



**iATS-S400**  
**50-3000A**

Installation and user manual.

# ACCRETIVE TECHNOLOGY

Operation and maintenance manual for the **iACS-S400**.  
Intelligent Automatic Change Over Switch.

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## INTRODUCTION

Congratulations on your purchase of S400. When contacting Accretive Technology about parts, services and support, you will need to supply the information of your product. Transcribe the information found on your product's nameplate label to the table below.

- Model number.
- Serial number.
- Date of purchase.
- Purchase location.

**Preliminary Comments and Safety Precautions:** This technical document is intended to cover most aspects associated with the installation, application, operation, and maintenance of the Intelligent Automatic Change over Switch S400 Controller. It is provided as a guide for authorized and qualified personnel only in the selection and application of the S400 Controller. Please refer to the specific WARNING and CAUTION, before proceeding. If further information is required by the purchaser regarding a particular installation, application, or maintenance activity, please contact an authorized Accretive technology sales representative, service engineer or the installation contractor.

**Warranty and liability information:** this product comes with 1 year warranty, during the course of this period if any mishap within this period, Accretive technology will take responsibility of it, but if by default internal component was tampered with, internal damage of the equipment or the company seal found broken, Accretive technology will not be liable for the damage and if need be for replacement of any component on the equipment it will attract the purchaser a maintenance fee charge.

**SAFETY PRECAUTIONS:** All safety codes, safety standards, and/or regulations must be strictly observed in the installation, operation, and maintenance of this device.

### **WARNING**

the warnings and cautions included as part of the procedural steps in this document are for personnel safety and protection of equipment from damage. an example of a typical warning label heading is shown above to familiarize personnel with the style of presentation. this will help to ensure that personnel are alert to warnings, which appear throughout the document. in addition, warnings and cautions are all upper case and boldface.

### **CAUTION:**

Completely read and understand the material presented in this document before attempting installation, operation, or application of the equipment. In addition, only qualified persons should be permitted to perform any work associated with this equipment. Any wiring instructions presented in this document must be followed precisely. Failure to do so could cause permanent equipment damage.

### **BACKGROUND**

Automatic changeover switches are used to protect critical electrical loads against loss of power. The load's PHCN power source is backed up by a Generator power. The automatic changeover switch is connected to both the PHCN and Generator power sources and supplies the load/home with power from one of the two sources. If power is lost from PHCN, the transfer switch transfers the load to the Generator power source. This transfer can be automatic or manual, depending upon the type of ACS equipment being used or if the ACS is operated in manual or automatic mode. Once PHCN power is restored, the load is automatically or manually transferred back to the PHCN power source, again depending upon the type of transfer equipment being used or the ACS operational mode. In automatic changeover switch (ACS) equipment, the switch's intelligence system initiates the transfer when the PHCN power falls below or rises above a preset voltage. If the Generator power source is an automatic generator, the ACS initiates generator start up command, and then transfers to the Generator power source when sufficient generator voltage is available. When PHCN power is restored, the ATS automatically transfers back to the PHCN power source and initiates generator engine shutdown command.

The S400 has 3nos of power source that can be connected.

1. PHCN
2. Inverter
3. Generator

**Note:** The PHCN power supply is priority 1, Inverter priority 2 and Generator is priority 3.

The S400 controller transfers power from one of the 3 source to the load/home according to priority.

An ACS consist of two basic elements:

1. Main contactors to connect and disconnect the load to and from the power sources.
2. Intelligence/supervisory circuits to constantly monitor the condition of the power sources and thus provide the intelligence necessary for the switch and related circuit operation.

This manual deals with the second basic element of the ACS, the required intelligence/supervisory circuits. Earlier ACSs were controlled by relay logic type or solid-state, single board controllers. In either case, the control panel consisted of several individually mounted and wired devices offering a limited amount of system flexibility, especially in the case of the relay logic design. The S400 Controller advances the application of intelligence, supervisory, and programming capabilities for ACS equipment.

#### **Product Overview**

The S400 Controller is a comprehensive, multi-function, microprocessor-based ACS controller. It is a compact, self-contained, panel mounted device designed to replace traditional relay and solid-state logic panels.

Designed to meet the needs of markets worldwide, the S400 Controller is a UL Recognized Component

- Meets IEC 1000-4-2, 1000-4-3, 1000-4-4, 1000-4-5, 1000-4-6, and 1000-4-11
- Meets CISPR 11, Class A
- Complies with FCC Part 15, Class A
- Meets African Standards Conformance.

The S400 Controller provides an unmatched degree of programmed flexibility to address the needs of any system. It operates from all system voltages between 180 and 260 Vac, single-phase at 50 or 60 Hz. The S400 Controller monitors the condition of the voltage of the PHCN & Generator power sources. The S400 Controller provides the necessary intelligence to ensure that the switching operates properly through a series of programmed sensing and timing functions.

#### **FEATURES OF THE STANDARD iATS-S400 CONTROLLER:**

- Triple power source.
- 1 phase.
- Fully computerized controls and operations.
- Switch operation.
- Single control package for sensing and timing delays.
- Voltage surge immunity.
- Under voltage and over voltage protection.
- Manual generator automatic OFF.
- Generator operational time function.
- Automatic and Manual operation.
- On-board diagnostics/fault detection and indication.
- Special load power configuration.
- End-user desirable programming.
- Fully adjustable timers and control parameters.
- Optimum generator runtime maintenance hours and fuel economy.
- Store customer and factory established parameters in nonvolatile memory.

#### **GLOSSARY**

With respect to their use within this document and as they relate to ACS and controller operation, the following terminology is defined.

**AVAILABLE:** A source is defined as “available” when it is within its under voltage/overvoltage (if applicable) set point ranges for the nominal voltage.

**CONNECTED:** Is defined as when the input is shorted by an external contactor or connection.

**FAILED OR FAILS:** A source is defined as “failed” when it is outside of the applicable voltage set point, ranges for the nominal voltage setting for a time exceeding the set seconds after the time delay expires for low voltage, power supply is cut off and instantly cut off power supply when high voltage is experienced.

#### **MANUAL MODE (Failsafe)**

Manual operation is a feature that enable only single power operation from the only available power source and forces a transfer or re-transfer operation to the only that available power source. This fail save can only operate in manual mode only

## RE-TRANSFER

Re-transfer is defined as a change of the load connection from the Generator or PHCN (Vise-versa).

## PHCN

PHCN is the primary source (normal source, normal power source, or normal).

## INVERTER

Inverter is one of these secondary or alternate sources. (Emergency source, emergency power source, emergency, standby, or backup source).

## Generator

Generator is one of these secondary or alternate sources (emergency source, emergency power source, emergency, standby, or backup source).

## AUTOMATIC Generator

Generator is said to be automatic if it has an internal controller that startup/stop the generator with a remote command.

## MANUAL Generator

Generator is regarded as manual if human intervention is required to startup with recoil starter or with starter motor via the key.

## PHCN: Failed or Fails

PHCN is defined as “failed” when it is outside of its under-voltage/overvoltage (if applicable) set point ranges for the nominal voltage.

## INVERTER: Failed or Fails

Inverter is defined as “failed” when the inverter fails to produce output, or the connected battery is discharged.

## Generator: Failed or Fails

Generator is defined as “failed” when it is outside of its under-voltage/overvoltage (if applicable) set point ranges for the nominal voltage setting for a time exceeding set seconds after the time delay expires.

