ATS2.0
Automatic Transfer Switch Controller

User manual for OEM

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This document contains all necessary information to understand and apply ATS2.0 transfer switch controller for its intended applications. Please take necessary precautions to read the warning and caution notes to make sure that; your application runs without any risk of failure.

1- Table of Contents

2- INTRODUCTION:

This document contains all the technical information, which is required for installation. Users should carefully read and observe all the information given in this document before making live connection to the control unit.

ATS group of controllers are mainly used for transferring load between the two bus-bars, such as Utility (Mains) and Generator, also provide necessary protection for both load and the generating system.

Throughout this document, there are various warning signs and caution signs, where user should be careful to observe. These signs indicate that; user should understand the conditions where serious health and physical damage can occur. If such conditions are faced, user should consult the factory or the authorized distributor.

The signs are shown below and should be observed carefully by the user:

CAUTION SIGN

WARNING SIGN

Since this document is delivered together with the device, it cannot be updated. As our intention is continuous improvement, please call the factory or visit company web site: www.enkoelektronik.com for the latest user manuals.

3- GENERAL DESCRIPTION:

ATS controllers are designed as **Automatic Transfer Switch** control devices, where the load can be switched between two independent bus-bars, depending on which bus-bar is active and has capability to feed the load. One of the bus-bars can be fed from a gasoline or diesel powered electric generator system and ATS2.0 will send all necessary signals to start and stop the generator and control the circuit breakers.

ATS2.0 controller can be placed away from the generator location, in order to reduce the complexity of controlling load power feed in existing installations, reducing the need for additional wiring and labor.

It is mechanically easy to install and electrically easy to connect. Front panel design helps user to control the functions easily and monitor system variables at the same time. Its *'easy-to-understand'* front panel design allows user to control bus-bar circuit breakers both manually and automatically.

In the ATS family of controllers, there are 3 devices and the main distinguishing features are:

- ATS2.0 range has 3 phase Utility and Generator voltage and frequency measurement, including programmable auxiliary input and output ports (i/o) and also phase sequence protection on Utility and Generator bus-bars,
- ATS1.0 and ATS1.1 are featured for more economic applications, where utility is measured in 3 phases but the generator side is measured in single phase and there is 1 set of auxiliary port for user to program. There is no phase sequence protection in these models,

All bus-bar voltage limits can be programmed independently and the unit can be used for both single phase and three phase applications. Controller offers test modes to be performed both with and without load. Comprehensive timing functions ensure stable control of bus-bar voltages and also make sure that; load is switched safely between the two bus-bars.

4- TECHNICAL SPECIFICATIONS:

General **Technical Specifications** of ATS transfer switch controllers are given below. Please note that; these specifications cover all family members and for specific models, ensure to read the correct data from the below table:

4.1 POWER SUPPLY INPUT SPECIFICATIONS:

Power supply input (nominal):	12Vdc/24Vdc
Minimum DC supply voltage:	9.0Vdc continuous
Maximum DC supply voltage:	33Vdc continuous
DC supply current:	80mA with the display and warning signals switched on at 12Vdc supply voltage
Reverse connection protection:	-36Vdc continuous

4.2 GENERATOR VOLTAGE SENSING INPUTS:

Number of phases measured:	3 phases and Neutral (ATS2.0) 1 phase and Neutral (ATS1.0 and ATS1.1)
Measurement concept:	True RMS measurement on all phases
Measured harmonics content:	Harmonic content of generator voltage is measured up to 11th harmonic with 1% accuracy
Reading accuracy: (ATS2.0)	±1% of full scale reading for phase-neutral measurement ±2% of full scale reading for phase-phase measurement
Reading accuracy: (ATS1.0 and ATS1.1)	±1.5% of full scale reading for phase-neutral measurement ±3% of full scale reading for phase-phase measurement
Resolution:	1Vac for phase-neutral reading 2Vac for phase-phase reading
Input impedance:	500KΩ phase-neutral
Maximum allowed earth voltage offset:	50Vac (max)
Measurement range:	100Vac to 300Vac phase-neutral measurement 150Vac to 500Vac phase-phase measurement
Frequency measurement:	Minimum 5Hz Maximum 99Hz

Frequency measurement accuracy:	±0.2 Hz
Frequency measurement resolution:	0.1 Hz

4.3 UTILITY VOLTAGE SENSING INPUTS:

Number of phases measured:	3 phases and Neutral (on all models)
Measurement concept:	True RMS measurement on all phases
Measured harmonics content:	Harmonic content of generator voltage is measured up to 11th harmonic with 1% accuracy
Reading accuracy: (ATS2.0)	±1% of full scale reading for phase-neutral measurement ±2% of full scale reading for phase-phase measurement
Reading accuracy: (ATS1.0 and ATS1.1)	±1.5% of full scale reading for phase-neutral measurement ±3% of full scale reading for phase-phase measurement
Resolution:	1Vac for phase-neutral reading 2Vac for phase-phase reading
Input impedance:	500KΩ phase-neutral
Maximum allowed earth voltage offset:	50Vac (max)
Measurement range:	100Vac to 300Vac phase-neutral measurement 150Vac to 500Vac phase-phase measurement
Frequency measurement:	Minimum 5Hz Maximum 99Hz
Frequency measurement accuracy:	±0.2 Hz
Frequency measurement resolution:	0.1 Hz

4.4 DIGITAL INPUTS:

Number of digital inputs:	3 programmable auxiliary inputs (ATS2.0 models) 1 programmable auxiliary input (ATS1.0 and ATS1.1 models)
Maximum input voltage:	DC supply positive terminal voltage
Minimum input voltage:	DC supply negative terminal voltage
Input type:	Single ended, “active high” or “active low” (programmable)

High level threshold:	Internal pull-up, >60% of DC supply voltage level
Low level threshold:	<40% of DC supply voltage level
Open circuit voltage:	DC supply voltage level
Minimum transition time:	<200mS
Minimum sourcing current form the input terminal:	2.5mA for 12Vdc operation 5.0mA for 24Vdc operation
Terminal arrangement:	Screw type plug-in terminals for connection. Cable connection 1.5mm²

4.5 DIGITAL OUTPUTS

4.5.1 CONFIGURABLE DIGITAL OUTPUTS:

Number of configurable digital outputs:	2 programmable auxiliary outputs
Type of output:	Dry contact relay output
Common terminal:	Single common terminal for both outputs
Contact rating:	6A/12-24Vdc rating for each contact (total common terminal current rating is 10A)
Relay position:	N/O contacts
Terminal arrangement:	Screw type plug-in terminals for connection. Cable connection 1.5mm²

4.5.2 FIXED FUNCTION DIGITAL OUTPUTS:

Number of fixed function digital outputs:	2
Type of output:	Dry contact relay output
Common terminal:	Single common terminal for both outputs
Contact rating:	6A/12-24Vdc rating each contact (total common terminal current rating is 10A)
Relay position:	N/O contacts
Output functions:	Engine crank relay output (remote start signal output) Fuel/Stop solenoid control output

Terminal arrangement:	Screw type plug-in terminals for connection. Cable connection 1.5mm²

4.5.3 CIRCUIT BREAKER CONTROL OUTPUTS:

Number of digital outputs:	2
Type of output:	Dry contact relay output
Common terminal:	No common terminal. Each output is galvanically isolated dry contact relay output
Contact rating:	10/250Vac rating each contact
Relay position:	N/O contacts
Output functions:	Control of Mains Circuit breaker (MCB) Control of Generator Circuit breaker (GCB)
Terminal arrangement:	Screw type plug-in terminals for connection. Cable connection 1.5mm²

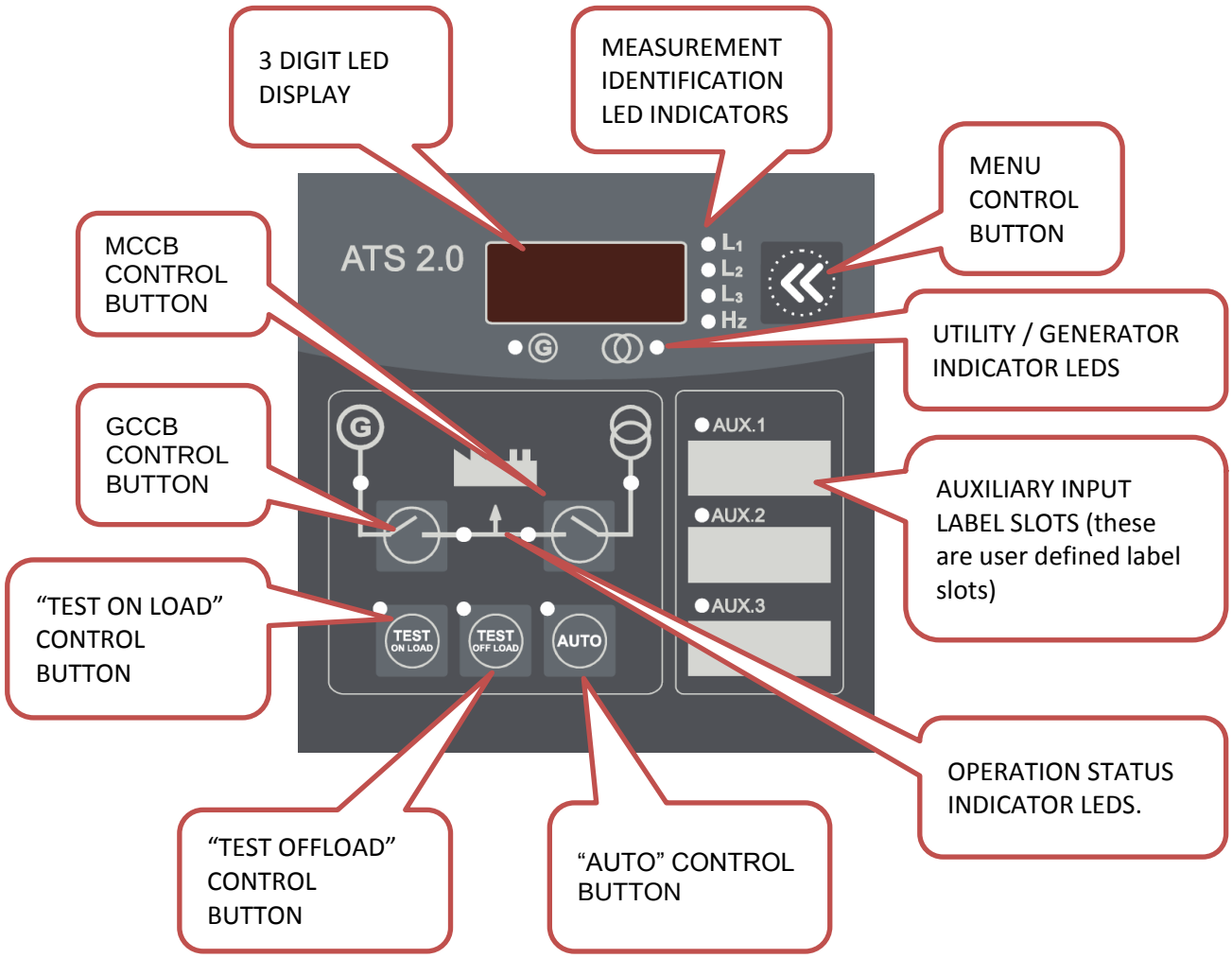
THE RELAY TYPE DIGITAL OUTTPUTS ARE NOT PROTECTED AGAINS SHORT CIRCUIT. PRECAUTION SHOULD BE TAKEN TO MAKE SURE THAT; THESE OUTPUTS ARE NOT SHORTED WHEN CONNECTED TO POWER. IF SHORTED, THE CONTACTS MAY GET DAMAGED.

PROGRAMMABLE DIGITAL OUTPUTS AUX-OUT1 AND AUX-OUT2 HAVE A COMMON INPUT TERMINAL AND CARE SHOULD BE TAKEN WHEN CONNECTING THESE AUXILIARY OUTPUTS. SAME VOLTAGE WILL BE FED THROUH BOTH AUXILIARY OUTPUTS DUE TO THE COMMON MODE CONNECTION.

5- FRONT PANEL ARCHITECTURE:

The front panel design of ATS2.0 family allows the user to monitor system variables easily and also control necessary functions. Front panel view is given in figure 1 below:

Figure: 1



5.1 Digital display:

1-	Digital display description:	The digital display is designed as 3 digit LED type display with red color for easy and comfortable reading. This display is used for reading all system variables, voltage values of both Utility and Generator and all program parameters are also displayed; The display decimal point indicates frequency reading with 1/10 resolution. All voltage readings are displayed as 3 digit values with a resolution of 1Vac. The following values can be read from the display: - Mains phase-phase voltage of each phase - Mains phase-neutral voltage of each phase - Mains frequency - Generator phase-phase voltage of each phase - Generator phase-neutral voltage of each phase - Generator frequency - Password - All parameter numbers - All parameter values - Alarm codes
2-	Display functions:	The display can be set to display any variable on the display as described above. This is done by the “menu roll” button placed on the right hand side of the display. By depressing this button momentarily, the variables can be displayed one at a time, given in the description list above. The display readings are also linked with the LED indicators which are placed around the display viewing area. These LED indicators show which value is being read. The reading of display values are organized according to the table given below: 1- L1 is on: Phase-neutral voltage value of phase L1 2- L2 is on: Phase-neutral voltage value of phase L2 3- L3 is on: Phase-neutral voltage value of phase L3 4- L1,L2 are on: Phase-phase voltage value of phases L1 and L2 5- L2,L3 are on: Phase-phase voltage value of phases L2 and L3 6- L1,L3 are on: Phase-phase voltage value of phases L1 and L3 7- Hz is on: Frequency value of Generator or Utility

3-	Generator and Utility bus-bar readings:	The above display readings are also grouped according to the LED indicators placed on the lower side of the display area. These two LED indicators show whether shown values belong to Generator bus-bar or Utility bus-bar. These LED indicators are labeled with their corresponding icons.

If ATS2.0 is programmed as single phase operation (L1 and Neutral connection only), you can only monitor the phase-neutral voltage and the frequency values on the display. Therefore; by depressing the MENU button for viewing data, unit will switch between phase-neutral voltage and frequency readings only.

5.2 Display parameter indicators:

	This icon LED indicates that; all display readings belong to Generator bus-bar.
	This icon LED indicates that; all display readings belong to Utility (Mains) bus-bar.

5.3 Control Buttons:

	**Automatic Mode Selection button:** When AUTO button is de-pressed, AUTOMATIC operation mode is resumed and unit starts working in this mode. When this mode is activated, the LED indicator lamp is lit. This button also serves to shift the active digit positions in the *"Parameter Adjust mode"* in order to adjust the required digit value. *"Automatic Operation"* mode is explained later in this user manual.

