

## **Welding Processes**

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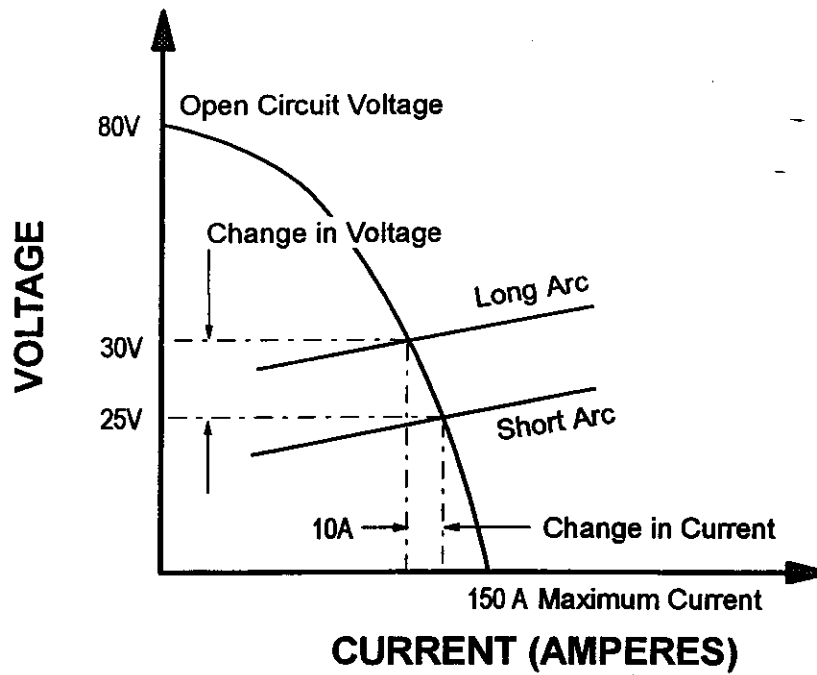
# **Welding Power Supplies & Controls**

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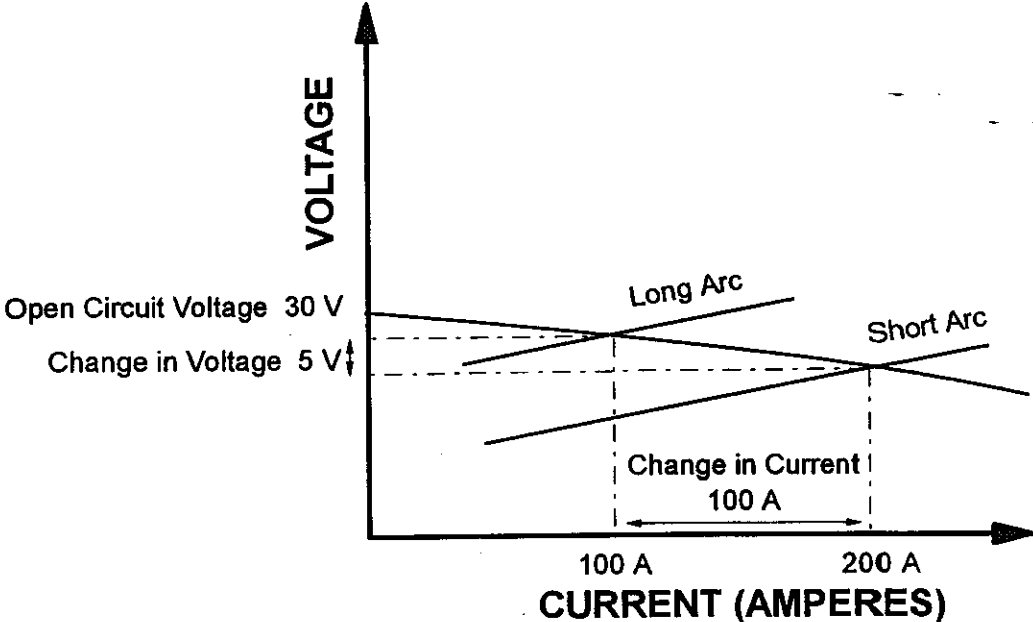
# **Lecture Scope**

- Power Supply Output Characteristics
- Relationship to Welding Processes
- Main Types of Power Supply
  - Transformer
  - Solid state
  - Alternator
- Process Controls

