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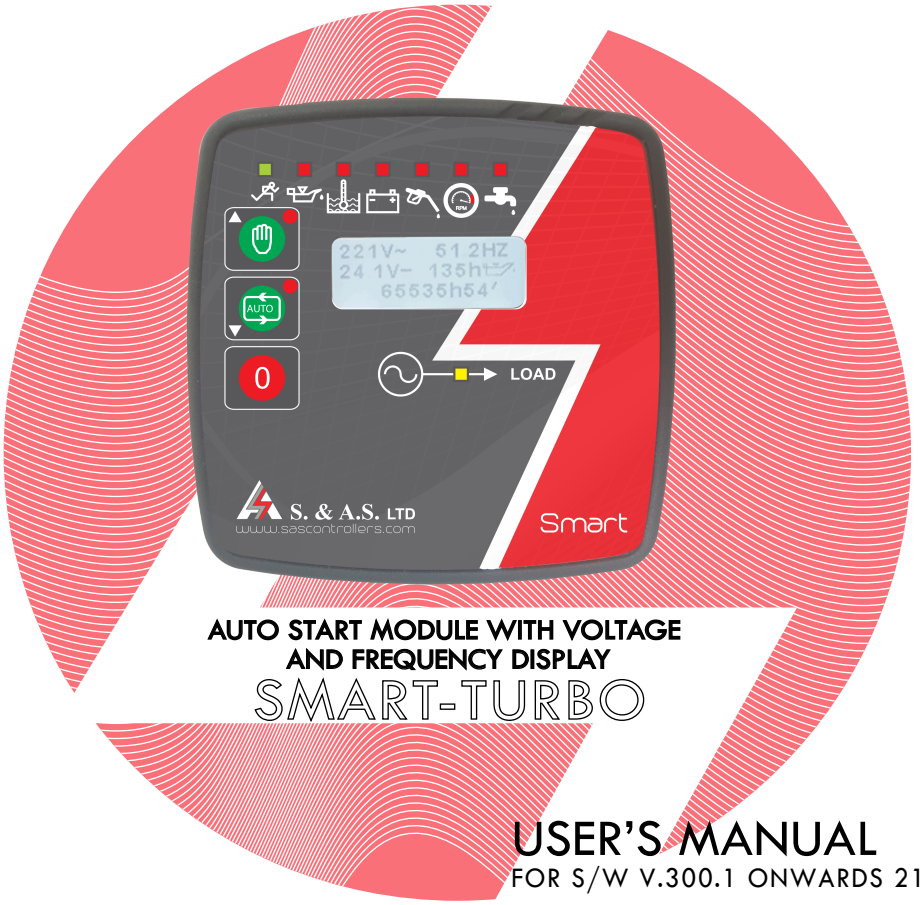
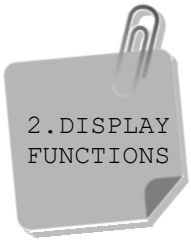


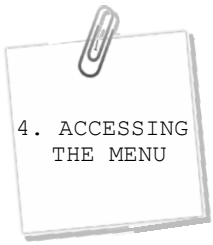
AUTO START MODULE WITH VOLTAGE AND FREQUENCY DISPLAY

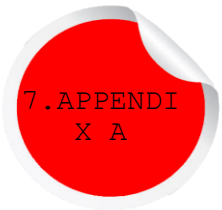
SMART-TURBO

USER'S MANUAL

FOR S/W V.300.1 ONWARDS 2131







1. OVERVIEW

1.1 FEATURES

Microcontroller based design
Operation by 3 push buttons
Easy to fit DIN standard 72x72 panel mount housing
Connection is via locking plug and socket connectors
Solid-state short circuit protected outputs
Simultaneous display of AC voltage, frequency, hour counter, battery voltage and the number of hours since the last oil change
Parameters can be edited and updated at any time even when engine is running
Menu accessible from front panel
Oil change notification alert
Front panel Leds for status and alarm indication
Automatic engine starting and stopping
Automatic shutdown on fault condition
Low oil pressure alarm and shut down
High engine temperature alarm and shut down
Dynamo failure alarm and shut down
Low fuel alarm and shut down
Over/Under speed alarm and shut down
Over/Under voltage alarm and shut down
Over/Under battery voltage alarm and shut down
Coolant level alarm and shut down
General alarm output

1.2 DESCRIPTION

Smart-TURBO is a new addition to the Smart series. It is an intelligent auto start and protection module with frequency display, AC voltage, battery voltage, run hour counter and run hours since the last oil change. Automatic assembly and microcontroller based high integration design resulted in this low-cost yet high performance controller.

1.3 OPERATION

Three modes of operation are provided. Following is a description of each mode:
Stop Mode: In this mode, the engine is shut down along with the module. All faults and alarms are reset.
Auto Mode: In this mode, the genset is ready to start. Starting is controlled by the remote control input. Following is a description of the operation in this mode:

1. The **Remote Control** input receives a start signal (activated by connection to –Vbat).
2. No action is taken until the delay set by **"REPSONSE DEL"** is elapsed.
3. When **"SPARE OP"** is set to **PHEAT**, the preheat relay is engaged via terminal **SPRE OP** for a time delay set in **"PREHEAT DEL"**
4. A starting sequence of a preset number of attempts **"ATTEMPTS NBR"** will initiate.
5. The **Electric Valve** engages 0.25sec before the **Starter**.
6. If the start signal is removed before the engine starts, all timers are reset and the module is ready for a new sequence.
7. Cranking is disconnected when either the frequency on the **Line** and **Neutral** terminals exceeds **"CRANKING DISC.F"** or a voltage exceeding "**DYN CRNK DISC"** (if not set to **BYP**) appears on the **Dynamo** input or the oil pressure switch opens given that **"BYPASS OILP"** is not set to **BYP** and its preset delay has elapsed.
8. If the engine fails to start after the preset number of attempts, a scan of the six red leds is initiated to indicate a start fail. The **Alarm** relay is engaged via terminal **SPRE OP** if **"SPARE OP"** is set to **ALARM**. The **Smart-TURBO** would reattempt starting by selecting the **Stop Mode** then selecting **Auto Mode** or by recycling the remote control signal.
9. After elapse of the warm-up delay, set by **"WARM-UP DEL"**, the load contactor is engaged via terminal **Contactor** and yellow led activated.
10. All protections are enabled when the engine is running and after the elapse of the fault bypass time set by **"FLT BYP TIME"**.
11. Any fault will shut the load down and then shut the engine down and the corresponding led is lit. The **Alarm** output is activated via terminal **SPRE OP** as well if **"SPARE OP"** is set to **ALARM**.
12. When the start signal is removed, the **Smart-TURBO** will shut the load down after the elapse of the delay set by **"OFF DEL"**. The engine is shut down after the elapse of the cooling time set by **"COOLING TIME"**.

