Theory of Operation

The SAK-60 is a microprocessor controlled dual latching relay with built in functionality to lock out or manage loads on generator power. The device is built around latching relays that are toggled on and off by a short pulse of energy to open and close the contacts. The relay incorporates SRT® (Smart Relay Technology) to control switching at the zero cross over point of the sine wave.

Mode LD - Generator Detection & Load Lock-Out

The SAK-60 uses a proprietary *Sine Wave-Distortion Index* with user adjustable sampling rates to adapt to most utility and generator sine waves. When Load-Drop (Mode **LD**) is selected from the main menu, at power the device will turn the relay off, execute power up delay **d**. The SAK-60 will analyze the sine wave to determine if the power source is utility or generator. When utility is detected, the Gen-Util LED will turn green, the Load On relay LED will illuminate yellow, closing the relay contacts and restoring the connected load. When generator is detected, the Gen-Util LED will illuminate red, and the load will remain off until stable utility power is restored. The Sine Wave Distortion Index® reading will be displayed on the LCD digital display. After utility power returns and is detected by the SAK-60, The Gen-Utility LED will turn green, the Load On LED illuminates yellow and the device enters sleep mode.

Mode UP & UA - Under Frequency Load Management Functions

The SAK-60 can load manage using Under Frequency detection for air-cooled generators. The **UP mode** has preset under frequency and delay times that cannot be adjusted. These values should be suitable for most air-cooled applications. The **UA mode** provides field adjustments for frequency and delay time to allow the installer to adjust up to three levels of under frequency detection. The option to adjust these parameters allows the SAK-60 to adapt to the majority of load management applications.

When power is restored after a power outage, and load management Mode UP or UA are selected, the SAK-60 relay opens. The system analyzes the sine wave to determine if the power source is utility or generator. When a utility sine wave is detected, the Gen-Util LED turns green, the Load On LED illuminates closing the relay contacts to restore the connected load. The SAK-60 will now enter sleep mode. When generator sine wave is detected, the Gen-Util LED illuminates Red indicating generator power is detected. After the adjustable delay “g 000.0”, the load is restored and the Gen-Util LED flashes red, indicating load management mode is active, and the yellow LED illuminates indicating the load is restored. The *Sine Wave-Distortion Index* is displayed on the front panel LCD. In the event of an under frequency condition meeting the trigger points of either **Mode UP** or **Mode UA** , the load is disconnected for the delay time set in Mode “O 000.0”. When utility power is restored, the Gen-Util LED will illuminate green and device enters sleep mode. Please note when the SAK-60 is in sleep mode, a power outage of at least 2-3 seconds is required to restart program. The SAK-60 will **not** recognize a Hot Swap transfer event so load shedding will not be activated.

Additional Modes of Operation

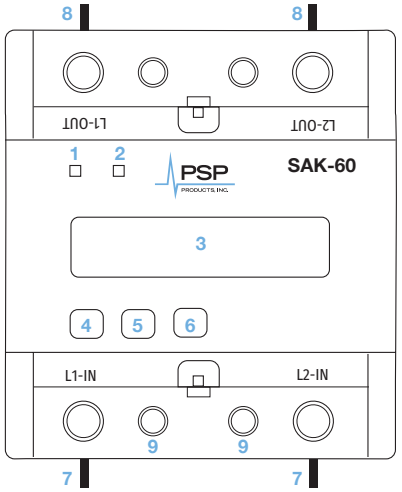
Scroll Compressor Saver Mode: The “Y” Mode was developed to help prevent HVAC Scroll compressors from over heating as a result of reverse rotation after a transfer from generator voltage back to utility. When “Y” Mode is adjusted to 000.0 the mode is inactive. Any setting greater than 000.0 will activate the mode. When “Y” mode is active the load connected will be turned off in approximately 45 seconds after a transfer from Generator to utility has occurred. The connected device will then remain off for the time in minutes set in the “Y” mode adjustment. YC-mode sets the # of utility cycles before entering Y-mode default YC-0001.

Factory Test Mode: The factory test mode is programmed to test the push buttons, LEDs and accuracy of the AC frequency reading during quality control testing. This feature can also be used in the field as a real time AC Line frequency meter. To enter test mode adjust the value of to 0001. To exit mode remove and restore power.

Dry Contact Mode: SAK-60 can be controlled by dry contact input using N/O, N/C logic input. ON delay can be adjusted from 000-999 seconds.