# "Drooping" Output Characteristic



# **"Flat" Output Characteristic**



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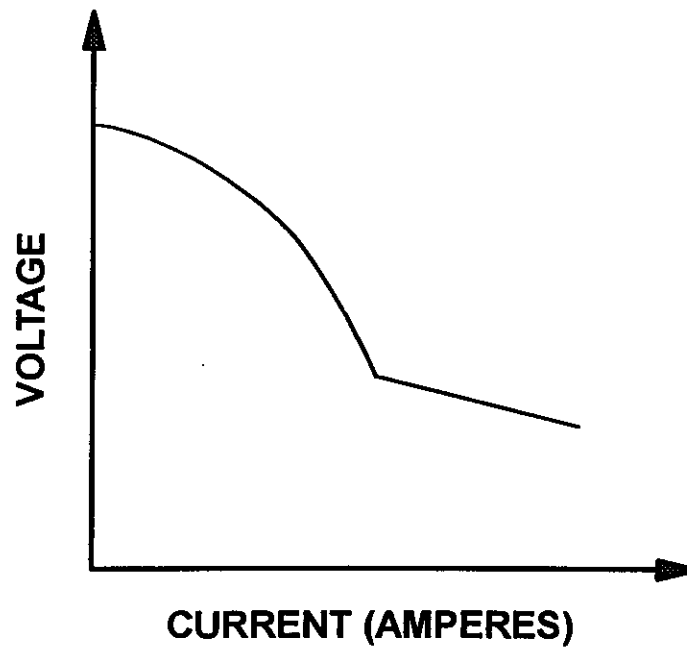
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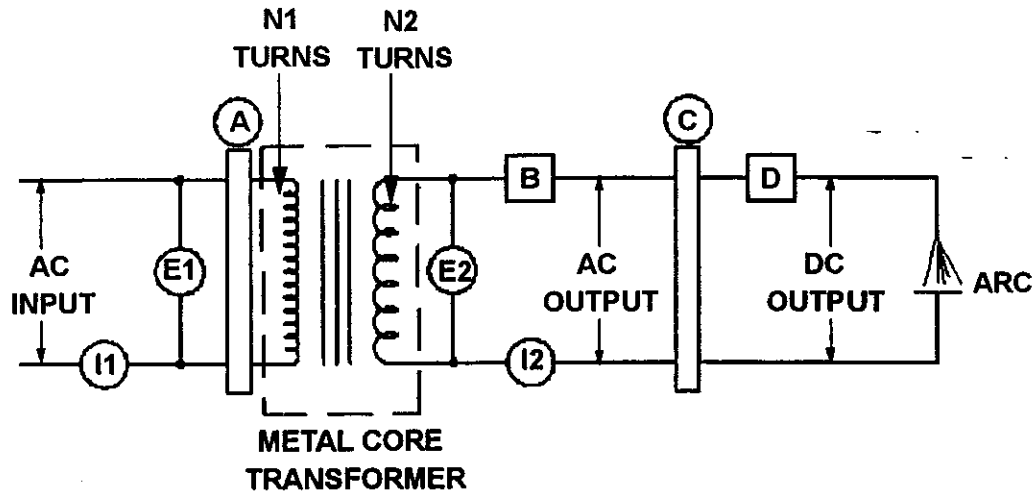
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## Combination Volt-Amp Curve

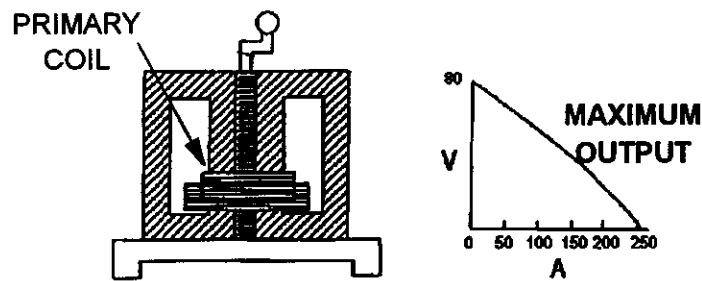
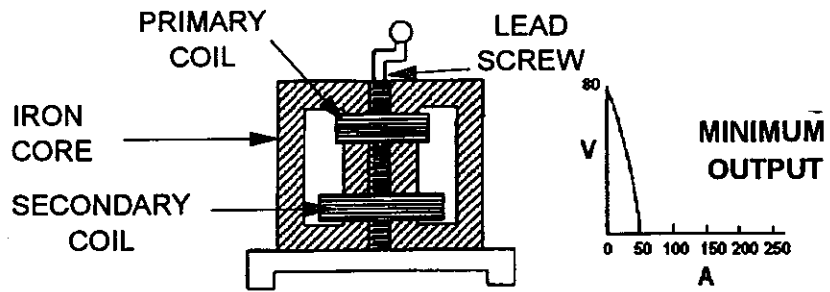