Manual Mode: This mode is similar to the **Auto Mode** except that the start signal is internally activated.

2. DISPLAY FUNCTIONS

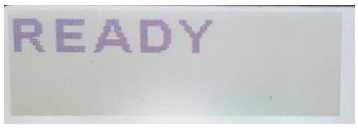
2. DISPLAY FUNCTIONS

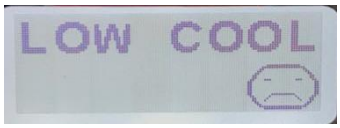
2.1. DISPLAYED PAGES

- The measured values **(Frequency, AC voltage, battery voltage, run hours counter, oil run hours counter and the Software version (VER###. #))** can be shown in a whole page (**DISP.TYPE = Small**) and/or each one in a separate page (**DISP.TYPE = Big**) depending on the **"DISP.TYPE"** selected. To start or stop scrolling between these pages, press the push button of the current operating mode.

- **DISP.TYPE = Small**

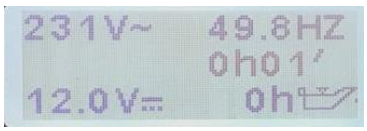
  - Genset Status page showing the genset status and the current fault if existing.





While standing-by for a start signal in **Auto Mode**, the display shows **"READY"** if the genset is ready to start. In case the genset is not ready, the display shows **"NOT READY"**. This could be the result of three causes: oil pressure switch not connected (or damaged), dynamo input sees a voltage exceeding **"DYN CRNK DISC"** or the **Line** and **Neutral** see an ac voltage exceeding 100 volts. If there is no oil pressure switch, set **"BYPASS OILP"** to **BYP**. If there is no dynamo (or dynamo not connected), set **"DYN CRNK DISC"** to **BYP** and **"DYN SHUTDOWN"** to **DIS**. The display will show **"CRANKING"** during cranking and it will also show the countdown of the response, warm-up, load shutdown (off delay) and cooling delays. Following a shutdown due to a fault, the display will show the fault with a sad face"☹".

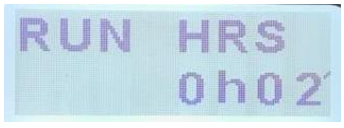
  - Genset page showing simultaneously the genset voltage, frequency, battery voltage, running hours and oil hours.



  - Product page showing simultaneously the SMART board type and the software version and revision.

- **DISP.TYPE = Big**

  Each measured value is shown in a separate page, for example:



3. FRONT PANEL DESCRIPTION

3.1 FRONT PANEL LEDS

- Two red leds are used to indicate the operating mode.
- Genset has one green led. Led OFF means that the genset is not requested to start. Led ON indicates that genset is running and ready to supply the load.
- Six red leds are used to indicate the fault status.
- Genset contactor has one yellow led to show its status.

3.2 DETECTED AND SIGNALED FAULTS AND WARNINGS

3.2.1 WARNINGS

High Engine Temperature Warning occurs when the engine temperature switch is active and the 4 seconds fault delay is still being counted.

The Engine Temperature led ( ) turns on due to an engine temperature switch warning.

Low Coolant Level Warning occurs when the coolant switch is detected active and the 4 seconds delay is being counted. The Coolant Level Led ( ) turns on to indicate this warning.

Low Oil Pressure Warning occurs when the oil pressure switch is detected and the fault delay (2 sec) is being counted. The Oil Pressure led ( ) turns on due to an oil pressure switch warning.

Low Fuel Level Warning occurs when the fuel switch is detected active and the 4 seconds delay is being counted. The Fuel Level Led ( ) blinks to indicate this warning.

Low Dynamo Voltage Warning occurs when the dynamo voltage decreases below the dynamo shutdown voltage set by **"DYN SHUT DOWN"** and the 5 seconds delay is being counted. The Dynamo Voltage ( ) Led turns on to indicate this warning.

Under Frequency Warning occurs when the frequency goes below the values set in **"UNDERFRQ"** and the delay set by **"UNDER FRQ DEL"** is being counted. The RPM led ( ) turns on to indicate this warning.

Oil Change Warning occurs when the hours since last oil change exceed the value set by **"OIL HRS"**. This warning is indicated by the blinking of the Oil Pressure Led ( ). To reset the oil change counter, press simultaneously both **AUTO** and **HAND** push buttons for 2 seconds.

3.2.2 FAULTS

To delete the current fault, press the OFF push button.

Fault	Comments
Fail to start	Genset fails to start after the maximum number of attempts was reached
High Battery	Shuts load and engine after the elapse of the High Battery delay (**HIGH BAT DEL**)
Low Battery	Shuts load and engine after the elapse of the Low Battery delay (**LOW BAT DEL**)
High Engine Temp.	Shuts load and engine due to high engine temperature
Low Coolant Level	Shuts load and engine due to low coolant level
Low Oil Pressure	Shuts load and engine due to low oil pressure
Low Fuel Level	Shuts load and engine due to low fuel level
Low Dynamo Volt	Shuts load and engine due to low dynamo voltage
Genset Over Voltage	Shuts the load and engine after the elapse of the over voltage delay (**OVER VOLT DEL**)
Genset Under Voltage	Shuts the load and engine after the elapse of the under voltage delay (**UNDER VOLT DEL**)
Genset Over Frequency	Shuts the load and engine after the elapse of the over frequency delay (**OVERFREQ DEL**)
Genset Under Frequency	Shuts the load and engine after the elapse of the under frequency delay (**UNDER FRQ DEL**)

Fail to Start Fault occurs when the engine does not turn on after **"ATTEMPTS NBR"** cranking attempts. **"ATTEMPTS NBR"** is set in the menu. The fault is removed when the Remote Control input is recycled. A scan of the six red leds is initiated to indicate a start fail fault and the LCD will show **"START FAIL"** with a sad face"☹".
High Battery Fault occurs when the battery voltage exceeds **"HIGH BAT VOLT"** for a delay set by **"HIGH BAT DEL"**. The Battery led ( ) turns on and the LCD indicates a high battery fault by displaying **"HIGH BAT VOLT"** with a sad face"☹".

