

Binary Inputs and Outputs

Types of loads

Isolation

Types of I/O

Summary

Binary I/O

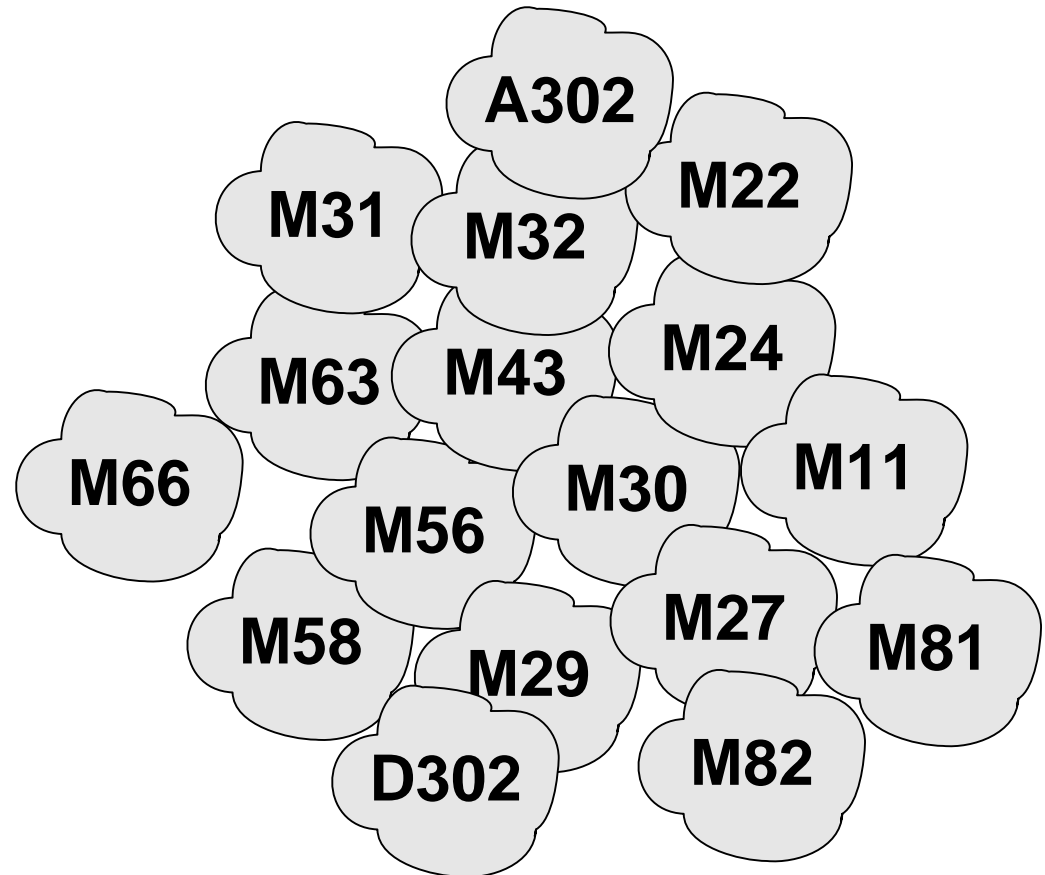
Binary = two valued

High and low

Digital \neq analog

Open / closed

On / off



Types of Binary I/Os

Lamps

Relays

Motors

Other computers

PLCs

Test equipment

Sensors

Resistance loads

Inductive loads

Capacitate loads

Lamp loads



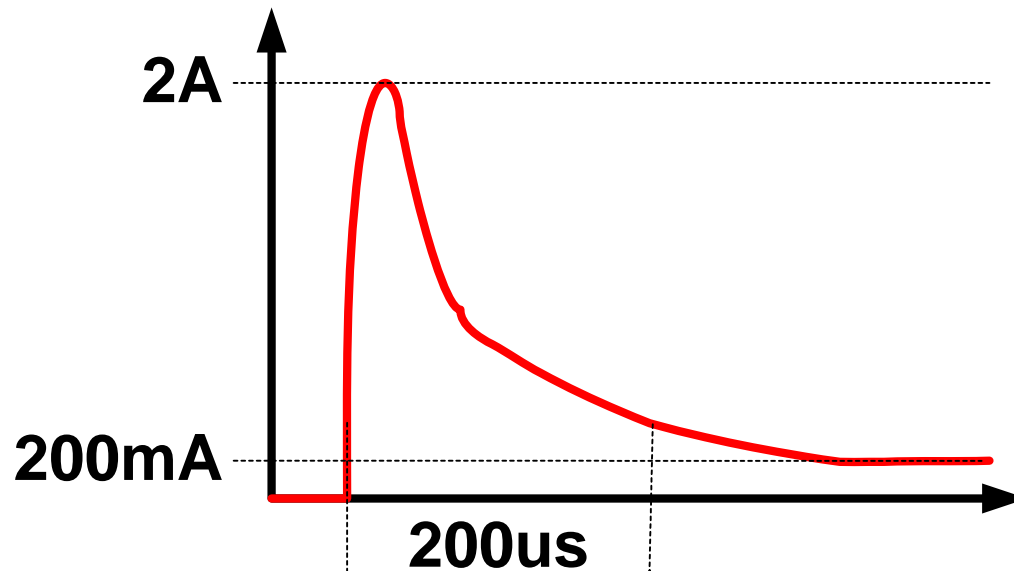
Lamps

Wattage typically between 1...100Watts

Voltage typically between 6...230Volts

Current typically between 5mAmps...5Amps

Particularity: extremely high inrush current



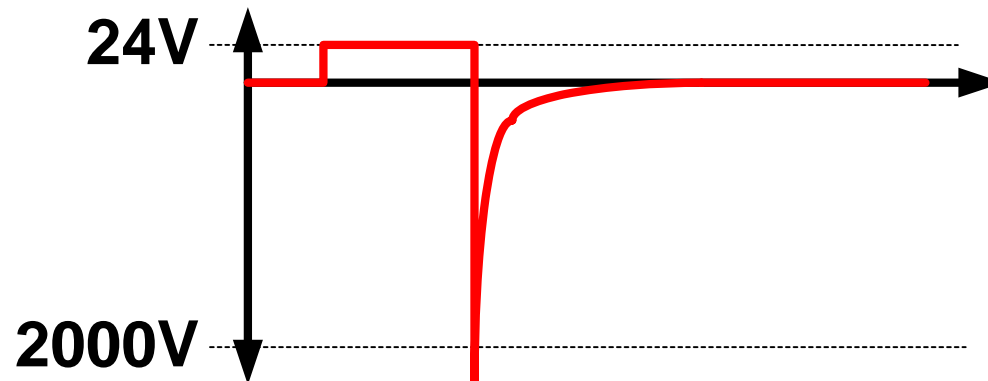
Relays and Other Inductive Loads

