CE-marking

Enforcement authorities can:

- Challenge any product on the market
- Pull samples from the market for examination
- Request a manufacturer, importer or retailer to provide their technical files
- Respond to public complaint
- Notify other member state (RAPEX)
- Instigate criminal proceedings resulting in potential:
  - Banning of product from sale
  - Ordering a product recall
  - Payment of fines
  - Imprisonments of responsible persons

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Conformity assessment

- **Self (first party) verification**:

The Supplier affirms that the requirements are fulfilled

- **Second party verification**:

The Client checks that the requirements are fulfilled

- **Third party verification**:

Independent organisations (third parties) check that the requirements are fulfilled

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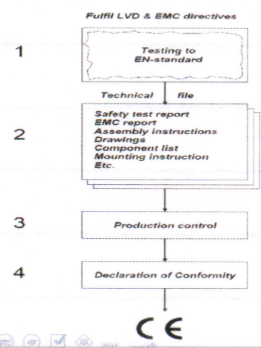
The 4 steps to CE-marking



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CE marking

Following slides are from
Intertek
Farzad Farzaneh.

Thank you!

Intertek Intertek Intertek Intertek Intertek Intertek Intertek

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CE-marking

CE Conformité Européenne

The manufacturer's assurance to the authorities that the product complies with essential requirements of applicable directives

The mark is granted by the manufacturer or an NB depending on Module

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NB = Notified Body

CE-marking

- CE-marking is not a quality mark
- CE-marking is not an indication of origin
- CE-marking does not mean that the product has been tested and approved by an authority.

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Lab 3 Filter

- Digital lowpass/highpass
- Overflow while sending data
- 10 kHz max sampling frequency due to other interrupts in AD conversion and USB sending

10 times lower f_c due to wrong order for y_f and y_{fold}....

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Lab 4 Sensor

Wanted: high SNR
high signal and low noise

To high signal out of sensor?
Some got 2 A triangular signal
Why?

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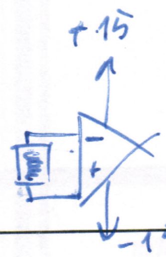

Lab 4 Sensor

Power resistor inductance

Inductance for different resistor types

Resistor type	Inductance
Wirewound	0.03 - 56 µH
Foil	<0.08 µH
Metal oxide	3 - 200 nH
Film	<2 nH

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Power resistor has high impedance
$Z = R + \omega L$
$0{,}1 + 10^6 \cdot 56 \cdot 10^{-6} = 5{,}6\ \Omega$
=> Different output.

LM2576 Datasheet

TEST CIRCUIT AND LAYOUT GUIDELINES

As in any switching regulator, layout is very important. Rapidly switching currents associated with wiring inductance generate voltage transients which can cause problems. For minimal inductance and ground loops, the length of the leads indicated by heavy lines should be kept as short as possible. Single-point grounding (as indicated) or ground plane construction should be used for best results. When using the Adjustable version, physically locate the programming resistors near the regulator, to keep the sensitive feedback wiring short.

(Picture 5)

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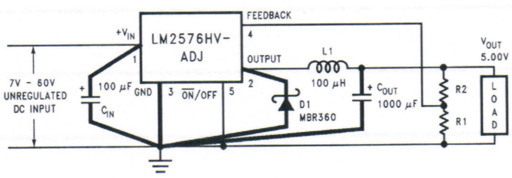
Hot loop



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Lab 2 Actuators

Some groups simulated FET...
Could see that 3.3 V is to low for Gate.

Even if the transistors worked with 3.3V on Gate at low currents it won't at higher currents.

Using bipolar transistor for raising Gate voltage..