Low Battery Fault occurs when the battery voltage drops below **"LOW BAT VOLT"** for a delay set by **"LOW BAT DEL"**. This fault is tested when the engine is not cranking and independent of the fault bypass delay. The Battery led ( ) turns on and the LCD indicates a low battery fault by displaying **"LOW BAT VOLT"** with a sad face"☹".

High Engine Temperature Fault occurs when the engine temperature switch is detected on for 4 seconds. The Engine Temperature led ( ) turns on and the LCD shows **"HIGH ENG TEMP"** with a sad face"☹". Genset goes into cooling if **"HI TEMP COOL"** is set to **ENA**.

Low Coolant Level Fault occurs when the coolant switch is detected active for 4 seconds. The Coolant Level Led ( ) turns on and the LCD shows **"LOW COOL"** with a sad face"☹".

Low Oil Pressure Fault occurs when the oil pressure switch is detected on for 2 seconds. The Oil Pressure Led ( ) turns on and the LCD shows **"LOW OIL PRES"** with a sad face"☹".

Low Fuel Level Fault occurs when the fuel switch is detected active for 4 seconds. The Fuel Level Led ( ) turns on and the LCD shows **"INPUT ERROR"** with a sad face"☹".

Low Dynamo Voltage Fault occurs when the dynamo voltage decreases below the dynamo shutdown voltage set by **"DYN SHUT DOWN"** for 5 seconds. The Dynamo Voltage Led ( ) turns on and the LCD shows **"DYNAMO ERROR"** with a sad face"☹".

Over/Under Voltage Fault occurs when the voltage goes above/below the over/under voltage limits set by **"OVER VOLT"/"UNDER VOLT"** for a delay set by **"OVER VOLT DEL"/"UNDER VOLT DEL"**. The RPM Led ( ) turns on and the LCD indicates an over/under voltage fault by displaying **"OVER/UNDER VOLT"** with a sad face"☹".

Over/Under Frequency Fault occurs when the engine speed goes above/below the values set in **"OVERFREQ"/"UNDERFRQ"** for a delay of **"OVERFREQ DEL"/"UNDER FRQ DEL".** The RPM Led ( ) turns on for an under frequency fault and blinks for an over frequency fault and the LCD shows **"OVER/UNDER FREQ"** with a sad face"☹".

3.3 DESCRIPTION OF STATUS MESSAGES SHOWN ON DISPLAY

Status Message	Description
READY	Genset ready
FAULT	A fault has occurred on the Genset
STARTING IN	Engine counting Response delay with count down
PREHEAT❶	Engine preheating with count down
CRANKING	Engine cranking
NOT READY	Genset not ready
ON LOAD	Engine running on load
SHUTTING LOAD	Engine shutting Load with count down
COOLING	Engine cooling with count down
WARM-UP	Engine warming Up with count down
ENGINE RUNNING	Engine running
LOW BAT VOLT	Low battery fault
HIGH BAT VOLT	High battery fault
START FAIL	Fail to start fault
LOW OIL PRES	Low oil pressure fault
HIGH ENG TEMP	High engine temperature fault
INPUT ERROR	Input fault
OVER VOLT	Genset over voltage fault
UNDER VOLT	Genset under voltage fault
OVER FREQ	Genset over frequency fault
UNDER FREQ	Genset under frequency fault
LOW COOL	Genset coolant fault
ENGINE STOP	Genset Emergency stop
DYNAMO ERROR	Genset dynamo fault
OP OC START	Starter output fault
OP OC EV	EV output fault
OP OC CONT	Contactor output fault
OP OC SPARE	Spare output fault
S. TURBO VER —.-	Software version with revision number
OIL HRS	Oil hours number
RUN HRS	Hourmeter

❶ Available only if "**SPARE OP**" is set to Preheat

4. ACCESSING THE MENU

The menu is accessed by pressing either **AUTO** or **HAND** push buttons for 3 seconds. Once in menu mode (i.e. scrolling the menu and editing parameters), the **AUTO** and **HAND** and **STOP** push buttons will no longer affect the operating mode of the **Smart-TURBO** controller. The **AUTO** push button scrolls down the menu and decrements values. The **RUN** push button scrolls up the menu and increments values The **STOP** push button selects the menu item for editing and memorizes the new value. If no buttons are pressed for 25 seconds, the **Smart-TURBO** will automatically exit the menu mode.

4.1 MENU DESCRPTION

Display	Description	Range	Factory Setting
RESPONSE DEL	Response delay	0 to 255sec	5sec
PREHEAT DEL❶	Preheat delay	0 to 255sec	5sec
STARTER TIME	Starter time	0 to 255sec	5sec
BET.TRIAL TIME	Time between trials	0 to 255sec	12sec
MAINTAIN EV	Maintain Electric Valve	0 to (BET.TRIAL TIME-1)	0sec
ATTEMPTS NBR	Number of starting attempts	0 to 255	3
FLT BYP TIME	Fault bypass delay	0 to 255sec	15sec
WARM-UP DEL	Warm-up delay	0 to 255sec	10sec
OFF DEL	Load shutdown delay (Off delay)	0 to 255sec	10sec
COOLING TIME	Engine cooling time	0 to 255sec	5sec
CRANKING DISC.F	Crank disconnect frequency set point	0 to 255Hz	15Hz
OVERFREQ	Over frequency set point or disables over frequency	DIS, 1 to 255Hz	55Hz
OVERFREQ DEL	Over frequency delay	0 to 255sec	2sec
UNDERFRQ	Under frequency set point or disables under frequency	DIS, 1 to 255Hz	45Hz
UNDER FRQ DEL	Under frequency delay	0 to 255sec	5sec
OVER VOLT	Over voltage set point	DIS, 1 to 255V	DIS
OVER VOLT DEL	Over voltage delay	0 to 255sec	3sec
UNDER VOLT	Under voltage set point	DIS, 1 to 255V	DIS
UNDER VOLT DEL	Under voltage delay	0 to 255sec	5sec
CT RATIO	Current Transformer ratio	0/5 to 9999/5	100
OVERLOAD	Overload %	DIS, 1 to 255%	90%
OVERLOAD DEL	Overload delay	0 to 99 sec	10sec
HIGH BAT VOLT	High Battery	DIS, 1 to 33V	30
HIGH BAT DEL	High Battery Delay	0 to 255sec	3sec
LOW BAT VOLT	Low Battery	DIS, 1 to 33V	8
LOW BAT DEL	Low Battery Delay	0 to 255sec	2sec
SOLENOID	Selects energize to run or energize to stop by setting time for stop solenoid. When energize to stop, if **SPARE OP** is not set to **CUTOF,** the **Electric Valve** terminal will operate as cut off solenoid output.	RUN, 1 to 255sec	RUN
HI TEMP COOL	Selects whether to enable cool down after high temperature/Overload shutdown	DIS, ENA	ENA
BYPASS OILP.	Selects whether to permanently bypass the Oil pressure switch for crank disconnect or whether to bypass it for a preset delay	BYP, 1 to 5sec	1sec
OILP SENS	Oil Pressure Sensor type	V1=VDO type 1 V5=VDO type 2 MU=Murphy TNE	V1
LOW OPS PREA.	Low Oil Pressure Pre-alarm	DIS, 1 to 255 PSI	DIS
LOW OPS ALA.	Low Oil Pressure Alarm	DIS, 1 to 255 PSI	DIS
TEMP SENS	Engine Temperature Sensor type	V1=VD0-1 V2=VD0-2 MU=Murphy PT=PT100 TNE	V1