## TRANSFER

Transfer is defined as a change of the load connection from the PHCN to Generator power source, except when specifically used as “Transfer to Neutral”.

## TRANSFER TO NEUTRAL

Transfer to neutral is defined as when the load circuits are disconnected from both the PHCN and generator power sources.

## UNCONNECTED

Unconnected is defined as when the input is not shorted by an external contactor or connection.

## FUNCTIONS/FEATURES/OPTIONS

The primary function of S400 Controller is to accurately monitor power sources and provide the necessary intelligence to operate an ACS in an appropriate and timely manner. In addition, the S400 Controller provides programming through the device’s switches, button and LED indicators to precisely show the parameter values.

## OPERATIONAL SIMPLICITY

From installation to programming to usage, the S400 Controller was designed with operational simplicity in mind. Only one style needs to be considered, regardless of input/output requirements or system voltages. The S400 Controller provides the functionality of numerous other devices combined in one package. The user-friendly switches, button and LED indicators simplifies routine operation, programming, data presentation, and setting adjustments.

## STANDARD AND OPTIONAL FEATURES

A variety of programmable features are available with the S400 Controller to meet a wide variety of application requirements. Individual features or feature combinations provide the intelligence required to tailor S400 to individual needs. The model is also equipped with special load function which can be configured for any or three power sources. The features are factory activated, depending upon customer requirements. The specific variable set points associated with standard and factory activated features are stored in nonvolatile memory. Activated feature set points are available for customer adjustment.

## HARDWARES

The purpose of this section is to familiarize the reader with the S400 Controller hardware.

### FRONT (OPERATOR) PANEL:

The front panel, depending on the installation, is normally accessible from the outside of a panel or door. S400 Controller front panel serves two primary functions: output and input.

- Alert the user to specific conditions/alarms.
- Program the S400.
- Operation of the S400.

**INDICATOR LAMP:** The indicator lamp shows the physical status of the S400, if PHCN/Inverter/Generator is available, if there is any fault and countdown timer ON/OFF status.

**S400CONTROLLER:** This is the brain behind the ACS, it controls and monitors all operations and functions of the entire unit.

**CONTACTORS:** This is an electrically controlled giant switches, which make or breaks the power supply to the load/home. These contactor ratings tell the capacity of the ACS which ranges from 50 – 200A.

**TRANSFORMER:** The transformer (220vac/12vac, 300ma) provides power supply to the controller. Its major function is to provide the equivalent power supply voltage which is being monitored by the controller.

**ENCLOSURE:** the S400 is packaged in a metal enclosure, (IP65) which the size depends on the rating of the unit.

## OPERATION

### ACS OPERATION, SWITCHES AND ITS FUNCTIONS:

- Power switch.
- Auto/manual switch.
- PHCN/Generator switch.
- Generator standby switch.
- Inverter ON/OFF switch.
- Inverter UPS mode switch.
- Operational timer knob.
- Bypass mode.
- LED indication.

### POWER SWITCH:

The S400 power switch should be in ON position, else the ACS will no functions.

**Note:** Once the power switch is ON all LED indicator flashes for 3sec.

### AUTO/MANUAL SWITCH:

The auto/manual operation of the S400 can be selected depending on the operational requirement. If auto is selected the S400 will function automatically either in PHCN or inverter or Generator, depending on which is available, based on the priority.

The Automatic Mode of the S400 Controller provides for automatic transfer and re-transfers from PHCN/INVERTER/GENERATOR as dictated by the features supplied and their programmed set point values. It provides a summary of the S400 Controller intelligence and supervisory circuits that constantly monitor the condition of all three power sources, thus providing the required intelligence for transfer operations. These circuits, for example, automatically initiate an immediate transfer of power when the power fails, or the voltage level drops below a preset value. Exactly what the S400 Controller will initiate in response to a given system condition depends upon the combination of standard and selected optional features.

### MANUAL PHCN:

The S400 auto/manual switch should be manual mode. Select PHCN with the PHCN/GEN switch, if the switches are correctly operated the S400 will power the load only on PHCN and other source will not be recognized.

### MANUAL INVERTER:

The S400 auto/manual switch should be manual mode. Select Generator with the PHCN/GEN switch and switch OFF the generator ignition switch. Switch ON the inverter switch. If the switches are correctly operated the S400 will power the load only on inverter and other source will not be recognized.

### MANUAL Generator:

The S400 auto/manual switch should be manual mode. Select Generator with the PHCN/GEN switch, if the switches are correctly operated the S400 will power the load only on Generator and other source will not be recognized.

**Note:** In manual operational mode, either PHCN or inverter or Generator can be operated or selected at a time.

**GeneratorSTANDBY:**

The generator standby switch controls ON/OFF the generator ignition. It can be used to stop the manual generator if it's running. Two generator selection modes can be made in the setup (Automatic generator or manual generator). For automatic generator, having the generator standby switch in ON position, will initiate a start command when PHCN is not available or inverter battery is discharged. And as for manual generator the user must start the generator.

**Note:** To start the manual generator via start recoil, the generator standby switch should be in ON position always.

If the generator is switched OFF by the ACS unit either automatically or via the generator standby switch, wait for at least 1min before restarting the generator.

**INVERTER ON/OFF SWITCH**

The inverter ON/OFF switch is used to switch ON/OFF the inverter or enable inverter standby mode (depending on the settings).

**Note:** If inverter standby function is disabled, in cases were inverter was online and PHCN/Generator supply is available. The S400 will initiate an OFF command to the inverter but remember the inverter switch is in ON position. To re-start the inverter when needed switch OFF and switch ON the inverter ON/OFF switch and the inverter will be back online.

**UPS MODE SWITCH**

The UPS mode ON/OFF switch enables the inverter to operate in UPS mode. The UPS mode will only function if the inverter ON/OFF switch is in ON position.

**Note:** The inverter must have UPS capability. Else this mode will not function.

**SET RUN TIMER**

Runtime is a function of the S400 to enable the user to run the generator or inverter for sometime duration, based on the set requirement. In this case you can run your generator or inverter without monitoring and helps manage your gasoline more efficiently. The timer ranges from 1 – 9hrs.

To set the timer, position the timer knob at zero position and press the knob (this refresh the timer to zero).

Rotate the timer knob to the desired hours, the timer LED flashes corresponding to the hours value computed inside the S400. After the flashing, the LED blinks every 0.5sec till the countdown timer is completed and initiates the stop command to the generator or inverter.

To OFF the timer, press the timer knob once and the timer LED stops blinking.

**Note:** The timer will only function when generator or inverter is online.

**INVERTER BATTERY CHARGING.**

The S400 can be operated to power inverter alone via PHCN for battery charging. To initiate this, the power ON/OFF switch should be OFF, and inverter ON/OFF switch should be ON.

**Note:** Inverter is always powered if PHCN or Generator is available.

**CUSTOMER OUTPUT RELAY**

The output relays are meant for Customer Connections. The primary control outputs of the S400 are dry relay contacts.

**S400 Inverter ON/OFF RELAY:**

The S400 comprises one special relay to provide ON/OFF operation of inverter, this is necessary to complete the electrical control function. The relay is rated DC rating is 3 A, 30 Vdc, 3 A, 250 Vac.

