Automatic Transfer Switch with ATS-5335 Control System Module

AOM969

Operations Manual

Revision 02

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SAFE SMART SERVICEABLE SWITCHGEAR &
ENGINEERED POWER SYSTEM SOLUTIONS

MADE IN THE USA

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APT Transfer Switch Operation with ATS-5335 Controller

The APT Automatic Transfer Switch (ATS) is designed to monitor an electrical source and automatically transfer the connected electrical load to a different source if the primary source fails. The primary source (S1) is typically a utility source, and the secondary source (S2) is typically a generator (or multiple generators).

The ATS typically controls two circuit breakers, one for each source. Only one circuit breaker can be closed and connected to the electrical load at a time, and an open transition of sources is provided when switching between two live sources.

The unit is equipped with an ATS-5335 automatic controller to facilitate automatic functions. It is also supplied with individual switches to provide for manual control of the circuit breakers.

The ATS-5335 controller is configured by APT for the application and includes a variety of field adjustable settings and timers to allow the user to set the transfer switch up as desired for their installation.

Field adjustable items include transfer times and voltage/frequency thresholds for managing transfer operation and engine cooldown. Refer to the ATS-5335 section of this manual for more information on field adjustments.

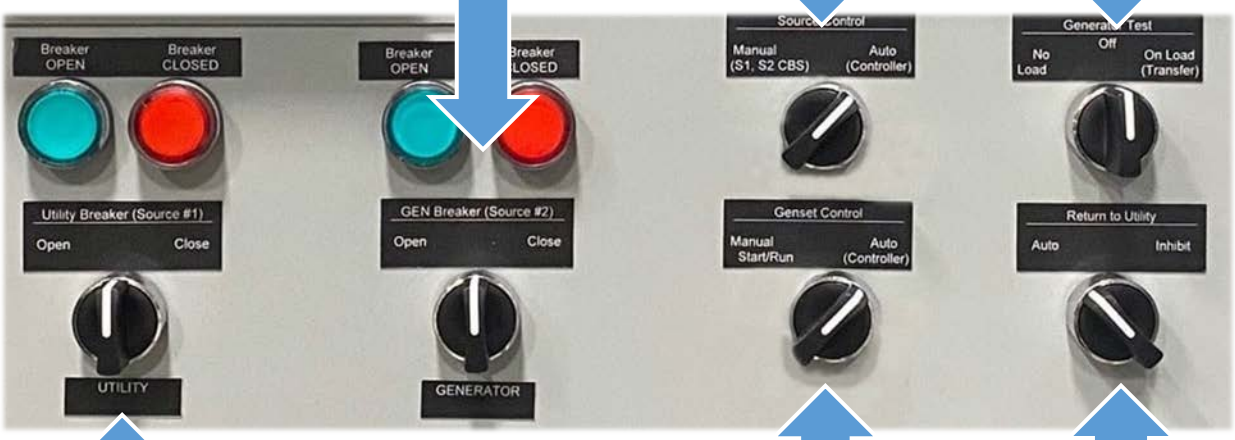
Transfer Switch Operator Controls

Normal Switch Position (for Automatic Operation)

*Generator Breaker (Source 2) Switch – Center/Neutral

*Source Control Switch – Auto (Controller)

*Generator Test – Off



*Utility Breaker (Source 1) Switch – Center/Neutral

*Genset Control Switch – Auto (Controller)

*Optional Item Shown

*Return to Utility – Auto

NOTE: For automatic operation on a utility failure the Generator Set(s) must be ready to start and provide power to the ATS through any intervening circuit breakers upon receipt of the transfer switch start command. The transfer switch Source Control Switch must be in the Auto (Controller) position and the ATS-5335 Controller must be in the Auto Mode.

Source Control Switch (Optional)

The source control switch establishes which devices(s) are in control of the circuit breakers and engine starting command. In the Auto mode control actions are initiated (manually or automatically) from the ATS-5335 controller. In the Manual position an operator initiates control actions from the switches on the front panel of the transfer switch.

The Source Control switch, combined with the manual circuit breaker control switches and Genset Control switch are optional and provide manual control of the circuit breakers and manual starting of the generator set, independently of the ATS-5335 controller. If the transfer switch is not equipped with these switches the ATS-5335 controller will behave as if the switch is the Auto (Controller) position.

Manual (S1, S2 CBS)

In the Manual (S1, S2 CBS) position the circuit breakers are controlled by the panel mounted circuit breaker switches. The Genset Control Switch is used to manually initiate starting of the generator set and the S1 and S2 CBS switches are then used to manually operate the circuit breakers. Note that the Genset Control Switch is always available to start the genset, regardless of the Source Control Switch position.

In the manual position the ATS-5335 controller is placed in the STOP mode and control from it is disabled.

Auto (Controller)

NOTE: When placed in Auto (Controller) the ATS-5335 is placed in automatic mode and the transfer switch may take actions to operate circuit breakers and command the generator to start without warning.

In the Auto (Controller) position the ATS-5335 controller is enabled and is placed into the AUTO mode. It will then respond to a power failure by commanding the generator set to start and transferring the load to generator power.

Additional operations are also possible from the ATS-5335 controller as described in the ATS-5335 section of this manual.

In the Auto (Controller) position the manual circuit breaker switches are disabled and will not trip or close the circuit breakers. The Genset Control switch will initiate an engine start when placed in Manual.

Refer to the ATS-5335 Operation section of this manual for a detailed description of the controllers operating modes and automatic sequences.

Genset Control Switch (Optional)

Manual Start/Run

When placed in Manual a start/run command is issued to the generator set. This function is enabled regardless of the Source Control Switch position. Returning the switch to the Auto (Controller) position will remove the start/run command from the generator set.

Auto (Controller)

When placed in Auto the start/run command is removed until the ATS-5335 calls for the generator set to start.

Circuit Breaker Control Switches and Lamps (Optional)

The circuit breaker control switches provide for opening and closing of the individual circuit breakers when the Source Control Switch is in the Manual (S1, S2 CBS). The OPEN / CLOSED lamps give a visual indication of the status of the circuit breaker.

The circuit breakers are interlocked so that only one circuit breaker can be closed at a once. If one of the breakers is closed the other will not close.

The circuit breaker switches are not active if the Source Control switch is in the Auto/Controller position.

Return to Utility Switch (Optional)

During automatic operation, the Return to Utility switch can be used to prevent the automatic return of utility power. This can be useful if additional utility outages are expected such as during inclement weather or utility line maintenance.

Auto

When the ATS-5335 is in the automatic mode and the Return to Utility switch is in the Auto position, the controller will automatically disconnect from S2, shut down the engine and reconnect to the Utility as soon as the utility has returned and been present for the Source Return time delay.

Inhibit

In the Inhibit position the controller will not initiate a return to utility power, even after the utility has returned. Return the switch to the Auto position to return to the utility source when desired.

Generator Test Switch (Optional)

Off

Discontinues any test that has been started by retransferring the load to utility power (if needed) and shutting down the generator set.

No Load

Will cause a start command to be issued to the genset for a “no load” test. The transfer switch circuit breakers do not operate, and the load remains connected to the utility.

On Load (Transfer)

Will cause a start command to be issued to the genset. When generator potential is detected the utility circuit breaker will be opened, and the generator circuit breaker will close after short transfer time.

Returning the switch to Off will cause the load to be retransferred from generator power to utility power, and the genset start/run signal will be removed.

A full-On Load cycle will cause the connected load to experience two brief power outages.

Source Available Lights (Optional)

The source available lights provide an indication that AC voltage is present on the utility or emergency (generator) sources. When illuminated the ATS-5335 controller will also indicate the source voltage on the LCD display.

Customizations

APT Automatic Transfer Switches can be customized to meet specific project needs. Refer to your project's drawings and APT for project specific details.

Customer Interface Signals

Several signals are provided as dry/volts free contacts to allow interface and monitoring of the transfer switch with the site electrical system. Refer to the project drawings for specific connection points. The signals are defined below.

Utility Circuit Breaker:

S1a – Closed when the S1 (Utility) circuit breaker is closed.

S1b – Closed when the S1 (Utility) circuit breaker is open.

