



In the lab or in the field, choose a safe solution for your measurements

The isolated channels of the METRIX® oscilloscopes offer concentrated technology

As technicians or electronics engineers, we are used to encountering the following measurement difficulties:

1. The ground of the card is connected to the mains whereas the ground of the oscilloscope is connected to the earth. I have to connect one probe to the oscilloscope but how should I connect the ground to avoid a short-circuit?
2. How can I check two signals simultaneously when one is a command and the other is a mains-referenced voltage without connecting the command ground to the power supply ground?

The worst answer to problem No.1 would be to disconnect the ground from the oscilloscope. Indeed, there is a risk of electrocution by contact with any metallic part of the oscilloscope, as well as with the ground of the unconnected probe.

Differential or isolated measurements

Measurement advice

Safe measurements

Examples of applications

Oscilloscopes with isolated channels

1ST SELECTION CRITERION

As a user you have the 3 following **safe solutions**:

1. Use an oscilloscope with differential channels (limited bandwidth but high voltage): these models are no longer on the market: OX8022 / 8042 / 8062
2. Use an oscilloscope with isolated channels (floating grounds): OX5000/OX7000/OXi6000

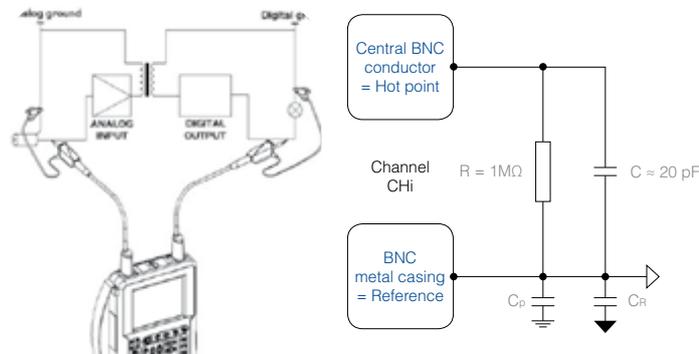
3. Use an oscilloscope with differential probes (do not confuse with an active HF probe): MTX9030/MTX1032

Every instrument has its preferential scope. However, in some cases you may have the choice between two or more devices. Below is a table with the limits and the selection criteria for each one

Type of input channel isolation	1 or 2 referenced signals at the same dangerous potential	2 referenced signals at 2 different potentials including the mains phase	Up to 4 different referenced signals at different potentials, all of which may be dangerous
Oscilloscopes with 2 built-in differential probes	✓	✓	2 channels only
Differential probes + oscilloscope up to 4 channels	✓	✓	✓
Oscilloscope with 4 isolated channels	✓	✓	✓

2ND SELECTION CRITERION

In addition to the common-mode rejection and dynamics, there is an additional selection criterion: the interference potential of the device (on ground / earth or on ground / ground).



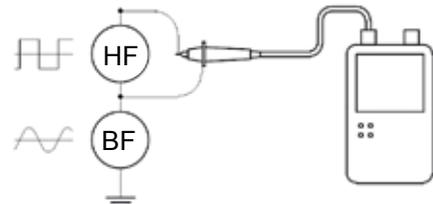
How do the ground interferences caused by the device affect my measurement results?

For each channel ground linked to a hot spot (alternating voltage), a current will flow. As the impedance is capacitive, the amplitude depends on the frequency.

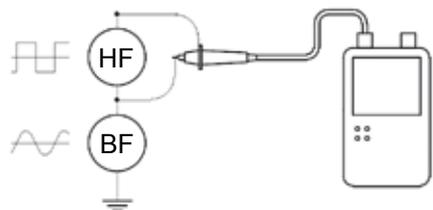
Consequences :

1. As the circuit being tested must provide this current, its behaviour will necessarily be modified
2. The quality of the ground as the signal reference will be reduced due to the impedance of the connection.

Both of the influences are proportional to the ground current so they are also proportional to the frequency of the signal connected to the ground channel.



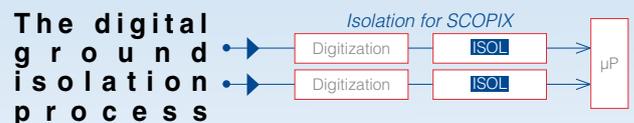
Correct: low ground current



Incorrect: high ground current

Be careful: The ground must always be connected to the coldest point of the circuit tested, even if the ground of an isolated-channel oscilloscope is completely floating.

Please note that unplugging the mains power supply decreases the capacitance between the ground and the earth but does not cancel it.

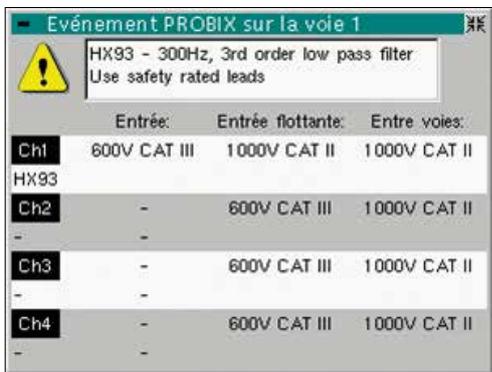


developed on the SCOPIX, OXi and Handscope offers crucial performance. You can use the same input terminals and acquisition chains for the oscilloscope and multimeter modes. This allows you to switch from one instrument to the other without changing the measurement connections.

