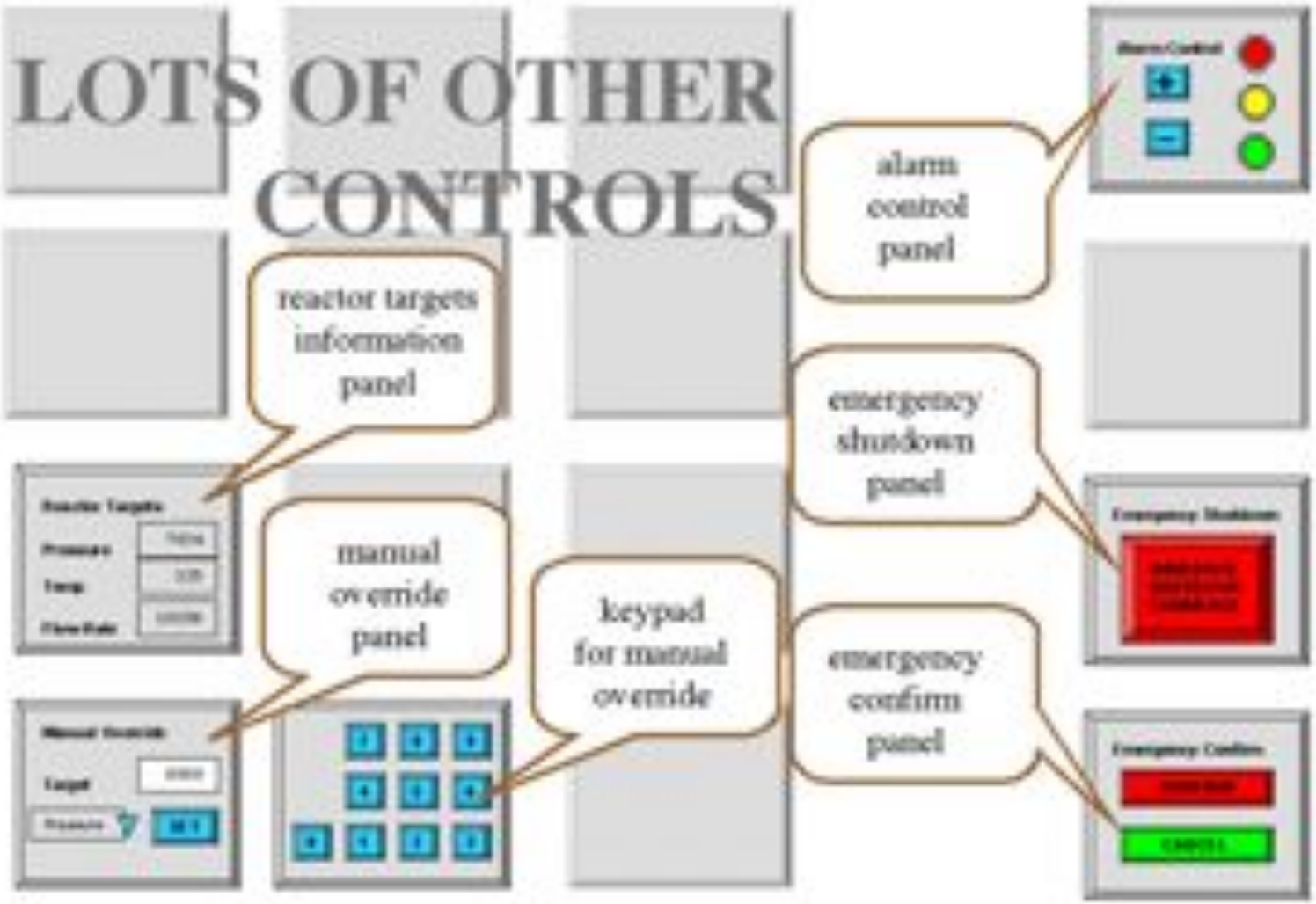