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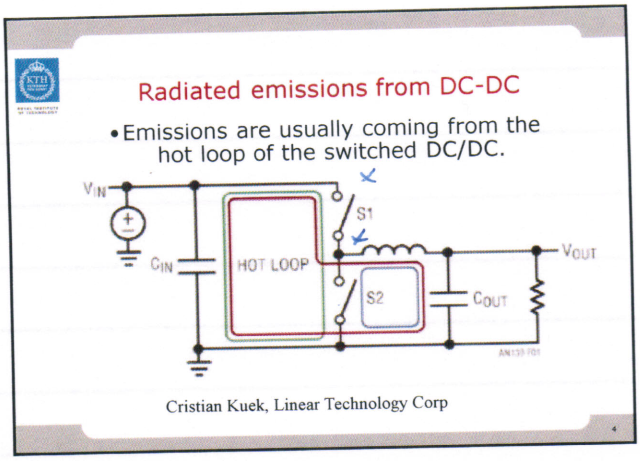
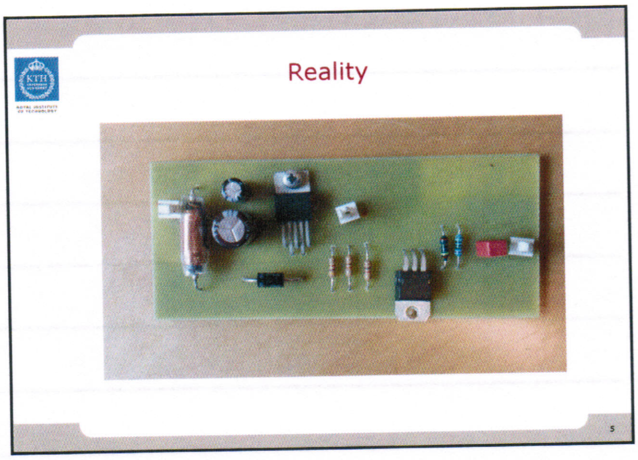


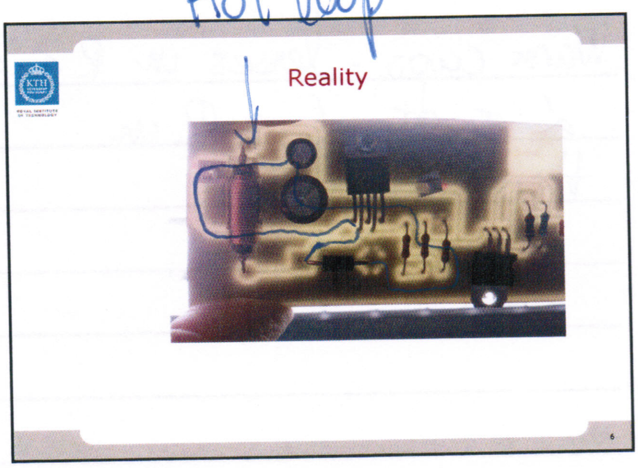
To calculate power dissipation, measure power between X–X.

Hot loop because there is big difference in current.

$\boxed{\text{Current change} = \text{EMI}}$



Hot loop



Failure Mode and Effects Analysis

- Identify components and its related failure modes
- What effects will these failures give, local and global
- Are the effects detectable
- Are they dangerous
- How often will they occur

FMEA example

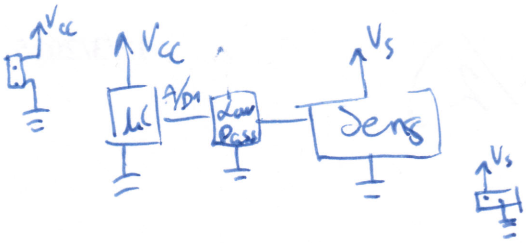
Example FMEA Worksheet

Item / Function	Potential Failure mode	Potential Effects of Failure	S (severity rating)	Potential Cause(s)	O (occurrence rating)	Current controls	D (detection rating)	CRIT (critical characteristic	RPN (risk priority number)	Recommended actions	Responsibility and target completion date	Action taken	New S	New O	New D	New RPN
Fill tub	High level sensor is disconnected	Liquid spills on customer floor	8	sensor is exposed at top and can be easily disconnected by user	2	Fill timeout based on time to fill to low level sensor	5	N	80	Perform cost analysis of adding additional sensor halfway between low and high level sensors to calculate fill rate at midpoint and determine max fill volume in case high level sensor is disconnected	Jane Doe 15-May-2012					

FMEA update

The FMEA should be updated whenever:

- A new cycle begins (new product/process)
- Changes are made to the operating conditions
- A change is made in the design
- New regulations are instituted
- Customer feedback indicates a problem



Example

- Micro controller with a sensor.