❶ *Available only if "SPARE OP" is set to Preheat*

4. ACCESSING THE MENU

Display	Description	Range	Factory Setting
HI ETS PREA.	High Engine Temp Pre-alarm	DIS, 1 to 255 °C	DIS
HI ETS ALA.	High Engine Temp Alarm	DIS, 1 to 255 °C	DIS
DYN CRNK DISC	Selects whether to permanently bypass the dynamo for crank disconnect or sets the voltage above which cranking stops	bYP, 10 to 26Volts	BYP
DYN SHUT DOWN	Selects whether to disable the dynamo shutdown or sets the voltage below which there will be a dynamo shutdown	DIS, 5 to 10Volts	5Volts
LOW COOL LOGIC	Low coolant input polarity logic	NO, NC	NC
SPARE OP	Selects whether the spare output is used as alarm, preheat or cutoff When **CUTOF** is selected, Cutoff time must be set in the **SOLENOID** parameter. In this case, **Electric Valve** output will retain its standard function.	ALARM PHEAT CUTOF	ALARM
DISP.TYPE	Selects the display mode of the measurements BOTH: The measured values are shown in 2 whole pages and each one in a separate page. BIG: displays a page for each measured value. SMALL: The measured values are shown in 2 whole pages. KWh value is shown in a separate page	BOTH, BIG, SMALL	BOTH
CONTRAST	LCD Display Contrast	0 to 63	7
OIL HRS	Sets the number of hours before alerting for an oil change	DIS, 1 to 255hours	150
HR. METER	Edits the run hour counter❷	0 to 65530	0 ❸
FACTORY RST	Load Factory settings❷	---	---
VIEW FAULTS	View Fault Log ❹	---	---
ERASE FLTS	Erase Fault Log ❹	---	---
EXIT	Exit the menu	---	---

❷ A three digit password (000) is required to access the hour counter or Kwh or to reset factory settings. Display shows E on the leftmost digit. Use the **HAND** (increment) and **AUTO** (decrement) push buttons to scroll to the desired number, use the **STOP** push button to select the digit. When the digit is entered, it is replaced by C. Repeat the previous steps for the second and third digit of the password. If the entered password is correct and it was an hour/Kwh counter modification order, the most significant digit of the hour/Kwh counter will start blinking. Use the **HAND** (increment) and **AUTO** (decrement) push buttons to scroll to the desired number, use the **STOP** push button to select the digit. When the digit is entered the next digit starts to blink. If the entered password is correct and a factory settings reset was requested, select YES in order to confirm the reset.

❸ Not affected after a load factory settings.

❹ Viewed and accessed only when at least one fault is already saved.

5. TECHNICAL SPECIFICATION

5.1 SPECIFICATION

Operating voltage	8 to 28vdc
Signal voltage range	50 to 250vac
Outputs	1A 50V
Dimensions (WidthxHghtxDepth)	72x72x32 mm

6.2 ABSOLUTE MAXIMUM RATINGS

Supply voltage	8-30Vdc
Supply voltage	8-30Vdc
Signal voltage	280vac
Outputs	1.4A
Operating temperature	-30 to 70˚C

6.
FIRMWARE
UPGRADE

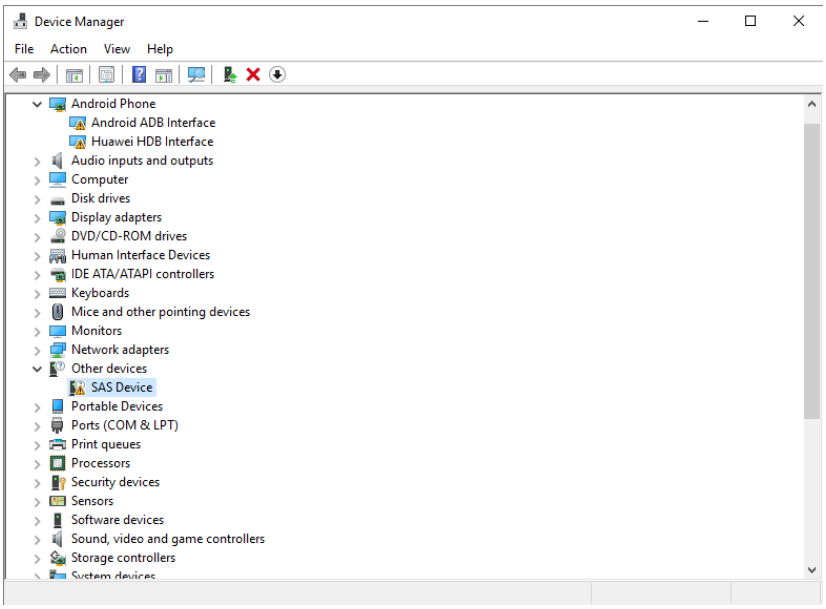
6. FIRMWARE UPGRADE❶

6.1 FIRMWARE UPGRADE USING PC

1. Plug in the USB cable to the SMART device before turning power on
2. Turn on power of the SMART device. All the LEDs on the front start blinking.
3. Please visit http://www.sascontrollers.com/applications and choose SAS Firmware Upgrade Driver or through the SASPTool desktop application.