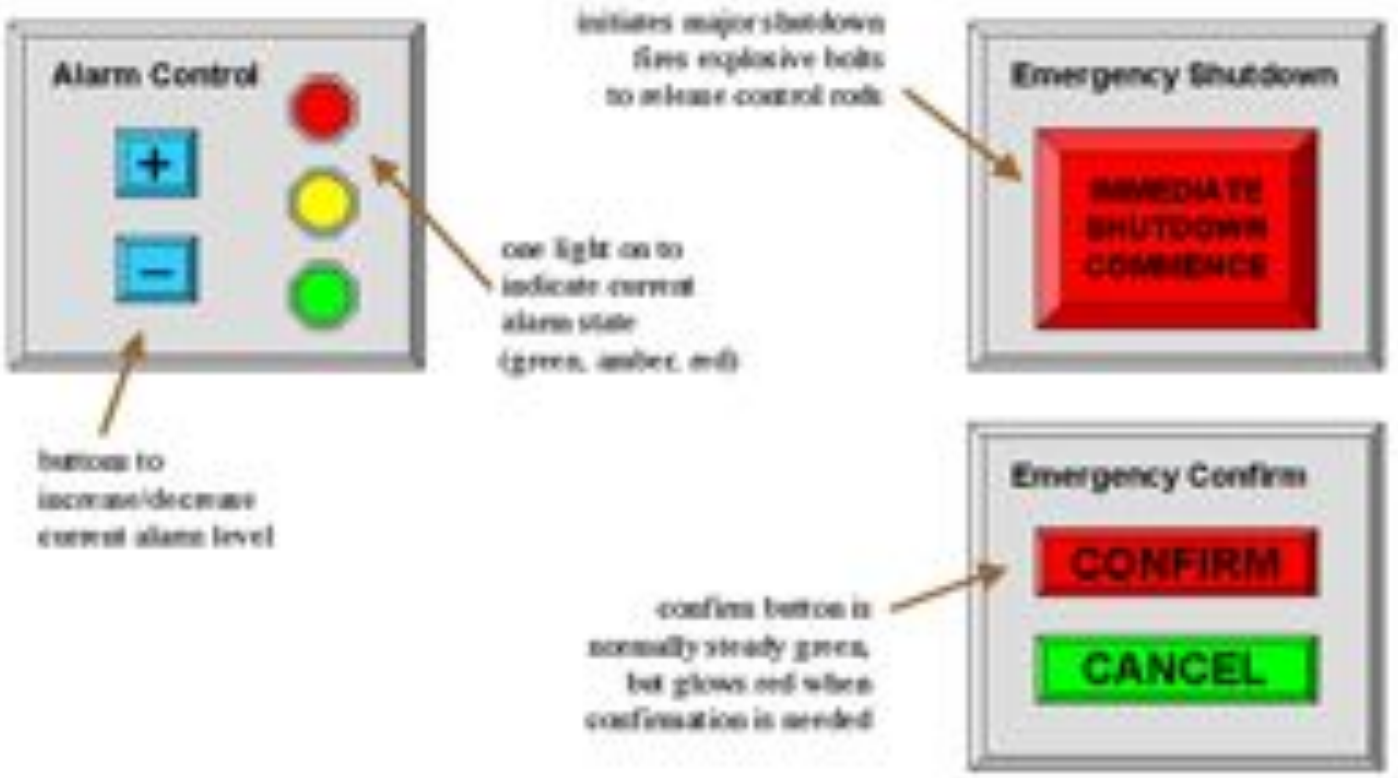
# Case Study: Nuclear Reactor