The 7 step method

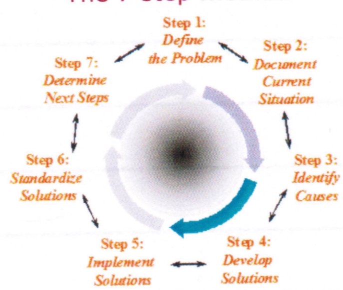


Figure 1. The 7 Step problem solving method

FTA, Fault Tree Analysis

- Find fault sensitive constructions
- Input: system or hardware description
- Top down approach

Cable clamping

Always use good clamping in the cable end.

Not really like this...

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Boxes

Different types

- IP class (for example IP65)
  first digit access protection
  second water protection

- Plastic
- Aluminium
- Steel
- Zinc alloy
- Plastic with carbon powder or aluminized inside

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Standards

- IPC-A-610E Electronic Assemblies
- IPC-A-620 Cable and Wire Harness Assemblies

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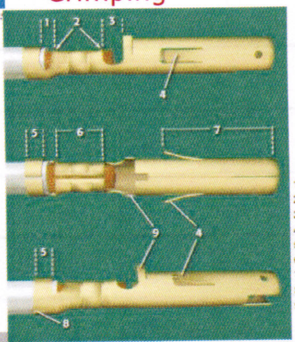
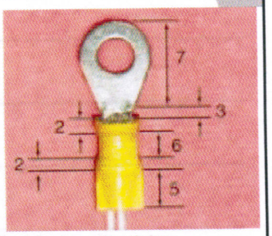
Crimping





1. Insulation inspection window
2. Bellmouth
3. Brush inspection window
4. Locking tab/tang
5. Insulation crimp area
6. Conductor crimp area
7. Terminal mating area
8. Cut off tab (may be at either end of terminal)
9. Terminal stop ear

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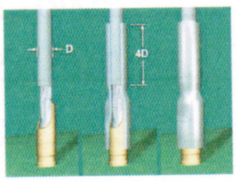
Soldering

- All strands within the pin
- Do not overfill with solder



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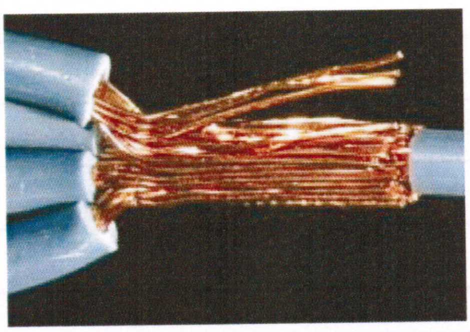
Ultrasonic welding



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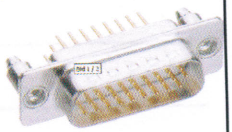
D-subs

Many different sizes, from 9 pin up to 50 pin in normal size.

High density -> 78 pin



You can get them for flatcable

With capacitors for each connector => low pass

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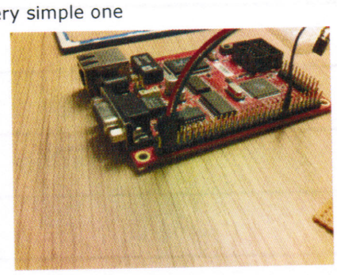
Board connectors

- Very simple one



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PCB connectors

- Keyed connectors
- Build your own
- KK
- And more

- Interconnection between PCBs

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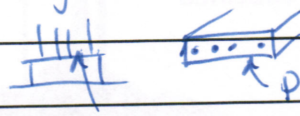
Keyed connecter:

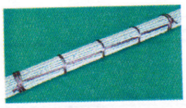


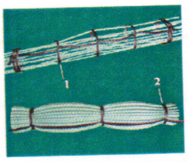
Plug hole

Remove pin

Bundling

Lacing ok/defect from IPC-A-610E





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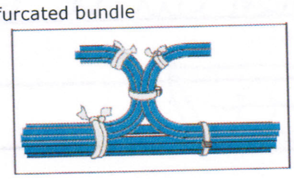
Bundling

Good bifurcated bundle



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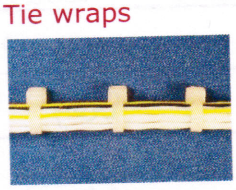
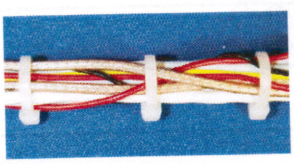
Tie wraps

- Ok, crossover between ties





Acceptable - Class 1
Process Indicator - Class 2
Defect - Class 3
- Wires twist and crossover underneath a tie wrap/strap.

