Current Monitor

FAQs

High impedance or 50 Ohm input?

Pearson CT's are generally intended to be used into a high impedance input such as an oscilloscope (1MΩ in parallel with 20 pF). The name-plate sensitivity applies to this type of input. When a 50Ω input instrument such as a spectrum or network analyzer is used the sensitivity will be reduced by a factor of 2. In this case the accuracy may be affected by the resistance in the cable and the accuracy of the input impedance. When viewing fast pulse rise times or when using long cables, signal fidelity may be improved by using an external 50Ω terminator or the 50Ω input scope input setting.

Can a CT measure DC current?

No. Pearson CT's operate by magnetic induction, and can only sense a time varying current. Below the rated low-frequency cut-off point the output falls at a rate of 20dB/decade of frequency. Furthermore, each model has a DC current level that will cause core saturation, resulting in a distorted output waveform. See our application note on biasing for more information on dc current and core saturation.

How long can a CT be used above its RMS limit?

The rated maximum RMS current for a typical CT is the value that produces minimal temperature rise due to dissipation in the CT. At this current level the CT can be used up to the maximum ambient temperature, usually 65°C. If the ambient temperature is lower than maximum the current may exceed the RMS rating as long as the temperature of the CT is kept below the rated maximum.

Why do I not read 50 Ohms with an Ohmmeter on the output connector?

A typical Ohmmeter measures resistance with a DC test current. The resistance obtained is the parallel combination of the winding resistance and internal terminating resistance plus the series matching resistance, if any. This is never expected to be 50 Ohms, although it is close for some models. If an AC bridge-type impedance meter is used, and the test frequency is in the pass-band of the CT, a value of 50 Ohms will be seen for most models.

Can CT’s be use to inject current?

Pearson CT’s can be used for current injection with certain limitations. Models with low numbers of turns, such as 1 V/A models (50 turns) work best, but power levels are usually low.

How much insulation?

Most Pearson CT’s are enclosed in a conductive metal case that serves as an electric field shield. This case is painted, and has no insulation rating. Pearson CT’s must always be used on an insulated conductor, or a conductor that is mechanically supported with enough air or oil space around it to withstand the operating voltage. See our application note on high voltage consideration for more information.

Can multiple turns be used?

Yes, multiple turns of the conductor under test can be wound through the hole of the CT. The sensitivity will be multiplied by the number of turns, but the maximum peak and RMS current ratings and I-t and I/f values will be divided by the number of turns. The inserted resistance will increase as the square of the number of turns.

How much position dependence is there?

In theory there should be no dependence of the output on the position of the test conductor in the hole of the CT. However, due to imperfections in the geometry of the winding and its connection to the output connector some position dependence may be seen, mainly in CT’s with low sensitivity such as 0.001 and 0.01 V/A.

Can current monitors be used in oil?

Yes, most Pearson CT’s are made with materials compatible with transformer insulating (mineral) oil, for example Shell Diala AX. A few models use a silicone filling material to reduce internal stray capacitance and improve rise-time performance. These models should not be used in silicone-based insulating oil, because if any oil penetrates the case it could cause the filling material to swell and break the case open.

Can current monitors be used in vacuum?

Yes, with limitations. Standard models are painted and have labels, both of which can be a source of out-gassing. On a custom basis we can build CT’s without paint and labels, allowing use in harder vacuum. See our beam instrumentation section for more information.

Are CT’s radiation resistant?

Standard CT models have connectors and sometimes internal wiring that are insulated with Teflon, which will be damaged by exposure to neutron radiation. Custom models can be made containing no Teflon to improved radiation compatibility.

What does the polarity arrow mean?

The polarity arrow on a Pearson CT indicates the direction of electron (negative charge) current that will produce a positive output on the center conductor of the CT connector. This direction is opposite to that for conventional (+) current. This marking convention has been used from the earliest products on, and we continue to mark them this way to avoid confusion with the installed base of Pearson CT’s. As a rule of thumb, the arrow should point toward the source of conventional current.

