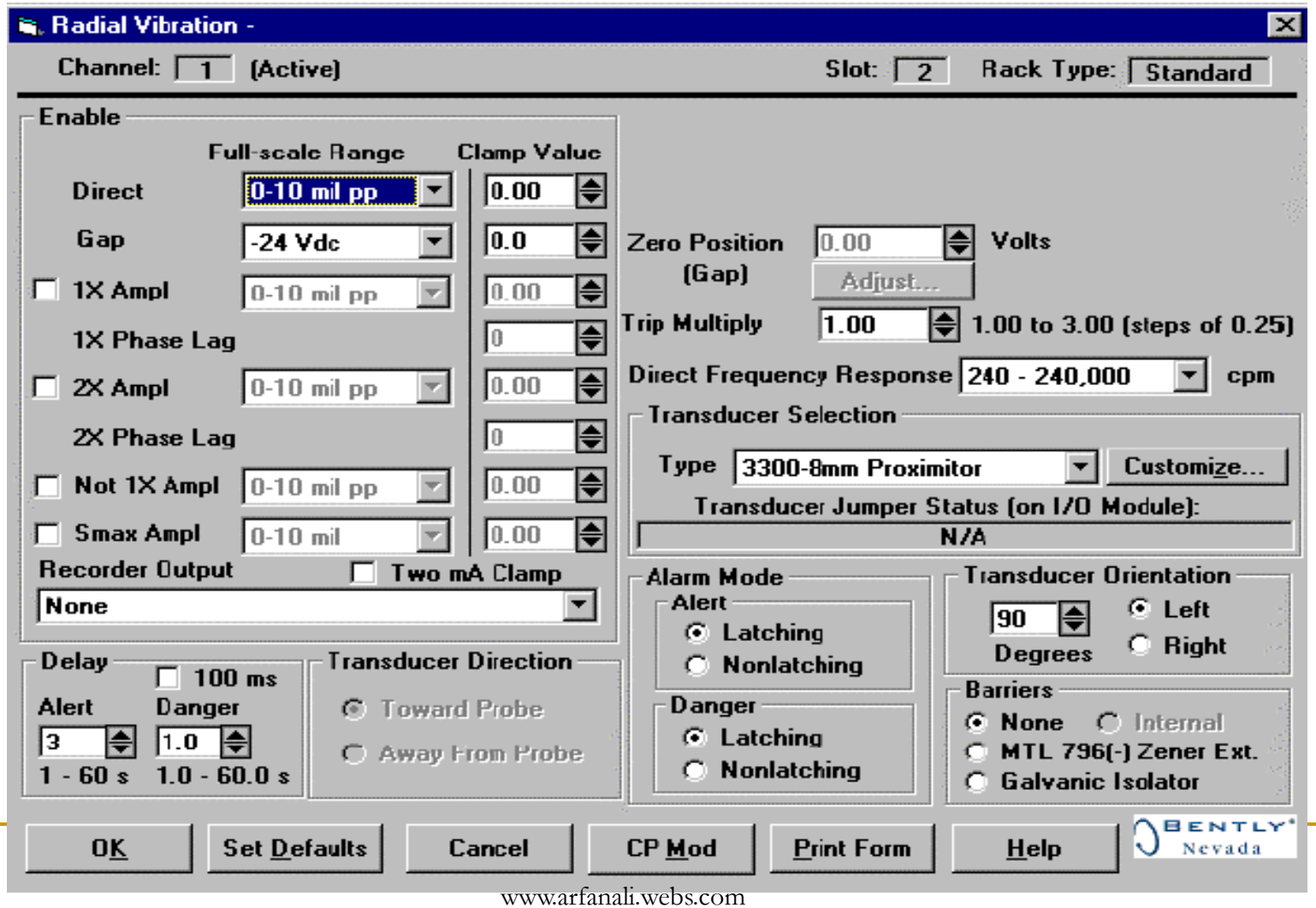
Alarm Event List