	**Test-On-Load selection button:** When TEST-ON-LOAD button is de-pressed, the control unit goes into Test-On-Load operation function. The function LED is lit and controller sends remote start signal to generator. The operation characteristics of this function depends on the selected parameters and explained in detail in the following chapters This button also acts as “Decrement” button, when entering the password. This function is explained in detail further in this user manual.
	**Test-Off-Load selection button:** When TEST-OFF-LOAD button is de-pressed, control unit will resume this function and the diesel generator will start without connecting the load. The operation characteristics of this function depends on the selected parameters and explained in detail in the following chapters This button also acts as *“Increment”* button, when entering the password. The detailed function is explained further in this manual.

	**Menu select button:** MENU button is a multi-function button. Depending in which operation it is used, it performs different functions. In the “AUTO”, “TEST-ON-LOAD” and “TEST-OFF-LOAD” modes, the MENU button serves to roll the display values and user can view all the available readings for Utility and for the Generator bus-bars. Each time the MENU button is de-pressed; next available display reading is placed on the display and stays there until this button is pressed again. If MENU button is not pressed again, the display keeps displaying the same selected value all the time. Therefore; this can be used for locking any desired display reading, until another value is desired. If the control unit is in the **“OFF”** mode, pressing the MENU button will place the unit into the “PASSWORD” mode. The required password can then be entered by using: - TEST-ON-LOAD button = decrement function - TEST-OFF-LOAD button = increment function
 	**OFF Button:** OFF button is a combined function button. When both “MENU” and “TEST-OFF-LOAD” buttons are pressed together at the same time, the controller will go into OFF mode operation. In this mode, the controller will not function and stay in disabled mode (SLEEP MODE) OFF Mode has to be selected if the user wants to adjust parameters in the system menu. While in OFF mode, if MENU button is pressed, the controller will enter into PASSWORD mode and following the correct password, user can select and change any parameter value as required. MCB can also be controlled during OFF mode operation and how this function works is explained in detail in the “OPERATION Modes” chapter of this user manual. If OFF Button is pressed while in PARAMETER programming mode, the unit will automatically escape from the parameter programming mode and go into OFF mode (sleep mode).

Fault Reset function button:	**Alarm Reset Button:** During the start of the Generator, if there is a start fault, this fault can be reset by pressing the active operation mode button again and this will reset the fault on the controller unit. for example; - If a generator start failure alarm occurs during AUTO mode, by de- pressing the “AUTO” button again will reset the alarm. - If a generator start failure alarm occurs during “TEST-OFF-LOAD” mode, by pressing “TEST-OFF-LOAD” button again will reset the alarm, - If a generator start failure alarm occurs during “TEST-ON-LOAD” mode, by pressing the “TEST-ON-LOAD” button again will reset the alarm condition.
	**GCCB control button:** The main function of this button is to manually control the position of Generator Circuit breaker (GCCB). This button is automatically activated if the Generator voltage values are within the set limits, otherwise it is disabled. GCB control button will not allow to control GCB, if the Utility (Mains) voltage is available within its limits and the load is being fed through the Mains Circuit Breaker (MCB). The MCB has to be disconnected by pressing the MCB button and the load will be disconnected from the Mains supply bus-bar and then, pressing the Generator circuit breaker (GCB) button will connect the load to Generator bus-bar. If the load is being fed from the mains in the AUTO mode of operation, by pressing GCB button will automatically put the controller into TEST-ON-LOAD mode and the generator will start automatically and as soon as the voltages are within the set limits, the load is going to be transferred to the Generator bus-bar. Therefore; if it is not required to feed the load from the Generator continuously, the user has to press the AUTO button again (or press MCB button) and put the system back into automatic operation. In this case, if Mains voltage is available and within its set limits, the load will be transferred back to the mains bus-bar. Available voltages are indicated by the LED indicators related to GCB button and explained in detail further in this manual

	**MCCB control button:** The main function of this button is to manually control the position of Utility (Mains) Circuit breaker for the load. This button is active if the Mains bus-bar voltages are within its set limits. If the Generator is working and the load is being fed from the generator bus-bar, in order to activate the MCB button, the GCB button has to be pressed first, disconnect the load from generator bus-bar and then press the MCB button to connect the load to Utility bus-bar. This function can also be used, if it is required to transfer the load back to the Mains bus-bar, without waiting for the voltage stabilizing time delay. By repeating the above algorithm, user can transfer the load back to Mains bus-bar, without waiting for the Mains voltage stability delay time period. This function can also be used in order to test the load from generator bus-bar, while the Mains voltage is still present. By applying the above sequence, the load can be tested from the Generator unit and user can then transfer the load back to Mains bus-bar and switch the system back to AUTO mode of operation. Available voltages are indicated by the LED indicators related to MCB button and explained in detail further in this manual.

5.4 LED Indicators:

There are LED indicators on the front panel in order to indicate the status of operation and also help the user to identify what operation should be done in the next step. These LED indicators have meanings, depending on their particular positions on the front panel and also their lighting patterns.

The voltage availability LED indicators are shown below:

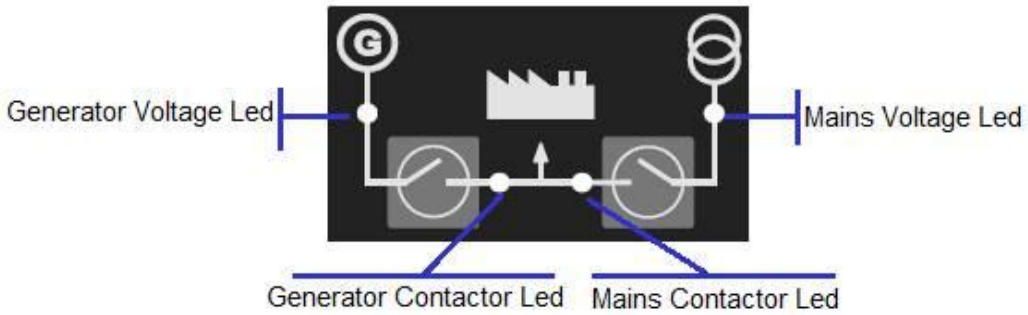
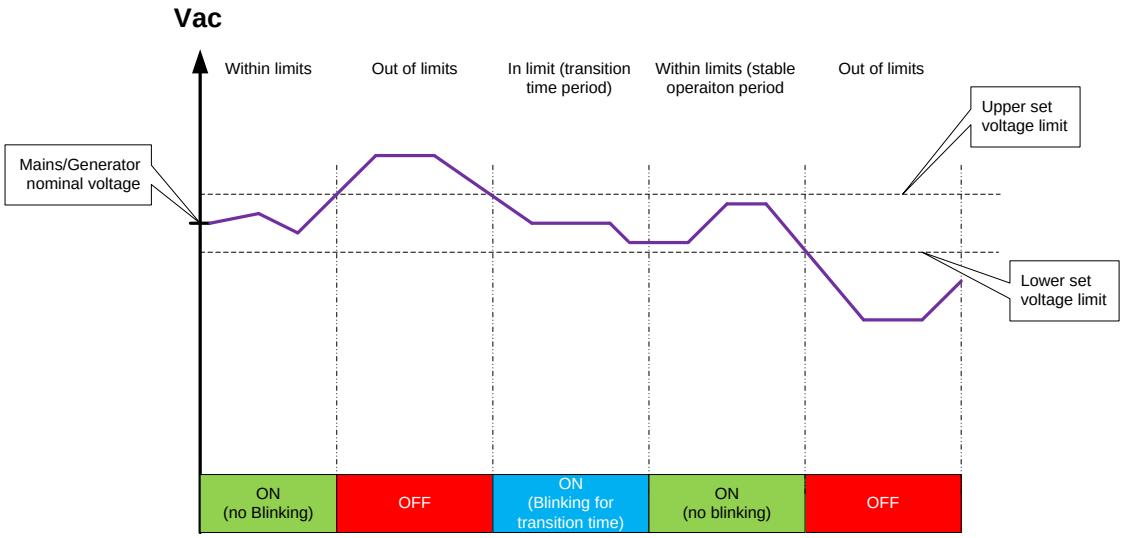


Figure: 2

As can be seen from the above section of the front panel picture, there are 4 LED indicators, which indicate the availability of Mains of Generator bus-bar voltages and also position of their related circuit breakers. The circuit breaker LED indicators also mean that; the load is being fed from that particular circuit breaker and the load bus-bar is live.

Mains Voltage LED indicator:

"Mains Voltage LED" indicates that; mains voltage is available and it is within the set limits. As soon as the mains voltage is within the set limits (Mains Voltage upper limit and Mains Voltage lower limit), the indicator LED will start to blink.



Voltage LED indicator behaviour

Figure: 3

Mains Voltage LED keeps blinking throughout the **"Mains Voltage Transition Delay"** time period, which is set by the user (configuration parameter P14). The setting of this parameter is explained in more detail in the "Descriptions of Parameters" section of this user manual. After "Mains Voltage Transition Delay" period is completed and the voltage is still within the limits, the LED indicator will light continuously, indicating that; the mains voltage is now stable.

Mains Contactor LED indicator:

Mains Contactor LED indicator is activated when Mains Contactor control relay is energized to switch the mains contactor on. Please note that; there is no feedback signal used from the contactor in order to verify the contactor closing action. The indicator LED will blink during **"Mains Contactor Energize Delay"** time duration (configuration parameter P16) and will stay on continuously after this duration is completed. This indicates that; the mains contactor is now activated and the load bus-bar is now energized.

Generator Voltage LED indicator:

Generator Voltage LED is activated when the unit detects generator voltage within the set limits. LED indicator will keep blinking until Generator voltage is stabilized within the set limits and will stay on continuously, once this condition is reached.

Generator Contactor LED indicator:

Generator Contactor LED is activated when the generator contactor control relay is switched on. This relay will switch on after the **"Generator Contactor Energize Delay"** time period is completed and during this time period, the LED will blink. Once this delay period is completed, the indicator will stay on continuously and the contactor will be energized. Please note that; there is no feedback signal from the generator contactor.

Auxiliary Input LED indicators:

There are three Auxiliary inputs, which the user can program. These Auxiliary inputs have dedicated indicators on their name tags and these LEDs indicate that the input is activated.

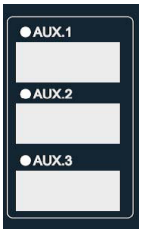


Figure: 4

Function Button LED indicators:

The function buttons also have LED indicators on each button. These indicators only light when the associated function is selected and activated. If the function is deselected, its LED indicator will switch off.

Figure: 5

Display LED indicators:

The display values are combined together with the LED indicators, which indicate the measured parameter and whether this value belongs to the Mains or Generator bus-bars. The measured voltage values of each phase are identified with L1, L2 and L3 LED indicators.

Figure: 6

If only one of these LEDs is lit, it indicates that; the measured voltage value on the display is between that particular phase and the Neutral line. If two of these LEDs are lit at the same time, this indicates that; the measured voltage is phase to phase voltage.

User can also select to read either Generator or Mains frequency and this is indicated by the Hz LED indicator.

Displayed values are identified by the Generator or Mains LEDs. This indicates whether the measured values belong to Mains or Generator.

6- TERMINAL CONNECTIONS ON THE REAR PANEL:

6.1 Rear side terminals:

The rear side view is shown in Figure 7. This diagram shows all the rear side connections and how the terminals are arranged. The terminals are placed in groups, depending on their purpose.

High voltage terminal connections are placed at the bottom side of the rear panel. The isolation voltage level of this group of terminals is 500Vac and meets the EN60001 standards.

Care should be taken when connecting these terminal wires. Make sure that the wires are not live and the controller is switched off while making the connections. Also, make sure that the screws are tightened securely as this may cause arcing, which may damage the unit

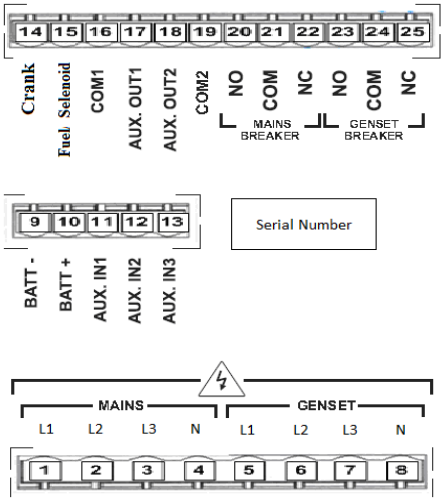


Figure: 7

Battery terminal connections together with the AUXILIARY input connections are placed in the middle of the rear panel. While connecting the battery terminals, make sure that the polarity is connected correctly. Failing to do so will not damage the unit but may also prevent the controller working properly. These terminals have 250Vac isolation standard.

The rest of the terminals are placed on the top side of the rear panel. These terminals are relay contacts with common connection inputs.

Mains and Generator contactor output relays are dry contacts and each relay common terminal is galvanically isolated. Therefore; when these relays are connected to their respective generator and mains contactors, the voltage feed into the relays has to be made to their common terminal inputs.

All terminal connections have sockets. These sockets must be detached while connecting the wires. Make sure that the wiring is correct before plugging in the sockets on the rear panel terminal bocks. Make sure that the screws are tightened securely. Failing to do so may cause failure.

6.2 Terminal connections and function description:

Terminal connection numbers are ordered, starting from the bottom left corner terminal connection on the rear panel. The terminal connection numbers and their functional names are given in table-1:

No:	Technical name of connection	Description of terminal function
1-	L1	Mains side R phase voltage sensing input
2-	L2	Mains side T phase voltage sensing input
3-	L3	Mains side S phase voltage sensing input
4-	N	Mains side Neutral Line connection input
5-	L1	Alternator U phase voltage sensing input
6-	L2	Alternator V phase voltage sensing input
7-	L3	Alternator W phase voltage sensing input
8-	N	Alternator Neutral Line connection input
9-	BATT.(-)	DC -'ve supply input (battery –'ve terminal and Gen-set chassis has to be connected together and the chassis has to be connected to PE)
10-	BATT.(+)	DC +'ve supply input. This input must be between 9-35V DC.
11-	AUX. IN-1	Configurable Auxiliary input (active low input, has to be connected to negative supply for activation)
12-	AUX. IN-2	Configurable Auxiliary input (active low input, has to be connected to negative supply for activation)
13-	AUX. IN-3	Configurable Auxiliary input (active low input, has to be connected to negative supply for activation)
14-	CRANK OUTPUT	Engine Crank Output (Relay contact out. 6A/250Vac, normally open)

15-	FUEL SELENOID OUTPUT	Fuel or Stop Selenoid Output (Relay contact out. 6A/250Vac, normally open)
16-	COM1	Common input terminal for Engine Crank and Fuel Selenoid relay connections.
17-	AUX. OUT-1	Programmable Auxiliary Output 1 (Relay contact out. 6A/250Vac, normally open)
18-	AUX. OUT-2	Programmable Auxiliary Output 2 (Relay contact out. 6A/250Vac, normally open)
19-	COM2	Common input terminal for AUX1 and AUX2 relay connections.
20-	MAINS BREAKER NO	Mains contactor control relay output. Normally open output contact, 6A/250Vac
21-	MAINS BREAKER COM	Mains contactor control relay Common terminal
22-	MAINS BREAKER NC	Mains contactor control relay output. Normally closed output contact, 6A/250Vac
23-	GENERATOR BREAKER NO	Generator contactor control relay output. Normally open output contact, 6A/250Vac
24-	GENERATOR BREAKER COM	Generator contactor control relay Common terminal
25-	GENERATOR BREAKER NC	Generator contactor control relay output. Normally closed output contact, 6A/250Vac.