# Principal Elements of Transformer Power Supply

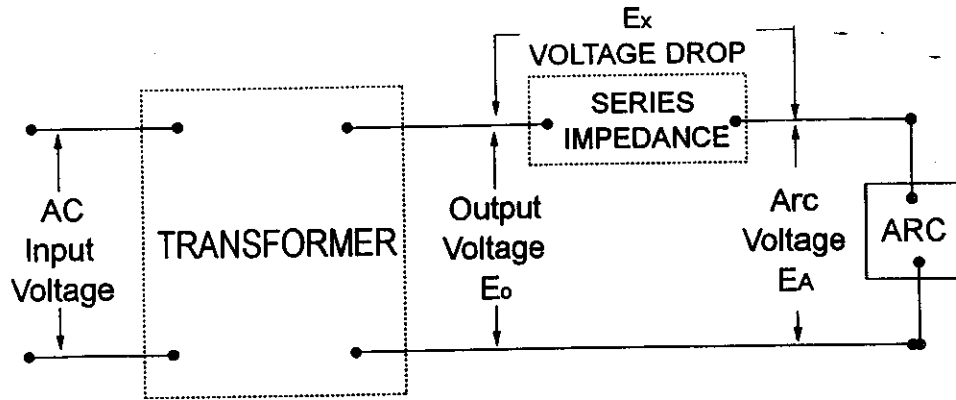


- A: Primary solid state inverter if used
- B: Series output control if used (AC/DC)
- C: Rectifier or SCR control for DC output
- D: Secondary switch for chopper type control of DC output

