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# SDFA-ATS Automatic Source Transfer System

## Reliability improvement product for Power Utilities

http://www.usa.siemens.com/sdfa

SDFA ATS system deployed at a location in Texas to improve system reliability of supply to a Natural Gas facility.

## SDFA ATS

The SDFA-ATS functions by connecting two or more substation power sources through the ATS system to a distribution transfer line section feeding a critical load e.g. a Hospital or Plastic Extrusion Factory that cannot tolerate short interruptions.

Typically, this is a fast acting or high-speed application. Ideally the transfer line section between the switches is kept as short as possible to minimize the line section exposure to damage e.g. falling trees or motor vehicle traffic accidents.

The system monitors the source voltages of all connected sources to this transfer line section.  A preferred source or sources is assigned and the associated primary switch is closed to supply the transfer line section with power. The alternative or power source primary switch is open and is not providing power to the transfer line section under normal operating conditions. A sudden decrease in the monitored preferred source voltage caused by a power system fault on the feeders or in the substations would trigger an opening of the preferred source primary switch and a closure of an alternative source primary switch. This source transfer process can take place in a very short time frame to ensure uninterrupted power to the critical load connected to the transferred line section. The ideal time frame is less than 6 power cycles or 1/10 of a second and is a standard feature of SDFA-ATS deployed on Siemens SDR reclosers. It is possible to apply the SDFA controllers on other recloser models but 6 cycle transfers will not be available.

## How it works

SDFA-ATS system is a canned solution. This solution has been refined through numerous field implementations and continuous system testing and improvements. The system is suitable for use on pole top primary switches. Magnetically actuated primary switches e.g. Siemens reclosers are ideally suited for high-speed source transfers applications. Each primary switch is equipped with a control cabinet that is mounted on the distribution pole.
Each cabinet is equipped with a 7SC80 control device that is hardwired to the primary switch control mechanism, voltage and current sensors.

All 7SC80 controllers are interconnected through fiber optic cables. The 7SC80 controllers provide onboard optical switching. The fiber cables can thus be cost effectively daisy chained form one controller to the other requiring no additional hardware.

The 7SC80 controllers share all necessary information between primary switches over the fiber optic communication links. This makes it possible to separate the primary switches by up to 12 miles using single mode fiber and can include multiple switches and sources in a single scheme.

It would not be feasible to do these using traditional hard wire connections between primary switches and controllers.


The information shared by all the controllers to perform the source transfers has been standardized and is field proven. The source transfer functions and functional logic contained in each controller is also standardized to form a canned decentralized system when interconnected with fiber optic cables.

When the 7SC80 controller located at the preferred source primary switch, detect a loss of this source voltage it would open its primary switch and send information via the fiber optic link to the alternative source primary switch's 7SC80 controller.

This controller will make sure that there is not a fault on the transfer line section or the connected load before it would issue a close signal to the alternative source primary switch. The opening and closing actions can be delayed with preset time if required.

If the preferred source returns after a period the controller at the preferred source can wait for a preset time e.g. 5 minutes and then automatically close the preferred source primary switch.

The alternative source controller will then open its primary switch returning the system to the normal operating condition.

The 7SC80 devices communicate with each other in a peer-to-peer fashion, operating autonomously with no need for a master controller.

The 7SC80 contains on-board GPS time synchronization providing synchronized operational and non-operational data to the utility enterprise.

The 7SC80 can simultaneously communicate to 2 DNP masters, making the device information accessible to multiple enterprise services and or applications.

During a power system fault or event, all 7SC80 devices will capture fault recordings that can be automatically retrieved. With GPS-synchronized data, fault recordings from numerous field devices can be compared using the SIGRA analysis software.

Siemens can develop custom ATS systems on request if the standard system does not fulfill utilities unique requirements.