**IACS-S400 Generator IGNITION RELAY:**

The S400 comprises one special relay to provide the generator ignition ON/OFF for manual generator, necessary to complete the electrical control function. The relay is rated DC rating is 3 A, 30 Vdc, 3 A, 250 Vac. An Auxiliary relay is provided with the ACS, if the generator is installed more than 20m away from the ACS, see the drawing for proper connection.

**Note:** The auxiliary relay must be powered with the generator battery (6 – 12vdc).

**BYPASS MODE:**

The bypass mode disables the ACS completely. It's meant to act as an interlock between the manual changeover switch and the auto changeover switch. The bypass is available on the ACS for this

reason, if there is a problem with the ACS, (extremely low or high voltage) which is not in range as per the setup parameter the ACS. In this case the existing manual changeover will be used to achieve this aim. Hence this will prevent the ACS from closing its contactors while the manual changeover is engaged, which might result to serious short circuit or damage to the ACS unit or personal injuries. When the, ACS is on bypass mode all LED starts blinking. If the manual changeover switch is equipped with auxiliary contacts, hence the bypass connection can be made.

**Note:** if the bypass is not connected, ensure to switch OFF the power switch before using the manual change over.

The bypass terminal has been internally linked inside the ACS unit, if the link is opened the ACS is disabled and goes into bypass mode.

## LED INDICATIONS

**PHCN LED INDICATOR:** This LED blinks when PHCN is available and when the load is powered, it remains permanently ON. When fault occurs on the PHCN section, the PHCN LED flashes corresponding to the fault number as reference in the fault and troubleshooting section.

**Generator LED INDICATOR:** This LED blinks when Generator is available and when the load is powered, it remains permanently ON. When fault occurs on the PHCN section, the PHCN LED flashes corresponding to the fault number as reference in the fault and troubleshooting section.

**INVERTER LED INDICATOR:** This LED flashes when inverter is on standby, blinks when inverter is on UPS mode and when the load is powered by inverter, it remains permanently ON. When fault occurs on the PHCN section, the PHCN LED flashes corresponding to the fault number as reference in the fault and troubleshooting section.

**TIMER LED INDICATOR:** This LED blinks every 0.5sec when countdown timer is ON.

## S400 SETUP

There are two basic setups of the S400.

- Normal parameter setup.
- Load-Factorydefault parameter.

At first power up of the S400, the controller loads the factory default parameters necessary for operation.

For normal parameter setup if the factory defaults parameter does not meet up with the owner's requirement.

**Note:** Either PHCN, inverter or Generator supply can be used for this setup. (Preferably inverter or generator supply to avoid interruption during the configuration).

### START NORMAL PARAMETER SETUP FOR S400.

- Either PHCN/inverter/generator must be available.
- Power ON/OFF switch should be on OFF position.
- Generator ignition switch should be ON position.
- PHCN /GEN switch should be on PHCN position.
- Auto/manual switch should be on manual position.
- Inverter ON/OFF switch should be in OFF position.
- Inverter UPS mode ON/OFF switch should be in OFF position.
- Press the timer knob for 15sec and wait till both PHCN/GEN indicators start blinking.

### Note:

In setup mode, toggling the AUTO/MAN switch moves the present parameter to the next. The parameter number is flashed by the PHCN, Inverter or GEN LED light.

The timer knob (range value 1 - 9) is used to set the value for each parameter and the value is flashed by the timer LED.

After any setting is made against the parameter, toggle the PHCN/GEN switch once. (Fast flashing occurs on all LED indicators; it indicates the parameter setting has been accepted and proceeds to the next parameter).

Any change of switch position will exit the setup mode.

All setup parameter will only be saved at the end of the setup.

If for any reason, just a single parameter is needed to be adjusted, set other parameters to zero till you reach the parameter you intend to adjust. Proceed till the setup procedure is completed. At the end of the set up the S400 saves only the parameter that was not set at zero.

### LOAD-FACTORY DEFAULT PARAMTERS FOR iACS-S15.

- Power ON/OFF switch should be on OFF position.
- Generator ignition switch should be ON position.
- PHCN/Generator switch should be on Generator position.
- Auto/manual switch should be on manual position.
- Press the timer knob for 30sec and wait till all indicators starts flashing.
- After loading the factory default parameters, the iACS-S200 restarts and ready for operation.



**NORMAL PARAMETER SETUP FOR S400.**

After initiating the setup mode below is the programming steps.

| S/N                  | PARAMETER                        | DESIGN STANDARD  | LED FLASH INDICATION |           |          |       | OPTION (Timer knob, computes this values)  | DEFAULT VALUE | HELP   |
|----------------------|----------------------------------|------------------|----------------------|-----------|----------|-------|--|---------------|--|
|                      |                                  |                  | PHCN                 | Generator | INVERTER | TIMER |  |               |  |
| <b>PHCN SETTINGS</b> |                                  |                  |                      |           |          |       |  |               |  |
| 1                    | STANDARD VOLTAGE                 | Voltage          | 1                    | 1         | 0        | 0     | Range 1 – 5 (position 1 is 180vac, position 2 is 200vac, position 3 is 220vac, position 4 is 240vac, position 5 is 260vac.   | 220vac        | The IACS is originally designed for 1phase 220vac operations.  |
| 2                    | PHCN OVER VOLTAGE                | %                | 2                    | 0         | 0        | 0     | Range 1 – 3 (position 1 is 10%, position 2 is 20% & position 3 is 30%  | 20%           | PHCN over voltage protection immediately cuts OFF power supply to the load if the voltage exceeds the settings.  |
| 3                    | PHCN OVER VOLTAGE RECOVERY DELAY | Delay (Seconds). | 3                    | 0         | 0        | 0     | Range 1 – 9 (position 1 is 10sec, position 2 is 20sec, position 3 is 30sec, position 4 is 40sec, position 5 is 50sec, position 6 is 60sec, position 7 is 70sec, position 8 is 80sec & position 9 is 90sec. | 30sec         | If over voltage is experienced, the iACS-S15 controller continuously checks the voltage as per the preset set delay, after which power is restored to the load.    |
| 4                    | PHCN UNDER VOLTAGE               | %                | 4                    | 0         | 0        | 0     | Range 1 – 6 (position 1 is 10%, position 2 is 20%, position 3 is 30%, position 4 is 40%, position 5 is 50% & position 6 is 60%   | 50%           | If under voltage is experienced, the iACS-S15 continuously checks the voltage as per the preset set delay (parameter 5), after which power is cut OFF to the load. |
| 5                    | PHCN UNDER VOLTAGE CUTOFF DELAY  | Delay (Seconds). | 5                    | 0         | 0        | 0     | Range 1 – 9 (position 1 is 10sec, position 2 is 20sec, position 3 is 30sec, position 4 is 40sec, position 5 is 50sec, position 6 is 60sec, position 7 is 70sec, position 8 is 80sec & position 9 is 90sec. | 30sec         | If under voltage is experienced, the iACS-S15 controller continuously checks the voltage as per the preset set delay, after which power is cut OFF to the load.    |
| 6                    | PHCN AUTO DELAY                  | Delay (Seconds). | 6                    | 0         | 0        | 0     | Range 1 – 9 (position 1 is 10sec, position 2 is 20sec, position 3 is 30sec, position 4 is 40sec, position 5 is 50sec, position 6 is 60sec, position 7 is 70sec, position 8 is 80sec & position 9 is 90sec. | 10sec         | In AUTO operation, If PHCN supply is available and OK, this delay is initiated and after it elapses the load is energized.   |