6.1.1 INSTALLING THE SAS DEVICE USB DRIVER❷

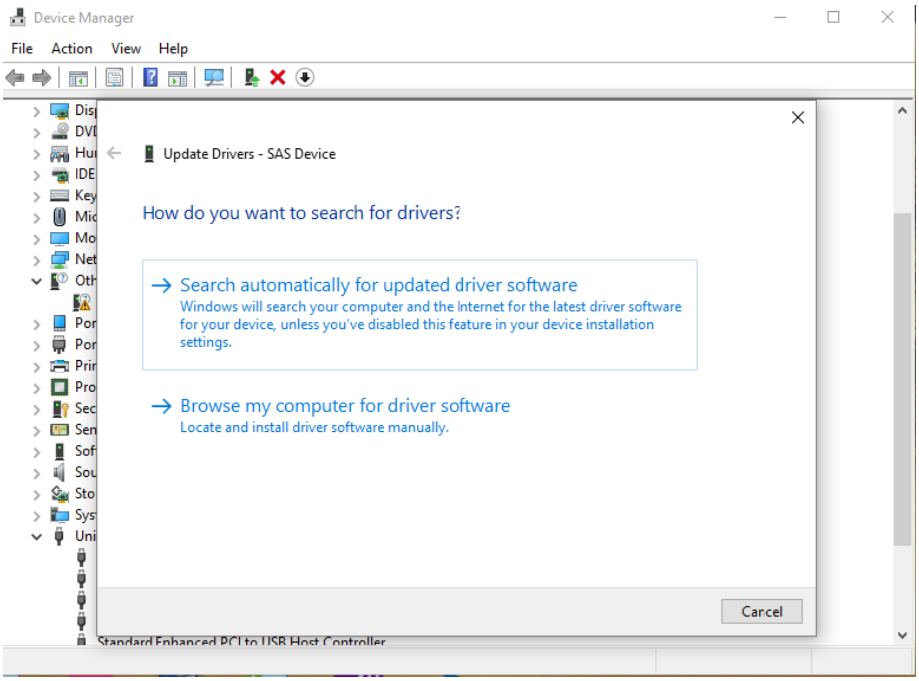
The first SMART plugged into the PC USB port may not launch an automatic start. In this case, right-click my computer and choose properties. On the left side of the window, click on Device Manager.
The "SAS DEV" device will appear in Other Devices, right-click it and choose "Update Driver Software".

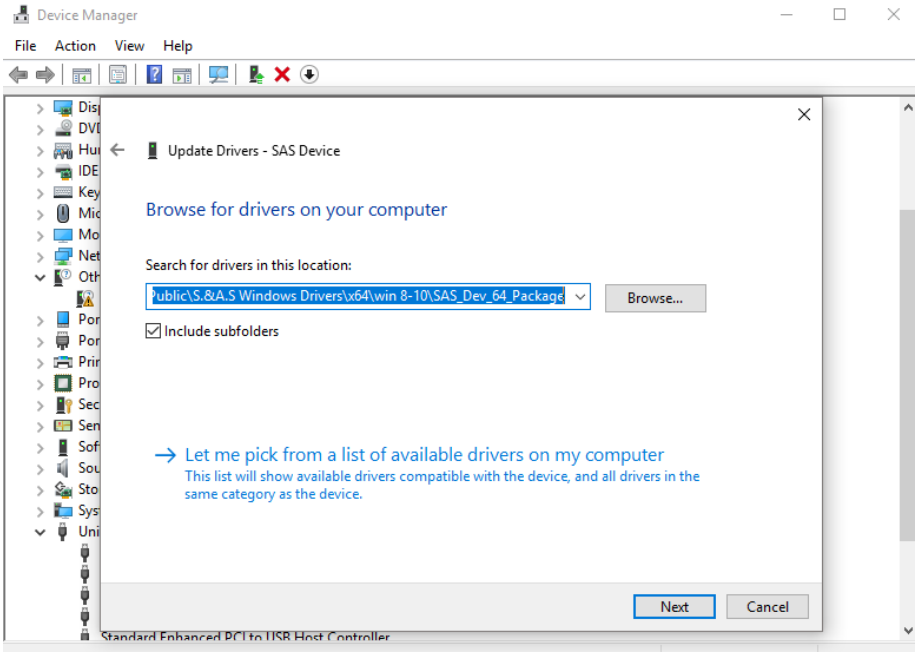


❶ Firmware upgrade is not applicable in Software version SGT10B302_TURBO_STM103C6.

❷ This will be implemented only one time when the first SMART is connected to PC through USB

Select "browse my computer" and select the downloaded windows driver.





The Driver SETUP procedure will be done only once for Windows.
So, the driver of any new SMART connected to the PC USB port will be installed automatically.

6.
FIRMWARE
UPGRADE

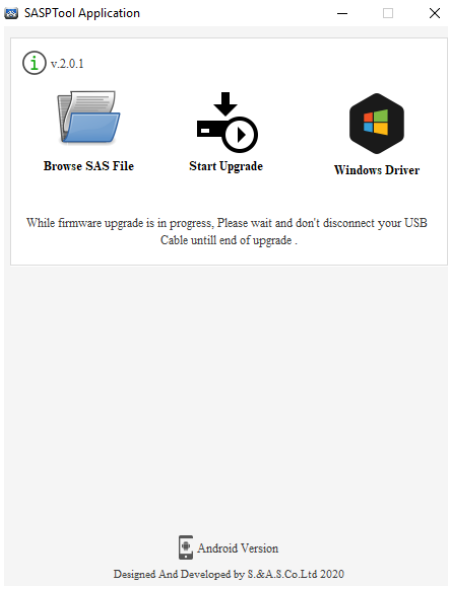
6.1.2 INSTALLING THE FIRMWARE UPGRADE SOFTWARE

In order to upgrade firmware on site, visit http://www.sascontrollers.com/applications and choose Desktop Firmware Upgrade App.

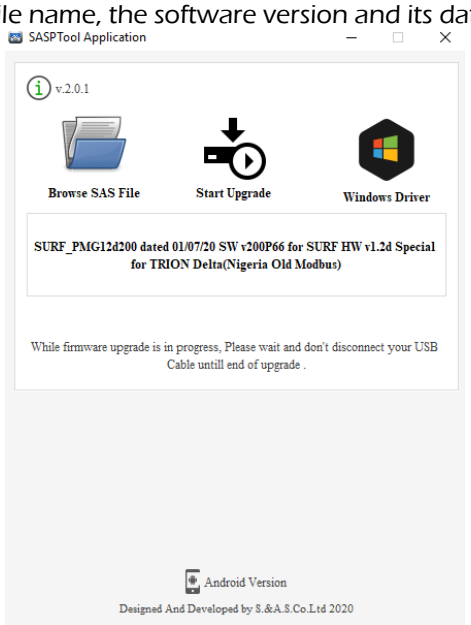
1. 64 and 32 bit folder will be downloaded respectively.
2. Run the executable file.

6.1.3 FIRMWARE UPGRADE PROCESS

Run "SAS_PTool v.2.0" application.