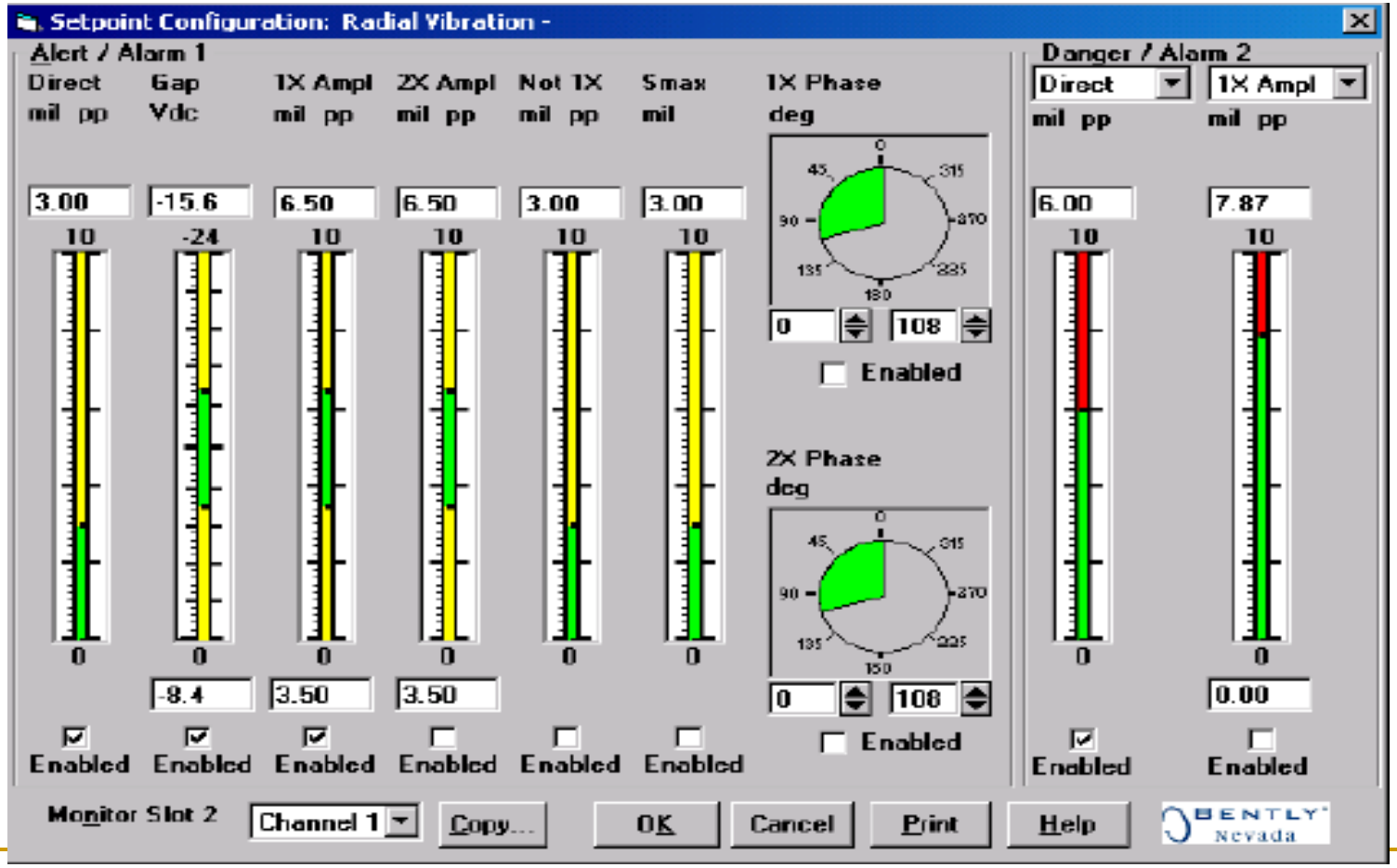
Configuration of Radial Vibration Channel