|                           |                                       |                  |   |    |   |   |  |       |  |
|---------------------------|---------------------------------------|------------------|---|----|---|---|--|-------|--|
| 7                         | TRANSITION DELAY                      | Delay (Seconds). | 7 | 0  | 0 | 0 | Range 1 – 9 (position 1 is 1sec, position 2 is 2sec, position 3 is 3sec, position 4 is 4sec, position 5 is 5sec, position 6 is 6sec, position 7 is 7sec, position 8 is 8sec & position 9 is 9sec.          | 5sec  | The transition delay is the changeover time interval between generator supply to PHCN supply.  |
| 8                         | PHCN MANUAL DELAY                     | Delay (Seconds). | 8 | 0  | 0 | 0 | Range 1 – 9 (position 1 is 1sec, position 2 is 2sec, position 3 is 3sec, position 4 is 4sec, position 5 is 5sec, position 6 is 6sec, position 7 is 7sec, position 8 is 8sec & position 9 is 9sec.          | 5sec  | In MANUAL operation, If PHCN supply is available and OK, this delay is initiated and after it elapses the load is energized.   |
| <b>Generator SETTINGS</b> |                                       |                  |   |    |   |   |  |       |  |
| 9                         | AUTO/MANUAL Generator                 | SELECT           | 0 | 9  | 0 | 0 | Range 1 – 2 (position 1 is Manual generator, position 2 is automatic generator).   | 1     | Manual generator (recall start type generator), Automatic generator, has an automatic start controller installed by the generator manufacture)                               |
| 10                        | Generator OVER VOLTAGE                | %                | 0 | 10 | 0 | 0 | Range 1 – 3 (position 1 is 10%, position 2 is 20% & position 3 is 30%  | 20%   | Generator over voltage protection immediately cuts OFF power supply to the load if the voltage exceeds the settings.   |
| 11                        | Generator OVER VOLTAGE RECOVERY DELAY | Delay (Seconds). | 0 | 11 | 0 | 0 | Range 1 – 9 (position 1 is 10sec, position 2 is 20sec, position 3 is 30sec, position 4 is 40sec, position 5 is 50sec, position 6 is 60sec, position 7 is 70sec, position 8 is 80sec & position 9 is 90sec. | 30sec | If over voltage is experienced on Generator, the iACS-S15 controller continuously checks the voltage as per the preset set delay, after which power is restored to the load. |
| 12                        | Generator UNDER VOLTAGE               | %                | 0 | 12 | 0 | 0 | Range 1 – 6 (position 1 is 10%, position 2 is 20%, position 3 is 30%, position 4 is 40%, position 5 is 50% & position 6 is 60%   | 50%   | If under voltage is experienced, the iACS-S15 continuously checks the voltage as per the preset set delay (parameter 5), after which power is cut OFF to the load.           |
| 13                        | Generator UNDER VOLTAGE CUTOFF DELAY  | Delay (Seconds). | 0 | 13 | 0 | 0 | Range 1 – 9 (position 1 is 10sec, position 2 is 20sec, position 3 is 30sec, position 4 is 40sec, position 5 is 50sec, position 6 is 60sec, position 7 is 70sec, position 8 is 80sec & position 9 is 90sec. | 30sec | If under voltage is experienced, the iACS-S15 controller continuously checks the voltage as per the preset set delay, after which power is cut OFF to the load.              |

|                   |                                    |                      |   |    |    |   |  |             |   |
|-------------------|------------------------------------|----------------------|---|----|----|---|--|-------------|---|
| 14                | Generator AUTO DELAY               | Delay (Seconds).     | 0 | 14 | 0  | 0 | Range 1 – 9 (position 1 is 10sec, position 2 is 20sec, position 3 is 30sec, position 4 is 40sec, position 5 is 50sec, position 6 is 60sec, position 7 is 70sec, position 8 is 80sec & position 9 is 90sec.       | 10sec       | In AUTO operation, If Generator supply is available and OK, this delay is initiated and after it elapses the load is energized.   |
| 15                | Generator MANUAL DELAY             | Delay (Seconds).     | 0 | 15 | 0  | 0 | Range 1 – 9 (position 1 is 1sec, position 2 is 2sec, position 3 is 3sec, position 4 is 4sec, position 5 is 5sec, position 6 is 6sec, position 7 is 7sec, position 8 is 8sec & position 9 is 9sec.                | 5sec        | In MANUAL operation, If Generator supply is available and OK, this delay is initiated and after it elapses the load is energized.   |
| 16                | Generator VOLATGE OUT OF RANGE     | Delay (Seconds).     | 0 | 16 | 0  | 0 | Range 1 – 9 (position 1 is 25sec, position 2 is 50sec, position 3 is 75sec, position 4 is 100sec, position 5 is 125sec, position 6 is 150sec, position 7 is 175sec, position 8 is 200sec & position 9 is 225sec. | 10sec       | If generator voltage is out of range as per the setting (parameter 8 & 10), after the preset delay iACS-S15 initiate a stop command to the generator.   |
| 17                | PHCN AVAILABLE Generator OFF DELAY | Delay (Seconds).     | 0 | 17 | 0  | 0 | Range 1 – 9 (position 1 is 10sec, position 2 is 20sec, position 3 is 30sec, position 4 is 40sec, position 5 is 50sec, position 6 is 60sec, position 7 is 70sec, position 8 is 80sec & position 9 is 90sec.       | 15sec       | In the case of when generator is online and PHCN is available, iACS-S15 transfers the power to PHCN and initiate a stop command to the generator after the delay elapses.   |
| INVERTER SETTINGS |                                    |                      |   |    |    |   |  |             |   |
| 18                | INVERTER COMMAND RELAY OPERATION   | Select (Latch/Pulse) | 0 | 0  | 18 | 0 | Range 1 – 2 (position 1 is Latch command, position 2 is Pulse command).  | Latch/Pulse | Latch command (continuous ON command to inverter), Pulse (ON command for some seconds and OFF)  |
| 19                | INVERTER ON DELAY                  | Delay (Seconds).     | 0 | 0  | 19 | 0 | Range 1 – 9 (position 1 is 1sec, position 2 is 2sec, position 3 is 3sec, position 4 is 4sec, position 5 is 5sec, position 6 is 6sec, position 7 is 7sec, position 8 is 8sec & position 9 is 9sec.                | 5sec        | Delay to start up inverter  |
| 20                | INVERTER AUTO/MANUAL TIMER         | Select (AUTO/MANUAL) | 0 | 0  | 20 | 0 | Range 1 – 2 (position 1 is Auto, position 2 is Manual).  | Auto/Manual | Auto (if the timer knob is set, and inverter comes online, the countdown timer automatically starts). Manual (when inverter is switched ON, the countdown timer will not startup even if its set, hence it must be enabled manual by putting the timer knob on zero, reset and set some hour range) |