Instructional videos available at: pspproducts.com **Technical Assistance Call: 703-687-4057**

PSP PRODUCTS, INC.
SAK-60 (software version 3.0)
Installation Programming Guide



Installation Instructions

1. Gen-Util LED: Illuminates solid green when utility voltage is detected, solid red when generator voltage is detected. Flashes red when load is restored under generator power modes UP & UA.
2. Load On LED: Illuminates yellow when relays are closed.
3. LCD Display: Displays status and adjustment values
4. Mode Button: Used to enter main menu and toggle
5. Up Button: Adjust value up
6. Down Button: Adjust value down
7. Line In
8. Line Out
9. Dry Contact Input

Warning! Do not apply external voltage to the dry contact input terminals. This will damage the SAK-60 and void the warranty.

Programming Instructions

To enter Programming Mode: Push “**Mode**” button (4) for three seconds and release. The present master mode will be displayed. Pressing the mode button for one second increments will scroll through the four available master modes as shown below. Once the desired master mode is displayed, press the mode button for 3 seconds to select that master mode. After releasing the mode button the SAK-60 will now be in the adjustment mode of the selected master mode. The menu mode will be exited after 7 seconds of inactivity.

Adjust Settings In Master Modes

Adjust settings within a Master Mode: After a Master Mode has been selected the adjustments within the Master Mode can be selected by pushing the Mode Button for 1 second increments to scroll through the adjustments. Use the Up Button and the Down Button to adjust the values to the desired setting.

Master Modes

Master Mode LD: Load drop mode. When this mode is selected the load controlled by the SAK-60 will be locked out when ever generator power is detected and will not be restored until stable utility power has returned. Adjustment “D” set the delay time before load is restored after any power outage event occurs.

Master Mode UP: Load Manage Preset Under Frequency Settings. When this mode is selected the load controlled by the SAK-60 will be connected under generator power after delay “G” when ever generator power is detected. The load will be disconnected should an under frequency event occur. After an under frequency event the load will be restores after delay “O”.

Master Mode UA: Load Manage Adjustable Under Frequency Settings. When this mode is selected the load controlled by the SAK-60 will be connected under generator power after delay “G” when generator power is detected. The load will be disconnected should an under frequency event occur. After an under frequency event the load will be restores after delay “O”. There are three sets of under frequency adjustment set points to customize the delay and intensity levels at which an under frequency event is detected.

Master Mode FA: Factory Adjustment Mode. When this mode is selected you have the option to adjust global settings that can effect all modes of operation. Please consult technical support prior to making any changes to these settings.

Master Mode DC: Dry Contact Control.

Master Mode OU: Over Under Voltage Protection. SAK-60 can be used as a standalone over-under voltage protector. Note this is an independent function and can’t be used in combination with any other function.

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SAK-60 (software version 3.0)

Menu Flow Chart with Default Settings

To Enter Mode Menu

Press and hold mode button for three seconds and release. Press mode button to scroll to desired mode, then press mode button for three seconds to store selected mode.

To Adjust Settings Within a Mode

Press mode button for one second and release. Use mode button to scroll to desired adjustment, then press up and down keys to desired settings. Value will stored after 7 seconds of inactivity.

LOAD DROP

- **Ld** — Press Mode button 1 sec. to adjust settings
- **d 000.2** — Delay at Power Up: Adjust relay program start up delay at Power-Up from 000.1 to 999.9 minutes to allow power to stabilize
- **MODE MENU** — Press Mode button 3 sec. to enter MASTER menu: Push MODE button for 3 seconds to return to MASTER MENU or wait 7 seconds to save adjustments and exit menu

UNDER FREQUENCY PRESET VALUES

- **UP** — Press Mode button 1 sec. to adjust settings
- **d 000.2** — Delay at Power Up: Adjust relay program start up delay at Power-Up from 000.1 to 999.9 minutes to allow power to stabilize
- **9 005.0** — Restore Delay on Gen: Adjust the delay time in minutes before restoring load after generator sine wave has been detected
- **0 005.0** — Restore Delay on Overload: Adjust the delay time in minutes before restoring load after under frequency load drop event
- **MODE MENU** — Press Mode button 3 sec. to enter MASTER menu: Push MODE button for 3 seconds to return to MASTER MENU or wait 7 seconds to save adjustments and exit menu

PRESET VALUES (NON-ADJUSTABLE)

- **F 157.0** — Preset Not Adjustable: Under Frequency F1 preset from 58.0 Hz. follows delay d1
- **d 103.0** — Preset Not Adjustable: Set delay time from 00.01 to 10.00 seconds for F1 Under Frequency Load Shed
- **F 255.0** — Preset Not Adjustable: Under Frequency F2 preset to 56.0 Hz. follows delay d2
- **d 202.0** — Preset Not Adjustable: Set delay time from 00.01 to 10.00 seconds for F2 Under Frequency Load Shed
- **F 352.0** — Preset Not Adjustable: Under Frequency F3 preset to 53.0 Hz. follows delay d3
- **d 300.5** — Preset Not Adjustable: Set delay time from 00.01 to 10.00 seconds for F3 Under Frequency Load Shed