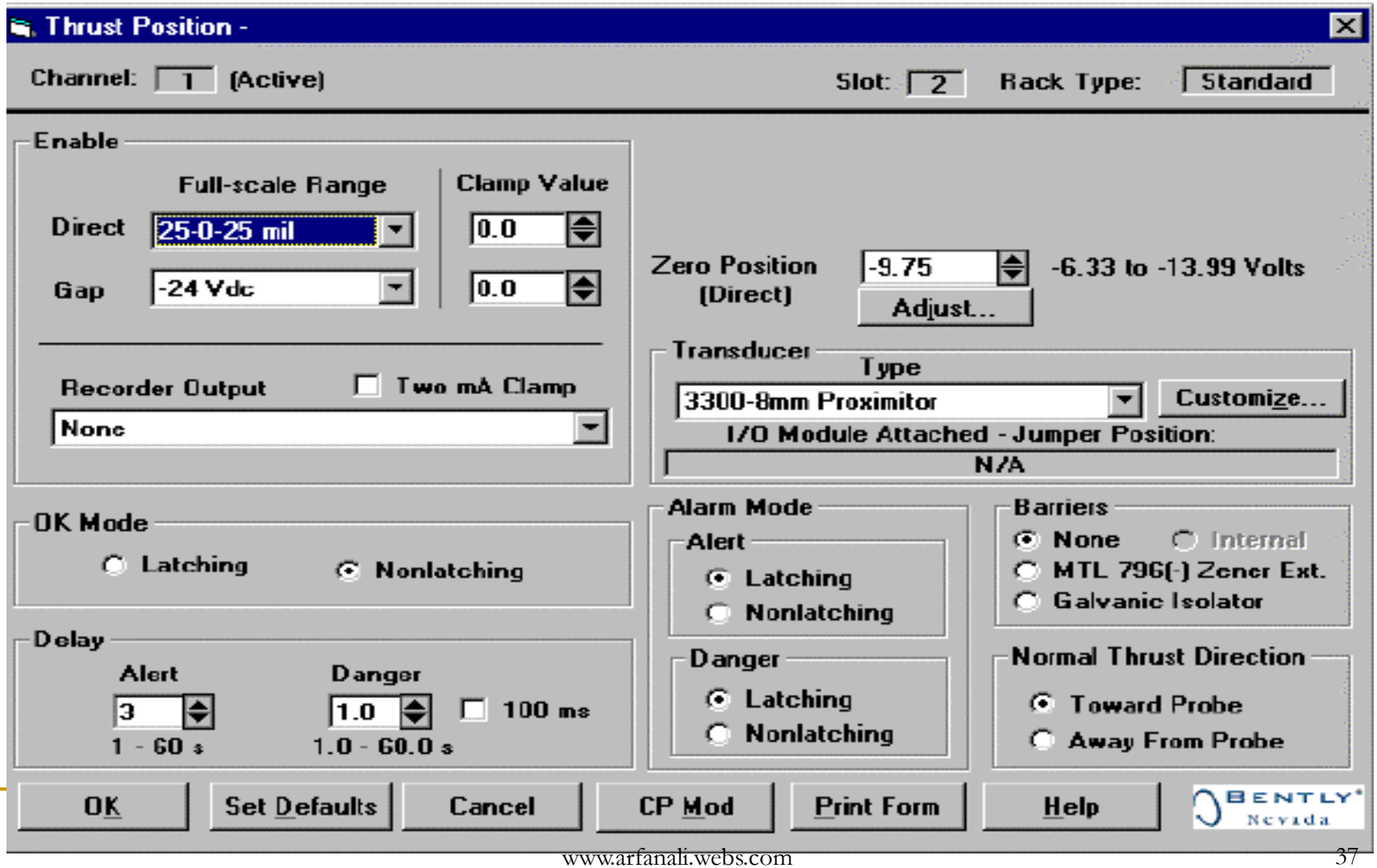
Configuration of Radial Vibration Channel (contd)