# Moveable-Coil AC Power Source

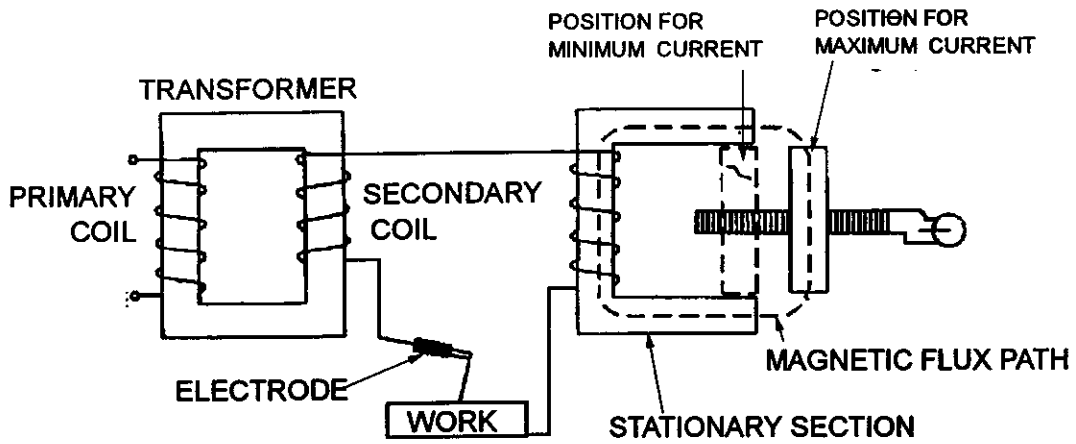


# Typical Series Impedance Control



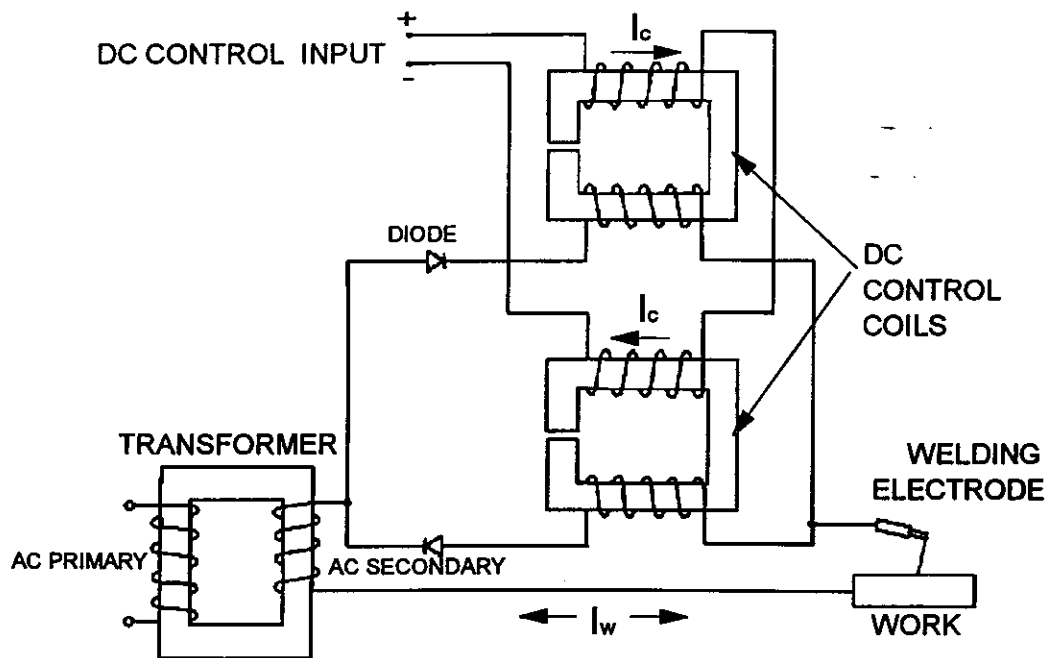


# Moveable-Core Reactor AC Power Source

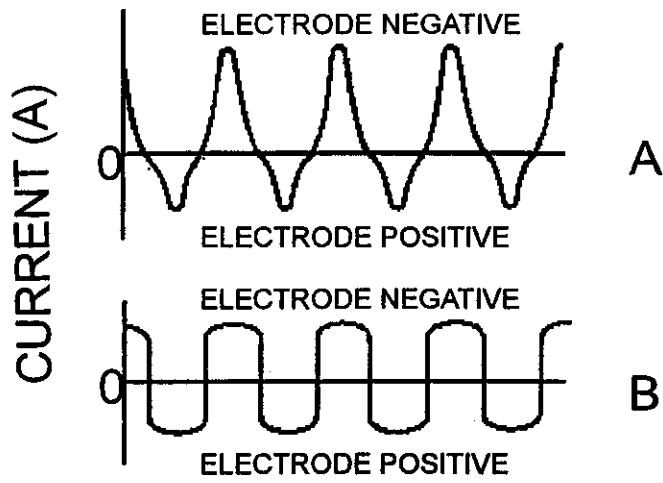




# Magnetic Amplifier Control



# AC Current Waveforms



A-Magnetic Amplifier  
B-Square Wave