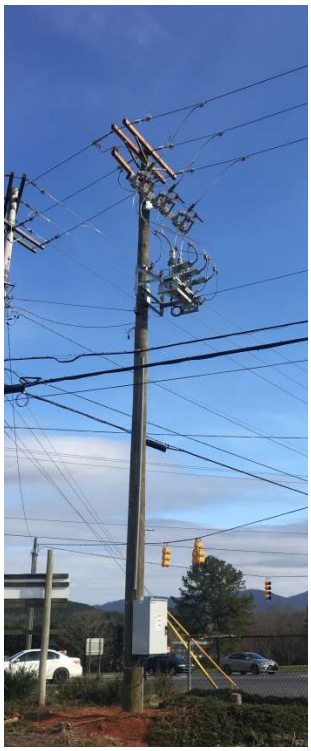
**Standard SDFA–ATS Features:**

- High Speed 6 cycle Source Transfer (SDR Reclosers)
- Normal Source Transfer (Load Break Switches or non-Siemens reclosers)
- Interoperable with conventional protection systems
- Downstream fault block functionality
- Source Sag Detection logic
- Support Mesh connected Multiple Source Topologies
- Control primary switches from any controller
- Synchronism Check Functionality
- Communication link monitoring
- Simulation mode for offline SCADA testing
- Scalable, decentralized architecture
- Detachable User Friendly HMI
- Simple Graphical Sequence Programming software (FASE)
- Each system thoroughly tested and supplied "Ready to Install"
- Turnkey solution from primary switch to automation

# SDFA ATS

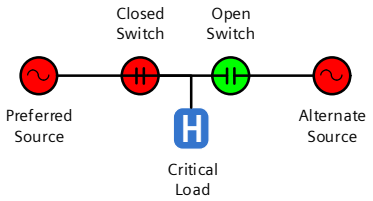
## Modes and Functions

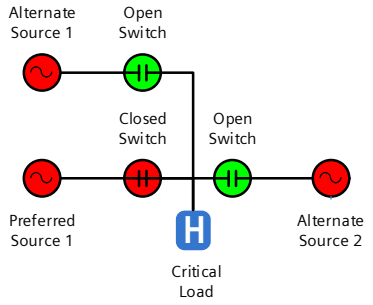
The 7SC80 controller is the device that makes it all possible.
The device was specifically developed for distribution automation applications.
The programmable logic capabilities combined with protection, communication and hardware features available makes it a very unique and capable device for automated switching applications.

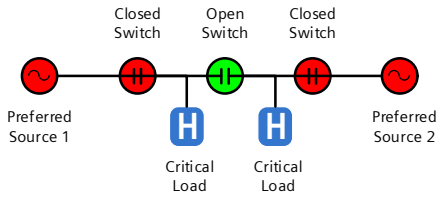


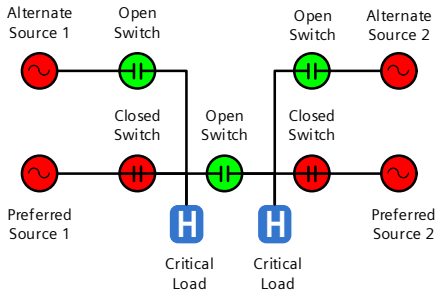
### Application Topologies

The SDFA-ATS support many different system topologies. The user can create the required topology using the FASE software. Below are a few examples of supported system topologies.




### Operational Modes

The SDFA-ATS standard functionality consists of the following:

**Auto Source Transfer On/Off**

Enable the system to execute automatic sequences. Disabled should the system detect a downstream fault on the load side.

**High or Normal Speed Transfer**

The system can be set to operate for any type of primary switch. High Speed is only available with fast acting Siemens Primary recloser type switches. All transfer sequences are done through open transition switching.

**Auto Restore On/Off**

The user can select if the system should automatically return to the preferred source or if it should be manually initiated from a control device HMI or the SCADA operator.

**Open / Closed Transition on Restoration**

The user can use this mode to select the restoration type to normal topology. If set to closed transition, the system will close the preferred source primary switch before the alternative source switch is opened. If open transition is selected, the system will first open the alternative source switch and then close the preferred source primary switch.

**Simulation Mode**

The SDFA-ATS system provides a device-based simulation and test mode. In this mode, the system can simulate all operating sequences, and control functions. The sources can be enabled or disabled to initiate an ATS sequence or restoration sequence. In the simulation mode, the control device will not operate the actual primary switchgear but internally simulate the primary switchgear.