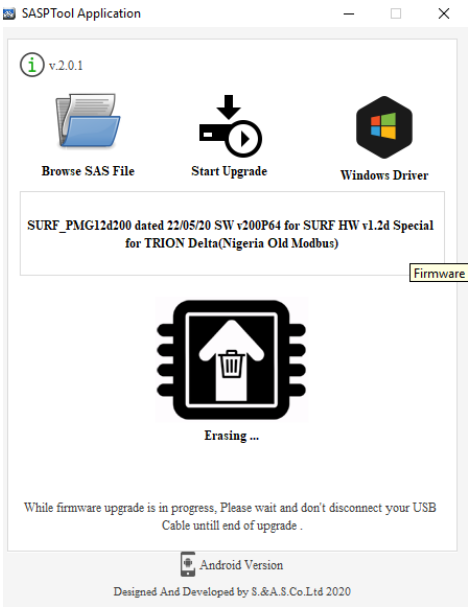


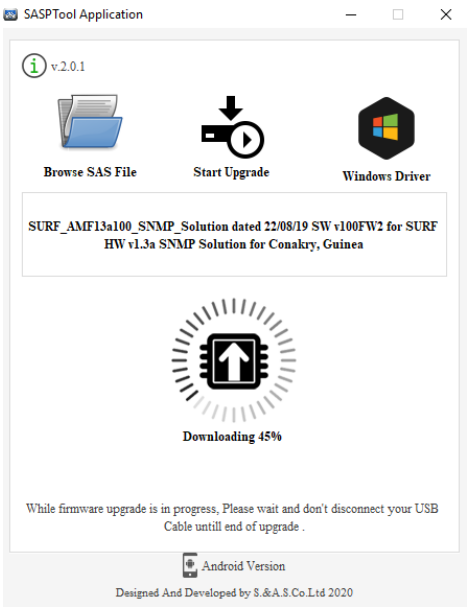
Click Browse SAS File button to choose the *.sas file that will be used to upgrade the firmware.
A Footnote will appear showing the file name, the software version and its date:



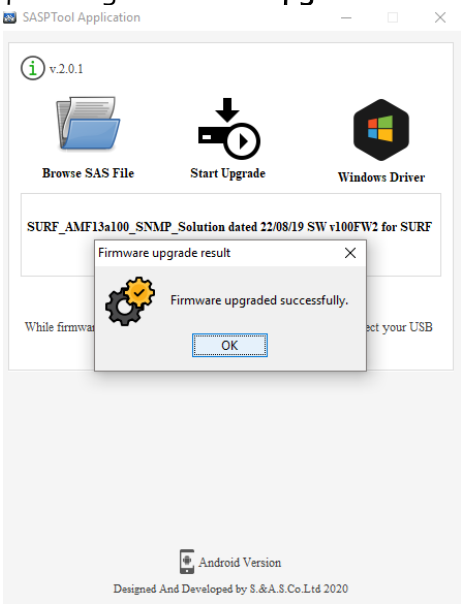
Click "Start Upgrade". The upgrade progress is shown as below:

6. FIRMWARE UPGRADE





Once the upgrade is complete, a popup message **"Firmware upgraded successfully"** will appear:



The firmware is upgraded successfully and the SMART will automatically restart.

6. FIRMWARE UPGRADE

6.2 FIRMWARE UPGRADE USING GOOGLE STORE ON SMART PHONE

6.2.1 INSTALLING THE SASPTOOL FIRMWARE APPLICATION ON THE MOBILE

Search for the application "SASPTool" on google store and install it, or follow the link below: https://play.google.com/store/search?q=SASPTool.

6.2.2 FIRMWARE UPGRADE PROCESS

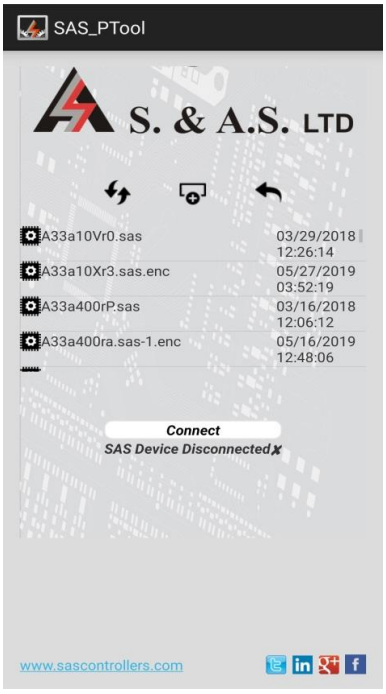
In order to upgrade firmware from a mobile, follow the below steps:

1. Run "SAS_PTool" application from the mobile.

The below window appears showing all *.sas files already saved.

2. Power off the SMART board
3. Use a USB cable to connect board to the mobile.
4. Turn SMART on.

The following window will appear:

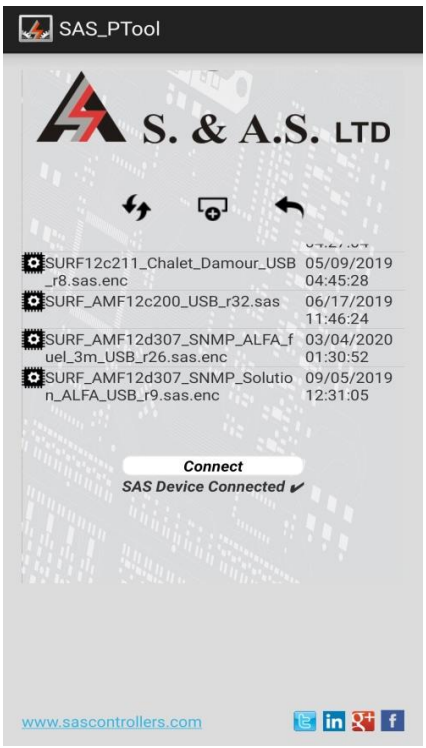



Press this button to refresh the firmware list.


Press this button to create SAS folder.

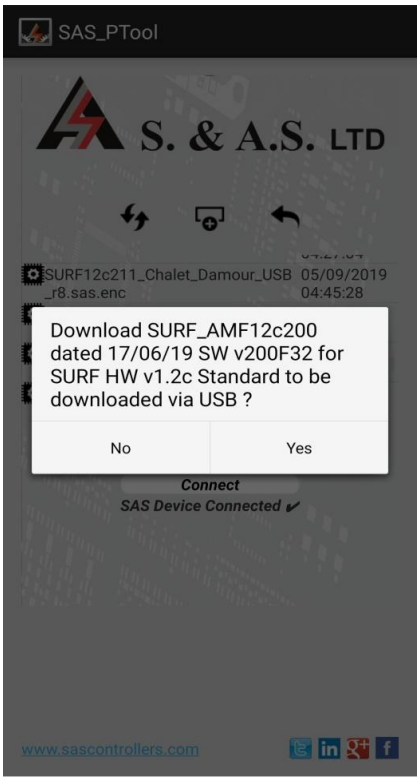

Press this button to go back one directory.