Generator Circuit Breaker:

S2a – Closed when the S2 (Generator) circuit breaker is closed.

S2b – Closed when the S2 (Generator) circuit breaker is open.

Generator Set Start

SIR – Start/Run initiated. Provides the start/run command to the remote generator set. Changes states to initiate generator start/run (normally open contacts close, normally open contacts close) and reverts to normal when the generator is not needed and can shut down.

A genset cooldown period is recommended by engine manufacturers. The ATS-5335 can be used to provide the genset cooldown function, or the ATS controller cooldown can be set to zero and the cooldown function can be provided by the generator controls.

Controller Not in Auto

Contact closes when the controller is NOT in automatic mode and ready to respond to a utility outage.

Utility Power Available

Contact closes when the utility voltage is present and within acceptable limits.

Standby Power Available

Contact closes when the generator (standby) voltage is present and within acceptable limits.

Description of ATS-5335 Controller

The ATS-5335 control module provides for continuous monitoring of an electrical source and automatic switching to an alternate source when the normal source fails. It also allows the operator to operate the system manually.

NOTE: The following descriptions detail the sequences followed by a module containing the standard 'factory configuration'. Always refer to the configuration source for the exact sequences and timers observed by any particular module in the field.

CAUTION: The module may instruct an engine start event due to external influences.

Therefore, it is possible for the engine to start at any time without warning. Prior to performing any maintenance on the system, it is recommended that steps are taken to remove the battery and isolate supplies.

Control of the module is via push buttons mounted on the front of the module with:

Start Inhibit/Reset

Manual

Auto

Mode

Alarm Mute

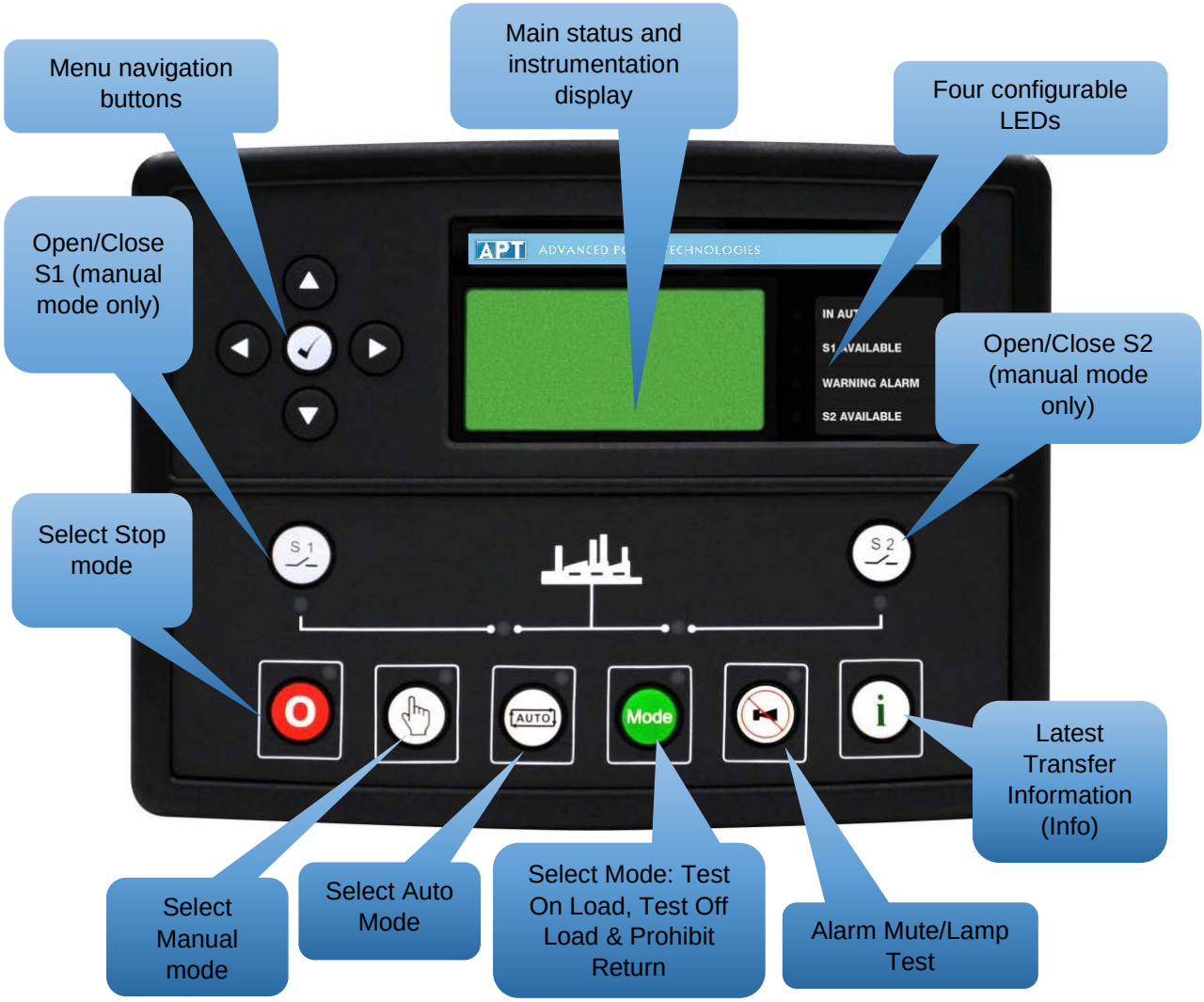
Latest Transfer Information

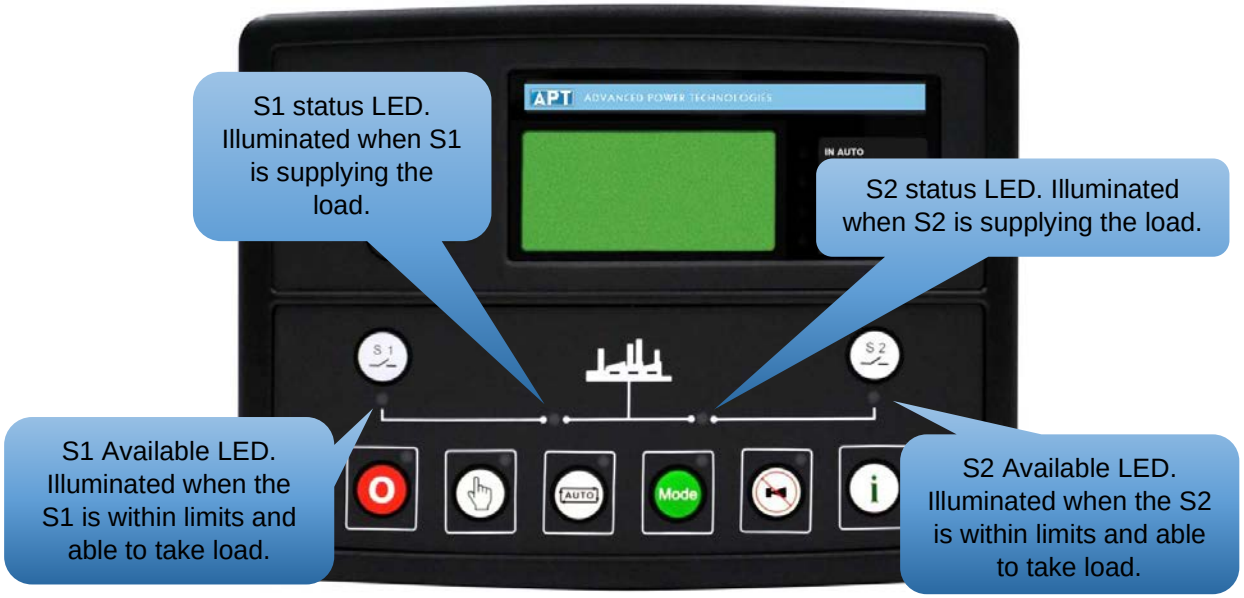
Close/Open S1

Close/Open S2

For normal operation, these are the only controls which need to be operated. Details of their operation are provided later in this document.

