Electrical Setup and Wiring for Discom Measurement System

Electrical Requirements

1. Separate sensor cables from power cables and keep them isolated.

- This rule applies to accelerometer and speed encoder cables.
- Never have them together in the same cable tray with power lines feeding the motors or robots or lines running high frequency and high power.
- Best route the *sensor cables in a separate metal cable tray*. Distance to power lines helps. Metal cable trays are made of galvanized iron sheet metal which has a much higher magnetic permeability than just a copper shield mesh. They therefore can shield better against magnetic crosstalk from power lines.
- Magnetic fields: *Distance is the best friend* to minimize the cross talk. In practical test stand design, 30 cm distance should be achievable.
- Within the sensor cable channels, do not use any BNC extensions, adapters or any other metal parts from the sensor cables. Also ensure that the sensor cable ends are mounted fully isolated from each other or any other metal parts of the test stand.

2. Avoid any cables going into the measurement PC to run in parallel to power cables.

A 10 m USB and monitor cable connected to the Discom PC running in the same cable tray for 5 m as the power cables picked up enough high frequency noise to feed this noise into the TAS measurement box. That the cables are shielded does not help as the high frequency will be induced into the shield and from the shield into the PC.

Electrical Requirements, Continued

3. Power the Tas Box from a cleaner UPS socket

If there is a UPS installed, use a connector to break out one of the outputs into a connector for the TAS power supply.

4. Grounding of Tas Box, Power Supply:

First connect Tas Box to ground then connect signals.
For TAS28 or TAS48 with more then 2 TAD cards, external power supply is required.

5. Choose appropriate type of accelerometer (ICP type or charge type)

ICP accelerometers are recommended for all medium to high power applications, because they have a much higher immunity to EMI-induced noise, which is proportional to the test stand's voltage and power levels.

Charge type accelerometers with external amplifier are recommended for low noise and low power applications. The combination of charge type sensor and ICP amplifier has lower noise and higher output voltage than ICP type sensors.
Because of the long distance between the high-impedance Piezo sensor and the external amplifier, this combination is more sensitive to EMI-induced noise, most often caused by high voltage and / or high-power inverters.

Electrical Requirements, Continued further

6. Use Differential Speed Signals

If the speed source is single ended, have a converter from single-ended to differential installed in close vicinity (30 cm) of the single-ended output (see next page and additional documentation).

7. Connecting other analog signals to Tas Box in differential mode only

When connecting non-Discom sensors which are not isolated, connect them in differential more only. (Tas Box input channel has to be set to differential mode *before* connecting the sensor.)