Wattage typically between 0.1...3 Watts

Voltage typically between 12...48Volts

Current typically between 50mAmps...500mAmps

Particularity: Off-switch voltage peak



TTL I/O

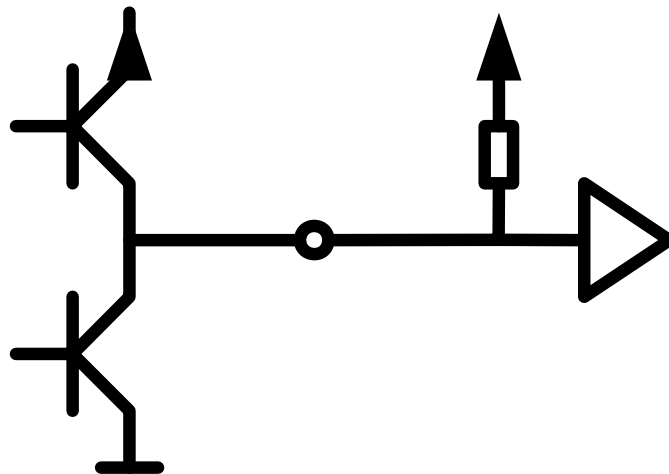
Low means lower than 0,8V

High means higher than 2,4V

- ◆ 5V logic is compatible to 3.3V logic

For open collector outputs, the input must be supplied by a pull-up resistor

For long distance the lines shall be terminated



Isolation

Isolation

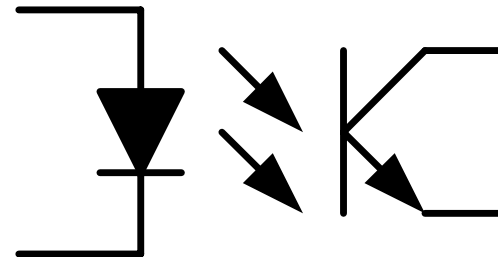
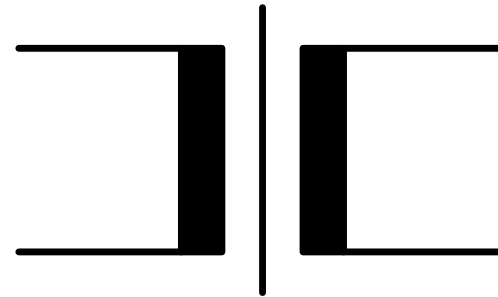
- ◆ Increases noise immunity
- ◆ Increases reliability
- ◆ Required for robust computing
- ◆ Essential in industrial environments