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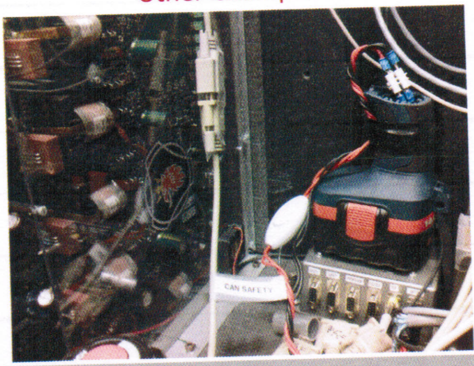
Other examples



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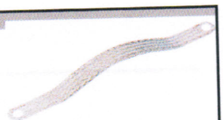
Wiring

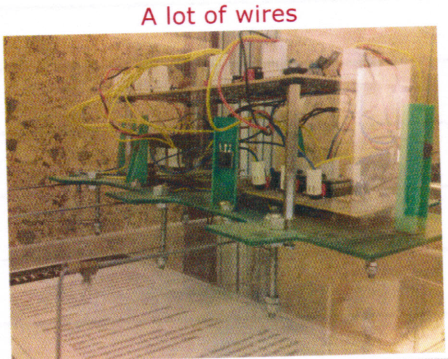


This is usually an expensive part of a system. It will also give you a certain weight to your system. Therefore:

- Try to keep it to a minimum
- Power return could be drawn in the chassis of your machine. If the chassis is made of plastic you may either mould some metallic into the chassis or build up some metallic structure for the wires. This will give you a good return path for the current. Use earth braid for interconnecting of earth planes
- Only one voltage level for the whole system?

5

A lot of wires



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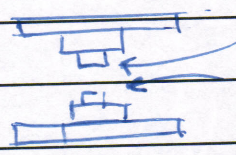
Getting rid of cables

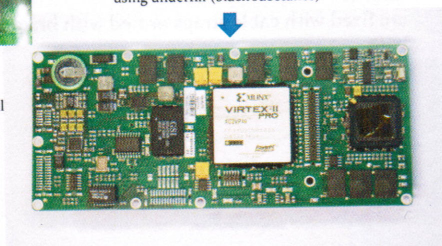


Snap on connectors

Vibration durability

Soldered Ball Grid Array (BGA)

The solderings are vibration secured by using underfill (black substance)



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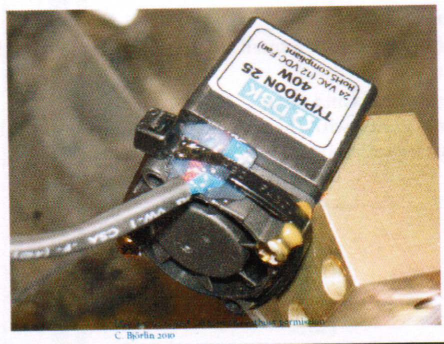
Cable straps together with approved silicon adhesive/sealant (Dow Corning RTV 3145)



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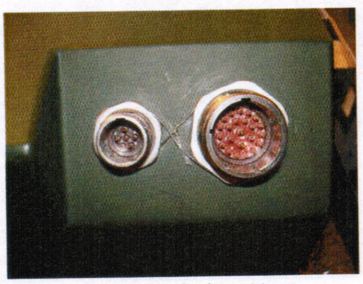
Vibration durability

Secured connectors



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the Bath Tub curve

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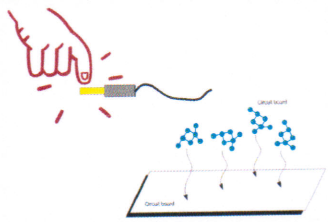
Silicon contamination

When using silicon based products, like lubrication, sealants, silicon rubber and similar, silicon vapor is spread in the air - or it creeps over surfaces.

A thin film of silicon will be present on surfaces including contact surfaces and solders.