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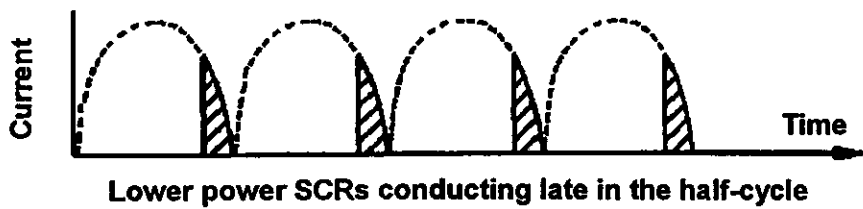
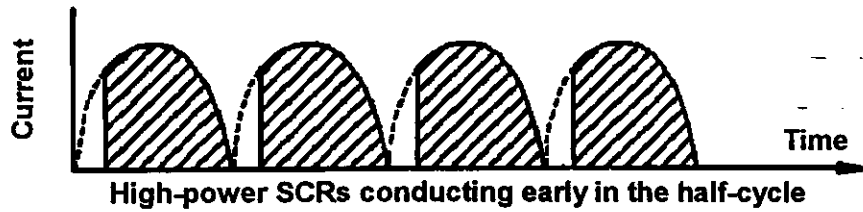
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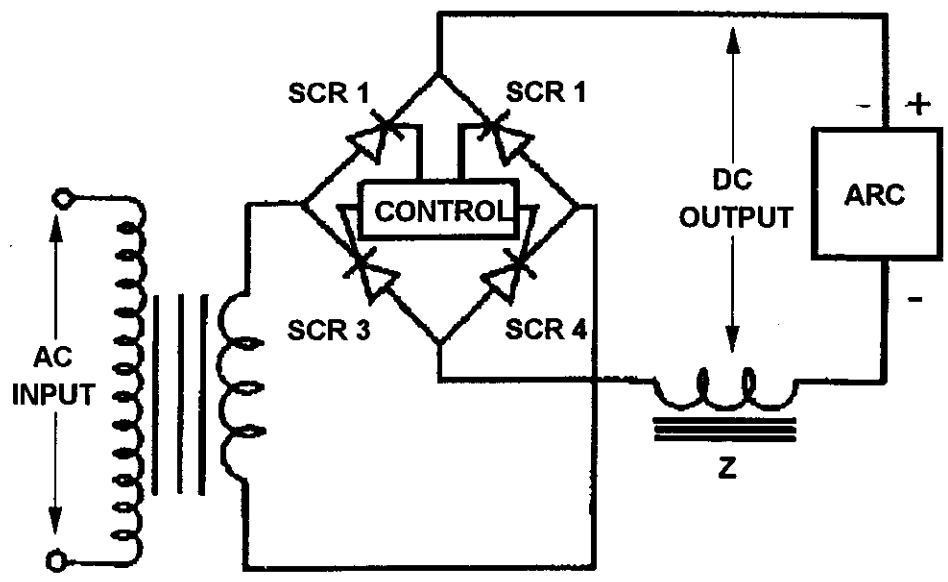
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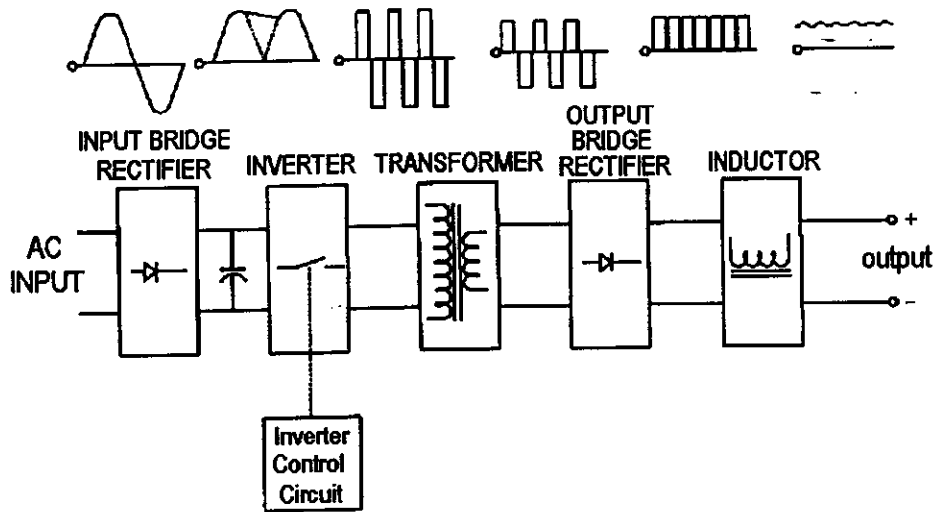
# Phase Control Using an SCR Bridge