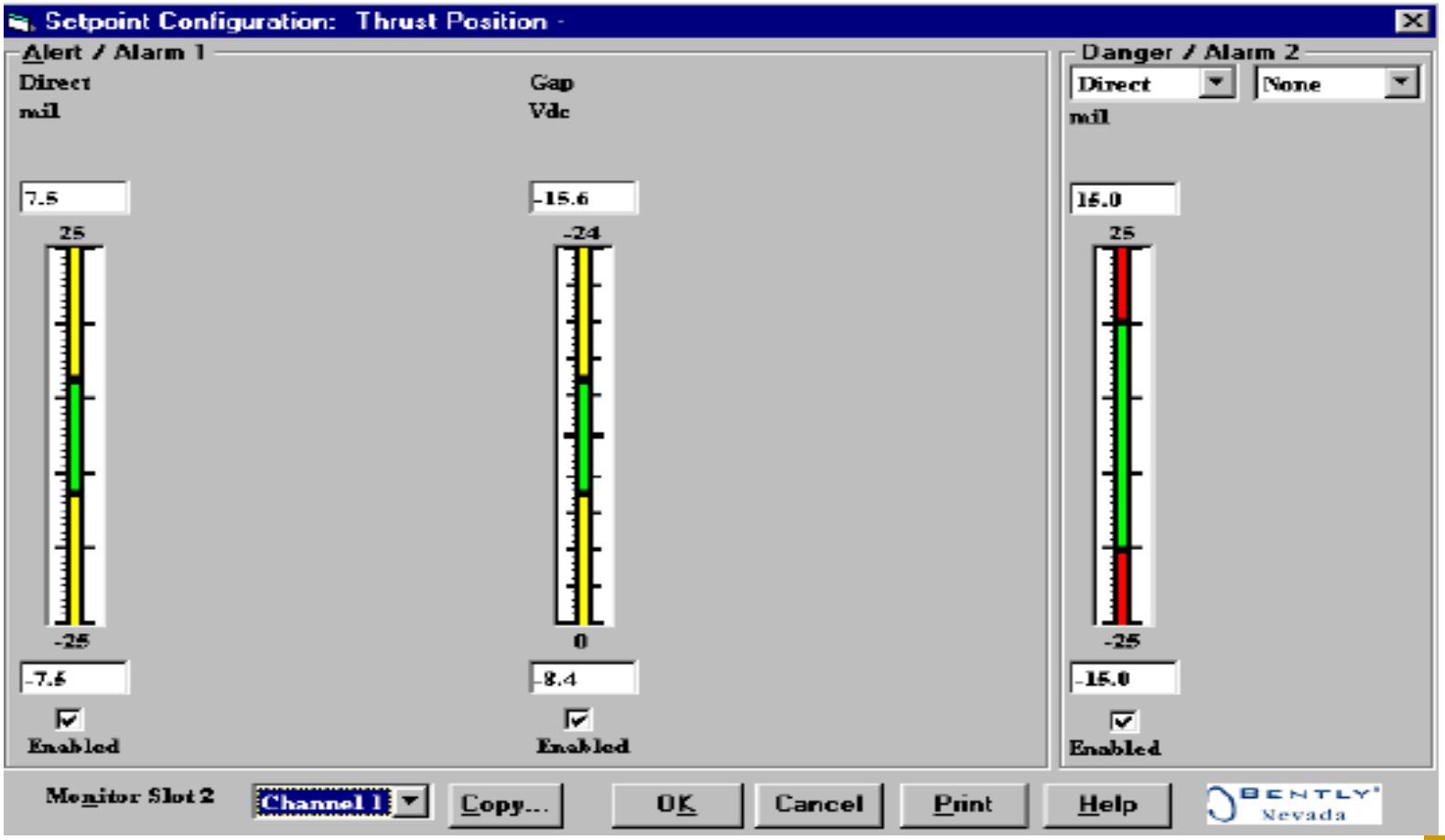
Configuration of Radial Vibration Channel (contd)