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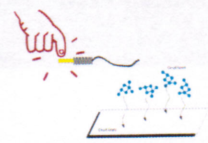
Silicon contamination

Silicon spreading

- By Silicon based liquids migrates and distributes itself over big surfaces
- By manual handling of silicon based substances which transfer to other objects by touching
- By curing substances and substances that are being heated (>100 deg C) vaporize silicon oil that is distributed in the air



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Silicon and electrical equipment is a no-no !

Handling electronics without proper grounding of yourself is bad !

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Vibration durability

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Handling of electronic circuit boards

ESD

ESD may damage the integrated circuits or other components partly or permanently

Normally, the environment for production of circuit boards or places where system are being integrated have controlled air humidity.

ESD

Low air humidity – **Poor** ESD conditions (Winter)
(high E-field levels)

High humidity – **Good** ESD conditions (Summer)

ESD

When handling circuit boards or components in industry that produces quality equipment

Grounding **wrist straps** or **shoes** are always being used

Means of cooling internal components

In a closed system there are limitations of what can be done:

Integrated circuits:

Convection (not for hotspots), weak method but cheap

Forced airflow (Fan blowing on the chip) – Efficient, decreases system reliability because of the fan

Processor fan – Very efficient, but big, heavy and decreases system reliability

Conduction (direct contact to a cooling body), cheap and is as efficient as the thermal mass of the cooling body. Early testing needs to be made.

Thermal considerations

Considering the operational profile of the system

- Will the apparatus be temperature cycled between cold and warm ? If so – how to deal with condensed water?
- Will the system be exposed to direct sunlight ?
- Will the apparatus be constantly switched on?
- Will power supply be constantly available for heaters ?

Spray drawback: Edges get poor coating

Coating of circuit boards

Typically used coatings for circuit boards are
Deposited coatings like Humiseal *products (applied by dipping/spraying/brushing)

- Synthetic rubber
- Urethane
- Silicone
- Epoxy
- Acrylic

Conformal coating
Parylene - The deposition is carried out in a vacuum chamber with free molecules that deposit uniformly on all surfaces

Prior to coating the board needs to be cleaned and pre-baked in an oven to remove humidity. Connectors are masked off.

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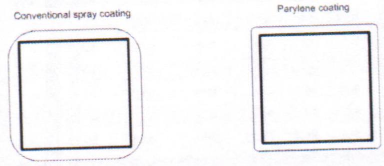
Coating

Parylene – a method that coats uniformly around edges and with very good resistance to mechanical and chemical stress.



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Parylene drawback: Slow, bad production flow

Coating of a needles tip

Spray coating

Parylene coating

Picture is courtesy of Paratech Scandinavia AB
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Heat management

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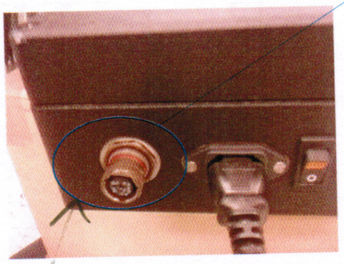
Electromagnetic Compatibility (EMC)

Connectors shall be grounded against surfaces that will not corrode over time. Chromate is a common method to surface treat Aluminium.



Connector must be in galvanic contact with the box.

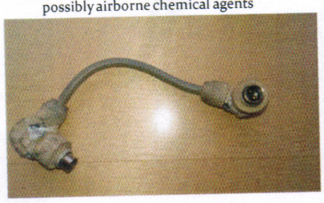
Corrosion

[Bild på mutter]

Examples of corrosion

New

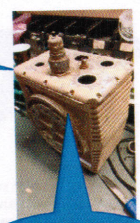
After a few months on a tower in the Persian Gulf being exposed to salt winds, UV radiation and possibly airborne chemical agents



Examples of corrosion

- Wrong surface treatment
- Wrong painting method
- Poor adhesion of the coating to the plating
- Wrong materials in the connectors

- Poor painting
- Incorrect selection of material and plating of the connectors
- Sharp edges



- Die cast Aluminium alloys often contain a higher percentage of Cu, which gives poorer corrosion resistance

Sealing

Example: Salt from wind and water has migrated across the o-ring due to poor compression of the o-ring. The cause may be bad mechanical tolerances of the o-ring trace depth.