# NUCLEAR REACTOR MAIN CONTROL PANEL



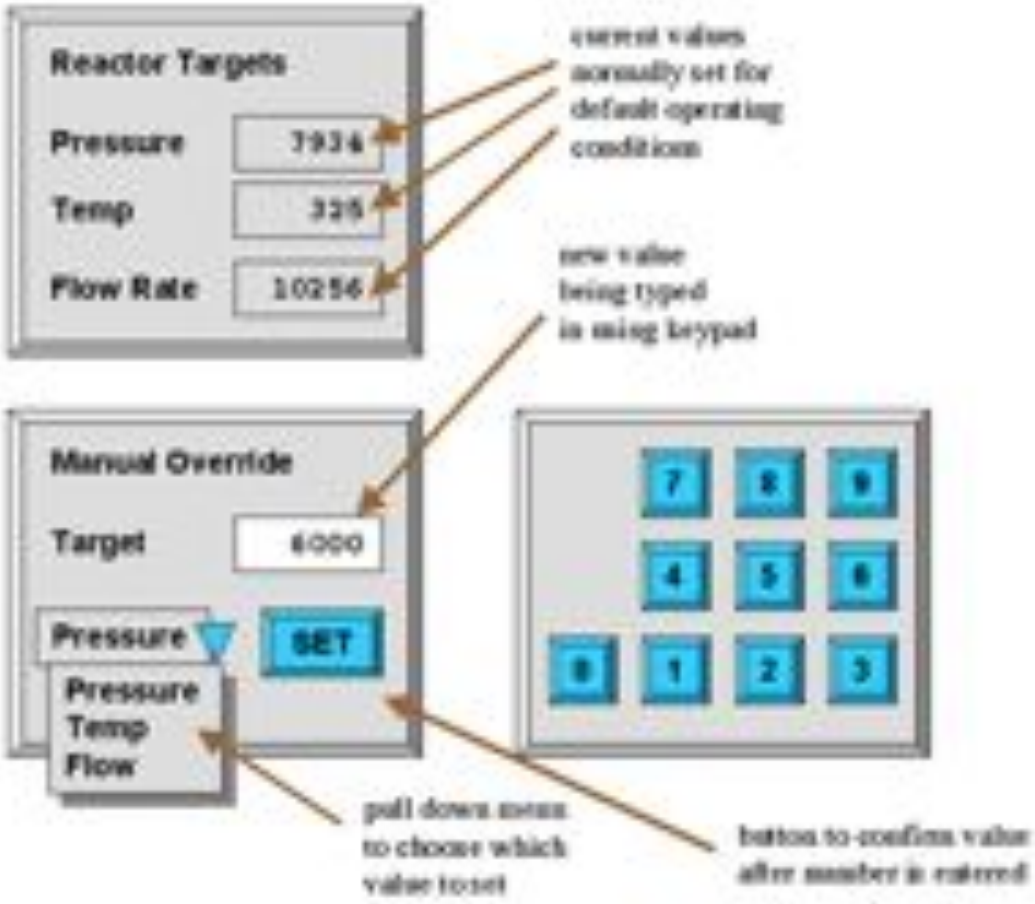
# DETAILS OF ALARM AND EMERGENCY SHUTDOWN CONTROL PANELS



# Alarm State

- The system can be in one of three alarm states: GREEN, AMBER or RED.
- (i) GREEN alarm state means everything is operating normally
- (ii) AMBER alarm state is for when there is a minor problem with reactor operation. Workers in the reactor area are warned and take additional precautions, but no external services are involved.
- (iii) RED alarm state is raised when the reactor is operating outside normal parameters and there is a possibility of external contamination. The police and other emergency services are alerted.
- Typically AMBER state is raised once or twice a week and red state only a few times a year (so far only false alarms!). Raising a RED alarm unnecessarily causes significant inconvenience and cost both to the station staff and the external emergency services.