Description of ATS-5335 Controller





Control Push-Buttons

Icon	Description
	**Stop / Reset** This button places the module into its *Stop / Reset* mode. This clears any alarm conditions for which the triggering criteria have been removed. If S2 is on load and the module is placed into Stop mode, the module automatically instructs the changeover device to unload the S2 source (*Close S2 Output* becomes inactive (if used)). If S2 is configured for a generator, the start signal given to the generator controller is also removed. If a *Remote Start* signal is present while operating in this mode, the remote start does not occur.
	**Manual** This button places the module into its *Manual* mode to allow manual control of the ATS functions. This starts S2 when configured as a generator and runs it off load. For further details, please see the more detailed description of 'Manual operation' elsewhere in this document.
	**Auto** This button places the module into its *Auto* mode. This mode allows the module to control the function of S1 and S2 automatically. The module monitors the *remote start* input and S1 supply status and once a start request is made, a start request is given to S2 if configured to a generator and once available, placed on load. Upon removal of the starting signal, the module automatically transfers the load from S2 and remove the start signal to the generator observing the *return delay* timer and *cooling* timer, as necessary. The module then waits for the next start event. For further details, please see the more detailed description of 'Auto operation' elsewhere in this manual.
	**Mode** This button allows the user to cycle through different operating *Mode* and press the *Tick* to accept the mode change. The modes available are: *Test On Load:* This mode allows the module to start and load S2 for test purposes. *Test Off Load:* This mode allows the module to start S2 and leave off load for test purposes. *Prohibit Return:* This mode is used to prevent the module from returning load the S1 until instructed. For further details, please see the more detailed description of 'Mode operation' elsewhere in this manual.

Description of ATS-5335 Controller

Icon	Description
	**Mute / Lamp Test** This button silences the audible alarm if it is sounding and illuminates all the LEDs as a lamp test feature.
	**Latest Transfer Information** Whilst pressing this button, the module displays the reason, time, date, and duration for the latest transfer that occurred, holding this button cycles between the last S1 transfer and the last S2 transfer. For further details, please see the more detailed description of 'Viewing Latest Transfer Information Page' elsewhere in this manual.
	**Close / Open to S1** **NOTE: This button only operates in manual mode.** Pressing the *Close / Open S1* button when S1 is on load, opens the S1 load switch. Pressing the *Close / Open S1* button when S2 is on load and S1 is healthy, the S2 load switch opens, wait for the duration of the *transfer delay*, then closes the S1 load switch. For further details, please see the more detailed description of 'Manual operation' elsewhere in this document.
	**Close/Open to S2** **NOTE: This button only operates in manual mode.** Pressing the *Close / Open S2* button when S2 is on load, opens the S2 load switch. Pressing the *Close / Open S2* button when S1 is on load and S2 is healthy, the S1 load switch opens, wait for the duration of the *transfer delay*, then closes the S2 load switch. For further details, please see the more detailed description of 'Manual operation' elsewhere in this document.
	**Menu navigation** Used for navigating the instrumentation, event log and configuration screens. For further details, please see the more detailed description of these items elsewhere in this manual.

Viewing the Instrument Pages

It is possible to scroll to display the different pages of information by repeatedly operating the ***Next /Previous*** page buttons

If you want to view one of the instrument pages towards the end of the list, it may be quicker to scroll left through the pages rather than right!

Example

Status S1 S2 Further presses of the ***Next Page Button*** returns the display to the Status page.

The complete order and contents of each information page are given in the following sections

Once selected the page remains on the LCD display until the user selects a different page, or after an extended period of inactivity (*LCD Page Timer*), the module reverts to the status display.

If no buttons are pressed upon entering an instrumentation page, the instruments are displayed automatically subject to the setting of the *LCD Scroll Timer*.

Alternatively, to scroll manually through all instruments on the currently selected page, press the scroll buttons. The 'autoscroll' is disabled.

If you want to view one of the instruments towards the end of the list, it may be quicker to scroll up through the instruments rather than down!

To re-enable 'autoscroll' press the scroll buttons to scroll to the 'title' of the instrumentation page (i.e., S1). A short time later (the duration of the *LCD Scroll Timer*), the instrumentation display begins to autoscroll.

When scrolling manually, the display automatically returns to the Status page if no buttons are pressed for the duration of the configurable *LCD Page Timer*.

If an alarm becomes active while viewing the status page, the display shows the Alarms page to draw the operator's attention to the alarm condition.

Status

This is the 'home' page, which is displayed when no other page has been selected, and the page that is automatically displayed after a period of inactivity (*LCD Page Timer)* of the module control buttons.

Contains summary information of both supplies along with different module status display.

- Main Summary (Backup source)
- Main Summary (Primary source)
- Source supply summary
- Supervisors summary
- Monitors summary

This page changes with the action of the controller, when S1 is on load, S1 parameters are seen and when changing to S2 on load, the S2 parameters are shown.

No Start Request		
S1 Closed		
L-N	**230V**	**40A**

Example of the first status screen showing no start request to S2 and S1 closed supplying the load…

S2 Available		
S2 Closed		
L-N	**229V**	**40A**
L-L	**399V**	**50.1Hz**

… and showing S2 on load.

Press  to access more status information about two supplies.

S1

Contains electrical values of S1 measured or derived from the module's voltage and current inputs.

- S1 Configuration
- S1 State
- S1 Summary
- S1 Voltage (ph-N)
- S1 Voltage (ph-ph)
- S1 Frequency
- S1 Current
- S1 Earth Current
- S1 Load (ph-N kW)
- S1 Load (Total kW)
- S1 Load (ph-N kV A)
- S1 Load (Total kV A)
- S1 Power Factor
- S1 Power Factor Average
- S1 Load (ph-N kvar)
- S1 Load (Total kvar)
- S1 Load (kW h, kV A h, kvar h)

S2

Contains electrical values of S2 measured or derived from the module's voltage and current inputs.

- S2 Configuration
- S2 State
- S2 Summary
- S2 Voltage (ph-N)
- S2 Voltage (ph-ph)
- S2 Frequency
- S2 Current
- S2 Earth Current
- S2 Load (ph-N kW)
- S2 Load (Total kW)
- S2 Load (ph-N kV A)
- S2 Load (Total kV A)
- S2 Power Factor
- S2 Power Factor Average
- S2 Load (ph-N kvar)
- S2 Load (Total kvar)
- S2 Load (kW h, kV A h, kvar h)
- Load Control

Module

Contains information on the module configuration.

- S1 Configuration
- S2 Configuration
- Date and Time
- Battery Voltage

Alarms

Contains the alarms currently active on the module. For more information, please see the section entitled *'Protections'* elsewhere in this manual.

Event Log

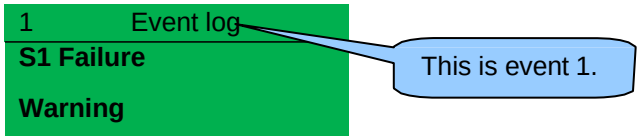
The module maintains a log of past alarms and/or selected status changes.
At the time of writing, the modules log can store the last 250 log entries.

The following events are logged:

Unit Power up	S2 Fail
S1 Return	Electrical trip alarms
S1 Fail	Warnings
S2 Return	

Once the log is full, any subsequent shutdown alarms overwrite the oldest entry in the log. Hence, the log always contains the most recent alarms.
The module logs the alarm, along with the date and time of the event

To view the event log, repeatedly press the next page button  until the LCD screen displays the Event log:



Press down  to view the next most recent shutdown alarm:

Continuing to press down  cycles through the past events after which the display shows the most recent alarm and the cycle begins again.

To exit the event log and return to viewing the instruments, press the next page  button to select the next instrumentation page.

Serial Port

RS232 SERIAL PORT

This section is included to give information about the RS232 serial port and external modem (if connected).

The items displayed on this page change depending upon configuration of the module. Refer to the system supplier for further details.