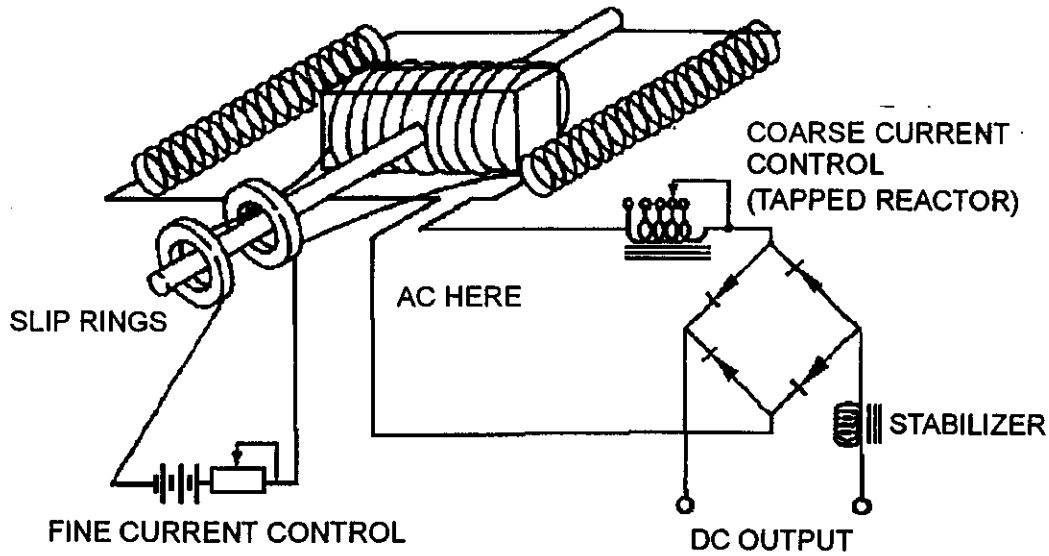
# SCR-Controlled DC Power Source



# Inverter Power Source



# Alternator Type Power Supply



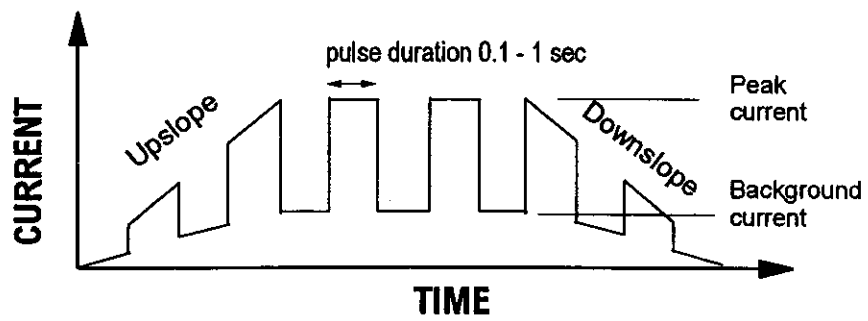


# **Process Controls**

- **Welding Current Programming**
  - upslope, downslope, crater fill
- **Process cycle control**
  - co-ordinate operation of welding power, wire feed, weld head motion, shielding gas flow, etc
  - Open loop logic
- **Adaptive or feedback control**
  - seam tracking
    - arc voltage control, electro-mechanical & optical methods
  - process control

# Current Programming

## Pulsed GTAW



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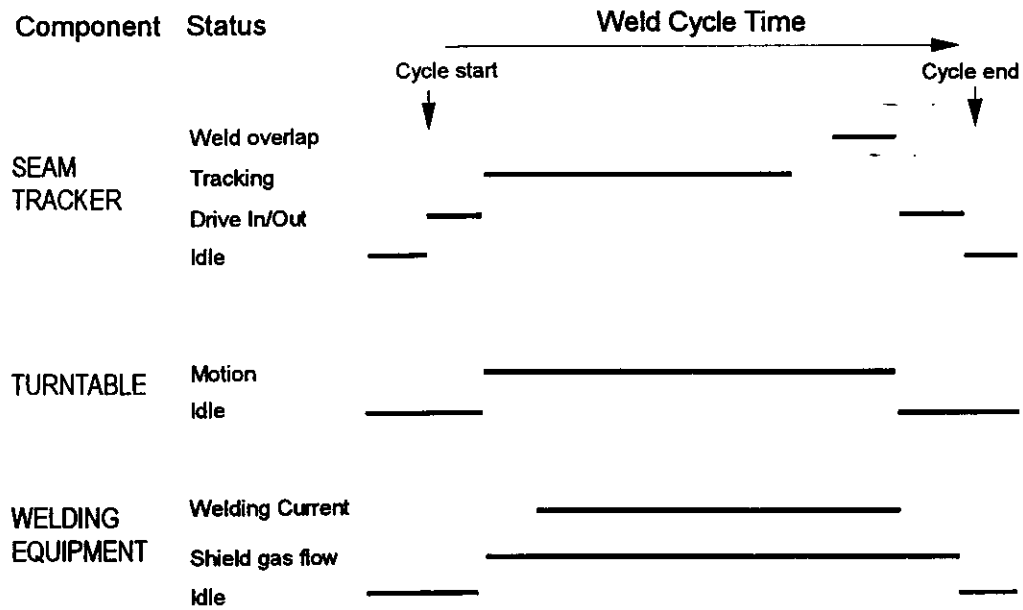
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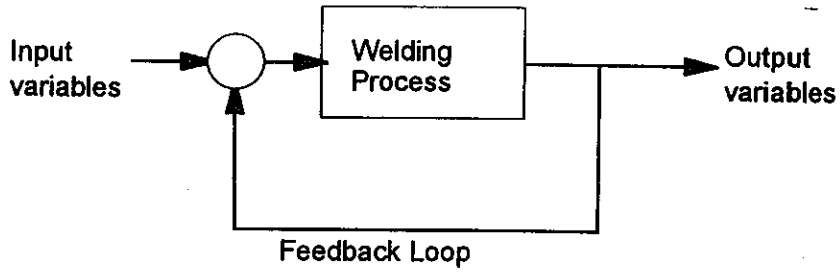
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# Process Control