Galvanic isolation = no DC current

- ◆ Optical isolation
- ◆ Inductive isolation

Inductive isolation is mainly used to transfer energy

Optical isolation is mainly used to transfer information



DC/DC Converters

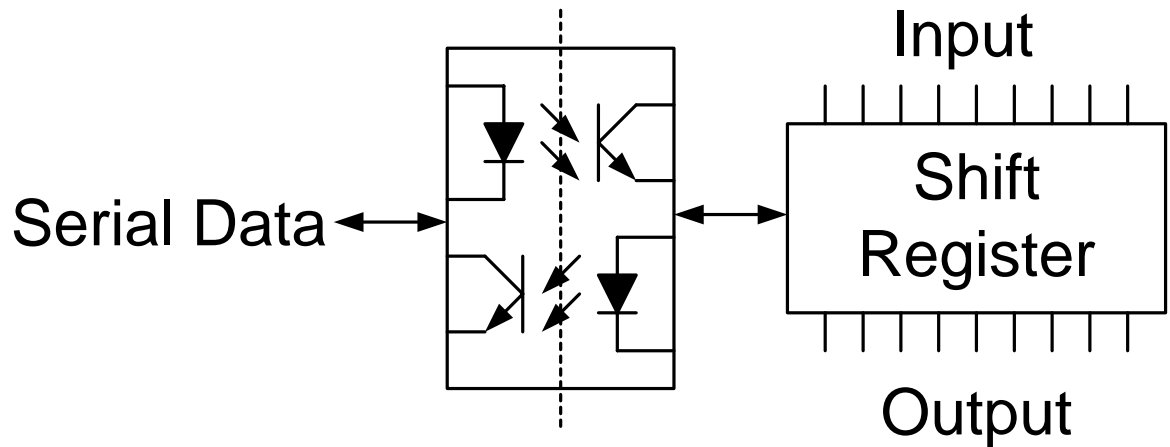
Energy transmission

- ◆ Photons (Light)
- ◆ Transformer coupling
- ◆ Electro mechanics (relays)

Isolation is expensive

Groups

- ◆ Separation of energy and information transmission
- ◆ Parallel via serial data transmission



Output Types

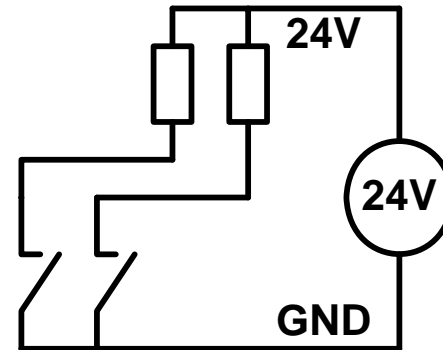
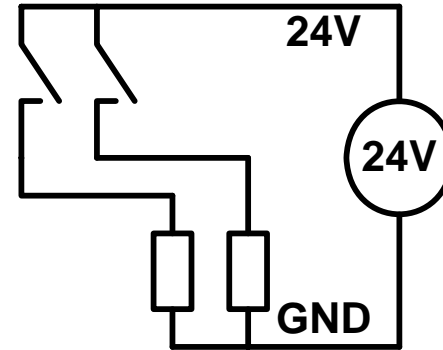
Load at ground open

- ◆ Collector outputs
- ◆ Open drain

Load at supply voltage

- ◆ Open emitter output
- ◆ Open source output

Totem pole output



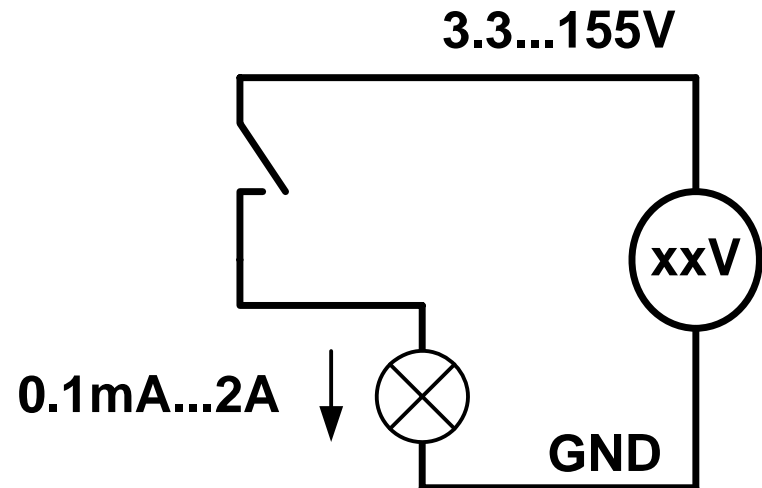
Output Characteristics

Output voltage range

- ◆ Voltage may be monitored

Output current range

- ◆ Short time maximum current
- ◆ Permanent current



Input Types

Voltage inputs

- ◆ Determination of voltage
- ◆ E.g.
 - “0” = 0..5V
 - “1” = 10...V
- ◆ No current -> no energy for data transmission