|  |                           |                         |    |    |    |   |   |       |   |
|--|---------------------------|-------------------------|----|----|----|---|---|-------|---|
| 21   | INVERTER STANBY MODE      | Select (ENABLE/DISABLE) | 0  | 0  | 21 | 0 | Range 1 – 2 (position 1 is Enable, position 2 is Disable).  |       | Enable(if the inverter standby is enabled, when inverter is switched ON with the inverter ON/OFF button, while online and PHCN or generator is available, inverter goes OFF automatically and if PHCN or generator is lost, the inverter comes back ON automatically). Manual (inverter will not come ON when there is a loss of PHCN or generator, it must be put ON manually) |
| <b>OTHER SETTINGS</b>  |                           |                         |    |    |    |   |   |       |   |
| 22   | BYPASS DELAY              | Delay (Seconds).        | 22 | 22 | 0  | 0 | Range 1 – 9 (position 1 is 10sec, position 2 is 20sec, position 3 is 30sec, position 4 is 40sec, position 5 is 50sec, position 6 is 60sec, position 7 is 70sec, position 8 is 80sec & position 9 is 90sec.  | 30sec | If bypass interlock is connected to the manual change-over switch. If for any reason the manual changeover is operated S400 immediately goes to standby mode, and if the manual changeover switch is put back to neutral position this delay is initiated and after the delay elapses, IACS-S15 goes back to normal operation.  |
| 23   | AUTO/MANUAL FAULT RESET   | SELECT                  | 23 | 23 | 0  | 0 | Range 1 – 2 (position 1 is AUTO fault reset, position 2 is manual fault reset)  | 1     | If set in AUTO, when fault occurs after 4mins the lacs-S400 resets the fault.   |
| 24   | NUMBERS OF FAULT RESET    | SELECT                  | 24 | 24 | 0  | 0 | Range 1 – 9 (Select maximum number of auto fault reset)   | 3     | If parameter 24 is set at AUTO, hence the number of faults reset depends on this parameter, after which the user attention is required for further checks and troubleshooting if the fault persist.   |
| 25   | SPECIAL LOAD POWER SUPPLY | SELECT                  | 25 | 25 | 0  | 0 | Range 1 – 8 (position 1 is special load on PHCN, position 2 is special load on generator, position 3 is special load on inverter, 4 PHCN & generator, 5 is PHCN & Inverter 6 is generator & inverter 7 is PHCN & generator & inverter, 8 if OFF). | 5     | If set at 1, the special load will only be powered on PHCN only, same goes for generator if set at 2. If set at 3, the special load is powered on both PHCN & generator.  |
| <p><b>THIS SECTION DEALS WITH VOLTAGE CALIBRATION OF THE ACS UNIT. AND HAS TO BE PERFORMED WITH A MULTIMETER.</b></p> <p><b>PROCEDURE:</b> use the digital multimeter to measure the actual voltage supply either PHCN or generator whichever is available on the ACS. Example if the voltage is 215vac, enter the below parameter accordingly.</p> <ul style="list-style-type: none"> <li>• Parameter 26 = 2</li> <li>• Parameter 27 = 1</li> <li>• Parameter 28 = 5</li> </ul> |                           |                         |    |    |    |   |   |       |   |
| 26   | Actual voltage            | value                   | 26 | 26 | 0  | 0 | Range 1 – 4 (position 1 is 100v, position 2 is 200v, position 3 is 300v, position 4 is 400v.  | 2     |   |

|    |                            |        |    |    |    |   |  |   |
|----|----------------------------|--------|----|----|----|---|--|---|
| 27 | Actual voltage             | value  | 27 | 27 | 0  | 0 | Range 1 – 9 (position 1 is 10v, position 2 is 20v, position 3 is 30v, position 4 is 40v, position 5 is 50v, position 6 is 60v, position 7 is 70v, position 8 is 80v & position 9 is 90v. | 2 |
| 28 | Actual voltage             | value  | 28 | 28 | 0  | 0 | Range 1 – 9 (position 1 is 1v, position 2 is 2v, position 3 is 3v, position 4 is 4v, position 5 is 5v, position 6 is 6v, position 7 is 7v, position 8 is 8v & position 9 is 9v.          | 1 |
| 29 | FEEDBACK<br>ENABLE/DISABLE | SELECT | 29 | 29 | 29 | 0 | Range 1 – 2 (position 1 is ENABLE FEEDBACK, position 2 is DISABLE DISABLE)   | 1 |
| 30 | BYPASS<br>ENABLE/DISABLE   | SELECT | 30 | 30 | 30 | 0 | Range 1 – 2 (position 1 is ENABLE BYPASS, position 2 is DISABLE BYPASS)  | 2 |

## TROUBLESHOOTING AND MAINTENANCE

**MAINTENANCE AND CARE:** The S400 is designed to be a self-contained and maintenance-free unit. The printed circuit boards are calibrated and conformally coated at the factory. They are intended for service by factory-trained personnel only.

| S/N | No's OF LED FLASING | FAULT LED STATUS          | PROBABLE CAUSES AND SOLUTIONS  |
|-----|---------------------|---------------------------|--|
| 1   | 1                   | WARNING! PHCN VOLTAGE LOW | Check PHCN voltage if lower than the low voltage cut-off set point. Wait till the voltage is normal or in the range of the acceptable voltage by the S400. If voltage is ok the S400 will reset automatically. If the voltage remains low, check with PHCN for further assistance on voltage problems. |
| 2   | 2                   | WARNING! PHCN             | Check PHCN voltage if higher than the high voltage cut-off set point. Wait till the  |

|    |    |   |  |
|----|----|---|--|
|    |    | VOLTAGE HIGH  | voltage is normal or in the range of the acceptable voltage by the S400. If voltage is ok the S400 will reset automatically according to the high voltage recovery delay. If the voltage remains high, check with PHCN for further assistance on voltage problems.   |
| 3  | 3  | PHCN CONTACTOR FEEDBACK FAULT                           | Check the PHCN contactor auxiliary feedback contact for any loose connection. Confirm contactor OK, check contactor mechanism, and check contactor is stock up due to overheating or loose connection. Else replace defective contactor  |
| 4  | 4  | PHCN AND AUX CONTACTOR JAM WITH INVERTER CONTACTOR      | Check for contactor short of overheating due to lose connection between PHCN contactor,AUXILIARY and INVERTER contactor. Check for contactor feedback for loose connection. Check if contactor is stock up due to mechanical failure. Replace defective contactor.   |
| 5  | 5  | PHCN CONTACTOR FLUNTUATE                                | Check PHCN voltage if low, increase the PHCN low voltage settings. Check for loose contactor coil connection, check contactor feedback for loose connection, check contactor mechanism if working properly. Replace defective contactor.   |
| 6  | 6  | AUXILIARY CONTACTOR FEEDBACK FAULT (PHCN)               | Check the AUXILIARY contactor auxiliary feedback contact for any loose connection. Confirm contactor OK, check contactor mechanism, and check contactor is stock up due to overheating or loose connection. Else replace defective contactor.  |
| 7  | 7  | PHCN CONTACTOR JAM WITH GENERATOR CONTACTOR             | Check for contactor short of overheating due to lose connection between PHCN contactor and generator contactor. Check for contactor feedback for loose connection. Check if contactor is stock up due to mechanical failure. Replace defective contactor.  |
| 8  | 8  | INVERTER CHARGING FAULT                                 | Check the PHCN contactor auxiliary feedback contact for any loose connection. Confirm contactor OK, check contactor mechanism, and check contactor is stock up due to overheating or loose connection. Else replace defective contactor  |
| 9  | 9  | PHCN CONTACTOR DROP-OUT                                 | PHCN contactor drop out, due to low voltage or voltage dip. check PHCN voltage, check PHCN contactor feedback contact, check connected load and ensure there's no overload or shot circuit.  |
| 10 | 10 | WARNING! GENERATOR VOLTAGE LOW                          | Check generator output voltage if lower than the low voltage cut-off set point. Wait till the voltage is normal or in the range of the acceptable voltage by the S400. If voltage is ok the S400 will reset automatically. If the voltage remains low, check with local generator technician for further assistance on voltage problems with the generator.  |
| 11 | 11 | WARNING! GENERATOR VOLTAGE HIGH                         | Check generator voltage if higher than the high voltage cut-off set point. Wait till the voltage is normal or in the range of the acceptable voltage by the S400. If voltage is ok the S400 will reset automatically according to the high voltage recovery delay. If the voltage remains high, check with local generator technician for further assistance on voltage problems with the generator. |
| 12 | 12 | GENERATOR CONTACTOR FEEDBACK FAULT                      | Check the Generator contactor auxiliary feedback contact for any loose connection. Confirm contactor OK, check contactor mechanism, and check contactor is stock up due to overheating or loose connection. Else replace defective contactor.  |
| 13 | 13 | GENERATOR AND AUX CONTACTOR JAM WITH INVERTER CONTACTOR | Check for contactor short of overheating due to lose connection between Generator contactor,AUXILIARY and INVERTER contactor. Check for contactor feedback for loose connection. Check if contactor is stock up due to mechanical failure. Replace   |