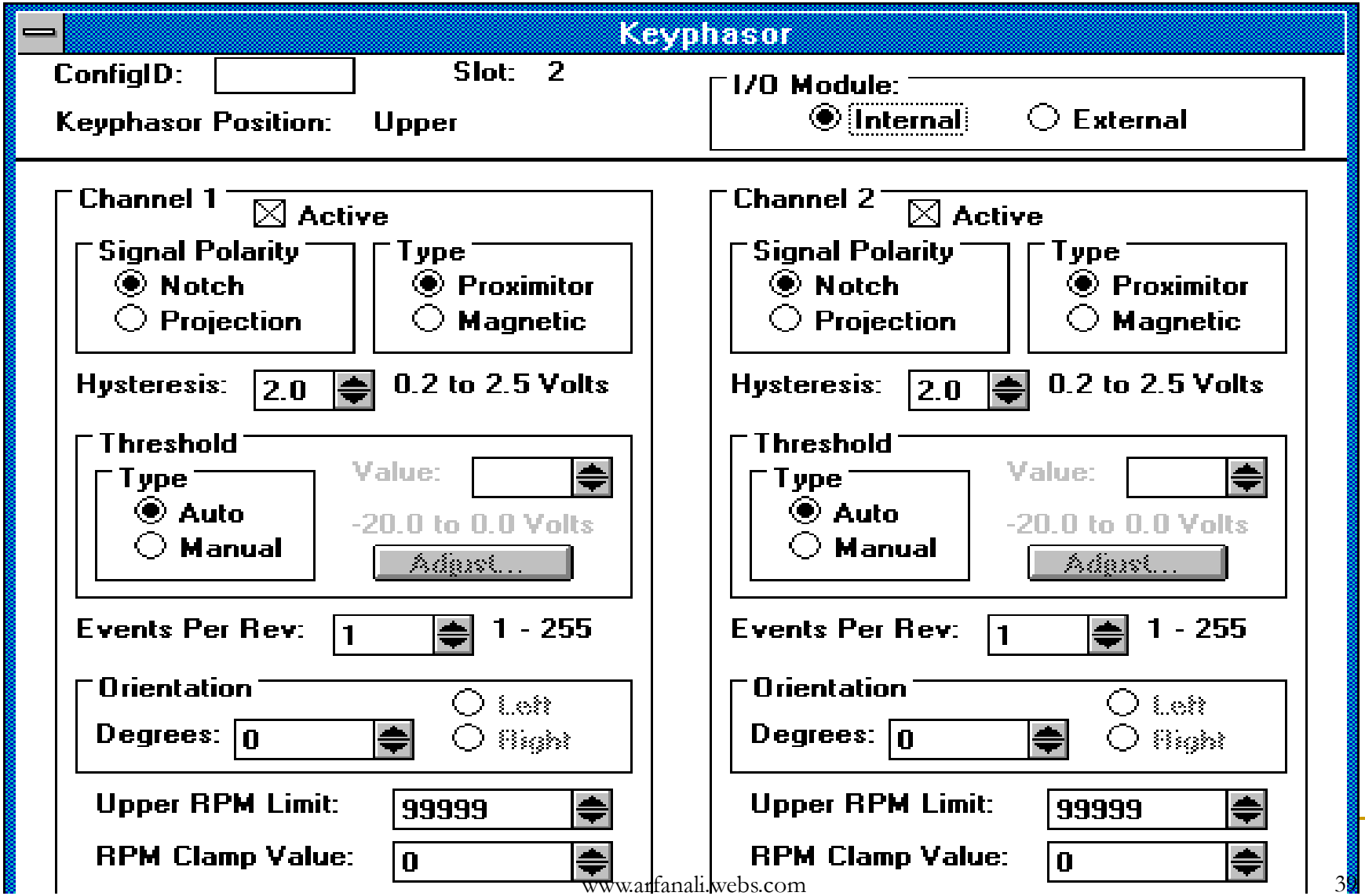
Configuration of Axial Vibration Channel