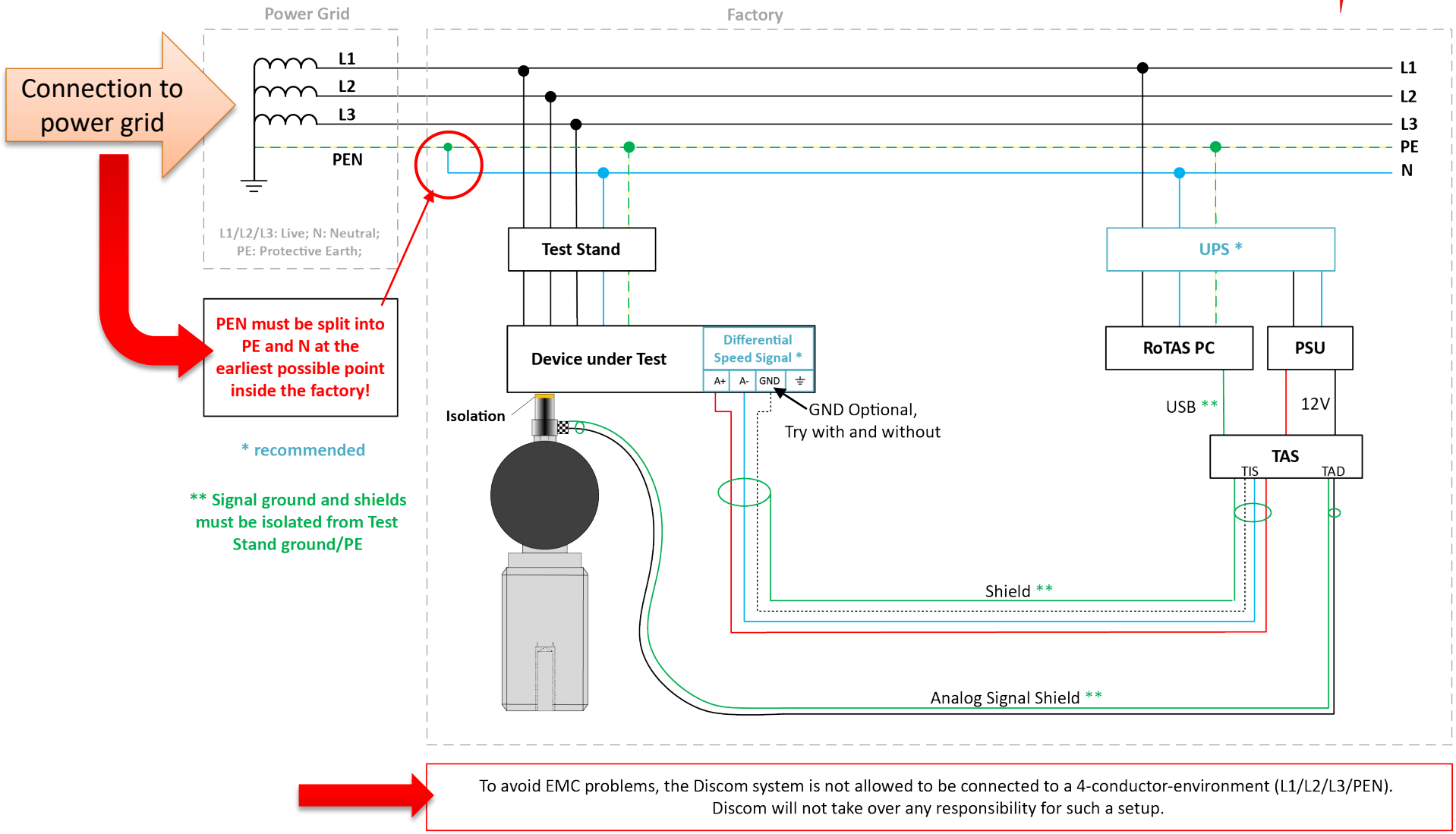
Make sure that there is no higher ground / potential difference than 10 V between the Tas Box ground (Tas Box case) and the signal ground.

8. Check Block Diagram

Each Discom measurement PC comes with a block diagram showing the correct connections between PC, Tas Box, sensors and other external devices.

It can be found in the paper folder which accompanies the PC and on the PC in the folder D:\Discom-Documentation\SystemSpecific. Refer to it when in doubt how and where to connect a sensor or other device.

Power Grid Connection and Grounding



To avoid EMC problems, the Discom system is not allowed to be connected to a 4-conductor-environment (L1/L2/L3/PEN).
Discom will not take over any responsibility for such a setup.

Avoiding Ground Loops

Tas Box – Analog Inputs

The **analog inputs** (TAD28, TAD48, TAD48+) are **NOT isolated**.

The ground (GND) of these inputs in *single-ended mode* equals the TAS system GND, which again equals the TAS case potential, which again is the same as the USB-connection's GND, which again equals the host PC's GND:

$$\mathbf{GND_{TAD} = GND_{TAS} = GND_{TAS\text{-}CASE} = GND_{USB} = GND_{PC}}$$

This leads to the following rules for connecting analog signals to the TAD inputs:

- Do not connect any analog signal from the test stand to a TAD input in single-ended mode. If an analog signal must be connected directly to a TAD input, use **differential** mode only:
  - turn on differential mode ***before*** connecting the signal
  - make sure that the potential difference between TAS GND and the used test stand signal GND (from source output) is **< 10 V**
- Make sure that no accelerometer sensor grounds (usually on the sensor's case and outer BNC connections) have any connection to any test stand metal or other conducting material. Also prevent GND connections within / to cable trays.
- Keep apart even the GND connections of any analog TAS signals, this prevents creating a "loop antenna".
- Prevent cable loops in general, these also might create loop antennas. If possible, trim cables to the needed length.