The controllers will provide feedback to the SCADA system making it very easy to test SCADA integration without having to

SDFA System deployed in Wake Forest North Carolina

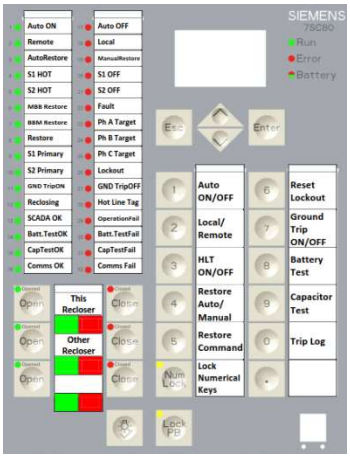
send a field crew out to bypass and operate the switchgear. The system also provides a live test capability to trigger an actual transfer.

## Human Machine Interface

Standard device HMI control functions using Push Buttons include:

- Open This Switch , Close This Switch,
- Open Other Switch, Close Other Switch
- Auto Mode ON/OFF
- Local/Remote
- Hotline Tag
- Auto/Manual Restore
- Restore Command
- Reset Lockout
- Block Ground Protection
- Start Battery Test
- Start Capacitor Test
- Display Trip Log
- Reset LED Flags

The Device HMI provides 32 LED indications. There are two columns of LED indications. The left column provide all healthy conditions as green indications and the right hand column provide Red LED indications for unhealthy or abnormal system conditions. If no Red LED's are illuminated the system is ready to execute all automatic transfer sequences.




If the devices detect that all 3 line voltages are healthy at both locations they will illuminate S1 Hot and S2 Hot LED's.

It must be noted that an ATS restore sequence is only possible if both S1 and S2 sources are Hot.

The HMI labels can be adapted with as required nomenclature for various functions.

## Protection Functions

The 7SC80 controller provides a full suite of protection and auto reclosing functions.

This functionality is used if the closed ATS reclosers must coordinate with an upstream breaker or recloser. If the closed ATS device detects a downstream fault it will inhibit transfer, trip and reclose per the protection settings.

If coordination is not possible or desirable, the ATS reclosers are set not to trip for downstream faults but merely inhibit transfer when a downstream fault is detected.

Synch-Check (25) is a standard function on the ATS system. For ATS applications the 25 function is continuously activated and will inhibit a transfer and/or restoration sequence if the device detect an out of synch condition.

The function can be enabled or disabled for ATS or restoration sequences.

## Monitoring Functions

### Source Sag Detection

The source sag detection is used to alarm if the ATS system detected simultaneous voltage sag on the connected sources exceeding 30 ms.

For the high-speed ATS system the sag detection is set to operate in two different modes. The system can transfer on loss of both sources. This mode provides the fastest operating times for the ATS system. The other mode will delay all ATS transfer sequences by an additional 10ms. If speed is of the utmost importance the first mode must be selected. In both modes of the sag detection will an alarm will be issued if a sag condition was detected.

On slow operating ATS systems the sag detection will alarm but have no influence on a transfer sequence.

### Device Status

The ATS system monitors the status of protection lockouts and hotline tags. If any of these states are active no automatic switching will be allowed. If the local mode is activated on a device it will disable SCADA control.

The system will immediately disable automatic operations whenever any operational failure of a recloser or switch is detected. For example, if the ATS sends an open signal to a primary switch and the switch does not respond to this signal.

### Communication Link

The ATS system continuously monitors the fiber optic link between the controllers. If a failure is detected the ATS system will not allow any automatic sequences to occur.

### Down Stream Faults

The system detects downstream faults and inhibits the high-speed automatic transfer sequences from executing.

### Hardware Monitoring

The ATS system controllers monitor and test the batteries and capacitors if included in the control cabinets.

The 7SC80 controller in addition does various hardware, software and firmware monitoring through its watchdog.

If a device failure is detected the device will illuminate the red Error LED.

### ATS System Communication

The 7SC80 control devices of the ATS system communicate and share information over the fiber optic link. IEC61850 "GOOSE" messages are used to share the required information between the device peers.

The devices simultaneously share DNP3 data from the same communication port.

The device provides measurements, status, alarms and controls to the operator.

## Engineering Tool

### FASE Configuration Software

The FASE configuration software is the graphical tool used to easily program the SDFA system.

System programming is accomplished using a drag-and-drop, point-and-click graphical user interface.