Table-1

The terminal functions and their related operating modes are explained in detail in the OPERATION MODES section of the manual. Please refer to these sections for detailed application notes.

7- OPERATION MODES:

There are 4 operation modes for ATS2.0 control unit. these operation modes are:

1- OFF
2- TEST-ON-LOAD
3- TEST-OFF-LOAD
4- AUTO

These operation modes are described in the following sections.

7.1 OFF Operation Mode:

ATS2.0 can be placed into “OFF” mode (sleep mode) by pressing MENU + TEST-OFF-LOAD buttons together at the same time. OFF mode is used for switching the controller into SLEEP MODE and stops the gen-set, if the engine is running at that time. If OFF mode (pressing MENU + TEST-OFF-LOAD buttons together at the same time) is selected, ATS2.0 controller will execute the following steps;

1- If engine is not running and ATS2.0 controller is feeding the load from Mains Bus-bar (MCB control relay is de-energized, feeding the MCB contactor through NC contact), controller will go into OFF mode (sleep mode) and start waiting for a command from user. In this mode, user can select the PASSWORD mode by pressing MENU button and change any parameter value as required.

2- If engine is running but not feeding the load, GCB control relay will be de-energized, Gen-set Engine Crank (Remote start) signal will be removed immediately and engine will shut down. Digital display will indicate “OFF” data and unit will go into Sleep Mode.

3- If engine is running and the load is being fed from the Gen-Set, then GCB control relay will be de-energized immediately but engine will carry on working until the engine cool-down timer is expired. After engine is cooled down, controller will remove the Engine Crank (Remote start) Signal and Gen-Set will shut down. ATS2.0 controller will then wait in this state, until user gives a new command.

4- While in OFF mode, if parameter P46 [Mains control in OFF mode (enable-disable)] is adjusted, ATS2.0 controller can control the MCB, depending on the selected configuration. If selected, the controller will control the mains voltage, according to the set upper and lower limits of mains voltage and will switch the MCB off, if mains voltage goes out of these limits. Selected otherwise will keep MCB control relay de-energized all the times, feeding the MCB contactor continuously.

While the module is in OFF mode, pressing the MENU button will put the controller into PASSWORD entering mode. After correct password is entered, pressing MENU button again will enter PARAMETER SELECT mode and user can choose the required parameter number to be changed. After the required parameter number is selected, press the MENU button again and controller will enter “PARAMETER ADJUST” mode and the parameter value can then be set as required.

IF PARAMETER MENU PASSCODE IS SELECTED AS [0], CONTROLLER WILL ENTER PARAMETER ADJUST MENU, WITHOUT ASKING FOR A PASSCODE.

To return back to normal operation mode, press TEST-OFF-LOAD and MENU buttons together (OFF mode) and the controller will enter OFF mode. By pressing one of the operation mode buttons; AUTO, TEST-ON-LOAD or TEST-OFF-LOAD, the controller will go into the corresponding operation mode and stay there until new action is required.

While in OFF mode, if GCB or MCB buttons are pressed, the display will show “tst” message and the circuit breakers can then be controlled manually. In order to be able to control these circuit breakers, the bus-bar voltages and the frequency values has to be within their corresponding set limit values.

7.2 AUTO Operation Mode:

The module is placed into AUTO mode by pressing the AUTO button. While in this mode, if a mains failure on any phase is detected, controller initiates a “Mains voltage fault condition control delay timer” and after this time delay expires, the Mains Circuit Breaker (MCB) control relay is switched on and the load is disconnected from the mains bus-bar.

The MCB control relay stays in the OFF position (de-energized) when the MCB contactor is to be switched on. Therefore; the MCB contactor drive signal has to be connected through the NC contact of the MCB relay output terminals (T21 and T22). This is necessary in order to allow the MCB contactor to be operated when the controller is in the OFF mode or out of service.

ATS unit will then automatically generate a start command to the gen-set controller. The Engine Crank (Remote start) signal will operate according to the parameter settings stored in the menu. When the generator output voltage is within the set limits, Generator Circuit Breaker (GCB) relay will close (energize) and the load will be transferred to the generator.

The GCB control relay stays in the ON position (energized) when the GCB contactor is to be switched on. Therefore; the GCB contactor drive signal has to be connected through the NC contacts of the GCB relay output terminals (T23 and T24). This is necessary in order to switch the GCB off when the controller is in the OFF mode or out of service.

When the mains supply is restored back and stays within the limits for the set period of time, ATS will first switch GCB control relay off, disconnect the load from Generator Bus-Bar and then de-energize the MCB control relay and transfer the load back to the mains supply. ATS will then remove the Engine Crank (Remote start) signal command from the gen-set, after engine cool-down period has expired (cool-down period can be set to zero, if the gen-set controller has the same function built-in to the system) and shut the Gen-Set down and start to monitoring mains voltage.

In case of a failure while operating with Gen-Set, the controller unit will stop the generator automatically by removing the Engine Crank (Remote start) signal from the engine. A clear mimic diagram and LED indicators provide information about the current status of mains and gen-set bus-bars voltages and MCB and GCB contactor positions for the user.

When mains voltage is restored, the mains voltage LED indicator starts to flash, indicating that the mains is back and ATS is waiting for the delay timer to expire. When delay timer expires, the LED indicator is on continuously.

7.3 TEST-ON-LOAD Operation Mode:

TEST-ON-LOAD mode is used, if the user requires a test run, with the gen-set on load. This mode can also be used in order to force the load on to the generator, even if the Mains voltage is available and within the set limits. During this operation, if the mains voltage is cut off, the system will carry on feeding the load from the gen-set until the controller is switched back to AUTO mode. During TEST-ON-LOAD operation, the user can

switch the GCB off by pressing the TEST-OFF-LOAD button and can switch the GCB back on by pressing TEST-ON-LOAD button again.

While working in this mode, if the there is a failure in the engine or alternator voltage goes out of its limits, ATS will de-energize the GCB control relay and disconnect the load.

While TEST-ON-LOAD is in progress, by pressing the AUTO button will put the controller back into AUTO operation and the controller will behave according to AUTO mode operation conditions.

7.4 TEST-OFF-LOAD Operation Mode:

TEST-OFF-LOAD mode is used, if the user requires a test run without transferring the load on to the generator. In this mode, the controller generates an Engine Crank (Remote start) signal, runs the engine but the load stays connected to the mains, if mains is within the set limits. This mode can be used in order to run the engine periodically so that the engine condition is kept at best.

While in TEST-OFF-LOAD mode, if the mains voltage is cut off or goes out of its limits, the load will automatically be transferred to generator and the controller will go back to AUTO mode. When mains is restored, the load will be transferred back to mains and generator will be switched off after engine cool-down period expires.

8- SYSTEM INPUTS AND OUTPUTS:

The system inputs and outputs are explained in this section and for each system input/output, corresponding terminal connection number is indicated in brackets and these numbers correspond to the terminal connection numbers indicated in the rear side terminal connection diagram in Figure 7.

8.1 DC Supply Voltage inputs [T9, T10]:

DC Battery positive supply connection terminal is T10 and the DC Battery negative supply connection terminal is T9. The positive and negative battery connection has to be made in order to feed the control module. The DC input is designed to operate from 9Vdc to 30Vdc and these input terminals are also protected against reverse connection of the DC lines.

The current drain from these terminals is approximately 50mA.

Power –On:

When the controller is connected to power at first, the unit can be configured to start at a predictable operation mode if required. P45 [Power-On Operating Mode select] parameter determines in which mode the controller will start at power on. According to the parameter settings, ATS can start with one of the following modes;

- OFF mode
- AUTO mode
- TEST-ON-LOAD mode
- TEST-OFF-LOAD mode

8.2 Generator Bus-Bar Voltage Inputs [T5, T6, T7, T8]:

Generator output phase and neutral lines should be connected to these inputs according to the following connection data:

- Generator PHASE U line (T5)
- Generator PHASE V line (T6)
- Generator PHASE W line (T7)
- Generator NEUTRAL line (T8)

ATS2.0 controller senses the Generator voltage level and Frequency from these inputs and all phase and neutral lines must be connected in order to sense the voltages correctly. The voltage sensing concept is TRUE RMS (TRMS) calculation method and this makes sure that the effects of all harmonics, up to 11th harmonic, are calculated within ±1% of the actual input voltage level. The voltage acceptance level settings can be made from the program menu. P01 [Generator Voltage Lower limit] and P02 [Generator Voltage Upper limit] parameters can be used.

Generator frequency acceptance level can also be adjusted, if required. These values can be adjusted with parameters P03 [Generator Frequency Lower limit] and P04 [Generator Frequency Upper limit].

Single Phase Connection:

When the controller is required to be used with single phase mains and generator systems (50Hz or 60Hz), the terminal connections has to be made according to the below information:

MAINS SIDE CONNECITON	T1 (Mains phase L1)	Connect to mains phase L1
	T2 (Mains phase L2)	No Connection
	T3 (Mains phase L3)	No Connection
	T4 (Mains Neutral Line)	Connect to Mains Neutral
GENERATOR SIDE CONNECITON	T5 (Generator phase L1)	Connect to Generator phase L1)
	T6 (Generator phase L2)	No Connection
	T7 (Generator phase L3)	No Connection
	T8 (Generator Neutral Line)	Connect to Generator Neutral

Table-2

From the controller menu, single phase operation must be selected to ensure correct operation of the system, parameter [P09] “Generator Single Phase/3 Phase Selection”. This parameter should be adjusted before the unit is set for operation.

8.3 Mains Voltage Inputs [T1, T2, T3, T4]:

Mains voltage lines are connected to Mains Voltage Input terminals according to the connection data given below:

- Mains PHASE R line (T1)
- Mains PHASE S line (T2)

- Mains PHASE T line (T3)
- Mains NEUTRAL line (T4)

ATS2.0 controller senses the Mains voltage level and Frequency from these inputs and all phase and neutral lines must be connected in order to sense the voltages correctly. The voltage sensing concept is TRUE RMS (TRMS) calculation method and this makes sure that the effects of all harmonics, up to 11th harmonic, are calculated within ±1% of the actual input voltage level.

The voltage acceptance level settings can be made from the program menu. P05 [Mains Voltage Lower limit] and P06 [Mains Voltage Upper limit] parameters can be used.

Mains frequency acceptance level can also be adjusted, if required. These values can be adjusted with parameters P07 [Mains Frequency Lower limit] and P08 [Mains Frequency Upper limit].

Single Phase Connection:

When the controller is required to be used with single phase mains and generator systems (50Hz or 60Hz), the terminal connections has to be made according to table-1 given above.

From the controller menu, single phase operation must be selected to ensure correct operation of the system, parameter [P09] “Generator Single Phase/3 Phase Selection”. This parameter should be adjusted before the unit is set for operation.

8.4 Auxiliary Input – 1 [T11]:

Auxiliary input (1) can be configured to be active in two distinct states:

- Active, when input is OPEN (no connection to V+ or GND)
- Active, when input is CLOSED (connected to GND)

This input activation configuration can be adjusted with parameter P23 [Auxiliary Input – 1 sensing configuration, active-low or active-high]. This parameter implements NORMALLY OPEN ACTION (NO) or NORMALLY CLOSED ACTION (NC) relay input behavior for Auxiliary input (1).

The auxiliary input (1) can also be programmed to implement various other characteristics and these are:

0- Unused input (no action allocated)
1- Engine Crank (Remote start) on load
2- Engine Crank (Remote start) off load
3- Mains simulation
4- Mains Failure
5- Engine Crank (Remote Start) signal disable
6- Mains contactor (MCB) disable
7- Generator contactor (GCB) disable
8- Engine running info
9- Type “C” failure characteristic input
10- Type “D” failure characteristic input
11- Type “E” failure characteristic input
12- Type “F” failure characteristic input
13- Alarm Reset

These input behavior characteristics can be selected by parameter number P22 [Auxiliary Inpu-1 Function selection]. If this input is not going to be used for any input signal, then the auxiliary input – 1 should be programmed as UNUSED [choose “0” for P22] and also NO ACTION [choose “0” for P23] and terminal should be left unwired.

8.5 Auxiliary Input – 2 [T12]:

Auxiliary input (2) can be configured to be active in two distinct states:

- Active, when input is OPEN (no connection to V+ or GND)
- Active, when input is CLOSED (connected to GND)

This input activation configuration can be adjusted with parameter P25 [Auxiliary Input – 1 sensing configuration, active-low or active-high]. This parameter implements NORMALLY OPEN ACTION (NO) or NORMALLY CLOSED ACTION (NC) relay input behavior for Auxiliary input (1).

The auxiliary input (2) can also be programmed to implement various other characteristics and these are:

0- Unused input (no action allocated)
1- Engine Crank (Remote start) on load
2- Engine Crank (Remote start) off load
3- Mains simulation
4- Mains Failure
5- Engine Crank (Remote Start) signal disable
6- Mains contactor (MCB) disable
7- Generator contactor (GCB) disable
8- Engine running info
9- Type “C” failure characteristic input (Failure mode selection)
10- Type “D” failure characteristic input (Failure mode selection)
11- Type “E” failure characteristic input (Failure mode selection)
12- Type “F” failure characteristic input (Failure mode selection)
13- Alarm Reset

These input behavior characteristics can be selected by parameter number P24 [Auxiliary Inpu-2 Function selection]. If this input is not going to be used for any input signal, then the auxiliary input – 2 should be programmed as UNUSED [choose “0” for P24] and also NO ACTION [choose “0” for P25] and terminal should be left unwired.

8.6 Auxiliary Input-3 [T13]:

Auxiliary input (3) can be configured to be active in two distinct states:

- Active, when input is OPEN (no connection to V+ or GND)
- Active, when input is CLOSED (connected to GND)

This input activation configuration can be adjusted with parameter P27 [Auxiliary Input – 3 sensing configuration, active-low or active-high]. This parameter implements NORMALLY OPEN ACTION (NO) or NORMALLY CLOSED ACTION (NC) relay input behavior for Auxiliary input (3).

The auxiliary input (3) can also be programmed to implement various other characteristics and these are:

0- Unused input (no action allocated)
1- Engine Crank (Remote start) on load
2- Engine Crank (Remote start) off load
3- Mains simulation
4- Mains Failure
5- Engine Crank (Remote Start) signal disable
6- Mains contactor (MCB) disable
7- Generator contactor (GCB) disable
8- Engine running info
9- Type “C” failure characteristic input (Failure mode selection)
10- Type “D” failure characteristic input (Failure mode selection)
11- Type “E” failure characteristic input (Failure mode selection)
12- Type “F” failure characteristic input (Failure mode selection)
13- Alarm Reset

These input behavior characteristics can be selected by parameter number P26 [Auxiliary Input-3 Function selection]. If this input is not going to be used for any input signal, then the auxiliary input – 3 should be programmed as UNUSED [choose “0” for P26] and also NO ACTION [choose “0” for P27] and terminal should be left unwired.