Why +1/-0% error limits?

Many Pearson CT models are made to an accuracy of +1, -0%. This was an early historical choice based on the characteristic drooping flat-top of a square pulse. It is the same as ±0.5% error from a 100.5% base sensitivity. We continue to make these models the same way to assure interchangeability with the existing installed base. Other models have ±1% or other custom tolerances as low as ±0.4%.

What is useable rise-time?

If the 10 to 90 percent rise time is greater than the specified usable rise time, initial overshoot and ringing will be less than 10% of the pulse step amplitude.

Why UHF connectors?

The UHF connector is largely obsolete. We retain it in certain models to assure interchangeability with the existing installed base. These are mainly larger models where a smaller connector such as the BNC would be more easily damaged. Typically a UHF to BNC adapter is used. If it becomes damaged by handling, it can be easily and cheaply replaced. Newer designs of large models usually use the type N connector.

How do I read a Pearson CT data sheet?

There are two types of data sheets for Pearson CT's. There are tabular sheets for fixed aperture current transformers, and clamp-on current transformers, and there are individual data sheets for each model. The tabular sheets organize electrical parameters into time-domain and frequency-domain groups. You should use the time-domain specifications for pulse and transient signals, and the frequency-domain for continuous periodic signals.

Mechanical specifications are available as drawings for families of CT's, and on each individual model data sheet. See our application note on how to select a current monitor for more information.

What is I/f?

This parameter indicates the ability of a given model to view sine-wave current without core saturation. Divide the RMS current amplitude by the frequency. If this number exceeds the rated I/f, the core will saturate and the output waveform will be distorted.

Choosing single or double shielding

Most Pearson CT's are either single or double shielded. Double shielding, mainly used in larger models, has two purposes. The outer shield intercepts noise capacitively coupled from the conductor under test so that it does not reach the instrument through the cable shield. This shield also increases safety when high voltage is present on the conductor under test, since a spark-over current will be sent to the ground of the circuit under test, and not reach the instrument via the cable shield.

How linear are current monitors?

Pearson Electronics current monitors are inherently linear to better than 0.1% over their specified operating range because of the theory governing their operation. There can be some non-linearity below the low frequency cut-off point because the core permeability can be smaller for small flux levels. This means that the low-frequency cut-off point can vary slightly with signal level, and so the output amplitude may be slightly non-linear. Independent testing on a large CT established that it was still in tolerance at 100 kA RMS.

How much inductance is inserted?

Compared to the same geometry without the CT, the inductance of the circuit under test is reduced by the presence of the CT. This decrease depends on the size of the core, and ranges from -6 to -57 nH depending on the model. See our application note on inductance for more information.

How much resistance is inserted?

Each Pearson CT has an internal terminating resistor that converts secondary current into an output voltage. This resistance is reflected back to the primary (circuit under test), reduced by the square of the number of turns of the secondary winding. Inserted resistance is highest for high sensitivity, and ranges from 0.02 Ω for 1 V/A models down to less than 10 μΩ for some of the low sensitivity models.

Can a CT be used with a hand-held multimeter?

Yes, with the consideration that the rated bandwidth (sampling rate) of the meter must be adequate for the signal to be measured, and an adapter from BNC to banana plugs will usually be needed.

What can damage a Pearson CT?

Pearson CT's can be damaged either mechanically or electrically. The most common mechanical damage is to connectors, making mating to cables impossible. Electrical damage is usually to either the internal termination or to the series impedance matching resistor between the winding assembly and the output connector. This is caused by exceeding the safe operating current. For pulses of one polarity, core saturation due to exceeding the I*t rating will usually protect the resistances from burn-out. However, an oscillatory transient can exceed the short-term burn-out energy without saturating the core. For such an application, you should obtain advice from Pearson's engineering department.

How high an external magnetic field can a CT work in?

External magnetic fields can affect a CT in two ways. A large time-varying field can induce voltage in the CT by stray pick-up. Also, a large DC field can cause core saturation and distort the signal output.