|    |    |   |   |
|----|----|---|---|
|    |    |   | defective contactor.  |
| 14 | 14 | GENERATOR CONTACTOR JAM WITH PHCN CONTACTOR     | Check for contactor short of overheating due to lose connection between PHCN contactor and generator contactor. Check for contactor feedback for loose connection. Check if contactor is stock up due to mechanical failure. Replace defective contactor.   |
| 15 | 15 | GENERATOR CONTACTOR FLUNTUATE                   | Check Generator voltage if low, increase the Generator low voltage settings. Check for loose contactor coil connection, check contactor feedback for loose connection, check contactor mechanism if working properly. Replace defective contactor.  |
| 16 | 16 | AUTO GENERATOR FAIL TO START                    | Check generator ignition relay contact, check generator ignition cable if ok. Check for loose connection in the S400 terminal connector check for loose connection in the generator start/stop command; check the ignition cable is ok. Check the ignition switch and cable if defective replace defective parts. |
| 17 | 17 | AUTO GENERATOR FAIL TO STOP                     | Check generator ignition relay contact, check generator ignition cable if ok. Check for loose connection in the S400 terminal connector check for loose connection in the generator start/stop command; check the ignition cable is ok. Check the ignition switch and cable if defective replace defective parts. |
| 18 | 18 | MANUAL GENERATOR FAIL TO STOP                   | Check generator ignition relay contact, check generator ignition cable if ok. Check for loose connection in the S400 terminal connector check for loose connection in the generator start/stop command; check the ignition cable is ok. Check the ignition switch and cable if defective replace defective parts. |
| 19 | 19 | GENERATOR CONTACTOR DROP-OUT                    | Generator contactor drop out, due to low voltage or voltage dip. check Generator voltage, check Generator contactor feedback contact, check connected load and ensure there's no overload or shot circuit.  |
| 20 | 20 | INVERTER CONTACTOR FEEDBACK FAULT               | Check the INVERTER contactor auxiliary feedback contact for any loose connection. Confirm contactor OK, check contactor mechanism, and check contactor is stock up due to overheating or loose connection. Else replace defective contactor.  |
| 21 | 21 | INVERTER CONTACTOR JAM WITH AUXILIARY CONTACTOR | Check for contactor short of overheating due to lose connection between INVERTER contactor and AUXILIARY contactor. Check for contactor feedback for loose connection. Check if contactor is stock up due to mechanical failure. Replace defective contactor.   |
| 22 | 22 | INVERTER CONTACTOR FLUNTUATE                    | Check INVERTER voltage if low, increase the Generator low voltage settings. Check for loose contactor coil connection, check contactor feedback for loose connection, check contactor mechanism if working properly. Replace defective contactor.   |
| 23 | 23 | AUXILIARY CONTACTOR FEEDBACK FAULT (Generator)  | Check the AUXILIARY contactor auxiliary feedback contact for any loose connection. Confirm contactor OK, check contactor mechanism, and check contactor is stock up due to overheating or loose connection. Else replace defective contactor.   |
| 24 | 24 | AUXILIARY CONTACTOR FLUNTUATE                   | Check PHCN/Generator voltage if low, Check for loose contactor coil connection, check contactor feedback for loose connection, check contactor mechanism if working properly. Replace defective contactor.  |
| 25 | 25 | S400 NOT FUNCTIONAL                             | Check the onboard PCB LED if flashing when power switch is ON. If not check the power button and cables if connected check all switched if ok, else replace defective parts.  |

**BYPASS CONNECTION TO YOUR LOCAL/MANUAL CHANGE OVER SWITCH GEAR.**

**NOTE:**

- Ensure the bypass connection is made on a potential free contact.
- Ensure there is nothing connected to the bypass going to the S400 controller. Else S400 will damage.

**INSTALLING S400**

- ATS is rated 50A – 200A, depending on the rating purchased.
- Install the S400 in a well-ventilated area.
- Follow the installation drawing guide.
- Connect the local power supply (PHCN) to the utility input via MCB (150% of the unit rating).
- Connect generator supply to generator input via MCB (150% of the unit rating).
- Connect the output to the load/home.
- Generator ignition terminal 1 & 2 or 2 & 3 are connected to your generator ignition switch. (Cable size: 2 core, 1.5sqmm). Seek your generator maintenance technician for support in connecting the ignition cable to the generator.

Note: if the generator is installed more than 10m away from the iACS-S50, hence use the auxiliary relay.