8.7 Mains Contactor Relay Output [T20, T21, T22]:

Mains contactor relay output terminal is used for energizing the MCB drive contactor to connect load to mains bus-bar. It outputs “R” phase of the mains voltage from its normally closed (NC) terminal and “R” phase voltage line has to be connected to the COMMON terminal (T21) of the Mains Contactor Control output.

8.8 Generator Contactor Relay Output [T23, T24, T25]:

Generator contactor output is used for energizing the generator contactor to transfer load to the generator bus-bar. It outputs “R” phase of the generator voltage from its normally open (NO) terminal. Therefore; feed voltage should be connected to COMMON terminal but contactor drive must be fed from the NO terminal of the relay output.

8.9 Engine Crank (Start) Output [T14]:

Engine Crank output can be configured by adjusting [P30…P35] in the parameter table. By adjusting the value of [P31] parameter, the Engine Crank output can be configured to behave as Normally Open (NO) output or Normally Closed (NC) output. It outputs the signal connected to COM1 from its terminal connection. The Engine Crank output active behaviour is selectable as continuous or pulse output [P32]. The pulse output simulates intermittent cranking signal. The cranking pulse ON duration setting is adjusted via [P33] and OFF duration time between pulses is adjusted via [P34].The Engine Crank pulse count is adjusted with the value of parameter [P35].

Engine Crank relay and Fuel/Stop Solenoid relay outputs have single common terminal; COM1 [T16].

8.10 Fuel / Stop Solenoid [T15]:

The diesel engine fuel system can be controlled with Fuel/Stop solenoid output of the control unit. This output can be used for both control methods; to open fuel inlet or to block fuel inlet, depending on the type of the diesel engine. This function can be selected by adjusting parameter [P36].

If engine type requires the fuel solenoid to be energized continuously during motor running time, (Fuel Solenoid action) the parameter is selected as “0”.

If engine type requires the fuel inlet to be interrupted for stopping (Stop Solenoid action), then this parameter should be set to “1”.

For Stop Solenoid function, the solenoid is energized for 20 seconds. If the engine cannot be stopped after 20 seconds, then the “StP” and “Err” alarm signals will be display, indicating that; the engine cannot be stopped.

8.11 Auxiliary Output – 1 [T17]:

Auxiliary output (1) is a relay type output with 6A/250Vac rating. This dry contact output has a COMMON terminal [T19].

Auxiliary output (1) function can be configured by adjusting [P37] in the parameter table. Also, relay active position can be configured by adjusting the value of [P38] parameter, to behave as Normally Open (NO) output or Normally Closed (NC) output.

By adjusting the value of parameter [P39], the auxiliary relay output can be configured to behave as continuous, intermittent or pulse output. If “Pulse” operation is selected, the pulse duration is adjusted by parameter [P40]. For intermittent operation, the period is 1 second with 0.5sec ON and 0.5sec OFF.

Operation of the output function is explained in more detail chapter 7.13

8.12 Auxiliary Output – 2 [T18]:

Auxiliary output (2) is a relay type output with 6A/250Vac rating. This dry contact output has a COMMON terminal [T19].

Auxiliary output (2) function can be configured by adjusting [P41] in the parameter table. Also, relay active position can be configured by adjusting the value of [P42] parameter, to behave as Normally Open (NO) output or Normally Closed (NC) output.

By adjusting the value of parameter [P43], the auxiliary relay output can be configured to behave as continuous, intermittent or pulse output. If “Pulse” operation is selected, the pulse duration is adjusted by parameter [P44]. For intermittent operation, the period is 1 second with 0.5sec ON and 0.5sec OFF.

Operation of the output function is explained in more detail chapter 7.13

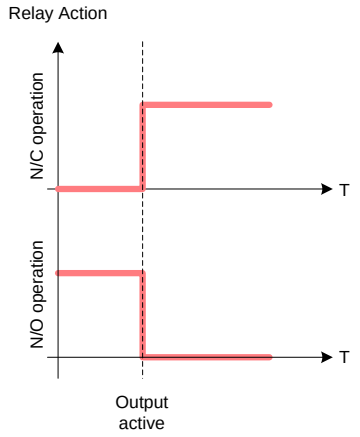
8.13 Intermittent and Pulse type operations:

The Auxiliary outputs can be configured as continuous, pulse or intermittent operation modes, depending on the type of application. These features can be used for various purposes, like controlling the fuel solenoid, stop solenoid or generating appropriate signals for air type circuit breaker controls.

The operations of these outputs are described in the following graphical examples;

a- Continuous Operation:

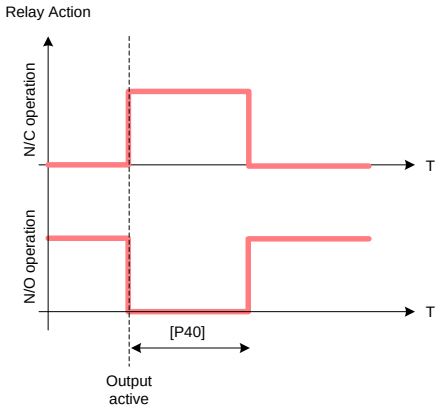
In this mode of operation, the relay output will change state according to the selected polarity and will stay in this new state until the instruction is executed;



b- Pulse Operation:

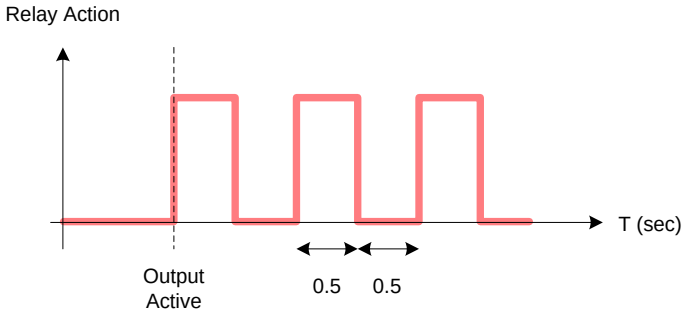
If this mode is selected, the output will operate in pulse mode and the pulse width can be adjusted with parameter [P40]. This parameter is adjusted in seconds and pulse duration can be adjusted between 1 second to 999 seconds.

The pulse action is monostable operation and will return back to its stable position after the pulse duration is executed. Operation can be seen in the below graphics;



c- Intermittent Operation:

In this mode of operation, the relay output operates as continuous pulse train with 0.5sec ON and 0.5sec OFF. The pulse train will operate during the active period of the Auxiliary output. Operation is as follows;



9- FAILURE MODES:

Various failure modes can be selected, while adjusting the auxiliary input characteristics. There are 4 types of auxiliary failure mode characteristics which the user can select from:

1- "C" type input characteristic
2- "D" type input characteristic
3- "E" type input characteristic
4- "F" type input characteristic

These input characteristics are "SELF ACKNOWLEDGE" type characteristics and the alarm will automatically reset, if the fault condition is removed from the input.

There are also "USER ACKNOWLEDGE" type alarms (Start, Stop and Alternator failures) and in order to reset these alarm signals, press the mode button after removing the alarm condition. For example; if the alarm condition occurs in "AUTO" mode, press the AUTO button again, in order to reset the alarm condition. The alarm condition has to be removed before pressing the button.

9.1 "C" Type Failure Input Characteristics:

"C" Type input characteristic is a GCB control characteristic and this type is used for failures where the engine "Engine Crank (Remote start) Signal" doesn't have to be removed. In other words, in "C" type failure characteristics, the engine carries on running while GCB is opened. This is a **"Self Acknowledge"** type failure input and the fault state is automatically reset, when the fault condition is removed from the auxiliary input terminal.

When "C" type auxiliary input is activated, the controller will de-energize the GCB contactor relay output. But the engine "Engine Crank (Remote start) Signal" keeps the engine running. When the failure condition is removed from this auxiliary input, the failure state is automatically reset and the GCB contactor will be energized.

9.2 “D” Type Failure Input Characteristics:

“D” type failure characteristics are used where the engine should also be switched off, when the failure input is activated. In this mode, after the auxiliary input is activated, GCB contactor control relay is de-energized immediately, removing the load from the generator but the engine keeps running until the cool-down timer expires. After the cool-down timer expires, the engine “Engine Crank (Remote start) Signal” is removed and the engine is shut down.

When the failure condition on the auxiliary input is removed, ATS unit will issue the engine “Engine Crank (Remote start) Signal” again and the engine will start automatically and gen-set will generate voltage. When generator voltage is restored (depending on the operation mode) the GCB control relay will be energized again, connecting the load to the generator bus-bar.

9.3 “E” Type Failure Input Characteristics:

“E” type failure characteristics are used where the needs to be switched off without waiting for the engine cool-down timer to expire. With this type of failure characteristic selected for the auxiliary input, following the failure activation, GCB contactor control relay will immediately de-energize and the “Engine Crank (Remote start) Signal” will also be removed at the same time, without waiting for the engine cool-down timer to expire.

Since the auxiliary input is a self-acknowledge type input, as soon as the failure condition is removed from the auxiliary input, depending on the mode selected, “Engine Crank (Remote start) Signal” will be generated by the controller and after generator voltage is restored, GCB contactor control relay will be energized load will be connected to generator.

9.4 “F” Type Failure Input Characteristics:

“F” type failure characteristics are used where both GCB and MCB contactor control relays are required to be switched off at the same time, following an engine shut-down function. With this type of failure characteristic selected for the auxiliary input, following the failure activation, both GCB and MCB contactor control relays are de-energized immediately and the “Engine Crank (Remote start) Signal” will also be removed at the same time, without waiting for the engine cool-down timer to expire.

Since the auxiliary input is a self-acknowledge type input, as soon as the failure condition is removed from the auxiliary input, depending on the mode selected, “Engine Crank (Remote start) Signal” will be generated by the controller and after generator voltage is restored, GCB contactor control relay will be energized load will be connected to generator bus-bar.

10-FAILURE MESSAGES:

ATS2.0 generates failure messages in order to indicate the fault condition on its display. When the message is displayed, the display blinks for 0.5 sec to show the failure code, followed by 0.5sec “Err” message. When the fault condition is removed, press the current operation mode button in order to reset the alarm condition on the unit.

For example; if the alarm condition occurs during AUTO operation mode, press the AUTO button again in order to reset the alarm condition on the control unit.

10.1 “Str Err” (Generator Start Error):

This error message is displayed, if the generator cannot be started within the set duration by the parameters. ATS2.0 controller expects to measure the generator bus-bar voltage within the set limits, after the Remote Start (Crank) signal is generated. If voltage is not available within the set duration, controller will generate “Str Err” message.

This failure message can be disabled by selecting parameter [P47] as “0”.

10.2 “Stp Err” (Generator Stop Error):

This error message is displayed, if the generator cannot be stopped within the set duration by ATS2.0 parameters. Once the “Remote Start (Crank) signal is removed, the controller expects to measure no voltage on the generator bus-bar and/or no “motor running” signal should be received from the generator side. If these conditions cannot be fulfilled during the set duration, ATS2.0 will generate “Stp Err” message on the display.

This failure message can be disabled by selecting parameter [P48] as “0”.

10.3 “PhS Err” (Phase Sequence Error):

ATS2.0 controller monitors the phase sequence of both Mains and Generator bus-bars and if this sequence is different to the initial set phase pattern, it will generate a “PhS Err” fault signal and will not allow the circuit breakers to close. This error signal can be disabled by adjusting parameter [P11] in the controller menu.

10.4 “GLu Err” (Generator Low Voltage Error):

If the Generator bus-bar voltage is measured to be below the set voltage limits, controller will not allow the GCB to be energized and feed the load. If this fault condition is detected while feeding the load, controller will automatically disconnect GCB in order to protect the load. Engine will keep running while this fault is present. Display will show “GLu Err” code and this error can be reset by pressing the current operation mode button. If the fault is removed, controller will energize GCB, if not, the error signal will be displayed.

10.5 “GHu Err” (Generator High Voltage Error):

If the Generator bus-bar voltage is measured to be above the set voltage limits, controller will not allow the GCB to be energized and feed the load. if the same error is detected while feeding the load, controller will automatically disconnect GCB and protect the load. Engine will not shut down if this error occurs. Display will show “GHu Err” code and this error can be reset by de-pressing the current operating mode button. If the fault is removed, controller will connect the GCB and feed the load, otherwise, error code will be displayed again.

10.6 “GLF Err” (Generator Low Frequency Error):

If the Generator Frequency reading is below the set limits, controller will disconnect the GCB and display this error message. The engine will keep running. In order to reset this error condition, current operating mode button should be de-pressed. Following a reset action, controller will automatically connect GCB and feed the load, otherwise, error message will be displayed and GCB will stay disconnected.

10.7 “GHF Err” (Generator High Frequency Error):

If the Generator Frequency reading is above the set limits, controller will disconnect the GCB and display this error message. The engine will keep running. In order to reset this error condition, current operating mode

button should be de-pressed. Following a reset action, controller will automatically connect GCB and feed the load, otherwise, error message will be displayed and GCB will stay disconnected.

11-PROGRAMMING and PARAMETER SETTINGS:

ATS2.0 can be programmed easily from the front panel. The control buttons can be used for setting all the parameter values to suit the application. The display will show all the parameter numbers and the setting values.

If the controller is in “PASSWORD”, “PARAMETER SELECT” and “PARAMETER ADJUST” modes, the front panel control buttons execute different functions and these button functions are explained below:

- TEST-ON-LOAD button acts as; DECREASE value button
- TEST-OFF-LOAD button cats as; INCREASE value button
- AUTO button acts as; SHIFT DIGIT POSITION button

11.1 Entering the PASSWORD:

To be able to adjust settings and configuration in ATS2.0 controller, user has to enter the correct **PASSWORD** as a first step. While in OFF mode, press “MENU” button and controller will enter into PASSWORD mode. In this mode, use the front panel buttons to enter your password, as described above and press “MENU” button (in this case, MENU button acts as ENTER button) to validate your password.

If the entered PASSWORD is correct, system will go into “PARAMETER SELECT” mode. If PASSWORD is wrong, “Err” will appear on the display and user has to press one of the front panel buttons in order to carry on with normal operations but cannot change parameter settings. If the PASSWORD is set as “000” initially, controller will directly go into PARAMETER SELECT mode and will not require the PASSWORD to be entered. This is only valid if the password is selected as “000”.

11.2 PARAMETER SELECT:

After entering correct PASSWORD, pressing the “MENU” button will enter the system into PARAMETER SELECT mode. In this mode, user can use the above buttons (Shift Digit Position, Increase, and Decrease) in order to select the required parameter number to be changed.

