

Automatic Transfer Switch Option Single Phase Protection

Introduction

A balanced system means that each phase of the three-phase (3 ϕ) power source are equal in voltage magnitude and are 120° apart. Since there are three phases, or “legs”, of power available from the source, it is possible to lose one of them during normal operation.

The loss of a single phase, or “leg”, can happen anywhere and is sometimes very difficult to detect. The following section will discuss the condition where “Single Phasing” is very difficult to detect simply by monitoring the voltage.

Induction Motors

The main reason that it may be difficult to detect is due to a condition known as “regeneration”. This occurs on loads that have 3 ϕ induction motors installed.

When a single-phase condition occurs and a motor is running, the motor will continue to run if there is no single-phase detection present. When this happens, the two good “legs” of power continue to run the motor. The third “leg” acts as a generator and regenerates the lost phase. The regenerated “leg” in this condition could potentially be equal to the other phases of power. Therefore, monitoring the power source 3 ϕ voltage will result in findings of, “The power source is good”, and the single-phase condition will go undetected.

Generally speaking, most of the newer motors will have their own form of single-phase detection equipment installed on them that monitors both “current” and “voltage” to help detect a single-phase condition. If a single phasing condition is detected, they will automatically disconnect the motor from the power source until the single-phase condition has been corrected.

On induction motors where there is no monitoring of “current” and “voltage” is typically where a regeneration condition will be seen. When a single-phase condition occurs, it can affect multiple customers on that faulted line. Even if your facility does not have large motors, other customers on this line might, which affects your facilities ability to sense a power outage.

When an induction motor ends up being run as a generator, it puts great strain on the motor windings and the insulation covering them. The insulation keeps the motor windings from shorting out to the motor casing, potentially causing a “ground fault” condition; a direct path of a phase “leg” of power to ground. Ground faults are very dangerous; often accompanied by an “arc flash”. Learn more in the Ground Fault Protection cutsheet.

If the single-phase condition is not caught in a reasonable amount of time, the insulation will eventually fail and the winding will short out. This will result in significant damage to the motor and potentially any loads that may be connected to the same power feed; worst of all, people may be seriously hurt or killed.

Phase Loss Sensitivity

Even when adding in a more sensitive voltage and phase sensing relay, there is no guarantee in this situation that the single-phase loss will be detected.

However, with the exception of lightly loaded motors, enough change is detected by the Phase Sequence Relay (PSR) supplied with the ATS for the Single-Phase Protection (SPP) option to provide the required protection when properly adjusted. The PSR will monitor for an undervoltage condition, improper phase rotation and a phase loss condition.

The specifying engineer should be contacted to determine if additional detection equipment is required to safely detect any “Single Phasing” conditions at the site of installation.

Product Features

- Rated for up to 600 VAC
- True Three Phase Sensing
- Phase Rotation Sensing
- Undervoltage Sensing
- Phase Loss Sensing
- Adjustable Pick-Up Range - Factory set to 90%

Microprocessor Description of Operation Molded Case Units (Option SPP)

In the event that a phase has been lost, this should be corrected before any work on the ATS is performed.

When the PSR drops out, the Single-Phase Protection Timer, (SPPT), begins timing. IF the transfer to emergency begins before this timer times out, this timer is turned off. If this timer times out before the transfer to emergency begins, an output is sent to trip the normal breaker. This is to prevent damage to the load in case the system is on a utility single phase condition.

SPPT: Single Phase Protection Timer - This timer is adjustable from 0 to 300 seconds and is factory set at 60 seconds.

The Normal side molded case unit will be tripped open in this event and will require operator intervention to reset the ATS for automatic operation. This unit will need to be physically reset, so a trained operator will be required to perform this maintenance because entry into the ATS enclosure is required. Be sure that all required PPE is used.

To reset the molded case unit, depress the control handle on the normal unit until it is in the “OFF” position.

Once the molded case unit has been physically reset, the microprocessor will need to be reset also. The faults seen will be displayed on the HMI screen. Follow the **RESET Instructions** in this cutsheet to clear the faults and resume automatic operation of the ATS.



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Microprocessor Description of Operation Insulated Case Units (Option SPP)

When the PSR drops out, the Single-Phase Protection Timer, (SPPT), begins timing. IF the transfer to emergency begins before this timer times out, this timer is turned off. If this timer times out before the transfer to emergency begins, an output is sent to open the normal breaker. This is to prevent damage to the load in case the system is on a utility single phase condition.

SPPT: Single Phase Protection Timer - This timer is adjustable from 0 to 300 seconds and is factory set at 10 seconds.

The ATS is capable of continuing automatic operation without an operator's intervention because opening and tripping the breaker are the same mechanism and the breaker does not need to be reset, but the HMI will display the Trouble fault. Follow the **RESET Instructions** to clear the trouble condition. A trained operator is required to perform this maintenance. Be sure that all required PPE is used.

However, until the SPP condition has been cleared, the ATS will remain on emergency power.

NOTE: If, during this time, something "Trips" the breaker, they will have to be physically reset. To do this, locate the red button that has popped out on the face of the breaker. There will be some form of identification saying that the "Breaker Tripped" near it. Push this red button back in to reset the breaker. Do this for both units.

RESET Instructions

The following instructions are to be performed using the keypad and HMI screen located on the front of the ATS.

1. Depress "Enter".
2. The display will read "MAIN MENU / Reset Faults / Troubles".
3. Depress "Enter" again and the display will read "Reset Faults / Troubles, Clear all now? No".
4. The word "No" will be underlined.
5. Depress either "↓" or "↑" until "Yes", the desired value, is displayed.
6. Depress "Enter" to clear or "ESC" to cancel.
7. All faults / troubles will be reset, and the display will show the operating mode again.

Electromechanical Description of Operation - Molded or Insulated Case Units (Option 24A)

Single phase protection is not available as a standard option on ATS with electromechanical controls.

However, Lake Shore Electric Corp. does have the PSR as an option to be added to these controls, but the ATS logic will treat it the same way it would the standard Phase Failure Relay (PFR). When the PSR signals the loss of power on the power source it is monitoring, the ATS will not trip the breaker open. It will simply see it as a source failure and operate accordingly.

Order Guide

Part Number Examples:

1. ICFA32000BPSB/**SPP** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with included option ACSP.
2. MCDA31200CPSB/**SPP** - Molded Case ATS, 3 pole, 1200 Amp, 277/480Vac, **24Vdc Microprocessor Controls**, 50kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with included option SPP.
3. MCDA30400CESA/**24A** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with option 24A by description; (SPP Required).



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