Safety Bulletin - PROsine 2.0 - Software Fails to Turn Off the Inverter in the Event of a Welded Transfer Relay, Creating a Shock Hazard

Technical Note

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XANTREX

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Summary

The PROsine 2.0 is designed with many advanced safety features, one of which is the ability to detect welded transfer relay contacts and take action to safely shut down the unit. An error preventing this software safety feature from operating properly has been identified. As a result, should the transfer relay fail with its contacts welded in the charge-mode (or bypass-mode) position, operation in inverter mode would apply the inverter output voltage to the AC input circuit connected to PROsine, creating a shock hazard.

Welding of relay contacts is rare during normal usage of a relay throughout most of its life, typically becoming a factor only as the number of cycles (transfers) the relay has completed gets very high. Under normal use, we expect the relay to have a lifetime in excess of 20 years. Therefore, the shock hazard presented by the combination of a welded relay and the software error described above, is unlikely until the PROsine 2.0 has been in service for a long time.

Xantrex has corrected the software, and is formulating plans (to be communicated separately) to provide upgrades for PROsine 2.0 units sold to date. In the meantime, this Safety Bulletin provides an explanation of the issue, outlines the conditions necessary for there to be a hazard, describes how to identify if your unit has the affected version of the software, how to test if your unit has a welded relay, and if so, what precautions to take.

Applicability

This bulletin applies to PROsine 2.0 units with HV microprocessor revisions of 1.10 or earlier. The revision level can be determined from the control panel, in Configure mode, under the Diagnostic menu, under the heading “HVP software”.

Explanation

PROsine 2.0 inverter/chargers contain an internal transfer relay (automatic switch) that switches between two positions. In the position used for charge mode and bypass mode, it connects the AC input (shorepower) to the AC loads and to the charger circuitry, since AC power is required for the charger function. In its invert-mode position, the relay disconnects the AC input from the AC output of the inverter. This is a safety feature that prevents the inverter output voltage from appearing on the inverter/charger AC input, and any equipment, panels, shorepower cords, and AC utility circuits that are connected to it.

As an added safety measure, the software is intended to detect a relay that is stuck (welded) in the wrong position (i.e. connecting the inverter/charger circuits to the AC

input in invert-mode), and to quickly shut off the inverter to remove the resulting shock hazard from the AC input. The intended ability of the PROsine 2.0 to detect a welded relay is an advanced feature of the PROsine inverter/chargers, and is not found on many other inverter/chargers on the market. This improved level of safety is required by the Canadian Standards Association but is not required by the UL safety standard for power conversion products for RV and marine applications (UL458).

Xantrex has discovered an error that prevents this safety function of the software from working as intended. If the relay is welded in the charge-mode position, and the AC input (shorepower) supply is lost or disconnected, the inverter output voltage will be present on the AC input circuit and everything connected to it.

This condition presents a shock hazard to the user while unplugging the shorepower connection on a boat or RV, because the cord's exposed male pins will have 120 Vac on them even after disconnecting from shorepower. There is also a shock hazard to personnel servicing circuits or equipment connected to the AC input, if they believe that the circuits have been de-energized by disconnecting the utility supply. Another risk is damage to AC generators connected to the input circuit, due to inverter voltage being applied to the generator output circuit.

How Likely Is the Problem to Occur?

It is important to realize that normal operation within the ratings of the PROsine 2.0 should result in long relay life without welding. Several factors can contribute to relay contact degradation leading to welding: the number of cycles (transfer operations) the relay has experienced while under load, the magnitude of the current being switched, and the types of load being switched (e.g. motors drawing high inrush currents). The relay manufacturer gives the relay an expected life of 100,000 cycles if used within its ratings of 30 A or 1hp at 120 Vac. Under normal use we expect less than 10 transfer operations per day, which translates into an expected life in excess of 20 years. The likelihood of the relay welding is therefore very low early in the life of the PROsine 2.0, and only becomes an issue in units that have experienced a very high number of cycles (especially motor-starting applications or other high-current or inductive loads).

Testing for a Welded Transfer Relay

If you have any reason to suspect a welded transfer relay, or if you just want to be sure that it has not welded, try the following simple test:

1. Turn off both the invert and charge modes on the PROsine 2.0 control panel, and turn off any loads connected to the inverter's AC output.
2. Disconnect the utility AC supply to the PROsine 2.0.
3. Turn on invert mode on the PROsine 2.0 control panel.
4. With the control panel in Display mode, go to the "PROsine: AC In" screen, and read the voltage displayed. If the relay is welded in the charge-mode position, the display will read approximately "117V". Any displayed voltage above 30Vac may be a shock hazard, and precautions should be taken (see below).

If the relay is not welded, the AC In screen will display approx. zero volts, while the AC Out screen displays approx. 117Vac.

Note: This test will only determine if the relay is welded in the charge-mode position, however there is no need to test for a relay welded in the invert-mode position. That condition is obvious since the product will not operate in charge mode since AC input voltage will never get through to the charger. Furthermore, that condition does not present a shock hazard.

What to do if the Transfer Relay is Welded

If you determine that your PROsine has a welded relay, take the following precautions and then contact our Customer Service department (see below) to determine how to get the new software and a replacement relay.

Take these precautions if the transfer relay is welded:

1. Stop using the product in invert mode. Disable invert mode from the control panel and disconnect the battery from the DC input to prevent inverter operation.
2. If you must use the product in invert mode, first disconnect all other sources (utility or generator) and other equipment from the AC input side of the PROsine. In many situations this can be done by opening the circuit breaker or disconnect switch supplying the PROsine's AC input branch circuit (note that one side of that breaker or disconnect will still be live when the PROsine is inverting). In other situations this will require disconnecting the AC input wiring in the PROsine's wiring compartment, first making sure the inverter is off and turning off any AC supply feeding that circuit.
3. Do not touch at any time the exposed blades or pins of the shorepower cord or any other live parts of equipment, breakers, panels, etc, connected to the AC input.

Upgrade Your Software Even if the Transfer Relay is not Welded

If you determine that your PROsine does not have a welded relay, it is still important to contact our Customer Service department (see below) to get the necessary software upgrade.

Make sure you obtain the software upgrade as soon as possible.

Contact Us for Further Assistance

If you determine that your PROsine 2.0 has the affected software, or you know or suspect that the transfer relay is welded, please contact our Customer Service department in one of the following ways:

Phone: 1-800-670-0707, press "2" (disregard the "for PROsine press 1" instruction)
Fax: 1-800-994-7828
Email: support.prosine@xantrex.com