Once the required parameter number is displayed on the digital display, then the user has to press “MENU” button again, to enter the PARAMETER ADJUST mode.

11.3 PARAMETER ADJUST Mode:

In **PARAMETER ADJUST** mode, press INCREASE (Test-Off-Load button), DECREASE (Test-On-Load) and AUTO (shift digit position) buttons in order to change the value of the parameter as required.

After the required parameter value is adjusted, then press the “MENU” (Enter) button again to save the new parameter value into the controller’s memory. When the new value is saved in the memory, display will flash 3 (three) times, indicating that new set value is written and stored into device memory.

If the user tries to enter a parameter value which is not valid or out of limits, “Err” warning signal will come up on the digital display for approximately 3 seconds the new value will not be accepted. The user has to enter new and valid parameter value and then press “MENU” (Enter) button in order to save the new parameter value into system memory. Once this is achieved successfully, the value on the display will flash 3 times.

The parameter list is given in the **"PARAMETER TABLE"** and user should read and select the correct parameter value depending on the application. Each parameter is explained in detail in the Parameter Tables. Care should be taken to select the correct parameter value before setting or changing the value of a particular parameter.

It is strongly advised that; user should use the parameter adjust page and enter all parameters on the page manually and control all the values before starting to enter these values directly into the controller memory. By doing this, user can follow all the set parameters easily and no errors will occur. The "Parameter Select Sheet" is given at the end of this user manual.

Setting unsuitable parameter values can cause the controller not to function properly. If such behaviour happens, user should put the controller into "OFF" mode and enter the "PARAMETER ADJUST Mode" again and check parameter values carefully. Use the "Parameter Select Sheet" given at the end of this manual in order to simplify the task.

To return back to normal operation, press **"MENU"** button and **"TEST-OFF-LOAD"** buttons together at the same time and ATS2.0 controller will return back to normal operation mode. User can then select one of the three available operating modes; **TEST-OFF-LOAD**, **TEST-ON-LOAD** or **AUTO.**

WRONG PASSWORD:

If wrong password is entered, the display will show [Err] message and the user has to press a button on the front panel in order to return back to normal operation mode. Password entering mode should be selected again in order to type in the correct PASSWORD and enter into the **"Parameter Adjust Mode"**.

WRONG PARAMETER VALUE:

If adjusted parameter value is wrong or out of its limits, then the display will show [Err] and the message on the display will flash 3 (three) seconds. The user has to correct the parameter value and press the "MENU" button to save the new parameter value into the memory.

In order to return form "Parameter Adjust Mode" back to normal operation mode, **TEST-OFF-LOAD** and **MENU** buttons should be pressed together at the same time. The unit will return back to its normal operation mode.

ESCAPE FUNCTION:

If wrong parameter value is entered during Parameter Adjust Mode, then user may want to escape without saving the entered parameter value. In order to achieve this, user has to press **TEST-OFF-LOAD** and **MENU** buttons simultaneously again and the system will automatically return back to normal operation mode, without saving the new parameter value.

11.4 Parameter Table:

ATS2.0 full parameter list is given in the table below. This table indicates the maximum and minimum adjustable values for each parameter and also it shows the default factory setting of parameters. If user needs to change

these parameter values, they should enter “Parameter Adjust Mode” and make the necessary changes from the front panel of the controller.

Please use the empty “Parameter Select Sheet” given at the end of this user manual. This will simplify the task and allow you to see all the related parameters at the same time and adjust correct values for a healthy operation of the system.

The factory setting values will be loaded, if the customer number is set as [000] and [P49] is set to “1”. If user sets the customer code [P00] as their unique “customer code number”, then instead of the factory settings given in the below table, customer specific parameter values will be loaded to the controller, when [P49] is set to “1”. User has to pay attention to what needs to be done.

After loading the factory settings or the customer specific parameter settings, user can always enter the “Parameter Menu” and change any parameter values and these values will stay as they are set, until user changes it again or default parameters are loaded.

PAR. NO	CONFIGURABLE PARAMETER NAME	UNIT	FACTORY SETTING	MIN. VALUE	MAX. VALUE
P00	Customer code (3 digit unique number)	-	0	0	200
P01	Generator Voltage Lower Limit	VAC	180	50	400
P02	Generator Voltage Upper Limit	VAC	240	50	400
P03	Generator Frequency Lower Limit	Hz	45	10	99
P04	Generator Frequency Upper Limit	Hz	55	10	99
P05	Mains Voltage Lower Limit	VAC	180	50	400
P06	Mains Voltage Upper Limit	VAC	240	50	400
P07	Mains Frequency Lower Limit	Hz	47	10	99
P08	Mains Frequency Upper Limit	Hz	53	10	99
P09	Mains Single Phase / Three Phase Selection	-	3	1	3
P10	Generator Single phase / Three phase selection	-	3	1	3
P11	Phase Sequence control enable / disable	-	0	0	1

P12	Mains Voltage Low level return Hysteresis	VAC	10	1	50
P13	Generator Voltage Fault condition control delay	sec	5	1	300
P14	Mains Voltage Transition time delay (15.2 = 912 seconds)	min	3	0.1	99.9
P15	Mains Voltage Fault condition control delay	sec	3	1	999
P16	Mains contactor energize delay time	sec	1	0	999
P17	Engine Warming Time	sec	30	0	900
P18	Generator Contactor Energize delay time	sec	9	0	999
P19	Engine Cool-down timer duration	sec	60	0	900
P20	Mains Frequency Control enable / disable	-	1	0	1
P21	Generator Frequency Control enable / disable	-	1	0	1
P22	Auxiliary Input-1 Function (choose one of 13 input characteristics)	-	8	0	13
P23	Auxiliary Input-1 sensing configuration (active low – active high)	-	1	0	1
P24	Auxiliary Input-2 Function (choose one of 13 input characteristics)	-	9	0	13
P25	Auxiliary Input-2 sensing configuration (active low – active high)	-	1	0	1
P26	Auxiliary Input-3 Function (choose one of 13 input characteristics)	-	10	0	13
P27	Auxiliary Input-3 sensing configuration (active low – active high)	-	1	0	1
P28	Fault Control delay timer after Engine Start	sec	8	0	300
P29	Engine Running Sense control delay	sec	30	1	120
P30	Engine Crank (Remote Start) signal output delay	sec	3	0	300
P31	Engine Crank (Remote Start) output selection (active low – active high)	-	0	0	1
P32	Engine Crank (Remote Start) signal type (Continuous / Pulse)	-	1	0	1
P33	Engine Crank (Remote Start) pulse duration	sec	6	1	300
P34	Engine Crank (Remote Start) wait period (between pulses)	sec	10	1	300
P35	Engine Crank (Remote Start) Pulse count	-	3	0	10
P36	Fuel / Stop solenoid function selection	-	0	0	1
P37	Auxiliary Output-1 Function selection (choose one of 9 operation characteristics)	-	2	0	9

P38	Auxiliary Output-1 active state selection (active low – active high)	-	0	0	1
P39	Auxiliary Output-1 signal type selection (Continuous – Intermittent - Pulse)	-	0	0	2
P40	Auxiliary Output-1 Pulse Duration (if P39 is selected as intermittent)	sec	10	1	999
P41	Auxiliary Output-2 Function selection (choose one of 9 operation characteristics)	-	1	0	9
P42	Auxiliary Output-2 active state selection (active low – active high)	-	0	0	1
P43	Auxiliary Output-2 signal type selection (Continuous – Intermittent)	-	0	0	2
P44	Auxiliary Output-2 Pulse Duration (if P43 is selected as intermittent)	sec	10	1	999
P45	Power-On operating Mode selection	-	1	0	3
P46	Mains Control in OFF mode (enable / disable)	-	0	0	1
P47	Start Fail control (enable / disable)	-	1	0	1
P48	Stop Fail control (enable / disable)	-	1	0	1
P49	Factory Default Parameter return selection	-	0	0	1
P50	Password	-	0	0	999
P51	Mains R – N voltage calibration constant	-	180	10	300
P52	Mains S – N voltage calibration constant	-	180	10	300
P53	Mains T – N voltage calibration constant	-	180	10	300
P54	Generator R – N voltage calibration constant	-	180	10	300
P55	Generator S – N voltage calibration constant	-	180	10	300
P56	Generator T – N voltage calibration constant	-	180	10	300

12- DESCRIPTION OF PARAMETERS:

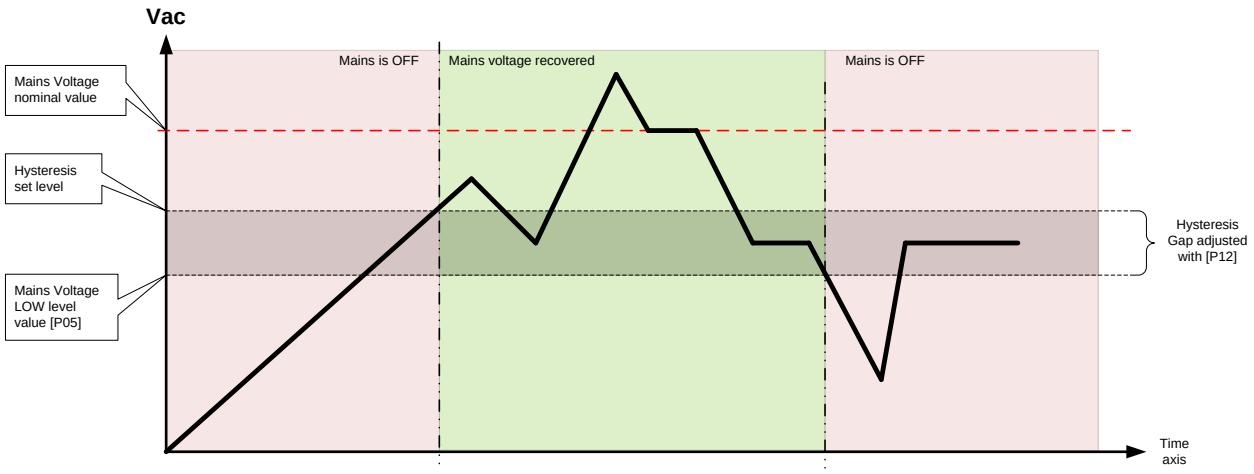
P00	**CUSTOMER CODE:** This is a factory allocated customer code and is used for OEM panel manufacturers in order to identify their company brand and specific factory parameter settings for that OEM. Each customer have their own unique identity code and this is factory nominated and cannot be changed. The customer should set this parameter to their unique customer code and if this code is entered correctly, then customer specific default parameter values will be loaded automatically, when **"Factory Default Parameter Loading"** parameter [P49] is set to "1". It is a 3 digit number and can be set between [000] and [200]. Default factory setting is [000]. Each customer specified code has to be nominated by ENKO and this specific value can be received form factory. If customer code is left as [000], then ENKO factory default settings will be loaded, when user sets [P49] to "1".
P01	**GENERATOR BUS-BAR VOLTAGE LOW LIMIT VALUE:** This parameter sets the low level Generator bus-bar voltage limit and if the measured Generator voltage is below this value (AC True RMS voltage measurement between phase and neutral lines), controller will generate "GLu Err" and disconnect the GCB contactor. This parameter is adjusted in AC Volts and can be set between [50] and [400]. Default factory setting is set at [180]
P02	**GENERATOR BUS-BAR VOLTAGE HIGH LIMIT VALUE:** This parameter sets the high level Generator bus-bar voltage limit and if the measured Generator voltage is above this value (AC True RMS voltage measurement between phase and neutral lines), controller will generate "GHu Err" and disconnect the GCB contactor. This parameter is adjusted in AC Volts and can be set between [50] and [400]. Default factory setting is set at [240]
P03	**GENERATOR BUS-BAR FREQUENCY LOW LIMIT VALUE:** Set value of this parameter determines the lower acceptable frequency limit of the Generator bus-bar voltage and if the frequency falls below this limit, GCB contactor will disconnect and protect the load and generate "GLF Err" signal on display. It is adjusted in Hz and resolution is 1Hz minimum. The parameter is set in Hertz and can be adjusted between [10] and [99]. Factory default setting for this parameter is [45].
P04	**GENERATOR BUS-BAR FREQUENCY HIGH LIMIT VALUE:** Set value of this parameter determines the high level acceptable frequency limit of the Generator bus-bar voltage and if the frequency increases above this limit, GCB contactor will disconnect and protect the load and generate "GHF Err" signal on display. It is adjusted in Hz and resolution is 1Hz minimum. The parameter is set in Hertz can be set between [10] and [99]. Factory default setting for this parameter is [55]
P05	**MAINS BUS-BAR VOLTAGE LOW LIMIT VALUE:** This parameter sets the lower voltage limit value of the mains bus-bar and ATS2.0 will assume that; mains voltage is out of limits if it measures below this voltage level and will disconnect the MCB contactor and initiate "Generator Start" sequence. The value is measured in True RMS AC voltage between phase and neutral lines. This parameter is set in AC Volts and can be set between [50] and [400]. Factory default setting of this parameter is [180]

P06	**MAINS BUS-BAR VOLTAGE HIGH LIMIT VALUE:** This parameter sets the high level voltage limit value of the mains bus-bar and ATS2.0 will assume that; mains voltage is out of limits if it measures above this voltage level and will disconnect the MCB contactor and initiate “Generator Start” sequence. The value is measured in True RMS AC voltage between phase and neutral lines. This parameter is set in AC Volts and can be set between [50] and [400]. Factory default setting of this parameter is [240]
P07	**MAINS BUS-BAR FREQUENCY LOW LIMIT VALUE:** If measured frequency of Mains bus-bar goes below this value, then the controller will automatically consider that the mains quality is out of expected limits and initiate a “Generator Start” sequence after disconnecting the MCB contactor. The display will also show mains failure code on the front panel. Mains frequency is measured in Hz and the resolution is 1Hz. This parameter is set in Hertz can be adjusted between [10] and [99]. Factory default setting is [45].
P08	**MAINS BUS-BAR FREQUENCY HIGH LIMIT VALUE:** If measured frequency of Mains bus-bar goes above this value, then the controller will automatically consider that the mains quality is out of expected limits and initiate a “Generator Start” sequence after disconnecting the MCB contactor. The display will also show mains failure code on the front panel. Mains frequency is measured in Hz and the resolution is 1Hz. This parameter is set in Hertz can be adjusted between [10] and [99]. Factory default setting is [55].
P09	**MAINS SINGLE PHASE – THREE PHASE SELECTION:** This parameter selects how many phases of Mains bus-bar will be monitored. If it is a MONOPHASE (Single Phase) application, then this parameter should be adjusted to [1]. If 3 phases are going to be monitored (3 PHASE) then this parameter should be set as [3]. Set to [1] for SINGLE PHASE Set to [3] for THREE PHASE
P10	**GENERATOR SINGLE PHASE – THREE PHASE SELECTION:** This parameter selects how many phases of Generator bus-bar will be monitored. If it is a MONOPHASE (Single Phase) application, then this parameter should be adjusted to [1]. If 3 phases are going to be monitored (3 PHASE) then this parameter should be set as [3]. Set to [1] for SINGLE PHASE Set to [3] for THREE PHASE
P11	**PHASE SEQUENCE CONTROL ENABLE/DISABLE:** This parameter allows the controller to monitor the phase sequence of both Mains and Generator. If this parameter is enabled, the controller will disconnect MCB and GCB, if the sequence of the phases is altered. Activation of the parameter is achieved by setting the parameter value as [1]. Factory default setting is [0] Set to [0] to DISABLE PHASE SEQUENCE control Set to [1] to ENABLE PHASE SEQUENCE control