Sealing

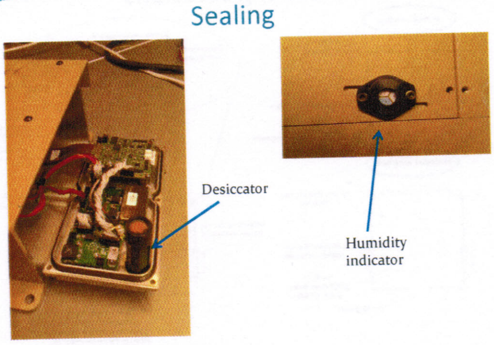
Semi-sealed system:

- Pressurized Nitrogen filled – requires refill regularly

Ventilated system:

- Coated circuit boards if condensed water is accepted
- Desiccator (requires preventive maintenance) or
- GoreTex plugs (works well with constant over-temperature) !! Observe the risk with vapor intrusion for equipment that is non-operational regularly !! GoreTex is good, but not magic.

Sealing



Sealing for Electromagnetic Interference

In order to co-exist with other equipment…

(mobile phones, radios, wireless networks, radars, medical electronics, etc, etc)..

…all electrical equipment must fulfil certain standards regarding
Radiated Emissions (RE)
and
Conducted Emissions (CE) - (*not in this lecture*)

Throug cables connected to the box

Enclosures and sealings

 8

Why do we want to encapsulate the electronics?

+ External environment (water, bugs)
+ Contain EMI
+ Keep it neat and tidy
- Difficult to remove heat
- Difficult to maintain

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Dealing with Humidity

Either you fight water intrusion - and do it well
(difficult and normally expensive)

or

You deal with the humidity
(more common)

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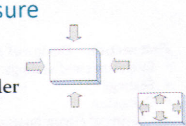
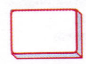
Hermetic enclosure

- Hermetic sealing requires that the housing can deal with over and under pressure (especially for aircrafts)

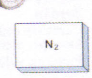


- Boxes are often (laser) welded



- Connectors have glass sealings (very expensive and few suppliers)

- It is common to fill the closed atmosphere with Nitrogen in order to prevent corrosion



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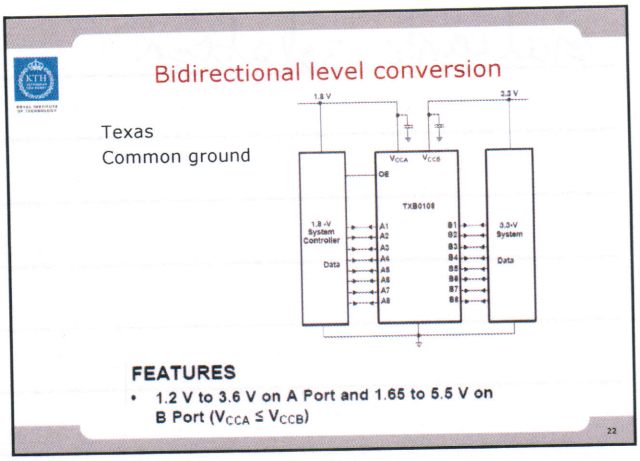
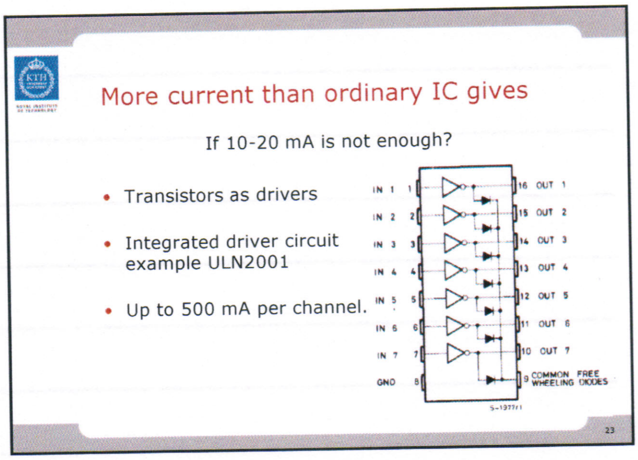
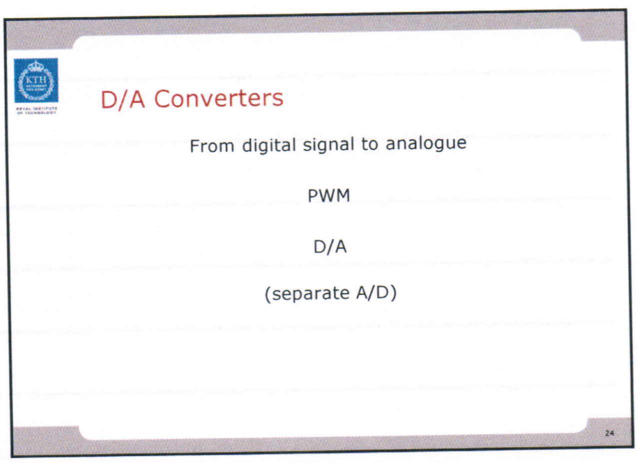
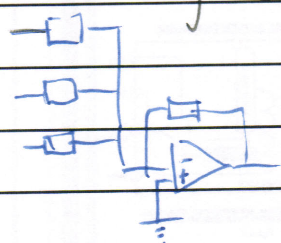
N_2 removes humidity, squeezes moisture out