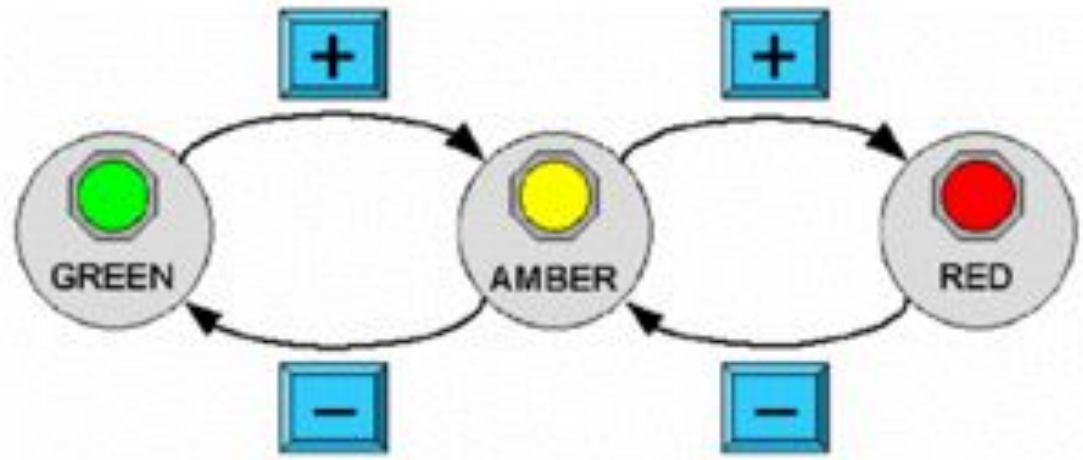
# DETAILS OF MANUAL OVERRIDE PANEL

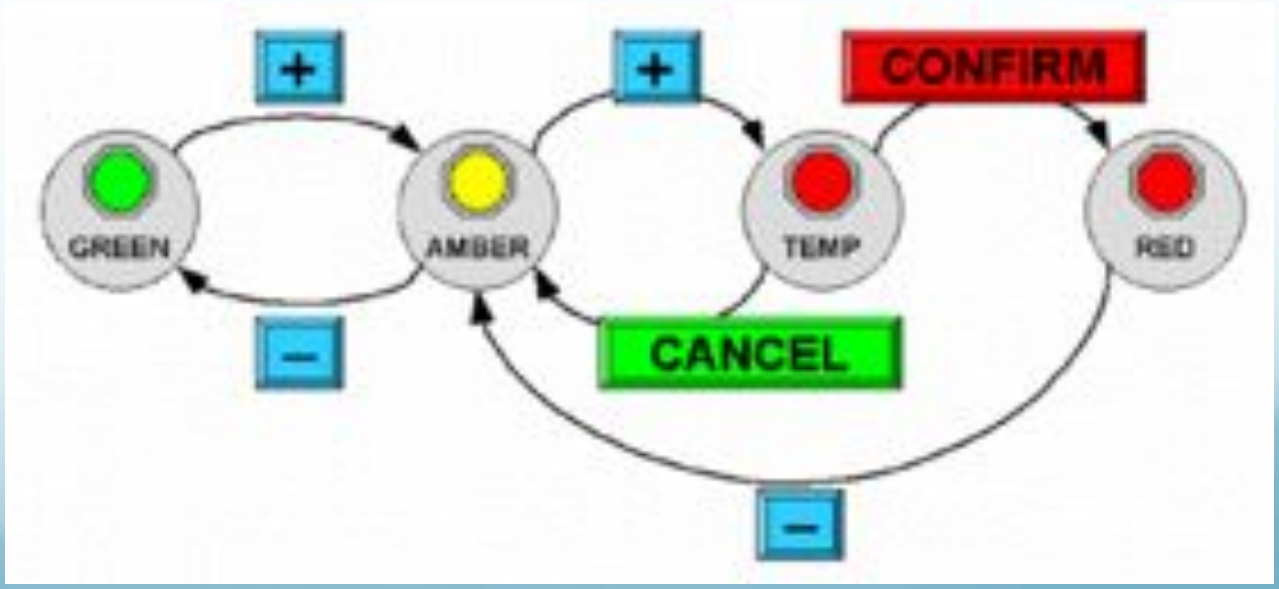


# Reactor Target Override

- The **Reactor Targets** panel shows the current target state of several reactor operating parameters. These are normally set by an automatic control system to values that ensure optimal energy production.
- In an extreme emergency the operator may need to control these targets. The **Manual Override** panel allows this.
- Manual override is *only enabled* in RED alarm state.

# Alarm Control Revision



# Scenario

- Jenny notices the core reaction rate has risen very rapidly
- she realises she must immediately change the reactor target pressure to correct this
- she goes to the Alarm Control Panel on the far right of the main reactor control panel and presses '+' twice (as it is starting off in green state)
- the Emergency Confirm button glows red
- she moves across to the Manual Override panel on the far left of the main reactor control panel

# Scenario (2)

- she selects 'Pressure' from the pull down on the Manual Override panel
- she types the new value '6000' using the keypad
- she notices that the number on the Reactor Targets panel has not changed
- she realises she forgot to press the SET button on the Manual Override panel
- she presses the SET button
- the value still doesn't change
- an automatic audio warning sounds "60 seconds to core meltdown"
- she presses the SET button repeatedly
- still the value doesn't change

# Scenario (3)

- she starts again, selects 'Pressure' from the pulldown, types 6000 and presses SET
- still the value doesn't change
- the audio warning says "30 seconds to core meltdown"
- Jenny runs across the room to the Emergency Shutdown panel
- "20 seconds to core meltdown"
- she presses "Immediate Emergency Commence" button
- the emergency confirm button glows red
- "10 seconds to core meltdown"
- she presses the "Emergency Confirm" button
- she hears the crash of the explosive bolts sending the control rods into the reactor
- the audio system announces "reactor shutdown successful"