Module Connected to an RS232 Telephone Modem

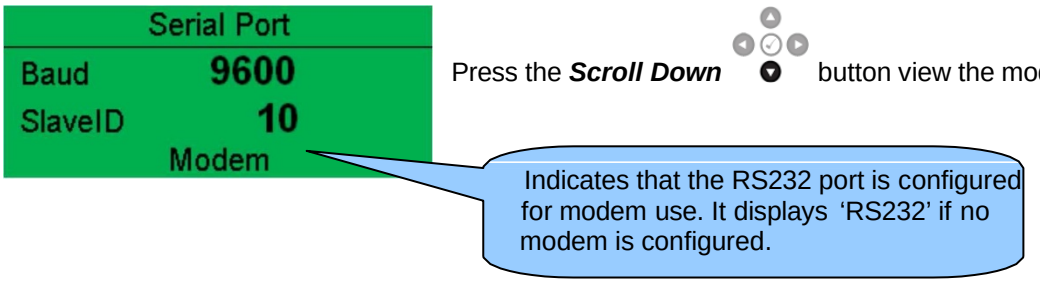
NOTE: Not all alarms generate a dial out command; this is dependent upon module configuration of the event log. Any event configured to be recorded in the event log causes the modem to dial out to a PC.

When the module is powered up, it sends 'initialization strings' to the connected modem. It is important therefore that the modem is already powered or is powered up at the same time as the module. At regular intervals after power up, the modem is reset, and reinitialized, to ensure the modem does not 'hang up'.

If the module does not correctly communicate with the modem, "Modem initializing' appears on the Serial Port instrument screen as shown overleaf.

If the module is set for "incoming calls" or for "incoming and outgoing calls", once the modem is dialed, it answers after two rings (using the factory setting 'initialization strings). Once the call is established, all data is passed between the dialing PC and the module.

If the module is set for "outgoing calls" or for "incoming and outgoing calls", then the module dials out whenever an alarm is generated.



Press the ***Scroll Down*** button view the modem status....

Scheduler

Contains the current schedule plan for S2 configured in module.

2/3	Schedule	10:39
Off Load		Week 3
On 12:00		Run Time 00:30
	T W T F S S	

Example of the 3rd scheduled operation in bank 2 for S2.

About

Contains important information about the module and the firmware versions.

About	
Variant	335
Application	V3.0.20
USB ID	BC614E

- Variant – 5335
- Application Version – The version of the module's main firmware file
- USB ID – Unique identifier for PC USB connection

Press  to access more information about the module.

About	
Bootloader	V1.3.4
Analogue	V2.0.0

- Bootloader - Firmware Update bootloader software version

Viewing Latest Transfer Information Page

It is possible to view the reason, time, date, and duration of the latest transfer by pressing and holding the *Latest Transfer Information* ⓘ. Holding this button cycles between the last S1 transfer and the last S2 transfer.

Example of the Latest Transfer page, which shows that there was a transfer cause by an S1 Under Voltage failure which lasted for 27 minutes.

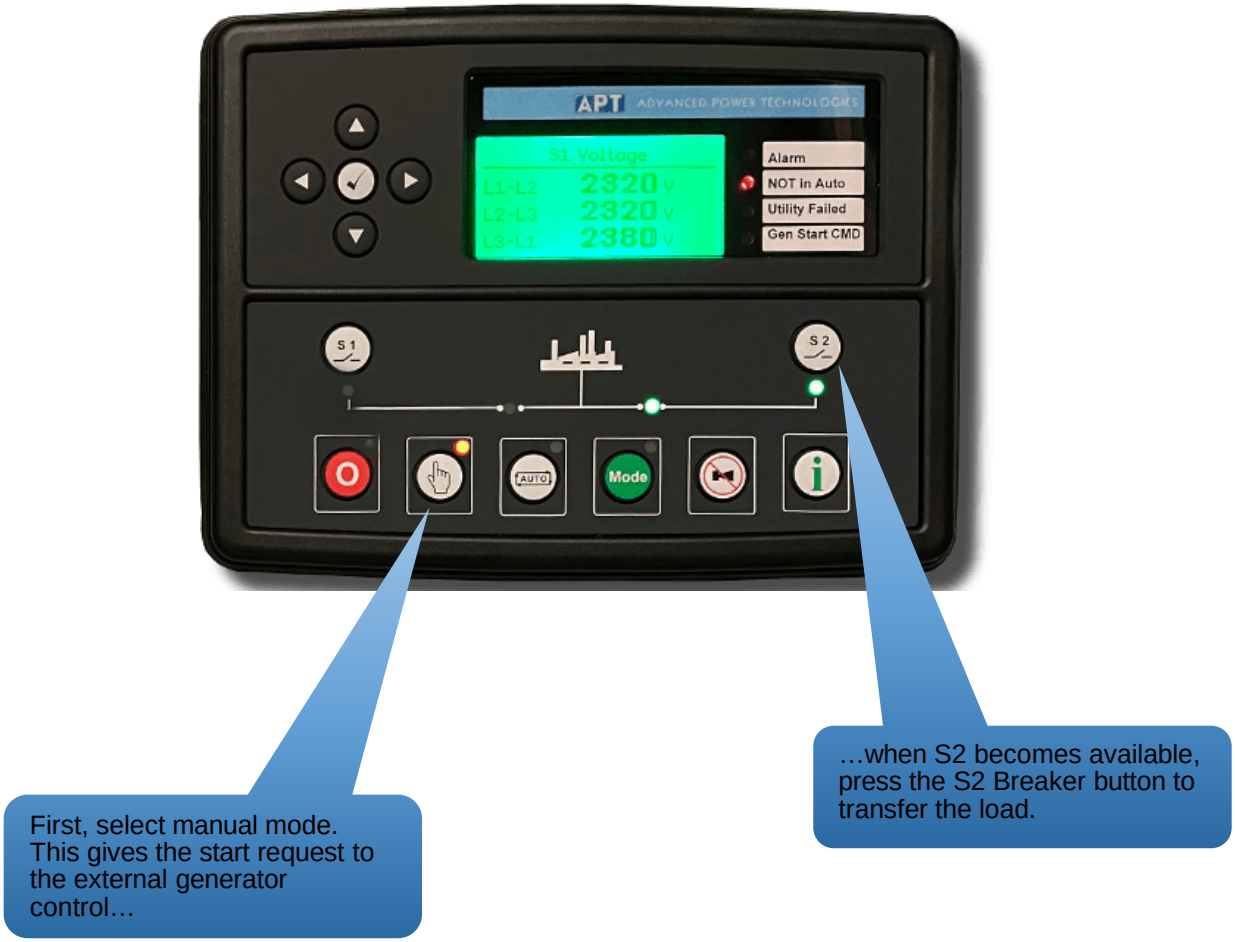
```
S1 Latest Transfer 16:53
    S2 Under Voltage

  22 Oct 2014, 12:59:47
```

This section provides a quick start guide to the module's operation.

Starting S2

NOTE: This only applies when S2 is configured as a generator supply.



Stopping S2

NOTE: This only applies when S2 is configured as a generator supply.

Select Stop/Reset mode.

S2 breaker is opened, and the start request is removed

Stop/Reset

NOTE: If a digital input configured to *Panel Lock* is active, changing module modes is not possible. Viewing the instruments and event logs is NOT affected by panel lock.

Stop mode is activated by pressing the button.

In *Stop* mode, the module removes S2 from load (if necessary) and removes the start signal given to the generator controller (if S2 is configured as a generator and it is running).

If S2 is configured as a generator and it does not stop after the cooling down time, the *Fail To Stop* alarm is activated (subject to if the *Fail To Stop* timer is enabled and its duration). To detect the generator (S2) is at rest the following must occur:

- S2 Frequency must be zero
- S2 Voltage must be zero

Any latched alarms that have been cleared are reset when *Stop* mode is entered.

S2 is not placed on load (or started if configured as a generator) when in *Stop* mode. If remote start signals are given, the input is ignored until *Auto* mode is entered.

Manual Mode

NOTE: If a digital input configured to *Panel Lock* is active, changing module modes is not possible. Viewing the instruments and event logs is NOT affected by panel lock.

Manual mode is activated by pressing the button.

In *Manual* mode, the module actives an output to give a start signal to an external generator controller (if S2 is configured as a generator supply), and if required, change the state of the load switching devices. An LED indicator beside the button confirms this action.

Starting Sequence

NOTE: There is no *start delay* in this mode of operation.

As soon as the *Manual* mode button is pressed, the output to give a start signal to an external generator controller is activated (if S2 is configured as a generator).