UNDER FREQUENCY ADJUSTABLE VALUES

- **UA** — Press Mode button 1 sec. to adjust settings
- **d 000.2** — Delay at Power Up: Adjust relay program start up delay at Power-Up from 000.1 to 999.9 minutes to allow power to stabilize
- **9 005.0** — Restore Delay on Gen: Adjust the delay time in minutes before restoring load after generator sine wave has been detected
- **0 005.0** — Restore Delay on Overload: Adjust the delay time in minutes before restoring load after under frequency load drop event
- **F 157.0** — F1 Under Freq. Setting: Under Frequency F1 set from 50.00 to 60.00 Hz. follows delay d1
- **d 103.0** — F1 Under Freq. Delay Time: Set delay time from 00.01 to 10.00 seconds for F1 Under Frequency Load Shed
- **F2 55.0** — F2 Under Freq. Setting: Under Frequency F2 set from 50.00 to 60.00 Hz. follows delay d2
- **d202.0** — F2 Under Freq. Delay Time: Set delay time from 00.01 to 10.00 seconds for F2 Under Frequency Load Shed
- **F3 54.0** — F3 Under Freq. Setting: Under Frequency F3 set from 50.00 to 60.00 Hz. follows delay d3
- **d3 00.5** — F3 Under Freq. Delay Time: Set delay time from 00.01 to 10.00 seconds for F3 Under Frequency Load Shed
- **Y 000.0** — Scroll Comp. Saver 0000 =OFF 0001= ON: Scroll Compressor Mode Y0000 Mode OFF Y0001 - 0030 load off for xx min after detect utility return
- **Y C00.0** — Scroll Comp. Saver # CYCLES B4 YMODE
- **MODE MENU** — Press Mode button 3 sec. to enter MASTER menu: Push MODE button for 3 seconds to return to MASTER MENU or wait 7 seconds to save adjustments and exit menu

FACTORY ADJUSTMENTS

- **FA** — Press Mode button 1 sec. to adjust settings
- **E 0020** — Gen Detect Set-Point: Adjust the Sine Wave Distortion Index™ to set generator detect threshold. Default setting: 0020 Consult technical support
- **S 0020** — Algorithm Adjustment 1: Service Adjustment. Default 020 Consult technical support
- **C 0020** — Algorithm Adjustment 2: Service Adjustment. Default 020 Consult technical support
- **P 000.3** — O/L On Restore Detect: Set delay time from 0001 to 0010 seconds for detection of Over-Load when load is restored. An extended delay will be executed as set up in "U"
- **U 030.0** — "P" Load Restore Delay: Upon load restoration, if under frequency event occurs within "P" seconds after restoration, this extended delay "U" is activated and added to setting "O" normal restore delay
- **H 0002** — Consecutive B4 Sleep: Repetitive cycles required to confirm Utility/Generator waveform default set to 3 cycles
- **3 0000** — Factory Test Mode: Factory Test Mode 0000 = OFF 0001 = ON UP = Relay On Down = Relay Off Real Time AC Freq. Meter
- **MODE MENU** — Press Mode button 3 sec. to enter MASTER menu: Push MODE button for 3 seconds to return to MASTER MENU or wait 7 seconds to save adjustments and exit menu

DRY CONTACT CONTROL

- **dC** — Press Mode button 1 sec. to adjust settings
- **d 000.2** — Delay at Power Up: Adjust relay program start up delay at Power-Up from 000.1 to 999.9 minutes to allow power to stabilize
- **A 0001 / A 0002 / A 0002** — A001 = N/O A002 = N/O 5 min delay A003 = N/C
- **Ad 000.0** — Delay After Input: ON delay A-1 and A-3
- **MODE MENU** — Press Mode button 3 sec. to enter MASTER menu

OVER UNDER VOLTAGE PROTECTION

- **OU** — Old H: Press Mode button 1 sec. to adjust settings
- **d 000.2** — Delay at Power Up: Adjust relay program start up delay at Power-Up from 000.1 to 999.9 minutes to allow power to stabilize
- **U 0190** — Old I: Under Vol 60-200: Undervoltage 060-0200
- **o 0270** — Old J: Over Vol 120-320: Overvoltage 0120-300
- **d A00.1** — Old L: Delay at Power Up: Overvoltage ON delay after O/U event
- **MODE MENU** — Press Mode button 3 sec. to enter MASTER menu

UL Testing Standards and Product Certifications

Construction of control: Independently mounted
Action: Type 1
Over voltage category: OVC III
Pollution degree: PD2
Rated Impulse Voltage: 2500 V
Maximum phase to ground voltage of the supply source: 150 V
Protection against electric shock class: Insulation-encased Class II Equipment
Environmental: IP00
Purpose of control: operating control

CE

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