P12

MAINS VOLTAGE LOW LEVEL RETURN HYSTERESIS:

When recovering from a “Mains Voltage Failure” condition, in order to prevent repetitive oscillations, ATS2.0 allows the user to define a hysteresis gap, which works together with parameter [P05]. This hysteresis gap ensures that; a stable operation can be achieved and no intermittent load disconnection occurs. The parameter operation is shown in the graphics:



Mains voltage AC RMS value with respect to time

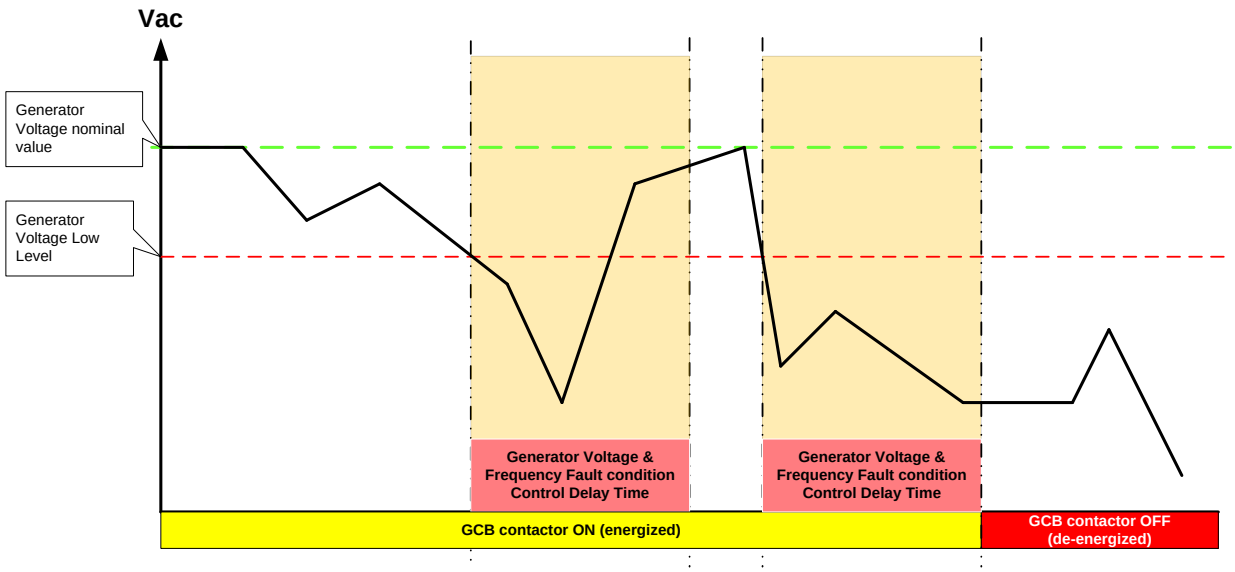
As can be seen from the above graphics; mains voltage return will not be accepted healthy until it exceeds the “Mains Voltage Low Level” value plus “Mains Voltage Low Level Return Hysteresis” voltage level. But as mains voltage decreases, the voltage will be accepted healthy until it drops below “Mains Voltage Low Level” value. Factory default setting is [10]

This parameter setting is set in AC volts and can be set between [1] and [50]

P13

GENERATOR VOLTAGE AND FREQUENCY FAULT CONDITION CONTROL DELAY TIME:

If the load is being fed from the Generator bus-bar, depending on the load change characteristics, Generator voltage may have sudden drops and the frequency may fluctuate before adapting to new load conditions. During this short voltage and/or frequency dip period, in order not to disconnect the GCB contactor, the fault acceptance may be delayed by adjusting this parameter. This parameter helps avoiding false failure alarms when there is sudden change in load.



Generator Voltage & Frequency Fault Condition Control Delay Time diagram

The parameter value is adjusted in “seconds” and until this set time is expired starting from the first instant detection of Generator Voltage and/or Frequency fault condition, the controller will not accept the fault condition and the GCB contactor will not be disconnected. After this timer has expired, if generator voltage and/or frequency values are still out of set limits, the controller will disconnect the GCB contactor and display Error code on the display.

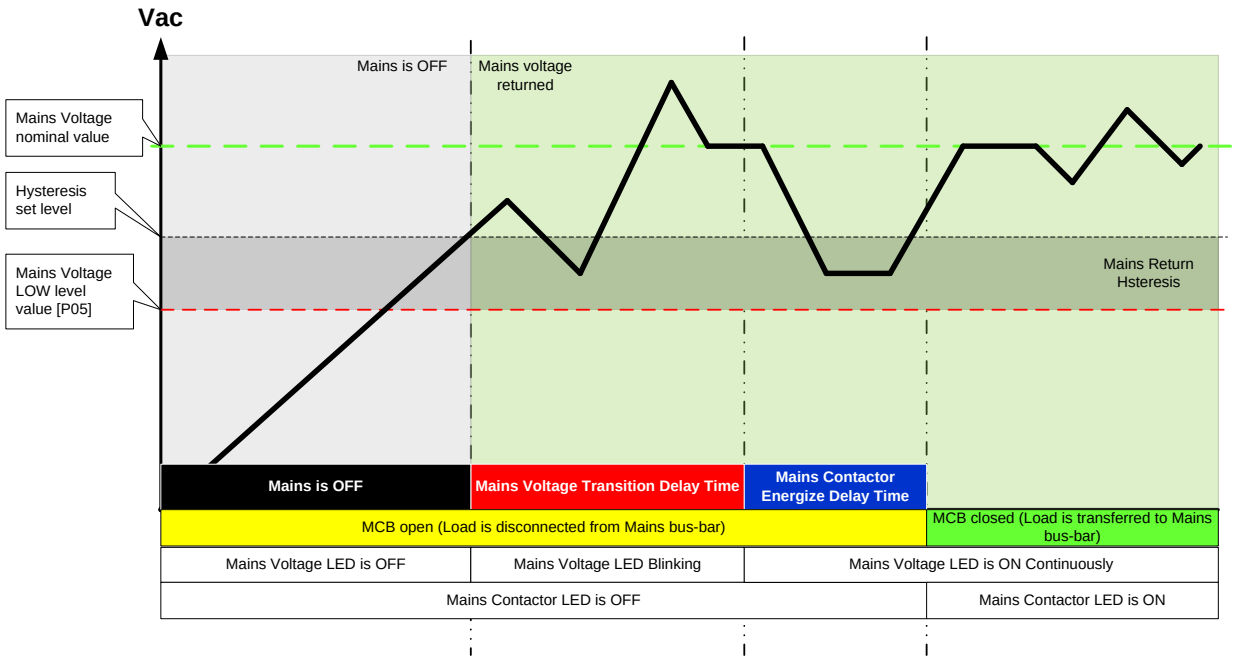
The parameter setting is in “seconds” and can be set between [1] and [300]. Factory default setting is [5]

P14

MAINS VOLTAGE TRANSITION DELAY TIME:

When mains returns back within its set limits, the controller activates “Mains Transition Delay Timer” and “Mains Voltage LED” indicator starts to blink. This timing period ensures that; Mains Voltage is healthy before transferring the load back to Mains bus-bar.

If, during this time, the measured Mains Voltage value stays within its set limits, ATS2.0 will accept Mains Voltage as ‘healthy’ and Mains Voltage LED will stop blinking and light continuously. When controller accepts Mains Voltage as healthy, then “Mains Contactor Energize” timer will be activated before transferring the load back to Mains bus-bar.



Mains Voltage Return acceptance and MCB control logic diagram

This parameter is adjusted in “minutes” and the resolution is 0.1 minutes (6 seconds) minimum. For example; if the parameter value is adjusted as 15.2, then the time delay will be;

15.2 X 60sec = 912 seconds

While waiting for this timer to expire, the user can connect the load manually by de-pressing the MCB control button on the front panel. Pressing this button will activate MCB contactor and connect the load to mains bus-bar and at the same time, reset the “Mains Voltage Transition Delay” timer register.

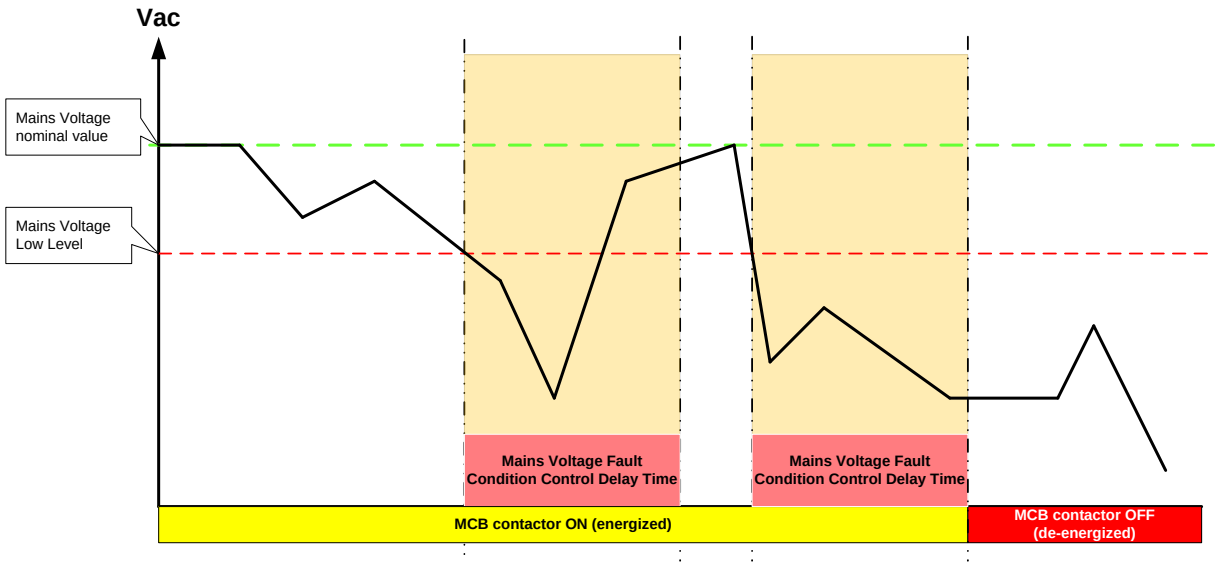
The Mains LED will blink during this timing duration. If MCB control button on the front panel is de-pressed before the timer has expired, LED indicator will stop blinking and will light continuously.

This parameter is set in minutes and the setting resolution is 0.1 minutes. This parameter can be set between [0.1] and [99.9]

P15

MAINS VOTAGE FAULT CONDITION CONTROL DELAY TIME:

When the Mains voltage and frequency values go out of set limits, the controller will initiate the “Mains Failure Control Delay” timer and through this timing duration, controller will not disconnect MCB contactor. If mains values are still out of set limits when this timer has expired, then the controller will accept mains failure and disconnect MCB and act as configured.



Mains Voltage Fault Condition Control Delay Time diagram

The parameter is adjusted in seconds and can be set between [1] and [999]. The factory default setting is [3]

P16

MAINS CONTACTOR ENERGIZE DELAY TIME:

When controller accepts mains as ‘healthy’ after “Mains Voltage Transition Delay” timer has expired, “Mains Contactor Energize Delay” timer is activated and the MCB contactor output will not be energized, until “Mains Contactor Energize Delay” timer has expired. When this timer expires, MCB contactor output is energized and the load is connected to Mains bus-bar.

During this timing duration, MCB contactor can be activated manually if required. In order to activate MCB contactor, press MCB control button on the front panel and contactor will be energized without waiting for the “Mains Contactor energize Delay” timer to expire.

The parameter is adjusted in seconds and can be set between [0] and [999]. Factory default setting is [1].

P17	**ENGINE WARMING TIME:** If generator bus-bar voltage is detected within the set limits, controller will wait for an additional period of time in order to allow the generator diesel engine to warm up. Warm engine load acceptance is better than cold state. “Engine Warming Time” parameter adjusts the amount of time before GCB contactor energize function is enabled. GCB contactor function is disabled during this timer duration. During this time, Generator Voltage LED is blinking. While waiting for “Engine Warming Time” to expire, user can override this timer and enable GCB contactor energize function by pressing GCB control button on the front panel. By doing so, the “Engine Warming Time” register will be reset and GCB contactor energize function will be enabled (“Generator Contactor Energize Delay Time” timer will be activated) so that; controller can control GCB contactor relay. The parameter setting is in seconds and can be adjusted between [0] and [900]. The factory default setting is [30].
P18	**GENERATOR CONTACTOR ENERGIZE DELAY TIME:** If generator starts and Engine Running conditions are detected (Engine Warming time has expired), “Generator Contactor Energize Delay Time” starts counting and GCB contactor control relay is not energized during this period. If no engine failure signals are detected during this period, the controller will energize GCB contactor control relay and transfer the load to Generator bus-bar. During “Generator Contactor Energize Delay Time” period, GCB contactor LED is blinking. During this period, if user wants to override the function and connect the load to the Generator, pressing GCB control button on the front panel will execute this function. When GCB contactor control relay is energized, GCB voltage LED will light continuously. Timing of this parameter and Generator Voltage and Frequency Fault Control Delay time parameter [P13] starts at the same time and therefore; when calculating Generator Contactor Energize Delay time parameter value, make sure that the value is larger than [P13]. The Energize delay time is the difference between [P18] – [P13] and units is in seconds. **PLEASE MAKE SURE THAT; VALUE OF THIS PARAMETER IS SELECTED LARGER THAN THE VALUE OF PARAMETER P13** This parameter value is adjusted in seconds and can be set between [0] and [999]. The factory default setting of this parameter is [9].
P19	**ENGINE COOL-DOWN TIMER:** After load is disconnected from Generator bus-bar, controller will initiate “Engine Cool-Down Timer” register and the Remote Start signal will not be removed until this timer has expired. This will allow the engine to keep running so that; it cools down before switched off. After this time has expired, controller will remove “Remote Start” signal from the Generator. The parameter adjustment is in seconds and can be set between [0] and [900]. The factory default setting is [60].