**INSTALLING THE AUXILIARY RELAY**

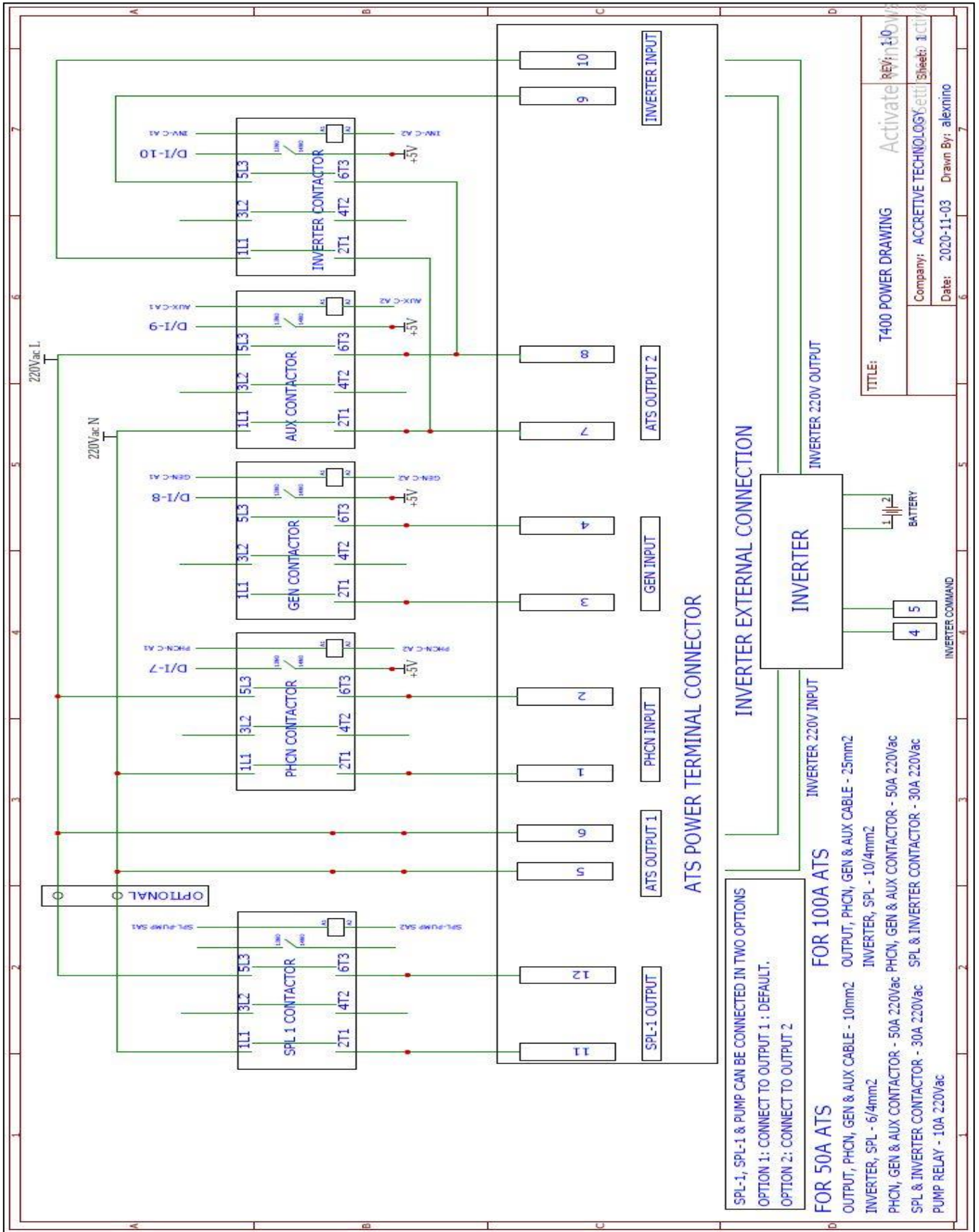
- Connect the Ignition terminal to the S400 generator ignition switch.
- Connect the command terminal to the S400 ignition terminal 1 & 2 or 2 & 3.
- Connect the battery terminal to the generator battery 12v.
- Note: ensure the battery polarity is correctly connected.

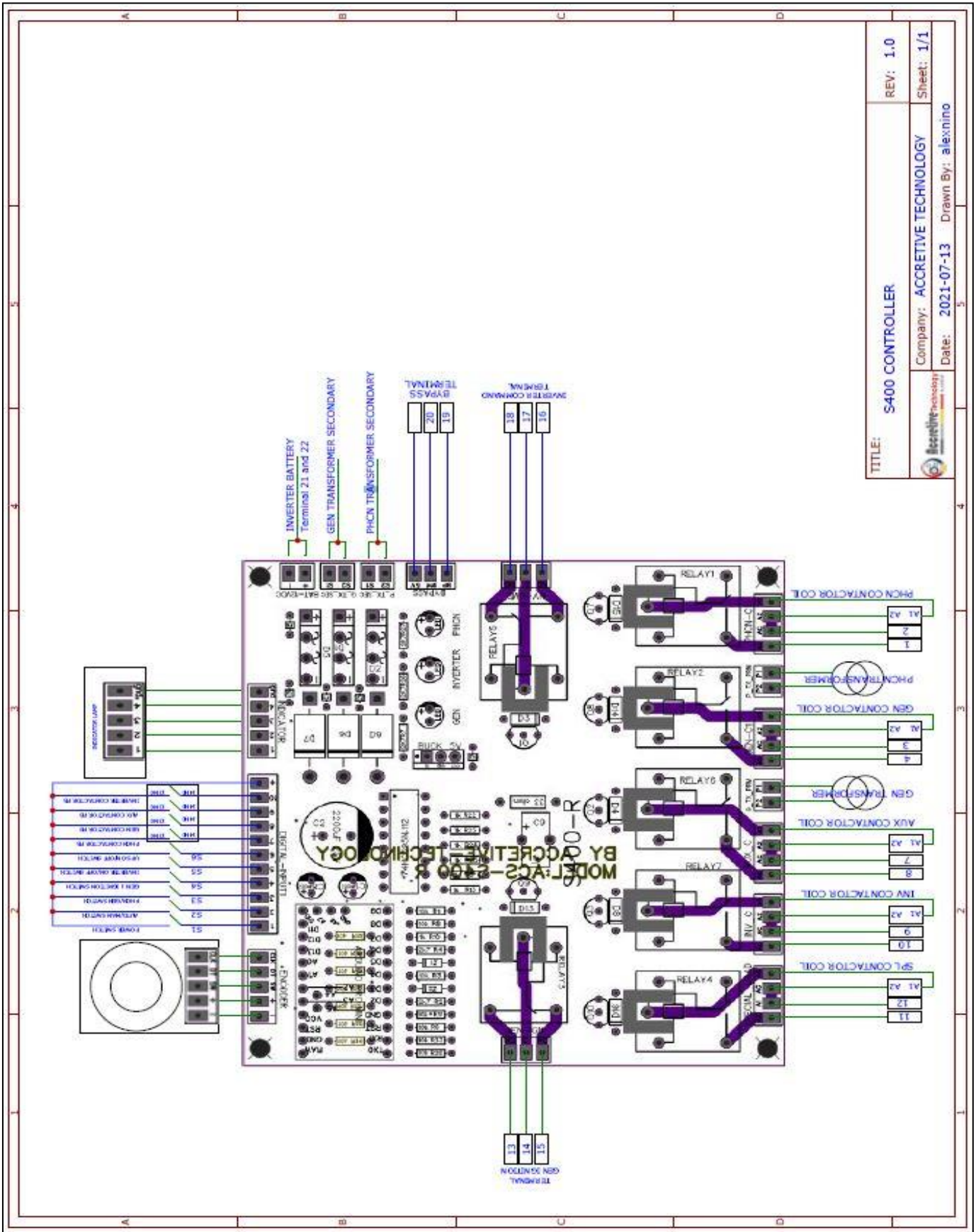
| S400 CABLE TERMINATION   |     |                                | DIN RAIL CONNECTOR |
|--------------------------|-----|--------------------------------|--------------------|
| NEPA TF                  | P1  | PHCN TRANSFORMER PRIMANRY 220V | Internal           |
|                          | P2  | PHCN TRANSFORMER PRIMANRY 220V | Internal           |
|                          | S1  | PHCN TRANSFORMER PRIMANRY 220V | Internal           |
|                          | S2  | PHCN TRANSFORMER PRIMANRY 220V | Internal           |
| GEN TF                   | P1  | GEN TRANSFORMER PRIMANRY 220V  | Internal           |
|                          | P2  | GEN TRANSFORMER PRIMANRY 220V  | Internal           |
|                          | S1  | GEN TRANSFORMER PRIMANRY 220V  | Internal           |
|                          | S2  | GEN TRANSFORMER PRIMANRY 220V  | Internal           |
| GEN IGN                  | NO  | IGNITION NORMALLY OPEN         | Terminal 13        |
|                          | C   | IGNITION COMMON                | Terminal 14        |
|                          | NC  | IGNITION NORMALLY CLOSED       | Terminal 15        |
| INVERTER TRIGGER COMMAND | NO  | INVERTER NORMALLY OPEN COMMAND | Terminal 16        |
|                          | COM | INVERTER COMMON COMMAND        | Terminal 17        |