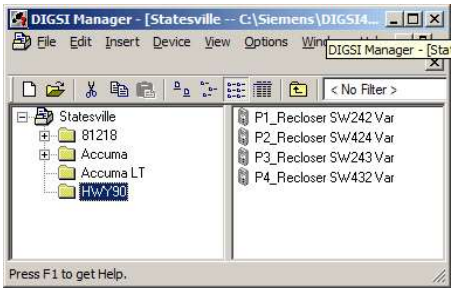
FASE software requires the user to first build a topology through a simple drag-and-drop, point-and-click method to define the network topology of primary switches, sources and interconnecting lines.

In the second step user then defines the normal power system operating state by selecting the Open and Close position of the primary switches by changing switches colors between Green and Red.

The third step the user enters all required protection and communication settings for the ATS system in a single table with easy-to-use, drag and copy features. There is no need to open individual devices to apply settings.

In the fourth step, the user has the option to program all operational sequences, following a simple straight forward sequence, or optionally have the system generate all sequences automatically.

In the final step, FASE automatically generates control device files that are downloaded to each 7SC80 field control device.

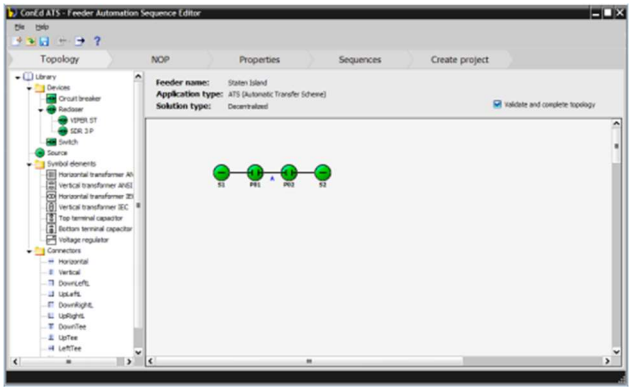



There is no complex programming required by the user to get a correctly programed and configured ATS system.

SDFA ATS system deployed at this very remote distribution system in North Carolina USA to improve system reliability. Cellular communication was the only cost-effective option at this location.

## FASE Software Programming

Step 1

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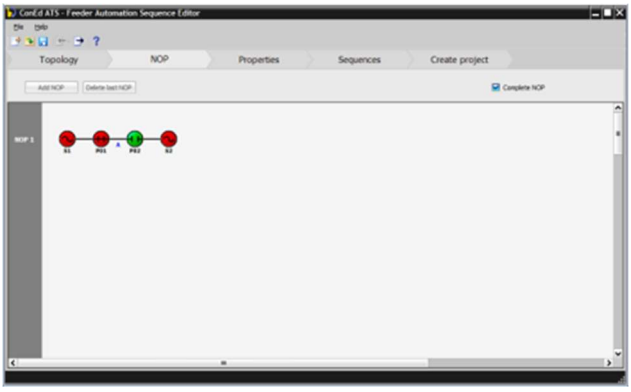


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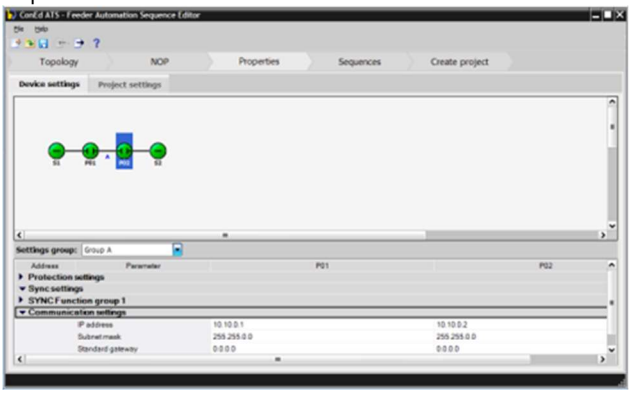
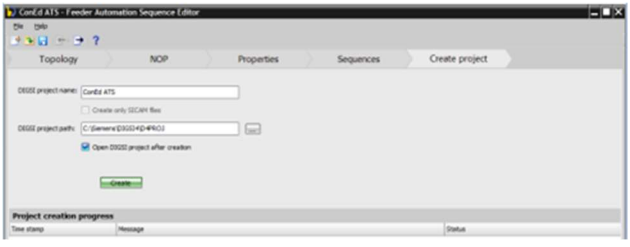



Step 4


Step 5



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