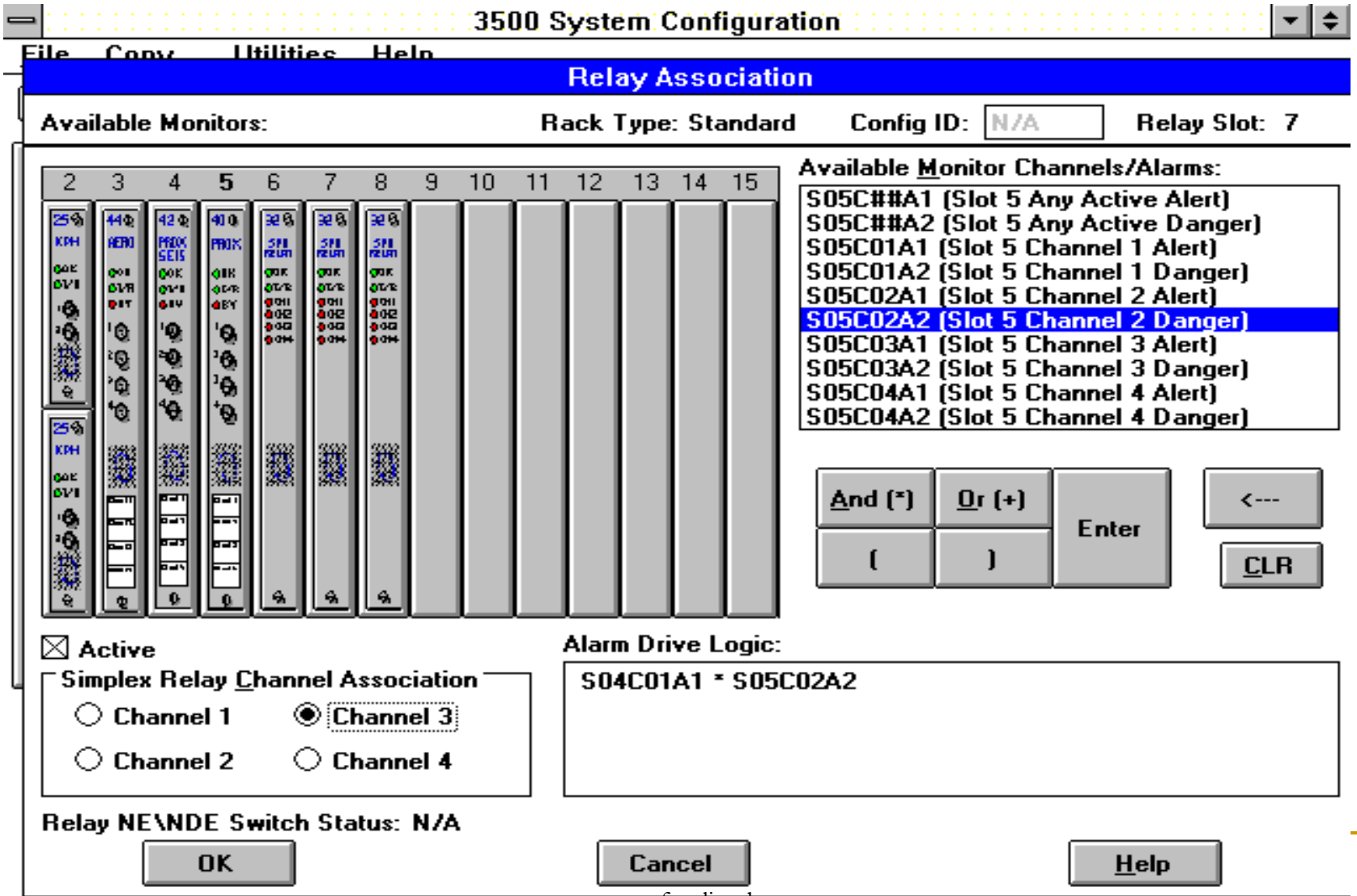
Configuration of Axial Vibration Channel (contd)



KeyPhasor Module Configuration



Relay Configuration



Not OK

- Channel not ok status results from any of the following conditions:
  - Probe is open
  - Connection looseness

    - Note: If time defeat is ON
      - 30 sec are required to move from not OK state OK state
      - When any channel go into Not okay state it will go into bypass state