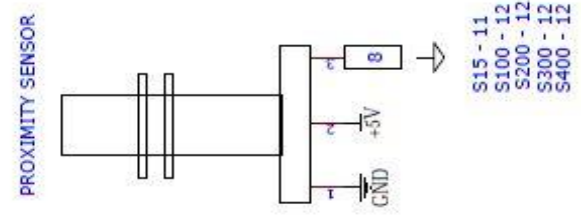
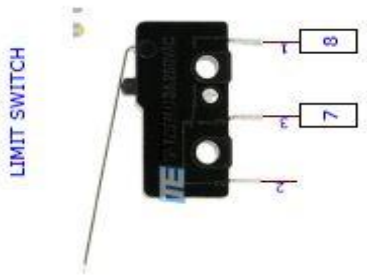
|                         |         |                                  |             |
|-------------------------|---------|----------------------------------|-------------|
|                         | NC      | INVERTER NORMALLY CLOSED COMMAND | Terminal 18 |
|                         |         |                                  |             |
| BYPASS                  | 1       |                                  | Terminal 19 |
|                         | 2       |                                  | Terminal 20 |
|                         |         |                                  |             |
| INVERTER BATTERY SUPPLY | 1       | POSITIVE 12VDC                   | Terminal 21 |
|                         | 2       | NEGATIVE 12VDC                   | Terminal 22 |
|                         |         |                                  |             |
| DIGITAL I/O             | 1       | POWER ON/OFF SWITCH              | Internal    |
|                         | 2       | AUTO/MANUAL SWITCH               | Internal    |
|                         | 3       | PHCN/GEN SWITCH                  | Internal    |
|                         | 4       | GEN IGNITION ON/OFF              | Internal    |
|                         | 5       | INVERTER ON/OFF                  | Internal    |
|                         | 6       | UPS ON/OFF                       | Internal    |
|                         | 7       | PHCN CONTACTOR FEEDBACK          | Internal    |
|                         | 8       | Generator CONTACTOR FEEDBACK     | Internal    |
|                         | 9       | AUXILIARY CONTACTOR FEEDBACK     | Internal    |
|                         | 10      | INVERTER CONTACTOR FEEDBACK      | Internal    |
|                         | +       | POSITIVE                         | Internal    |
|                         |         |                                  |             |
| INDICATOR               | 1       | PHCN INDICATOR                   | Internal    |
|                         | 2       | GEN INDICATOR                    | Internal    |
|                         | 3       | TIMER INDICATOR                  | Internal    |
|                         | 4       | FAULT INDICATOR                  | Internal    |
|                         | GND     |                                  |             |
|                         |         |                                  |             |
| ENCODER                 | CLK     | CLK                              | Internal    |
|                         | DT      | DT                               | Internal    |
|                         | SW      | SW                               | Internal    |
|                         | +       | +                                | Internal    |
|                         | -       | -                                | Internal    |
|                         |         |                                  |             |
| PHCN INPUT              | LIVE    |                                  | Terminal 1  |
|                         | NUETRAL |                                  | Terminal 2  |
|                         |         |                                  |             |
| GEN INPUT               | LIVE    |                                  | Terminal 3  |
|                         | NUETRAL |                                  | Terminal 4  |
|                         |         |                                  |             |
| ATS OUTPUT 1            | LIVE    |                                  | Terminal 5  |
|                         | NUETRAL |                                  | Terminal 6  |
|                         |         |                                  |             |
| ATS OUTPUT 2            | LIVE    |                                  | Terminal 7  |

|                               |                |   |                    |
|-------------------------------|----------------|---|--------------------|
|                               | <b>NUETRAL</b> |   | <b>Terminal 8</b>  |
|                               |                |   |                    |
| <b>INVERTER INPUT</b>         | <b>LIVE</b>    |   | <b>Terminal 9</b>  |
|                               | <b>NUETRAL</b> |   | <b>Terminal 10</b> |
|                               |                |   |                    |
| <b>SPECIAL LOAD OUTPUT</b>    | <b>LIVE</b>    |   | <b>Terminal 11</b> |
|                               | <b>NUETRAL</b> |   | <b>Terminal 12</b> |
|                               |                |   |                    |
| <b>PHCN CONTACTOR</b>         | <b>AC</b>      | <b>220V Supply from PHCN</b>            | <b>Internal</b>    |
|                               | <b>AC</b>      | <b>220V Supply from PHCN</b>            | <b>Internal</b>    |
|                               | <b>A2</b>      | <b>220v to PHCN contactor A2</b>        | <b>Internal</b>    |
|                               | <b>A1</b>      | <b>220v to PHCN contactor A1</b>        | <b>Internal</b>    |
|                               |                |   |                    |
| <b>GEN CONTACTOR</b>          | <b>AC</b>      | <b>220V Supply from GEN</b>             | <b>Internal</b>    |
|                               | <b>AC</b>      | <b>220V Supply from GEN</b>             | <b>Internal</b>    |
|                               | <b>A2</b>      | <b>220v to GEN contactor A2</b>         | <b>Internal</b>    |
|                               | <b>A1</b>      | <b>220v to GEN contactor A1</b>         | <b>Internal</b>    |
|                               |                |   |                    |
| <b>AUXILIARY CONTACTOR</b>    | <b>AC</b>      | <b>220V Supply from ACS OUTPUT 1</b>    | <b>Internal</b>    |
|                               | <b>AC</b>      | <b>220V Supply from ACS OUTPUT 1</b>    | <b>Internal</b>    |
|                               | <b>A2</b>      | <b>220v to AUX contactor A2</b>         | <b>Internal</b>    |
|                               | <b>A1</b>      | <b>220v to AUX contactor A1</b>         | <b>Internal</b>    |
|                               |                |   |                    |
| <b>INVERTER CONTACTOR</b>     | <b>AC</b>      | <b>220V Supply from INVERTER SUPPLY</b> | <b>Internal</b>    |
|                               | <b>AC</b>      | <b>220V Supply from INVERTER SUPPLY</b> | <b>Internal</b>    |
|                               | <b>A2</b>      | <b>220v to INVERTER contactor A2</b>    | <b>Internal</b>    |
|                               | <b>A1</b>      | <b>220v to INVERTER contactor A1</b>    | <b>Internal</b>    |
|                               |                |   |                    |
| <b>SPECIAL LOAD CONTACTOR</b> | <b>AC</b>      | <b>220V Supply from ACS OUTPUT</b>      | <b>Internal</b>    |
|                               | <b>AC</b>      | <b>220V Supply from ACS OUTPUT</b>      | <b>Internal</b>    |
|                               | <b>A2</b>      | <b>220v to SPL contactor A2</b>         | <b>Internal</b>    |
|                               | <b>A1</b>      | <b>220v to SPL contactor A1</b>         | <b>Internal</b>    |





|                               |                    |
|-------------------------------|--------------------|
| TITLE: S400 CONTROLLER        | REV: 1.0           |
| Company: ACCRETIVE TECHNOLOGY | Sheet: 1/1         |
| Date: 2021-07-13              | Drawn By: alexnino |



|                               |                    |
|-------------------------------|--------------------|
| TITLE: FEILD DEVICES          | REV: 1.0           |
| Company: ACCRETIVE TECHNOLOGY | Sheet: 4           |
| Date: 2020-11-06              | Drawn By: alexnino |