THE SOLUTIONS FOR SAFE MEASUREMENT

Measurements on systems or circuits in which the circuits are often at **different potentials** can be very dangerous. The risk comes either from a short-circuit inside the device, or from the potentials themselves. Thanks to the Scopix and OXi models with their isolated channels, you can check the command signals of each phase of a three-phase installation as well as the output current very easily. No need for complicated or dangerous assemblies.

Thanks to the **Probig accessories**, users are informed at all times of their instrument's limits in terms of the rated maximum isolation voltage. This is what we call **active safety**.



Evénement PROBIG sur la voie 1

HX93 - 300Hz, 3rd order low pass filter
Use safety rated leads

	Entrée:	Entrée flottante:	Entre voies:
Ch1	600V CAT III	1000V CAT II	1000V CAT II
HX93			
Ch2	-	600V CAT III	1000V CAT II
-	-	-	-
Ch3	-	600V CAT III	1000V CAT II
-	-	-	-
Ch4	-	600V CAT III	1000V CAT II
-	-	-	-

Thanks to the independently-insulated channels and the floating inputs, SCOPIX and HANDSCOPE can take genuine differential measurements on a 2-wire system such as an RS-485 network or a CAN bus. One of the

APPLICATIONS

An oscilloscope with isolated channels is also the best solution for people not familiar with electricity in an unknown environment (no diagram) or in the following cases :

1. Measurement of different types of signals: for example, command signals of each phase of a three-phase chopper as well as the output current
2. Measurement of input and output signals in an industrial environment: feedback loop, locking of the safety elements, impedance attenuation or mismatching
3. Measurement in three-phase systems: variable speed drive, inverter or converter: detection of harmonics, the loads on power supply inputs, troubleshooting of faulty IGBT gates on DC/AC converters or filtered circuits, voltage unbalance on PWM output
4. Measurement of 600 V CAT III or 1000 V CAT II industrial power supply voltages: waveform display to estimate the switching losses, harmonic distortion measurements on wide bandwidth
5. In power electronics, qualification of equipment like variable speed drives or inverters, as designers do when measuring single or three-phase power
6. Measurement of the 3 phases in a three-phase system, between phases dv and between phase and earth (ground) without removing the probes while avoiding interference or disturbance capability
7. Measurement of 3 phases + 1 channel for monitoring a clock to synchronize a system
8. Measurement of the switching loss on the IGBT which supports high voltage and current with fast switching, as found in Hi-Fi power amplifiers, switching power supplies, medical devices, home automation motor control, induction furnaces, electric arc welding, etc.
9. Electronics: power supply of electronic equipment, differentiated grounds on the boards, sensors and associated electronics not referenced to ground, couplers, transformers, communication systems, electronic systems not powered by the mains or not referenced to ground.

input channels can measure the voltage between the two signal wires, and the other the difference of potential in common mode in relation to the ground, simultaneously and independently. This method was applied for the CAN fieldbus integrity test on SCOPIX BUS.

For user protection against electric shocks, the oscilloscopes have plastic casings which prevent access to the metal parts. Double-insulated oscilloscopes (insulation class 2) with isolated channels require Ni-Mh batteries.

To sum up: *oscilloscopes with isolated channels are recommended if you want to measure different types of electrical signals. It is the solution whenever there are insulation faults:*

- *Insulation fault between the oscilloscope and its power supply, which may create short-circuits during measurement;*
- *Faulty insulation between several inputs on the oscilloscope.*



METRIX® proposes 3 ranges of oscilloscopes with isolated channels for safe measurements



	SCOPIX III Portable oscilloscope	HANDSCOPE Portable oscilloscope	OXi 6204 Benchtop oscilloscope
Applications	Industry, electronics, energy	Maintenance	Laboratory
Bandwidth	40 to 200 MHz	20 or 40 MHz	200 MHz
Number of channels	2 or 4 isolated channels Probix input	2 totally-isolated BNC channels	4 isolated plastic BNC channels
One-shot sampling rate	2.5 GS/s	50 MS/s	2.5 GS/s
Repetitive	50 or 100 GS/s	2 GS/s	100 GS/s
Vertical resolution	12 bits	9 bits	12 bits
Max. input sensitivity	156 μ V/div to 200V/div	5 mV/div to 200V/div	2,5 mV/div to 200 V/div
Memory depth	2,500 to 50,000 points/channel	2,500 points/channel	50,000 points/channel
Other functions	FFT analysis, multimeter, harmonic analysis, power, MATH functions	Multimeter, harmonic analysis, power, MATH functions	Multimeter, harmonic analysis, MATH functions
Communication multiple	Ethernet, USB, microSD	USB	Ethernet, USB, microSD
Electrical safety	600 V CAT III / 1000 V CAT II	600 V CAT III / 1000 V CAT II	600 V CAT II

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