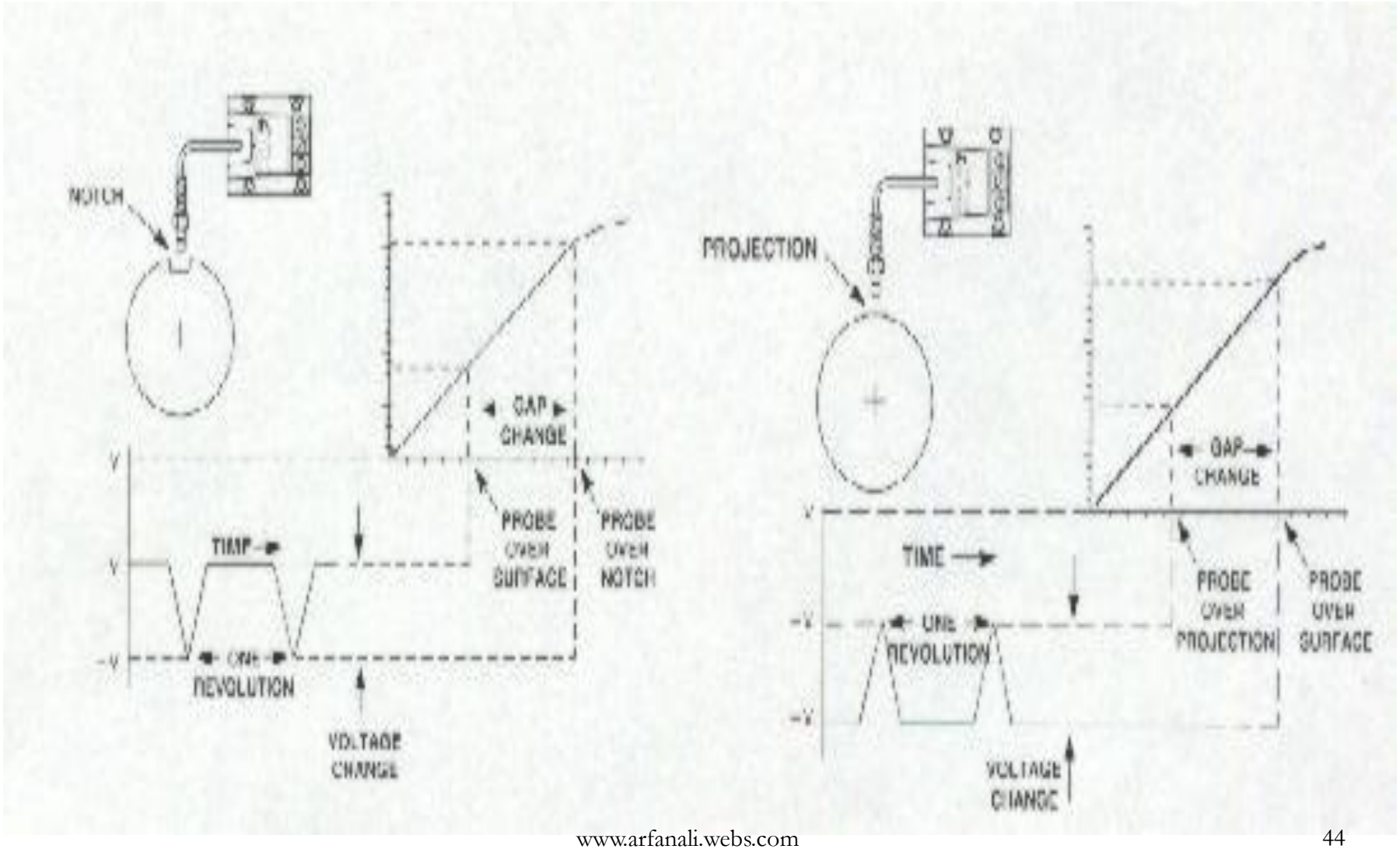
By Pass

- A software switch is bypassing any channel alarming function
- A transducer is not okay and the channel is configured for “Timed ok Channel Defeat”
- The Keyphasor associated with the channel has gone invalid
- The monitor has detected a serious internal fault