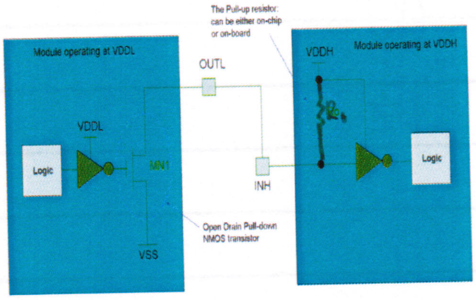




Network with resistance,
Summing amp.



Level conversion



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Level conversion

Digital circuits with open drain/collector

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Level conversion

http://www.sparkfun.com/products/8745

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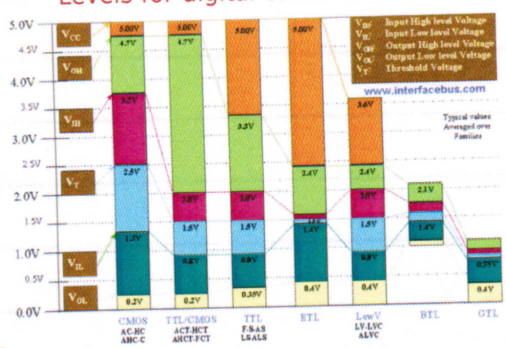
Levels for digital communication



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Source and sink capability

Depending on technology and type.

CMOS, TTL, ECL ...

Push/pull, Open collector/drain

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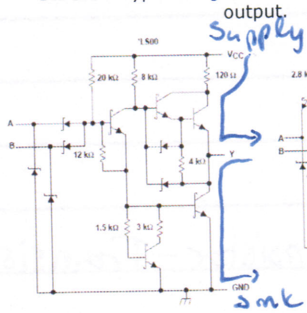
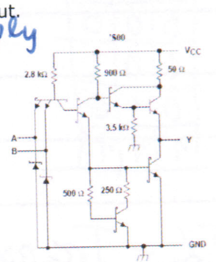
Levels for digital communication

Different type of digital circuits with push pull output.





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Encoder interface (left from sensors)

- µ-Controller with or without hardware interface
- Software solution
- Hardware solution, for example 7084
- External counter

SW: Usually doesn't work, lots of interrupts → Hangs µC

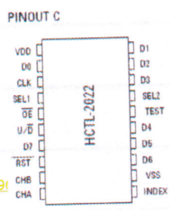
Counter HCTL2022

Parallel communication

Serial communication (not incl.)

Interfacing for a controller
C:\Users\hellgren\Downloads\AV02-009

How to connect the encoder
in a robust manner? Timing!



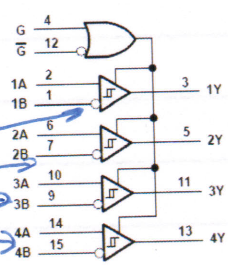
I/O-D7 data pins

$\overline{Xx}$ ← Active low

Check data sheet for when data is stable.
Timing important!

Robust Encoder-Counter HCTL2022

Use a line receiver for
connecting both A,B
and /A, /B (RS422)
26LS32 for example.



Will the levels be right from counter to µ-C ?

RS422: ≤1200 m
< 10 mBit/s

Schmitt trigger - Hysteres
For noise reduction

Schmitt
Trigger