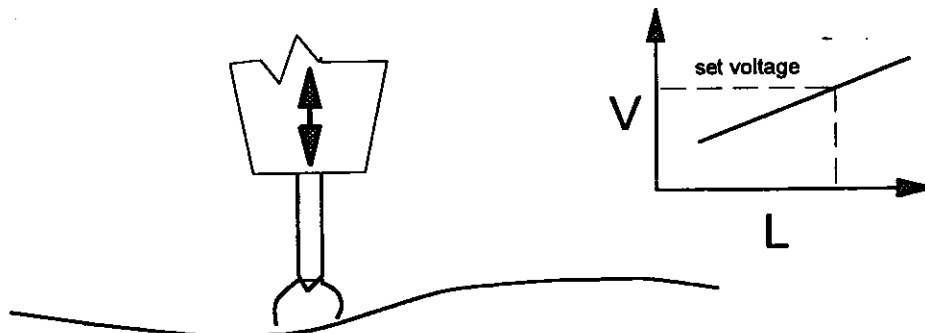


# Adaptive Control



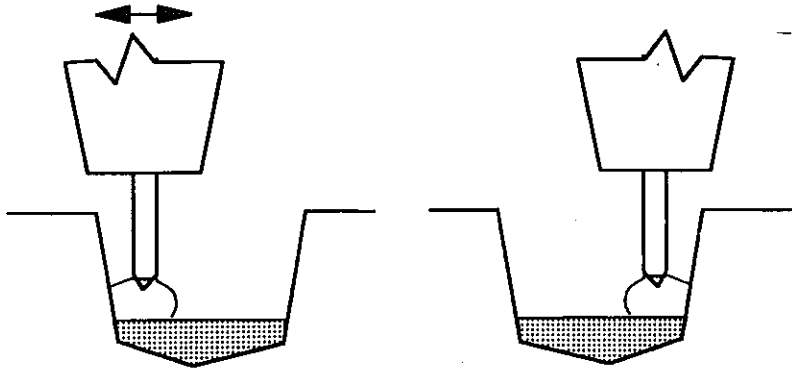
# Adaptive control

Arc length control based on arc voltage



# Adaptive Control

Joint tracking using arc voltage sensing



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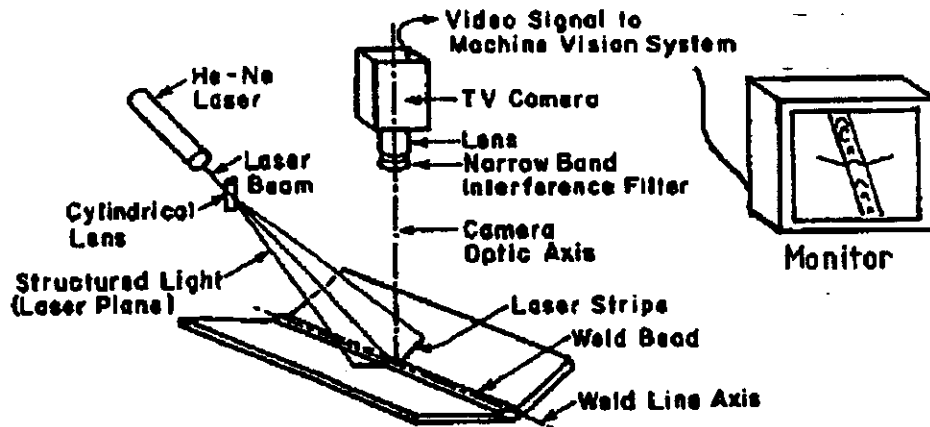
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# Adaptive control

## Optical joint tracking method



# Adaptive control

Feedback control of GTAW weld penetration based on photodiodes