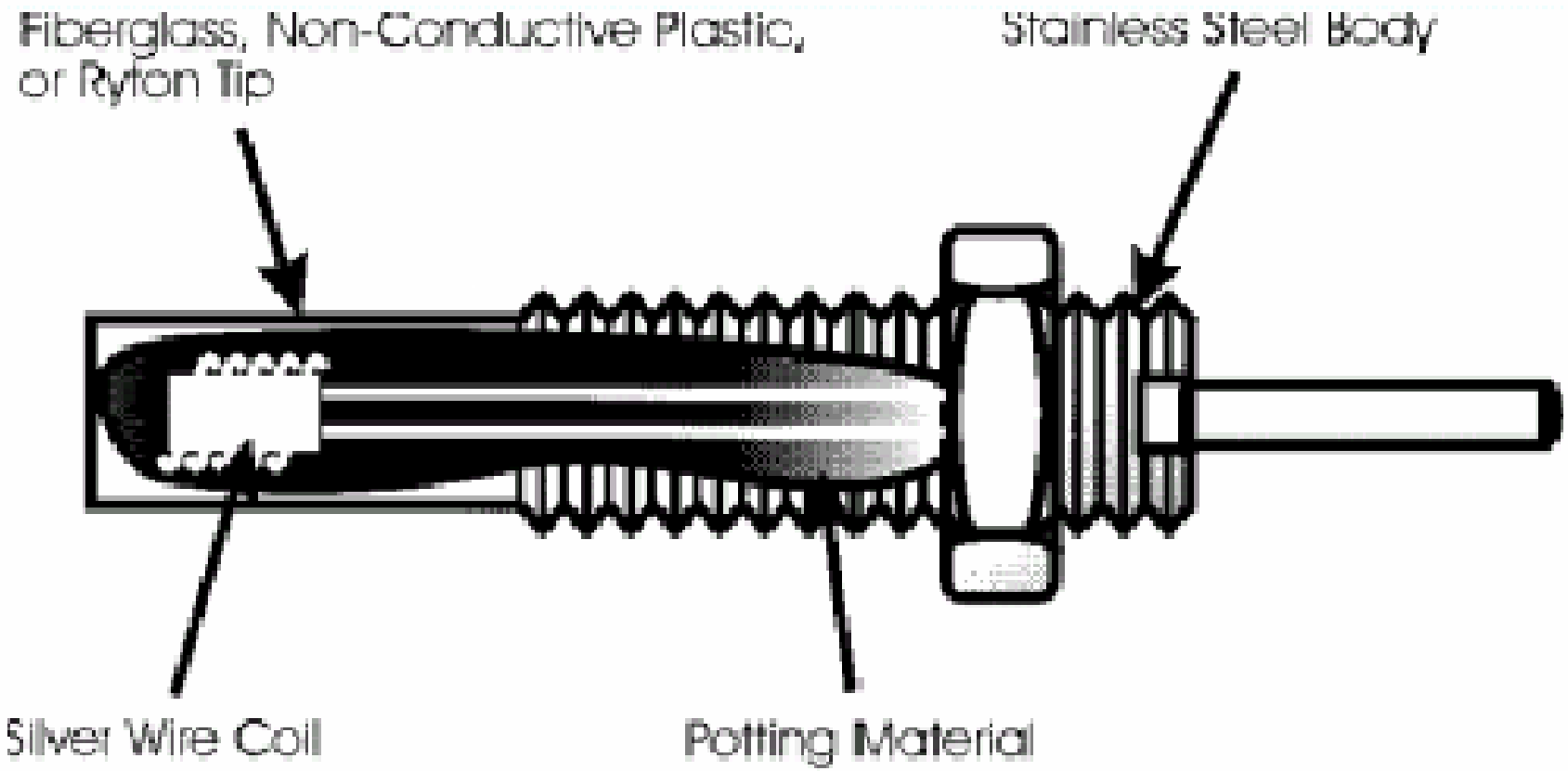
Internal Fault

- Internal faults are rectified by checking the code (event number) from the system event list and checking the corresponding value in the system manual.

Key Phasor


NOTCH
GAP CHANGE
PROBE OVER SURFACE
PROBE OVER NOTCH
TIME
ONE REVOLUTION
VOLTAGE CHANGE
PROJECTION
GAP CHANGE
TIME
ONE REVOLUTION
PROBE OVER PROJECTION
PROBE OVER SURFACE
VOLTAGE CHANGE

Shape of proximity probe



Negative Supply of Proximitor

- I am glad you benefited from my article. To answer your question is that the first reliable transistors that were commonly available for use were NPN, which required a negative supply .

  Mark Snyder, Bently Nevada