TIS – RPM Inputs

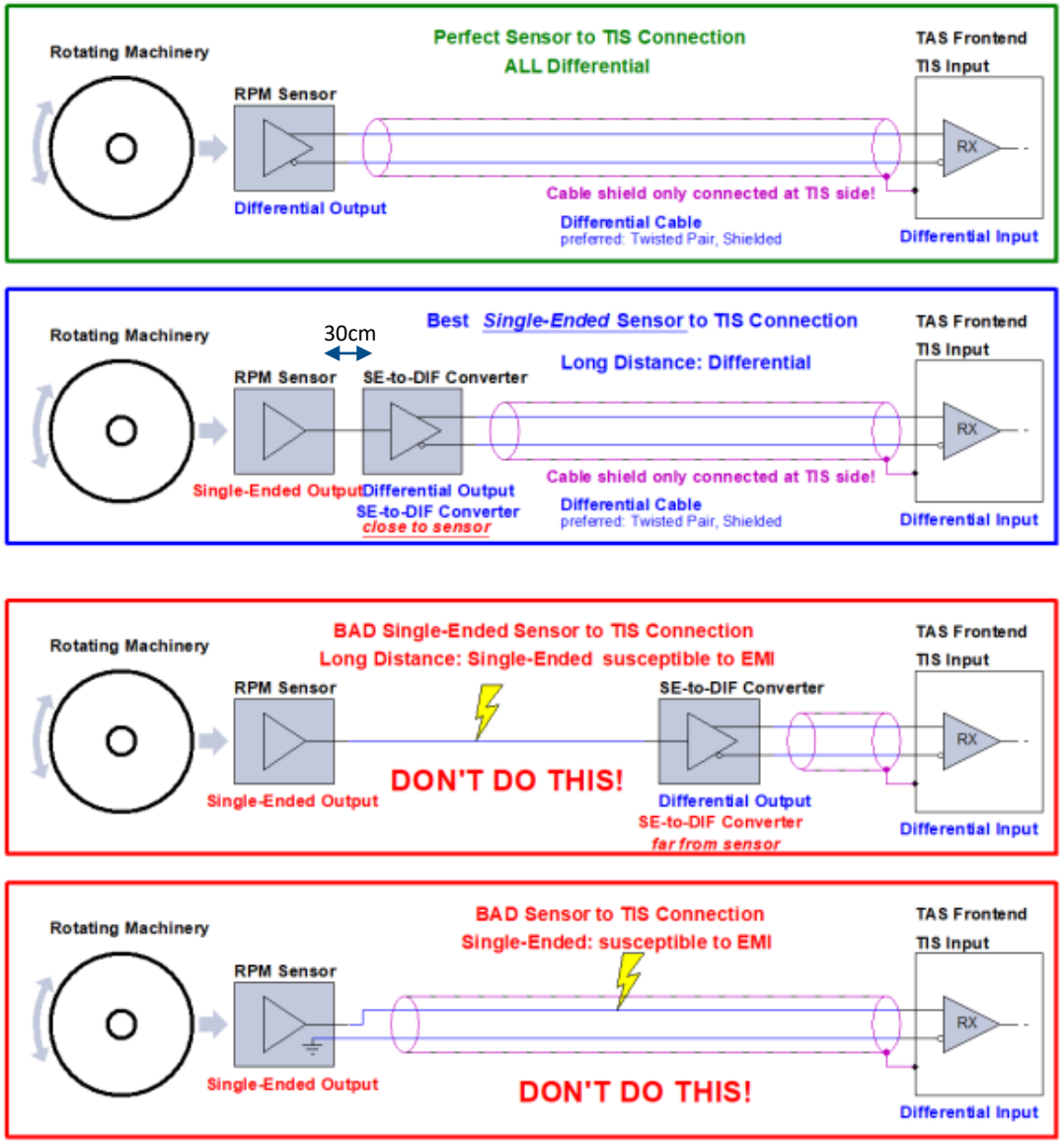
The TIS input lines are isolated to the Tas Box – but not to each other within one and the same TIS card.

Further, the TIS connector's shield, and so the cable shield, is usually connected to the TAS-case, so make sure that the TIS cable shield is connected only on one side (TAS side preferred).

And again: the TIS inputs prefer differential signals. If the original source is single-ended, use a converter to differential *close to the source*. The single-ended signals are much more sensitive to noise induced by electromagnetic fields, which might make the signals unusable.

Speed Pulse Signal Connection

Picture below: TIS to sensor connection scenarios, top to bottom = best to worst (don't!)



See also separate extended documentation on this topic!

Download extra documentation here:
https://download.discom.de/Documentation/TestStand_Speeds

Communication between test stand and NVH system

1. The test stand must as a minimum communicate transmission model, serial number, and test step information to the NVH test system. Communication uses text commands so that the communication can be logged and supervised. See separate command protocol documentation for details.
2. The test stand shall be capable to repeat any test step (gear, ramp) in case of an acoustic anomalies, automatically or when the operator presses a button. The number of allowable repeats can be specified.
3. The test stand can signal own errors and test results to the acoustic system. In case that the test stand software also stores results it is desirable that the test stand sends a time stamp to the NVH system to keep both results aligned.

Download communication protocol manual from
https://download.discom.de/Documentation/TestStand_Communication