If the generator fails to start during the 'S2 Fail Delay' timer, an alarm appears on the display which shows *Fail to Start.* S2 is seen as available once the supply is within limits (if configured as a mains supply) or had achieved loading voltage and frequency (if configured as a generator).

S2 Available

NOTE: The load transfer signal remains inactive until S2 is seen as available. This prevents loading to a supply that has failed or is not yet available.

In *Manual* mode, the load is not transferred to S2 unless a 'loading request' is made and the S2 supply is within limits (if configured as a mains supply) or achieve *Loading Voltage* and *Loading Frequency* (if configured as a generator).

A loading request can come from several sources.

- Pressing the *Close/Open S2* button
- S1 supply out of limits
- Activation of an auxiliary input that has been configured to *remote start on load*
- Activation of the inbuilt exercise scheduler if configured for 'on load' runs.

As the load increases and decreases, the module may (depending upon optional configurations) remove non-essential loads.

Once the load has been transferred to S2, it is not automatically transferred back to the S1 supply. To manually transfer the load back to the mains either:

- Pressing the *Close/Open S1* button
- Pressing the *Auto* button to return to automatic mode.
- Pressing the *Start Inhibit* button to return to start inhibit mode.

For further details of breaker control, see the section entitled “controls and indications” elsewhere in this manual.

Stopping Sequence

In manual mode, S2 continues to run until either:

- Pressing the *Start Inhibit* button to return to start inhibit mode.
- Pressing the *Auto* button to return to automatic mode.

Automatic Mode

Auto mode is activated by pressing the button.

In *Auto* mode, the module operates fully automatically, changing between the two supplies in case of failure without user intervention. An LED indicator beside the button confirms this action.

Waiting in Auto Mode

If a starting/loading request is made, the starting sequence begins. Starting/loading requests can be from the following sources:

- S1 supply out of limits
- Activation of an auxiliary input that has been configured to *remote start on load* or *remote start off load.*
- Activation of the inbuilt exercise scheduler.
- Instruction from external remote telemetry devices using the RS232 or RS485 interface

Starting Sequence

To allow for 'false' start/load requests such as S1 brownouts, the *Start Delay* timer begins. There are individual start delay timers for each of the different start/load request types.

When all start/load requests are removed during the *Start Delay* timer, the unit returns to a stand-by state.

If a start/load request is still present at the end of the *Start Delay* timer, an output to give a start signal to an external generator controller is activated (if S2 is configured as a generator).

If the generator fails to start during the 'S2 Fail Delay' timer, an alarm appears on the display which shows *Fail to Start.* S2 is seen as available once the supply is within limits (if configured as a mains supply) or had achieved *Loading Voltage* and *Loading Frequency* (if configured as a generator).

If a start/load request is present but the starting sequence has not begun, an input configured to *'Auto Start Inhibit'* could be active.

S2 Available

In *Auto* mode, the load is automatically transferred to S2 when it is within limits (if configured as a mains supply) or achieve loading voltage and frequency (if configured as a generator).

If a start/load request is present but S2 does not go on load, an input configured to *'S2 Load Inhibit'* could be active.

A loading request can come from several sources.

- S1 supply out of limits
- Activation of an auxiliary input that has been configured to *remote start on load*
- Activation of the inbuilt exercise scheduler if configured for 'on load' runs.

NOTE: The load transfer signal remains inactive until S2 is seen as available. This prevents loading to a supply that has failed or is not yet available.

As the load increases and decreases, the module may (depending upon optional configuration) remove non-essential loads.

Stopping Sequence

The *Return Delay* timer operates to ensure that the start/load request has been permanently removed and is not just a short-term removal. In case another start request is made during the *Return Delay* (or cooling down period when S2 is configured as a generator), the set returns on load.

If there are no starting requests at the end of the *Return Delay* timer, the load is transferred back from the S2 to the S1 supply, and the *Cooling* timer is initiated (when S2 is configured as a generator).

The *Cooling* timer allows S2 (when configured as a generator) to run off load and cool sufficiently before the start signal to the external generator control unit is removed. This is particularly important where turbo chargers are fitted to the engine.

After the *Cooling* timer has expired, the start signal given to the external generator controller is removed.

Mode Selection

NOTE: If a digital input configured to *Panel Lock* is active, changing module modes is not possible. Viewing the instruments and event logs is NOT affected by panel lock.

Pressing the *Mode* button sets which of the three modes below to leave the controller in.

Test On Load

Activate by pressing the *Mode* button repeatedly until *Test on Load* is shown on the display, then press the *Tick* button to confirm the change. An LED indicator beside the button confirms this action.

The *Test on Load* mode starts S2 (if configured as a generator) and transfers the load to S2.

Starting Sequence

As soon as the *Mode* is selected and confirmed by pressing the *Tick* button is pressed, the output to give a start signal to an external generator controller is activated (if S2 is configured as a generator).

If the generator fails to start during the 'S2 Fail Delay' timer, an alarm appears on the display which shows *Fail to Start.* S2 is seen as available once the supply is within limits (if configured as a mains supply) or had achieved *Loading Voltage* and *Loading Frequency* (if configured as a generator).

S2 Available

In *Test on Load* mode, the load is automatically transferred to S2 when it is within limits (if configured as a mains supply) or had achieved loading voltage and frequency (if configured as a generator).

If a start/load request is present but S2 does not go on load, an input configured to *'S2 Load Inhibit'* could be active.

NOTE: The load transfer signal remains inactive until S2 is seen as available. This prevents loading to a supply that has failed or is not yet available.

As the load increases and decreases, the module may (depending upon optional configuration) remove non-essential loads.

Stopping Sequence

In *Test on Load* mode, S2 continues to run on load until either:

- Pressing the *Start Inhibit* button to return to start inhibit mode.
- Pressing the *Auto* button to return to automatic mode.

Test Off Load

Activate by pressing the *Mode* button repeatedly until *Test off Load* is shown on the display, then press the *Tick* button to confirm the change. An LED indicator beside the button confirms this action.

The *Test off Load* mode only starts S2 (if configured as a generator) and leave it off load.

Starting Sequence

As soon as the *Mode* is selected and confirmed by pressing the *Tick* button is pressed, the output to give a start signal to an external generator controller is activated (if S2 is configured as a generator).

If the generator fails to start during the *S2 Fail Delay* timer, an alarm appears on the display which shows *Fail to Start.* S2 is seen as available once the supply is within limits (if configured as a mains supply) or had achieved *Loading Voltage* and *Loading Frequency* (if configured as a generator).

S2 Available

In *Test Off Load* mode, the load is not transferred to S2 unless a 'loading request' is made and the S2 supply is within limits (if configured as a mains supply) or has achieved loading voltage and frequency (if configured as a generator).

A loading request can come from several sources.

- S1 supply out of limits
- Activation of an auxiliary input that has been configured to *remote start on load*
- Activation of the inbuilt exercise scheduler if configured for 'on load' runs.

NOTE: The load transfer signal remains inactive until S2 is seen as available. This prevents loading to a supply that has failed or is not yet available.

As the load increases and decreases, the module may (depending upon optional configuration) remove non-essential loads.

Stopping Sequence

In *Test off Load* mode, S2 continues to run on load until either:

- Pressing the *Start Inhibit* button to return to *Start Inhibit* mode.
- Pressing the *Auto* button to return to *Automatic* mode.

Prohibit Return

Activate by pressing the *Mode* button repeatedly until *Prohibit Return* is shown on the display, then press the *Tick* button to confirm the change. An LED indicator beside the button confirms this action.

The *Prohibit Return* mode prevents the load being transfer back to the S1 from the S2 supply until the module is instructed to do so.

Waiting in Prohibit Return

If a starting/loading request is made, the starting sequence begins. Starting/loading requests can be from the following sources:

- S1 supply out of limits
- Activation of an auxiliary input that has been configured to *Remote Start On Load* or *Remote Start Off Load.*
- Activation of the inbuilt exercise scheduler.
- Instruction from external remote telemetry devices using the RS232 or RS485 interface

Starting Sequence

To allow for 'false' start/load requests such as S1 brownouts, the *Start Delay* timer begins. There are individual *Start Delay* timers for each of the different start/load request types.

When all start/load requests are removed during the *Start Delay* timer, the unit returns to a stand-by state.