P20	**MAINS FREQUENCY FAILURE CONTROL ENABLE/DISABLE:** ATS2.0 controller can monitor Mains Frequency and disconnect the load from Mains bus-bar by de-energizing MCB contactor relay, if the measured frequency value is outside the set limits. In order to enable this function, P20 has to be set accordingly. If set as [0]: Controller will monitor and measure Mains Frequency, indicate this value on the digital display but will not initiate a mains failure condition, if frequency value goes out of set limits. If set as [1]: Controller will monitor and measure Mains Frequency, indicate this value on the digital display and also; if measured frequency value goes out of set limits, controller will initiate a “Mains Failure” condition and act as configured. Parameter setting is adjusted as [0] or [1]. Setting [0] means “NO” and setting [1] means “YES”. The factory default setting is [1].
P21	**GENERATOR FREQUENCY FAILURE CONTROL ENABLE/DISABLE:** ATS2.0 controller can monitor Generator Frequency and disconnect the load from Generator bus-bar by de-energizing GCB contactor relay, if the measured frequency value is outside the set limits. In order to enable this function, P21 has to be set accordingly. If set as [0]: Controller will monitor and measure Generator Frequency, indicate this value on the digital display but will not initiate a failure condition, if frequency value goes out of set limits. If set as [1]: Controller will monitor and measure Generator Frequency, indicate this value on the digital display and also; if measured frequency value goes out of set limits, controller will initiate a “Generator Frequency Failure” condition and act as configured. Parameter setting is adjusted as [0] or [1]. Setting [0] means “NO” and setting [1] means “YES”. The factory default setting is [1].
P22	**AUXILIARY INPUT-1 FUNCTION SELECTION:** ATS2.0 controller allows user to define various Auxiliary input functions to be selected according to the application. There is a wide choice of function list which can be allocated for the Auxiliary inputs. The functions are selected according to their respective function numbers. There are altogether 13 different functions which can be allocated to any one of the auxiliary inputs. These function numbers are set consecutively between [0] and [13]. The functions are described according to their respective parameter setting numbers in the following document: **[0] – UNUSED:** If Auxiliary – 1 input is not going to be used, the parameter should be set to [0]. In this case, Auxiliary – 1 input terminal should be left open and no wires should be connected to this terminal. **[1] – ENGINE CRANK (REMOTE START) ON-LOAD:** This parameter is used, if load transfer to Generator is to be forced. If Auxiliary – 1 input parameter is set as [1], controller will generate an “Engine Crank (Remote Start)” signal upon activation of this input and transfer the load directly to Generator bus-bar, without considering the Mains voltage status (this is an unconditional load transfer function to Generator). This function is valid only in AUTO mode. If there is a generator output failure during this operation, ATS2.0 controller will transfer the load back to Mains bus-bar, disconnect GCB and remove the “Remote Start” signal

from the generator. This function can be used to test the generator and load transfer from a remote controller.

[2] – ENGINE CRANK (REMOTE START) OFF-LOAD:

This setting is used, if Auxiliary – 1 input is required to start the generator without load transfer. If this parameter is set to [2], then ATS2.0 controller will generate an “Engine Crank (Remote Start) signal upon activation of Auxiliary – 1 input terminal. The Generator will then start but GCB contactor will not be activated. Therefore, load will not be disconnected from the mains bus-bar.

During this time, if there is a mains failure, controller will automatically transfer the load to Generator bus-bar. This function is valid only in AUTO mode of operation. This function is used in order to test the generator set without transferring the load.

[3] – MAINS SIMULATION:

If the parameter value is set to [3], controller will assume that; Mains Voltage is available and healthy at all times, even if there is a mains failure. Controller will stop monitoring the Mains bus-bar and will not take any action if Mains bus-bar fails. This function will be active only in AUTO mode of operation. This function is used if ATS2.0 is required to be idle and not react to Mains bus-bar failures.

[4] – MAINS FAILURE:

If the parameter value is set to [4], then the controller will assume that there is an unconditional Mains bus-bar failure and immediately disconnect the MCB control relay and generate Remote Start (Engine Crank) signal. This function will be active only in AUTO mode of operation. This function can be used for Mains failure simulation tests.

[5] – ENGINE CRANK (REMOTE START) SIGNAL DISABLE:

This parameter setting can be used, if it is required that the controller never initiates a Remote Start (Engine Crank) signal, even if the Mains bus-bar fails. Setting this parameter value to [5] will prevent a start signal to the generator. This function is available only in AUTO mode of operation.

[6] – MCB CONTACTOR DISABLE:

If this parameter is set to [6], then as long as ATS2.0 controller is connected to DC power supply, MCB contactor control relay is always active (energized) and MCB contactor will not operate. In this mode of operation, load cannot be transferred to Mains bus-bar. This function is available only in AUTO mode of operation.

[7] – GCB CONTACTOR DISABLE:

If the parameter setting is [7], controller will not energize GCB contactor controller relay under any conditions. This prevents the load to be transferred to Generator bus-bar even if there is healthy voltage available on Generator bus-bar. This function is available only in AUTO mode of operation.

[8] – ENGINE RUNNING INFORMATION:

This is a special function selection, which allows ATS2.0 controller to remove the Remote Start signal, as soon as Auxiliary – 1 input is activated. If parameter setting is [8] and Auxiliary – 1 input is activated, controller will accept this signal as “Engine Running” information and immediately remove the “Engine Crank (Remote Start)” signal to the generator. In this case, the Remote Start output will cut off like a Engine Crank pulse.

This function can be used in order to start the engine as an “Engine Starter Relay”, if an “engine running confirmation signal” is fed back to the Auxiliary – 1 input terminal.

[9] – “C” TYPE INPUT FAILURE CHARACTERISTIC:

If parameter is set to [9], controller will behave according to “C Type” input characteristics upon activation. The behaviour pattern of “C Type” input characteristics are explained in the “Failure Modes” section (Chapter 8) of this user manual. This type of function can be activated in all modes of operation.

[10] – “D” TYPE INPUT FAILURE CHARACTERISTIC:

If parameter is set to [10], controller will behave according to “D Type” input characteristics upon activation. The behaviour pattern of “D Type” input characteristics are explained in the “Failure Modes” section (Chapter 8) of

	this user manual. This type of function can be activated in all modes of operation. **[11] – "E" TYPE INPUT FAILURE CHARACTERISTIC:** If parameter is set to [11], controller will behave according to "E Type" input characteristics upon activation. The behaviour pattern of "E Type" input characteristics are explained in the "Failure Modes" section (Chapter 8) of this user manual. This type of function can be activated in all modes of operation. **[12] – "F" TYPE INPUT FAILURE CHARACTERISTIC:** If parameter is set to [12], controller will behave according to "F Type" input characteristics upon activation. The behaviour pattern of "F Type" input characteristics are explained in the "Failure Modes" section (Chapter 8) of this user manual. This type of function can be activated in all modes of operation. **[13] – ALARM RESET FUNCTION:** This function can be used in order to "RESET" all alarm functions in ATS2.0 controller from a remote location. If parameter setting is set to [13], then upon activating Auxiliary – 1 input terminal, any alarm occurred before this instant will be removed and reset. If, upon this action, the alarm condition still exists, then the alarm status will activate the alarm condition of the controller again. In order to reset the alarm status on ATS2.0 with Auxiliary – 1 input activation; the alarm condition should not exist, at the time the RESET signal is applied. This function can be used for all types of alarms available in ATS2.0 controller.
P23	**AUXILIARY INPUT-1 SENSING CONFIGURATION SELECTION:** The Auxiliary-1 input sensing configuration can be selected to work as NO (normally open) or NC (normally closed) polarities. "NO" means that; under normal operating conditions, the terminal is not connected to any potential (open circuit) and in order to activate the Auxiliary-1 input, the terminal has to be connected to DC negative rail (shorted to the ground). "NC" means that; under normal operating conditions, the terminal is connected to DC negative rail (shorted to the ground) and in order to activate Auxiliary-1 input, the negative potential has to be removed from the input terminal (open circuit).
P24	**AUXILIARY INPUT-2 FUNCTION SELECTION:** ATS2.0 controller allows user to define various Auxiliary input functions to be selected according to the application. There is a wide choice of function list which can be allocated for the Auxiliary inputs. The functions are selected according to their respective function numbers. There are altogether 13 different functions which can be allocated to any one of the auxiliary inputs. These function numbers are set consecutively between [0] and [13]. The functions are described according to their respective parameter setting numbers, same as Auxiliary input-1 function selection table above.
P25	**AUXILIARY INPUT-2 SENSING CONFIGURATION SELECTION:** The Auxiliary-2 input sensing configuration can be selected to work as NO (normally open) or NC (normally closed) polarities. "NO" means that; under normal operating conditions, the terminal is not connected to any potential (open circuit) and in order to activate the Auxiliary-2 input, the terminal has to be connected to DC negative rail (shorted to the ground). "NC" means that; under normal operating conditions, the terminal is connected to DC negative rail (shorted to the ground) and in order to activate Auxiliary-2 input, the negative potential has to be removed from the input terminal (open circuit).

P26	**AUXILIARY INPUT-3 FUNCTION SELECTION:** ATS2.0 controller allows user to define various Auxiliary input functions to be selected according to the application. There is a wide choice of function list which can be allocated for the Auxiliary inputs. The functions are selected according to their respective function numbers. There are altogether 13 different functions which can be allocated to any one of the auxiliary inputs. These function numbers are set consecutively between [0] and [13]. The functions are described according to their respective parameter setting numbers, same as Auxiliary input-1 function selection table above.
P27	**AUXILIARY INPUT-3 SENSING CONFIGURATION SELECTION:** The Auxiliary-3 input sensing configuration can be selected to work as NO (normally open) or NC (normally closed) polarities. “NO” means that; under normal operating conditions, the terminal is not connected to any potential (open circuit) and in order to activate the Auxiliary-3 input, the terminal has to be connected to DC negative rail (shorted to the ground). “NC” means that; under normal operating conditions, the terminal is connected to DC negative rail (shorted to the ground) and in order to activate Auxiliary-3 input, the negative potential has to be removed from the input terminal (open circuit).
P28	**FAULT CONTROL DELAY TIMER AFTER ENGINE START:** ATS2.0 controller monitors the generator voltage and frequency (rpm) after the generator is successfully started. As diesel engine speed stabilizes, the voltage can also fluctuate before settling to within the safe limits. ATS2.0 will initiate a “Fault Control Delay Timer” internally and during this time period, generator voltage and frequency fluctuations are not monitored. This will allow a certain time for the generator values to stabilize before ATS2.0 controller starts to monitor these values for failure alarm triggering. The parameter adjustment is in seconds and can be set between [0] and [300]. The factory default setting for this parameter is [8].
P29	**ENGINE RUNNING SENSE CONTROL DELAY:** As part of Auxiliary input function selection table, user can select any one of the auxiliary inputs to behave like “Engine Running Information” signal. This signal can be supplied from oil pressure switch or some similar sensor which indicates that the engine has started to run, after crank signal has applied. Therefore; this parameter allows the user to be able to mask any unwanted false signal fluctuations at this auxiliary input in order to avoid unwanted actions. This parameter is used to set an internal timer, which will mask any signals at this input, until the timer duration is expired. The parameter adjustment is in seconds and can be set between [1] and [120]. The factory default setting for this parameter is [30].
P30	**ENGINE CRANK (REMOTE START) SIGNAL OUTPUT DELAY:** When Mains Voltage failure condition is detected, ATS2.0 controller will generate an Engine Crank (Remote Start) signal in order to start the generator. This parameter is used in order to delay this signal output. Remote Start signal will not be generated until this timer has expired. During this time period, MCB will remain disconnected. The parameter is adjusted in seconds and can be set between [0] and [300]. The factory default setting for this parameter is [3].

P31	**ENGINE CRANK (REMOTE START) OUTPUT POLARITY SELECTION:** The polarity of Engine Cranking (Remote Start) signal can be selected using this parameter setting. It can be used as “Active High” or “Active Low”. If parameter setting is [0], controller will energize the Remote Start relay and connect COMMON terminal voltage to the output terminal (N/O condition) when Remote Start is activated. If parameter setting is [1], controller will de-energize the Remote Start relay and disconnect COMMON terminal voltage from the output terminal (N/C condition) when Remote Start is activated. When load is fed from Mains bus-bar (Generator is OFF) this relay is energized and COMMON terminal is connected to the output terminal. Factory default setting of this parameter is [0].
P32	**ENGINE CRANK (REMOTE START) SIGNAL TYPE CONFIGURATION:** Engine Crank (Remote Start) signal can be configured as “Continuous” or “Pulse” type. This allows all engines types to be interfaced easily to ATS2.0 controller unit. If parameter is set to [0], Remote Start signal will be continuous type and will stay at the same position until this signal is removed. This type signal configuration is used, if the generator is fitted with an Engine Starter control relay unit, which will control the starter motor function. If parameter setting is [1], Remote Start signal will be “Pulse Type” and pulse duration can be controlled by adjusting parameter [P33]. Pulse operation is explained in more detail in chapter 7.13 –b section of this document.
P33	**ENGINE CRANK (REMOTE START) SIGNAL PULSE DURATION:** Engine Crank (Remote Start) output relay pulse duration can be set by adjusting this parameter value. Remote Start signal output will be activated during this set parameter duration and will be de-activated after this duration. While the pulse duration is active, if there is an “Engine Running” signal detected, the pulse will be terminated and the Remote Start signal will be automatically terminated. This action allows ATS2.0 Remote Start signal to control the engine starter motor directly, if Engine Running information is fed into one of the auxiliary inputs and Auxiliary Input function is set as “Engine Running Information”.
P34	**ENGINE CRANK (REMOTE START) WAIT PERIOD BETWEEN PULSES:** When Engine Crank (Remote Start) function is selected as pulse type configuration, waiting duration between the pulses can be adjusted by this parameter setting. The parameter adjustment is in seconds and can be set between [1] and [300]. The factory default setting for this parameter is [10].

P35	**ENGINE CRANK (REMOTE START) PULSE COUNT:** ATS2.0 Remote start output can also be used as Engine Crank output control. Therefore, configuration for this function also includes the number of crank pulses to be applied to the engine starter motor and number of start attempts can be set with the value of this parameter. During this operation period, if “Engine Running Information” is received or Generator voltage is detected within the set values, then this function will be terminated even if the set number of pulses is not reached.
P36	**FUEL / STOP SOLENOID SELECTION:** ATS2.0 controller also allows to switching the generator off, directly from its Auxiliary output ports. If any one of the Auxiliary Outputs is configured as “Remote Stop”, then this parameter should be set appropriately, depending on the type of generator. The output can then act to control the stop action as “Fuel Solenoid” or “Stop Solenoid”. If parameter is set as [0], the auxiliary output will act as FUEL SOLENOID control and will be energized while the engine is running, If parameter is set as [1], the auxiliary output will act as STOP SOLENOID control and will be energized only to stop the engine in the pulse mode of operation.