5. Click on the Connect button. The following window will appear showing that a SAS Device is now connected:



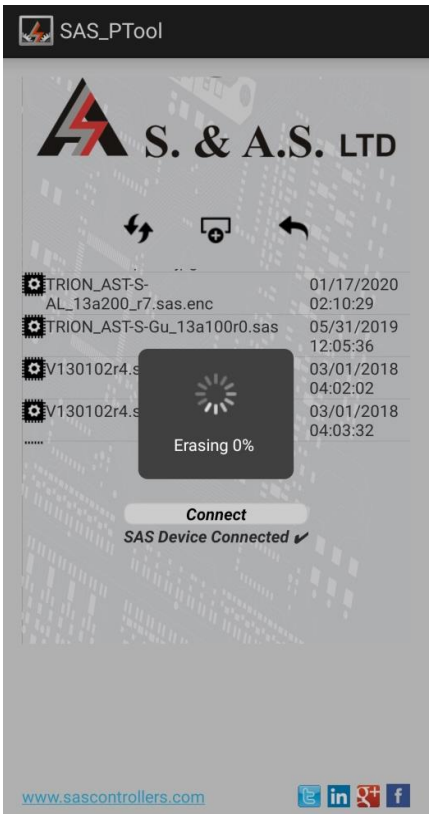
6. Click on the SAS file that you need to download.

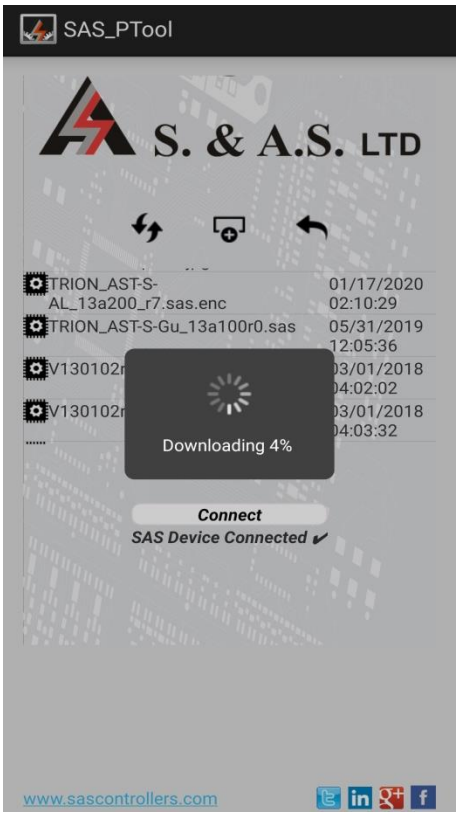
A Popup window will appear showing the file name, its description and its date:



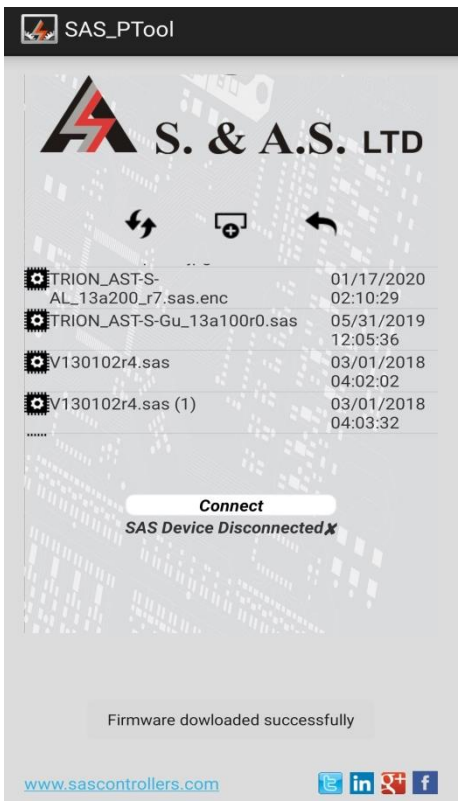
6. FIRMWARE UPGRADE

7. Click Yes. The download will start:

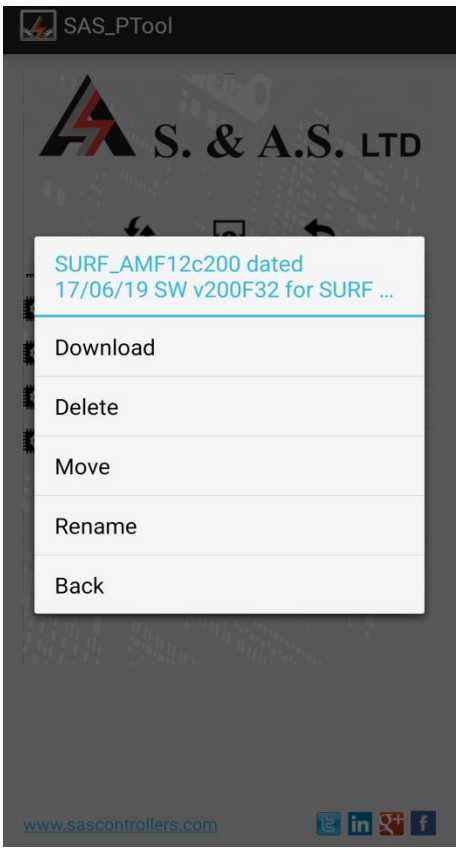




Once the download is complete, the message "Firmware Downloaded successfully" will appear:

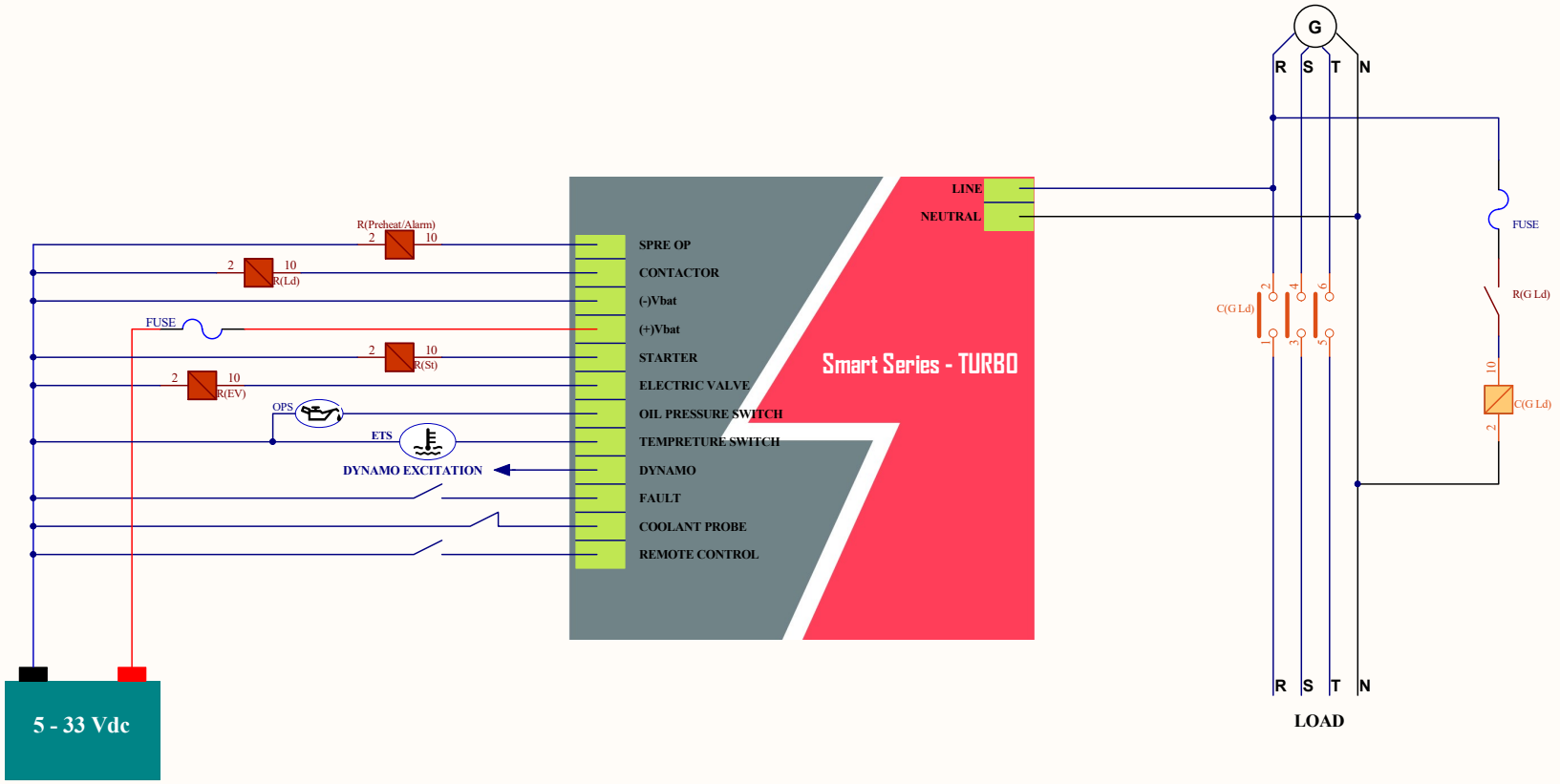


8. Disconnect the USB cable.
   If you desire to delete any SAS file from the mobile list, press on the filename until a Popup window appears showing you multiple choices and then click on Delete.



7. APPENDIX A

This section contains the wiring diagram of the SMART- TURBO



NB: R(Preheat/Alarm), R(Ld), R(St) and R(EV) relays should all be DC relays with their coil voltage equal to the battery voltage

WHICH GENERATOR CONTROLLER IS RIGHT FOR YOU?

	Smart Turbo v1.2	Smart GT v1.0	Surf LT v1.0	Surf 1.2c
				
Automatic engine starting and stopping	✓	✓	✓	✓
Automatic mains failure	—	—	✓	✓
User Access	3 Push Buttons	3 Push Buttons	8 Push Buttons	5 Push Buttons
Dimensions (WidthxHeightxDepth)	72x72x32 mm	72x72x32 mm	208x160x32 mm	196x144x33 mm
Panel cut out	68.5x68.5 mm	68.5x68.5 mm	184x139 mm	182x137 mm
Number of Phases	1 Phase	1 Phase	1phase/3Phases	1phase/3Phases
Digital Outputs	4	4	6	10
Digital Inputs	5	5	5	5
Analog Inputs	—	2	4	4
Voltage Measurement	1 L-N	1 L-N	3 L-N, 3L-L	3 L-N, 3L-L
Frequency Measurement	✓	✓	✓	✓
Current Measurement	—	✓	✓	✓
Power Measurement	—	✓	✓	✓
Energy Measurement	—	✓	✓	✓
Run hours counter	✓	✓	✓	✓
Oil run hours counter	✓	✓	✓	✓
Over / Under voltage alarm and shut down	✓	✓	✓	✓
Over / Under frequency alarm and shut down	✓	✓	✓	✓

	Smart Turbo v1.2	Smart GT v1.0	Surf LT v1.0	Surf 1.2c
				
Overload alarm and shut down	—	✓	✓	✓
Low oil pressure alarm and shut down	✓	✓	✓	✓
High engine temperature alarm and shut down	✓	✓	✓	✓
Battery alarm	✓	✓	✓	✓
Dynamo fail alarm and shut down	✓	✓	✓	✓
Low coolant level alarm and shut down	✓	✓	✓	✓
Low fuel alarm and shut down	✓	✓	✓	✓
Tank Empty alarm and shut down	—	—	✓	✓
Automatic shutdown on fault condition	✓	✓	✓	✓
Solid-state short circuit protected outputs	✓	✓	✓	✓
Galvanic isolation for utility and Genset AC inputs	—	—	—	✓
Oscilloscope	—	—	✓	—
Faults Logging	—	Up to 10 faults	Up to 15 faults	Up to 100 faults

	Smart Turbo v1.2	Smart GT v1.0	Surf LT v1.0	Surf 1.2c
				
EVENTS AND DATA LOGGING	–	–	–	✓
USB interface	✓	✓	✓	✓
CAN Module (J1939 Protocol)	–	–	Optional	✓
Ethernet Module	–	–	–	✓
RS485 (Modbus)	–	–	Optional	✓
MicroSD Card	–	–	–	✓
SMS via GSM Module (RS232 Interface)	–	–	–	✓
On-site Firmware Upgrade	✓	✓	✓	✓
Remote Online Firmware Upgrade	–	–	–	✓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