If a start/load request is still present at the end of the *Start Delay* timer, an output to give a start signal to an external generator controller is activated (if S2 is configured as a generator).

If the generator fails to start during the 'S2 Fail Delay' timer, an alarm appears on the display which shows *Fail to Start.* S2 is seen as available once the supply is within limits (if configured as a mains supply) or had achieved *Loading Voltage* and *Loading Frequency* (if configured as a generator).

If a start/load request is present but the starting sequence has not begun, an input configured to *'Auto Start Inhibit'* could be active.

S2 Available

In *Prohibit Return* mode, the load is automatically transferred to S2 when it is within limits (if configured as a mains supply) or has achieved *Loading Voltage* and *Loading Frequency* (if configured as a generator).

If a start/load request is present but S2 does not go on load, an input configured to *'S2 Load Inhibit'* could be active.

A loading request can come from several sources.

- S1 supply out of limits
- Activation of an auxiliary input that has been configured to *Remote Start On Load*
- Activation of the inbuilt exercise scheduler if configured for 'on load' runs.

NOTE: The load transfer signal remains inactive until S2 is seen as available. This prevents loading to a supply that has failed or is not yet available.

As the load increases and decreases, the module may (depending upon optional configuration) remove non-essential loads.

Stopping Sequence

In *Return Inhibit* mode, S2 continues to run on load even if S1 has return until either:

- Pressing the *Start Inhibit* button to return to start inhibit mode.
- Pressing the *Auto* button to return to automatic mode.

Scheduler

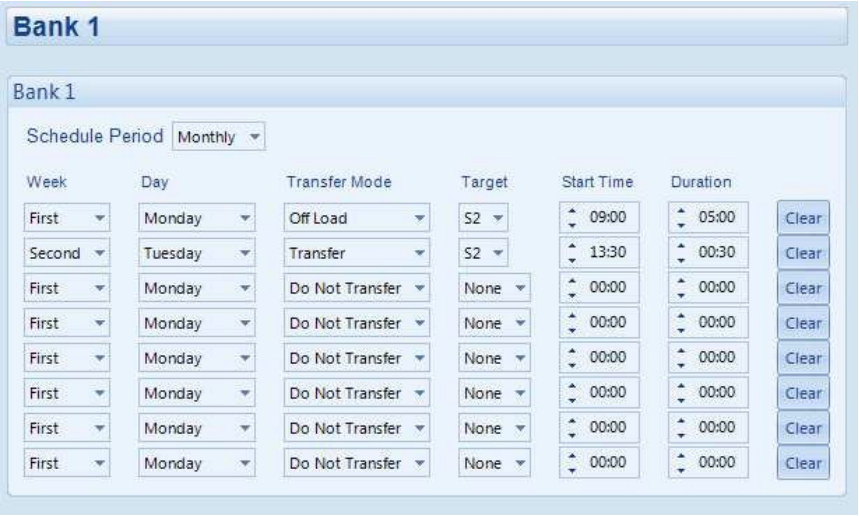
The controller contains an inbuilt exercise run scheduler, capable of automatically starting and stopping the set. Up to 16 scheduled start/stop sequences can be configured in banks of 8 to either repeat on a 7-day or 28-day cycle.

Scheduled runs may be on load or off load depending upon module configuration. Contact APT for assistance setting up your module for a specific schedule.

Example

Configuration scheme for the configuration of the Exercise Scheduler.

In this example the set starts at 09:00 on the first Monday of each month and run for 5 hours, then start at 13:30 on every Tuesday and run for 30 minutes.



Stop Mode

- Scheduled runs do not occur when the module is in *Stop* mode.

Manual Mode

- Scheduled runs do not occur when the module is in *Manual* mode.
- Activation of a Scheduled Run 'On Load' when the module is operating Off Load in Manual mode has no effect, the set continues to run Off Load.

Auto Mode

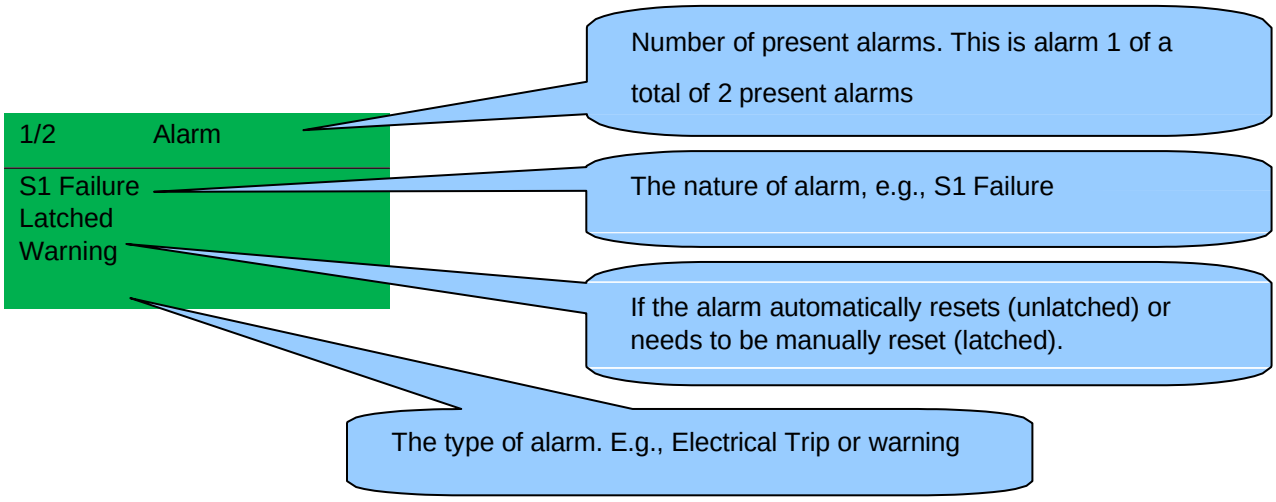
- Scheduled runs operate ONLY if the module is in *Auto* mode with no Electrical Trip alarm present.
- If the module is in *Stop* or *Manual* mode when a scheduled run begins, S2 is not started (if configured as generator). However, if the module is moved into *Auto* mode during a scheduled run, S2 is called to start.
- Depending upon configuration by the system designer, an external input can be used to inhibit a scheduled run.
- If S2 is Off Load in *Auto* mode and a scheduled run configured to 'Transfer to S2' begins, S2 is placed On Load for the duration of the Schedule.

Protections

When an alarm is present, the Audible Alarm sounds and the Common alarm LED if configured illuminates.

The audible alarm can be silenced by pressing the *Alarm Mute*

The LCD display jumps from the 'Information page' to display the Alarm Page



The LCD displays multiple alarms E.g., "S1 Failure Warning", "Fail to Stop Warning" and "Digital Input A Electrical Trip". These automatically scroll in the order that they occurred.

In the event of a warning alarm, the LCD displays the appropriate text. If an electrical trip then occurs, the module again displays the appropriate text.
Example: -

Alarm 1/2
Fail to Stop Unlatched Warning

Alarm 2/2
Digital Input A Unlatched Electrical Trip

Warnings

Warnings are non-critical alarm conditions and do not affect the operation of the system; they serve to draw the operator's attention to an undesirable condition.

Example

```
1/2          Alarm

S1 Failure
Latched
Warning
```

In the event of an alarm, the LCD jumps to the alarms page, and scroll through all active warnings and shutdowns.

By default, warning alarms are self-resetting when the fault condition is removed. However, some warning alarms are latched and need to be reset manually.