Current inputs

- ◆ Determination of current
- ◆ E.g.
 - “0” = 0..2mA,
 - “1” = 4...mA
- ◆ Current may depend on voltage
- ◆ Constant current delimiter
- ◆ Current limitation causes heat dissipation

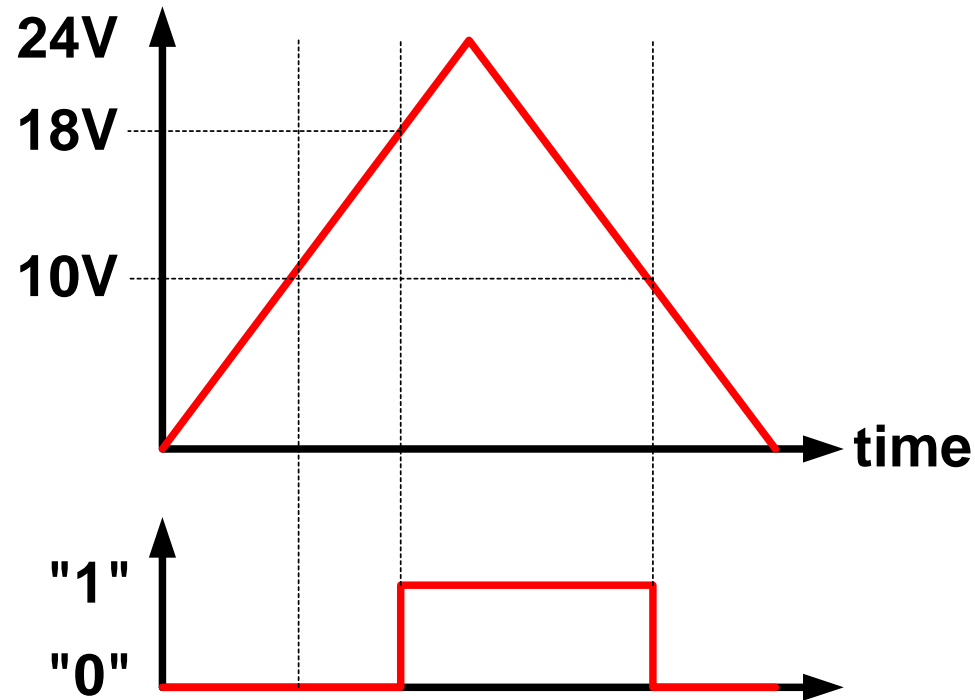
Voltage Input with Hysteresis

Input must be rather high to switch to 1

Input must be rather low to switch to 0

Can be used with current or voltage inputs

Mostly used for voltage inputs



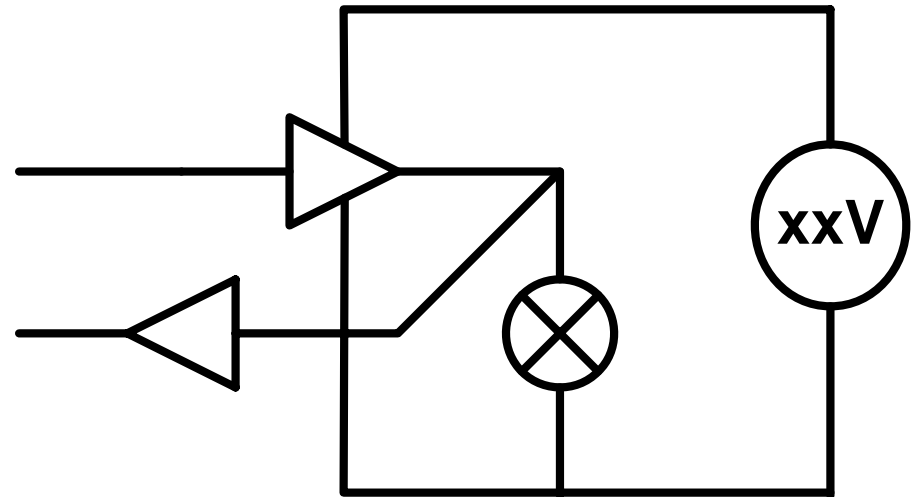
Diagnosis and Fault Tolerance

Over current (but lamp loads..)

Over voltage

Reading back output values

Reading back vault status



Summary

Different types of loads

Load on ground versus load on supply voltage

Demanding I/O needs energy - a lot of information must be transmitted

In general this is done in a serial way -> groups

MEN has products for nearly every type of binary I/O

- ◆ Mainly based on ANSI standard M-Modules
- ◆ High density PLC-like I/O on CompactPCI and VMEbus
- ◆ IP cores