Display	Reason
Auxiliary Inputs	If an auxiliary input has been configured as a warning the appropriate LCD message is displayed and the **COMMON ALARM LED** illuminates.
Battery Under Voltage	The DC supply has fallen below the low volts setting level for the duration of the low battery volts timer
Battery Over Voltage	The DC supply has risen above the high volts setting level for the duration of the high battery volts timer
Calibration Lost	The module has lost its calibration settings. Contact APT for assistance.
Expansion Inputs	If an expansion input has been configured as a warning the appropriate LCD message is displayed and the **COMMON ALARM LED** illuminates.
Fail To Start	S2 has not reached the configured limits or loading voltage and frequency before the S2 Fail Delay timer has expired.
Fail To Stop	The module has detected a condition that indicates that S2 is present when it has been instructed to stop.
Loading Voltage Not Reached	Indicates that the S2 voltage is not above the configured *loading voltage.* S2 does not take load when the alarm is present after the safety timer. **NOTE: Only applicable when S2 is configured as a generator supply.**
Loading Frequency Not Reached	Indicates that the S2 frequency is not above the configured *loading frequency.* S2 does not take load when the alarm is present after the safety timer. **NOTE: Only applicable when S2 is configured as a generator supply.**

Protections

Display	Reason
PLC Functions	If a PLC Function has been configured as a warning the appropriate LCD message is displayed and the **COMMON ALARM LED** illuminates.
S1 Breaker Auxiliary Fail	Indicates that the *S1 Closed Auxiliary* input has not activated along with the *Close S1 Output* or *Open S1 Output*, or the input has activated when the output was not energized.
S1 Failure Unlatched	The module has detected that S1 has failed for an under/over voltage/frequency condition. The unlatched alarm is automatically cleared upon S1 returning to an available state.
S1 Phase Rotation	The module has detected a wrong phase sequence for S1.
S2 Breaker Auxiliary Fail	Indicates that the *S2 Closed Auxiliary* input has not activated along with the *Close S2 Output* or *Open S2 Output*, or the input has activated when the output was not energized.
S2 Failure Unlatched	The module has detected that S2 has failed for an under/over voltage/frequency condition. The unlatched alarm is automatically cleared upon S2 returning to an available state.
S2 Phase Rotation	The module has detected a wrong phase sequence for S2.

Electrical Trips

Electrical trips are latching unload and stop S2 (if configured as a generator) but in a controlled manner. On initiation of the electrical trip condition, the module de-energizes the **'Close S2 Output'** to remove the load from S2. Once this has occurred, the module starts the Cooling timer and allows the generator to cool down and shut off. The alarm must be accepted and cleared, and the fault removed to reset the module.

Depending on system configuration, an electrical trip may be received from external protective devices. These trips can be configured to trip S1, S2 or both breakers. The external electrical trip may will need to be cleared as described below.

Example

1/2 Alarm
Digital Input A Latched Electrical Trip

Electrical trips are latching alarms and unload and stop S2 (if configured as a generator). To clear these alarms the *STOP* button is pressed.

Display	Reason
Auxiliary Inputs	If an auxiliary input has been configured as an electrical trip, the appropriate LCD message is displayed and the **COMMON ALARM LED** illuminates.
Expansion Inputs	If an expansion input has been configured as an electrical trip, the appropriate LCD message is displayed and the **COMMON ALARM LED** illuminates.
PLC Functions	If a PLC Function has been configured as an electrical trip, the appropriate LCD message is displayed and the COMMON **ALARM LED** illuminates.
S1 Breaker Auxiliary Fail	Indicates that the *S1 Closed Auxiliary* input has not activated along with the *Close S1 Output* or *Open S1 Output*, or the input has activated when the output was not energized.
S1 Phase Rotation	The module has detected a wrong phase sequence for S1.
S2 Failure Unlatched	The module has detected that S2 has failed for an under/over voltage/frequency condition. The unlatched alarm is automatically cleared upon S2 returning to an available state.
S2 Phase Rotation	The module has detected a wrong phase sequence for S2.

Front Panel Configuration

This configuration mode allows the operator limited customizing of the way the module operates.

Use the module's navigation buttons to traverse the menu and make value changes to the parameters:

Accessing the Main Front Panel Configuration Editor

To enter the configuration editor the Source Control Switch must be in the Auto (Controller) position. Once the configuration editor has been entered the Source Control Switch can be placed in Manual. If the switch is in Auto (Controller) when exiting the editor, the ATS-5335 controller will revert to AUTO Mode and may take actions depending on conditions. If the transfer switch is not equipped with the Source Control switch, this step can be disregarded.

Press and hold the *Stop* *and Tick* buttons simultaneously to enter the editor.

If a module security PIN has been set, the PIN number request is then shown:

Editor
# # # #

Press the *Tick* button, the first '#' changes to '0'. Press (up or down) to adjust it to the correct value.

Press (right) when the first digit is correctly entered. The digit entered is now shown as '#' for security.

Repeat this process for the other digits of the PIN number. Press (left) to move back and adjust one of the previous digits.

When the *Tick* button is pressed after editing the final PIN digit, the PIN is checked for validity. If the number is not correct, re-enter the PIN.

If the PIN has been successfully entered (or the module PIN has not been enabled), the editor is displayed:

Editor - Display
Contrast
54 %

NOTE: If the module has a PIN code set, contact APT to obtain it.

Editing a Parameter

NOTE: The editor automatically exits after 5 minutes of inactivity to ensure security.

NOTE: The PIN number is automatically reset when the editor is exited (manually or automatically) to ensure security.

Enter the editor as described above.

Press the  (left) or  (right) buttons to cycle to the section to view/change.

Press the  (up or down) buttons to select the parameter to view/change within the currently selected section.

To edit the parameter, press the *Tick* button to enter edit mode. The parameter begins to flash to indicate that value is being edited.

Press the  (up or down) buttons to change the parameter to the required value.

Press the *Tick* button to save the value. The parameter ceases flashing to indicate that it has been saved.

When exiting the editor, the position of the Source Control switch will impact the mode the controller enters:

If in Manual (or not equipped with a source control switch) – The ATS-5335 will remain in Stop mode.

If in Auto (Controller) - The ATS-5335 will enter Auto mode and may take actions depending on system conditions.

To exit the editor at any time, press and hold the *Tick* button.

Adjustable Parameters

Section	Parameter As Shown On Display	Values
Display	LCD Contrast	0%
	Language	English
	LCD Page Timer	hh:mm:ss
	Scroll Delay	hh:mm:ss
	Date and Time	dd-mm-yyyy, hh:mm:ss
S1	S1 Option	Generator, Mains
	Immediate S1 Dropout	Inactive, Active
	Under Voltage Trip	0 V
	Over Voltage Trip	0 V
	Under Frequency Trip	0 Hz
	Over Frequency Trip	0 Hz
S2	S2 Option	Generator, Mains
	Immediate S2 Dropout	Inactive, Active
	Under Voltage Trip (Generator Option)	0 V
	Over Voltage Trip (Generator Option)	0 V
	Under Frequency Trip (Generator Option)	0.0 Hz
	Over Frequency Trip (Generator Option)	0.0 Hz
	Under Voltage Trip (Mains Option)	0 V
	Over Voltage Trip (Mains Option)	0 V
	Under Frequency Trip (Mains Option)	0.0 Hz
	Over Frequency Trip (Mains Option)	0.0 Hz
Timers	S1 Transient Delay	mm:ss
	Start Delay	hh:mm:ss
	Warming Up Time	hh:mm:ss
	S2 Fail Delay	mm:ss
	Elevator Delay	mm:ss
	Non-sync Transfer Time	mm:ss.s
	Check-Sync Transfer time	mm:ss.s
	Return Delay	hh:mm:ss
	Cooling Time	hh:mm:ss
	Fail to Stop Enable	Inactive, Active
	Fail to Stop Delay	mm:ss
	S2 Transient Delay	s.s

Section	Parameter As Shown On Display	Values
Scheduler Bank 1	Scheduler Enable	Inactive, Active
	Bank 1 Run Mode	Do Not Transfer Transfer to S1 Transfer to S2 S1 Off Load (When S1 = Gen) S2 Off Load (When S2 = Gen)
	Bank 1 Period	Weekly, Monthly
	Bank 1 Event 1 Week	1-4
	Bank 1 Event 1 Day	Monday to Sunday
	Bank 1 Event 1 Start Time	hh:mm
	Bank 1 Event 1 Duration	hh:mm
	Bank 1 Event 2 Week	1-4
	Bank 1 Event 2 Day	Monday to Sunday
	Bank 1 Event 2 Start Time	hh:mm
	Bank 1 Event 2 Duration	hh:mm
	Bank 1 Event 3 Week	1-4
	Bank 1 Event 3 Day	Monday to Sunday
	Bank 1 Event 3 Start Time	hh:mm
	Bank 1 Event 3 Duration	hh:mm
	Bank 1 Event 4 Week	1-4
	Bank 1 Event 4 Day	Monday to Sunday
	Bank 1 Event 4 Start Time	hh:mm
	Bank 1 Event 4 Duration	hh:mm
	Bank 1 Event 5 Week	1-4
	Bank 1 Event 5 Day	Monday to Sunday
	Bank 1 Event 5 Start Time	hh:mm
	Bank 1 Event 5 Duration	hh:mm
	Bank 1 Event 6 Week	1-4
	Bank 1 Event 6 Day	Monday to Sunday
	Bank 1 Event 6 Start Time	hh:mm
	Bank 1 Event 6 Duration	hh:mm
	Bank 1 Event 7 Week	1-4
	Bank 1 Event 7 Day	Monday to Sunday
	Bank 1 Event 7 Start Time	hh:mm
	Bank 1 Event 7 Duration	hh:mm
	Bank 1 Event 8 Week	1-4
	Bank 1 Event 8 Day	Monday to Sunday
	Bank 1 Event 8 Start Time	hh:mm
	Bank 1 Event 8 Duration	hh:mm

Section	Parameter As Shown On Display	Values
Scheduler Bank 2	Bank 2 Run Mode	Do Not Transfer Transfer to S1 Transfer to S2 S1 Off Load (When S1 = Gen) S2 Off Load (When S2 = Gen)
	Bank 2 Period	Weekly, Monthly
	Bank 2 Event 1 Week	1-4
	Bank 2 Event 1 Day	Monday to Sunday
	Bank 2 Event 1 Start Time	hh:mm
	Bank 2 Event 1 Duration	hh:mm
	Bank 2 Event 2 Week	1-4
	Bank 2 Event 2 Day	Monday to Sunday
	Bank 2 Event 2 Start Time	hh:mm
	Bank 2 Event 2 Duration	hh:mm
	Bank 2 Event 3 Week	1-4
	Bank 2 Event 3 Day	Monday to Sunday
	Bank 2 Event 3 Start Time	hh:mm
	Bank 2 Event 3 Duration	hh:mm
	Bank 2 Event 4 Week	1-4
	Bank 2 Event 4 Day	Monday to Sunday
	Bank 2 Event 4 Start Time	hh:mm
	Bank 2 Event 4 Duration	hh:mm
	Bank 2 Event 5 Week	1-4
	Bank 2 Event 5 Day	Monday to Sunday
	Bank 2 Event 5 Start Time	hh:mm
	Bank 2 Event 5 Duration	hh:mm
	Bank 2 Event 6 Week	1-4
	Bank 2 Event 6 Day	Monday to Sunday
	Bank 2 Event 6 Start Time	hh:mm
	Bank 2 Event 6 Duration	hh:mm
	Bank 2 Event 7 Week	1-4
	Bank 2 Event 7 Day	Monday to Sunday
	Bank 2 Event 7 Start Time	hh:mm
	Bank 2 Event 7 Duration	hh:mm
	Bank 2 Event 8 Week	1-4
	Bank 2 Event 8 Day	Monday to Sunday
	Bank 2 Event 8 Start Time	hh:mm
	Bank 2 Event 8 Duration	hh:mm

Serial Communication

The ATS-5335 is a versatile automatic transfer switch controller. As every system has different requirements, refer to drawings specific to your project for

Communication Ports

The ATS-5335 has two serial port options. It can be configured as a Modbus RTU Slave with a RS232 OR RS485 connection. The configuration of the serial port (Connection type, baud rate and Slave ID) can be viewed on the module display on Serial Port screen.

RS232

The RS232 port on the controller supports the Modbus RTU protocol.

RS232 is for short distance communication (max 15m) and is typically used to connect the controller to a telephone or GSM modem for more remote communications.

Many PCs are not fitted with an internal RS232 serial port. APT DOES NOT recommend the use of USB to RS232 convertors. PC add-ons to provide the computer with an RS232 port are available from various suppliers.

The RS232 Port is always configured for 8 data bits, 1 stop bit and no parity.

RS485

The RS485 port on the series controller supports the Modbus RTU protocol.

RS485 is used for point-to-point cable connection of more than one device (maximum 32 devices) and allows for connection to PCs, PLCs, and Building Management Systems (to name just a few devices).

One advantage of the RS485 interface is the large distance specification (1.2km when using Belden 9841 (or equivalent) cable. This allows for a large distance between the module and other devices.

The various operating parameters (such as output volts, currents, etc.) of the remote ATS can be viewed over the RS485 link.

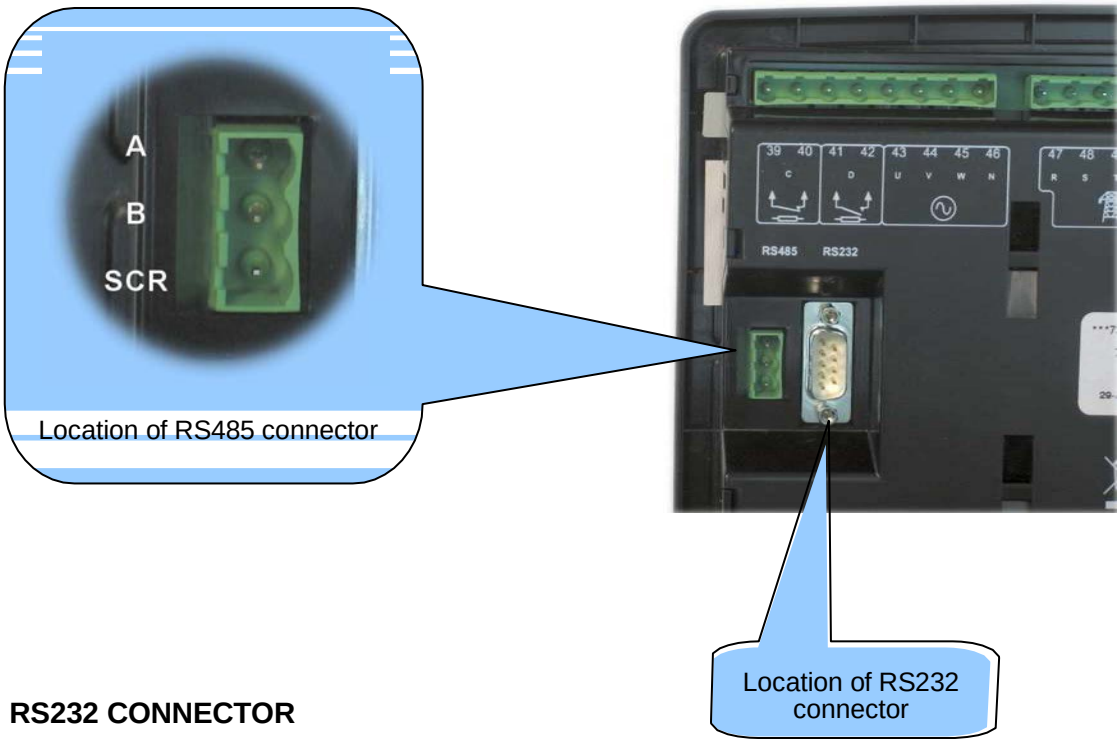
The RS485 Port is always configured for 8 data bits, 2 stop bits and no parity.

*Refer to the ATS-5335 Modbus Register List for your connection type.

Serial Communication

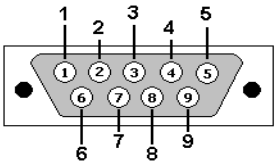
RS485 CONNECTOR

Pin No.	Notes
A (-)	Two core screened twisted pair cable. 120Ω impedance suitable for RS485 use. Recommended cable type - Belden 9841 Max distance 1200 m (1.2 km) when using Belden 9841 or direct equivalent.
B (+)	
SCR	



RS232 CONNECTOR

Pin No.	Notes
1	Received Line Signal Detector (Data Carrier Detect)
2	Received Data
3	Transmit Data
4	Data Terminal Ready
5	Signal Ground
6	Data Set Ready
7	Request To Send
8	Clear To Send
9	Ring Indicator



View looking into the male connector on the module