P37	**AUXILIARY OUTPUT-1 FUNCTION SELECTION:** There are various functions, which the user can allocate to each of the Auxiliary outputs of ATS2.0 controller. Depending on this parameter setting, auxiliary outputs can behave in different patterns which can serve to control different types of operations. The parameter setting values can be selected among 10 different special functions and can be set between [0] to [9] and these are explained in below topics; **[0] – UNUSED** The auxiliary output is disabled and will never be energized under any conditions. **[1] – MAINS FAULT FUNCTION:** Auxiliary output will act in relation to Mains Fault conditions. If Mains voltage or frequency goes out of their set limits or cut off completely, the auxiliary output will be activated, otherwise will not change state. **[2] – GENERATOR FAULT FUNCTION:** Auxiliary output will act in relation to Generator Fault conditions. If Generator voltage or frequency goes out of their set limits or cut off completely, the auxiliary output will be activated, otherwise will not change state. **[3] – ENGINE RUNNING SIGNAL:** ATS2.0 measures the generator frequency and determines engine speed value in rpm. If the engine speed is within the set limits, auxiliary output can be activated to indicate that; engine is running. If parameter setting is [3], then auxiliary output will execute this function. **[4] – LOAD ON GENERATOR BUSBAR:** This function can be used to indicate that; the load is now transferred to Generator bus-bar. If set to [4], auxiliary output will be activated when load is transferred to Generator bus-bar. **[5] – LOAD ON MAINS BUSBAR:** This function can be used to indicate that; the load is transferred to Mains bus-bar. If set to [5], auxiliary output will be activated when load is transferred to Mains bus-bar. **[6] – AUTO MODE:** This setting of the parameter will allow the auxiliary output to be activated when ATS2.0 is set in AUTO mode of operation from the front panel controls. **[7] – CONTROLLER ACTIVE:** This function will activate the auxiliary output if there is healthy voltage connection to ATS2.0 controller inputs either from Mains or from the Generator bus-bars. **[8] – ALARM OUTPUT:** If parameter value is set to [8], then the auxiliary output will be activated if there is an alarm condition in the controller. This auxiliary output will be active on any active alarm state in the controller. **[9] – REMOTE STOP FUNCTION:** If required, the auxiliary output function can be set to control the stopping action of the generator engine. In order to set this function for the auxiliary output of the controller, parameter should be set to [9] and this will generate an independent stop signal (either as fuel solenoid function or stop solenoid function) for the generator. This signal will act in “PULSE” mode of operation. The parameter settings are adjusted by numbers between [0] and [9]. Factory default setting is [2], meaning that; Auxiliary Output-1 is selected as **“Generator Fault Alarm”** output.

P38	**AUXILIARY OUTPUT-1 ACTIVE STATE SELECTION:** Auxiliary Output-1 active operation polarity can be adjusted by this parameter setting. The output can be selected to operate as “Active High” or “Active Low” depending on this setting. [0] – Normally Open (N/O) operation: Auxiliary Output-1 relay will be energized when the output is activated. The relay is not energized if the auxiliary output is not active. [1] – Normally Closed (N/C) operation: Auxiliary Output-1 relay will be de-energized when the output is activated. The relay is energized if the auxiliary output is not active.
P39	**AUXILIARY OUTPUT-1 SIGNAL TYPE SELECTION:** Auxiliary output signal type can be configured depending on the setting of this parameter. The available types of operations are described in chapter 7.13 in more detail. Auxiliary output-1 signal type can be configured as follows: [0] – CONTINUOUS OPERATION: In this setting mode, auxiliary output-1 will change state on activation and stay in this state as long as it is active. The output relay will not change state during activation period. [1] – INTERMITTENT OPERATION: In this setting mode, auxiliary output-1 will be oscillating with 0.5 second “on” (relay energized) and 0.5 second “off” (relay de-energized) pulse chain, when the output is activated. This cyclic operation will continue as long as the output is active and will switch off when it is de-activated. [2] – PULSE OPERATION: If set to this mode of operation, auxiliary-1 output will operate as a single pulse, on activation. The pulse time duration can be set with parameter [P40]. This is a single pulse operation.
P40	**AUXILIARY OUTPUT-1 PULSE DURATION:** If pulse operation mode is selected for auxiliary output-1, pulse duration can be adjusted in seconds by setting this parameter. The parameter set value determines the pulse length when the output is activated. Parameter is adjusted in seconds and can be set between [1] and [999]. The factory default setting is [10].
P41	**AUXILIARY OUTPUT-2 FUNCTION SELECTION:** Auxiliary output-2 functions can be selected among 10 different modes and these available function modes are same as Auxiliary Output-1 functions. The function settings are the same as described in parameter [P37]. Check detailed explanations of parameter [P37] before adjusting the value of [P41]. The parameter settings are adjusted by numbers between [0] and [9]. Factory default setting is [1], meaning that; Auxiliary Output-2 is selected as **“Mains Fault Alarm”** output.
P42	**AUXILIARY OUTPUT-2 ACTIVE STATE SELECTION:** Auxiliary Output-2 active operation polarity can be adjusted by this parameter setting. The output can be selected to operate as “Active High” or “Active Low” depending on this setting. [0] – Normally Open (N/O) operation: Auxiliary Output-2 relay will be energized when the output is activated. The relay is not energized if the auxiliary output is not active.

	[1] – Normally Closed (N/C) operation: Auxiliary Output-2 relay will be de-energized when the out is activated. The relay is energized if the auxiliary output is not active.
P43	**AUXILIARY OUTPUT-2 SIGNAL TYPE SELECTION:** Auxiliary Output-2 signal type can be configured depending on the setting of this parameter. The available types of operations are described in chapter 7.13 in more detail. Auxiliary Output-2 signal type can be configured as follows: [0] – CONTINUOUS OPERATION: In this setting mode, Auxiliary Output-2 will change state on activation and stay in this state as long as it is active. The output relay will not change state during activation period. [1] – INTERMITTENT OPERATION: In this setting mode, Auxiliary Output-2 will be oscillating with 0.5 second “on” (relay energized) and 0.5 second “off” (relay de-energized) pulse chain, when the output is activated. This cyclic operation will continue as long as the output is active and will switch off when it is de-activated. [2] – PULSE OPERATION: If set to this mode of operation, Auxiliary Output-2 will operate as a single pulse, on activation. The pulse time duration can be set with parameter [P44]. This is a single pulse operation.
P44	**AUXILIARY OUTPUT-2 PULSE DURATION:** If pulse operation mode is selected for Auxiliary Output-2, pulse duration can be adjusted in seconds by setting this parameter. The parameter set value determines the pulse length when the output is activated. Parameter is adjusted in seconds and can be set between [1] and [999]. The factory default setting is [10].
P45	**POWER-ON OPERATING MODE:** When ATS2.0 is connected to DC power, user can choose the operation mode which the controller will start with. All four available operation modes can be selected, depending on this parameter setting. [0] – controller starts in OFF mode, during power up [1] – controller starts in AUTO mode, during power up [2] – controller starts in TEST-ON-LOAD mode, during power up [3] – controller starts in TEST-OFF-LOAD mode, during power up After Power-Up, user can change the operation modes by pressing the appropriate mode button on the front panel. Controller will operate in this mode, unless another mode is selected. If the controller power is cut off and connected again (power-up condition) controller will automatically be set, according to the value of this parameter.
P46	**MAINS CONTROL IN OFF MODE:** This parameter allows ATS2.0 controller to act as a protection device for the load connected to Mains bus-bar, even when the device is switched off. In order to achieve this function, unit can be switched off but has to be connected to DC power source. This parameter enables Mains protection during “OFF” position of the controller. If Mains bus-bar voltage and/or frequency values go out of set limits, then depending on the set limits of this parameter value, Mains control relay will be energized and load will be disconnected from the Mains bus-bar. When Mains (Utility) is back within the set limits and stabilized within the set time duration, Mains control relay will be de-energized (normal

	operation mode) and the MCCB will be connected, resulting in safe powering of the load. [0] – this means that; controller will not control the Mains Circuit breaker relay during OFF mode, even if the Mains values are out of set limits (Function disabled). [1] – this means that; controller will control and disconnect load from Mains bus-bar, if the Mains values go out of set limits (Function enabled). The parameter adjustment can be either [0] or [1]. The factory default setting is [0]
P47	**START FAIL CONTROL ALARM ENABLE:** During Remote Start operation, ATS2.0 controller monitors the Generator bus-bar voltage in order to decide if the generator has started successfully. If this condition is not satisfied, ATS2.0 will generate a “Str Err” and display the code on the digital display. If this error code is not required, user can disable it by using this parameter setting. If set to [0], Generator Start Error function will be disabled. If set to [1]. This function is enabled. The factory default setting is [1] and function is enabled.
P48	**STOP FAIL CONTROL ALARM DISABLE:** If the generator is controlled with Remote Start signaling, ATS2.0 will remove this signal in order to stop the generator and will monitor the generator bus-bar voltage for validation. If this condition is not satisfied, ATS2.0 will generate a “StP Err” alarm code on the display to indicate that; generator could not be stopped. If one of the Auxiliary Inputs are programmed as “Engine Running Information” modes, the controller will also expect this signal to reset after the engine has stopped. If this signal does not reset, controller will generate “StP Err” alarm code. In order to disable this function, user has to set this parameter to [0]. The factory default setting is [1] for this parameter and function is enabled.
P49	**FACTORY DEFAULT PARAMETER LOADING:** ATS2.0 offers a flexible parameter setting system for each specific customer. Parameter [P00] indicates specific unique customer code and this customer code allows different default settings for each customer. Therefore, the customer code is essential to be set correctly before loading “Factory Default Settings” so that; customer specific default parameters are loaded correctly. If customer code is left as [000], then when factory default parameters are loaded, these parameters are going to be the ones, which are set at ENKO factory but not the customer specific factory default values. For each customer, the default settings are different. Therefore; it is essential to enter the “Customer Code” value correctly into parameter [P00] before loading the customer specific default settings. In order to load the correct factory default setting, set this parameter [p49] as “1”. When factory default parameters are loaded, the password will also change to [000] and therefore; user should also change the password again, after loading factory default parameter values with [P49]. When “Customer Code” number is entered and then [P49] is set to “1” in order to load the customer specific default parameters into the controller, then the password is automatically set to [customer code] + 1 For example, if the “Customer Code” is 115 and parameter [P00] is set to “115”; then the customer specific default values will be loaded into the controller and the new password is set to “116”. The customer can then use this password and enter parameter menu and change the password again, to match his own usual password. Set to [1] in order to load factory default settings for all parameters.

P50	**PASSWORD ADJUSTMENT** ATS2.0 can be protected against unauthorized persons to change the parameter settings. In order to achieve this, a three, non-zero parameter value has to be entered for [P50]. Factory default setting of this parameter is [000] and with this setting, ATS2.0 controller will not require any authorized password for parameter menu entrance. If user changes this parameter value to a non-zero, three digit value, ATS2.0 will require this password, each time user wants to enable parameter menu entrance. Password value can take any 3 digit value between [000] to [999]. The factory default setting of this parameter is [000]. If parameter is set to [000], ATS2.0 will not require any password in order to enter parameter change menu.
P51	**MAINS L1-N VOLTAGE CALIBRATION CONSTANT** Multiplication factor for calibrating L_1 – N Mains (Utility) voltage reading. See chapter 13 for detailed explanation before setting this value. This parameter is only available for the engineer and should not be set by inexperienced persons.
P52	**MAINS L2-N VOLTAGE CALIBRATION CONSTANT** Multiplication factor for calibrating L_2 – N Mains voltage reading. See chapter 13 for detailed explanation before setting this value. This parameter is only available for the engineer and should not be set by inexperienced persons.
P53	**MAINS L3-N VOLTAGE CALIBRATION CONSTANT** Multiplication factor for calibrating L_3 – N Mains voltage reading. See chapter 13 for detailed explanation before setting this value. This parameter is only available for the engineer and should not be set by inexperienced persons.
P54	**ALTERNATOR L1-N VOLTAGE CALIBRATION CONSTANT** Multiplication factor for calibrating L_1 – N Generator voltage reading. See chapter 13 for detailed explanation before setting this value. This parameter is only available for the engineer and should not be set by inexperienced persons.
P55	**ALTERNATOR L2-N VOLTAGE CALIBRATION CONSTANT** Multiplication factor for calibrating L_2 – N Generator voltage reading. See chapter 13 for detailed explanation before setting this value. This parameter is only available for the engineer and should not be set by inexperienced persons.
P56	**ALTERNATOR L3-N VOLTAGE CALIBRATION CONSTANT** Multiplication factor for calibrating L_3 – N Generator voltage reading. See chapter 13 for detailed explanation before setting this value. This parameter is only available for the engineer and should not be set by inexperienced persons.

13-PHASE VOLTAGE MEASUREMENT CALIBRATION:

ATS2.0 allows calibration of each phase voltage measurement for Mains and Generator bus-bars. The calibration is made by adjusting the parameter values for each phase measurement for Mains and Generator.

The parameters from [P51] through to [P56] are phase voltage calibration parameters. The value for each parameter is a correction factor for phase voltage measurement error. These correction factors have to be adjusted for each phase (ATS2.0 measures phase-neutral voltages of each phase and calibration is also made for phase-neutral voltage readings). If calibration is made carefully, phase voltage reading errors can be kept around 1% of actual reading.

The phase voltage reading constant of the ATS2.0 controller measurement circuit is [0.5556] and is fixed by design. Due to component tolerances and temperature variations, the reading error can change and ***"Calibration Constant"*** multiplication factor is used, in order to compensate for this error value. The formula for *"Calibration Constant"* is:

$$Vd = [0.5556] * Vm * (\frac{CC}{100})$$

Where:

$Vd = RMS\ Voltage\ value\ read\ on\ ATS2.0\ display$

$Vm = RMS\ Voltage\ value\ measured\ on\ accurate\ Multimeter$

$CC = Calibration\ Constant\ multiplication\ factor$

For calibration, the following steps should be executed:

1- For correct measurement of the phase voltages, a TRUE RMS measuring multimeter has to be used,
2- While adjusting calibration parameters, use a stable voltage source if possible. Read the correct actual voltage value from the multimeter (V_m) and then adjust the phase voltage calibration constant (CC) value accordingly.
3- Repeat this process for every phase.
4- Check the calibrated phase voltage readings on ATS2.0 controller display $(_{Vd})$ and repeat the process again if necessary.
5- Factory default adjustment for "Calibration Constant" is 180,
6- Change this value "up" or "down" to match ATS2.0 display voltage reading, as close as possible, to the actual voltage value read on the calibration Multimeter display,

MAKE SURE THAT; MEASURED PHASE IS THE PHASE THAT YOU ARE ACTUALLY CALIBRATING. IF "MEASURED" AND "CALIBRATED" PHASES DO NOT MATCH, THERE MAY BE LARGE READING ERRORS AND THIS WILL CAUSE THE CONTROLLER TO MALFUNCTION.

14-CONNECTION DIAGRAM:

The wiring connection diagram is shown in figure 8 below. This is a “typical” connection diagram but user can make different connection designs for different applications. Essentially, ATS2.0 controllers can be configured and connected to control any two bus-bars.

If not required, MCCB and GCCB can be selected as three pole circuit breakers, provided that; the neutral connections are common and connected together for both bus-bar systems.

The fuse values can be selected as 1A for each phase terminal connection. Ensure to use fuses for this connection.

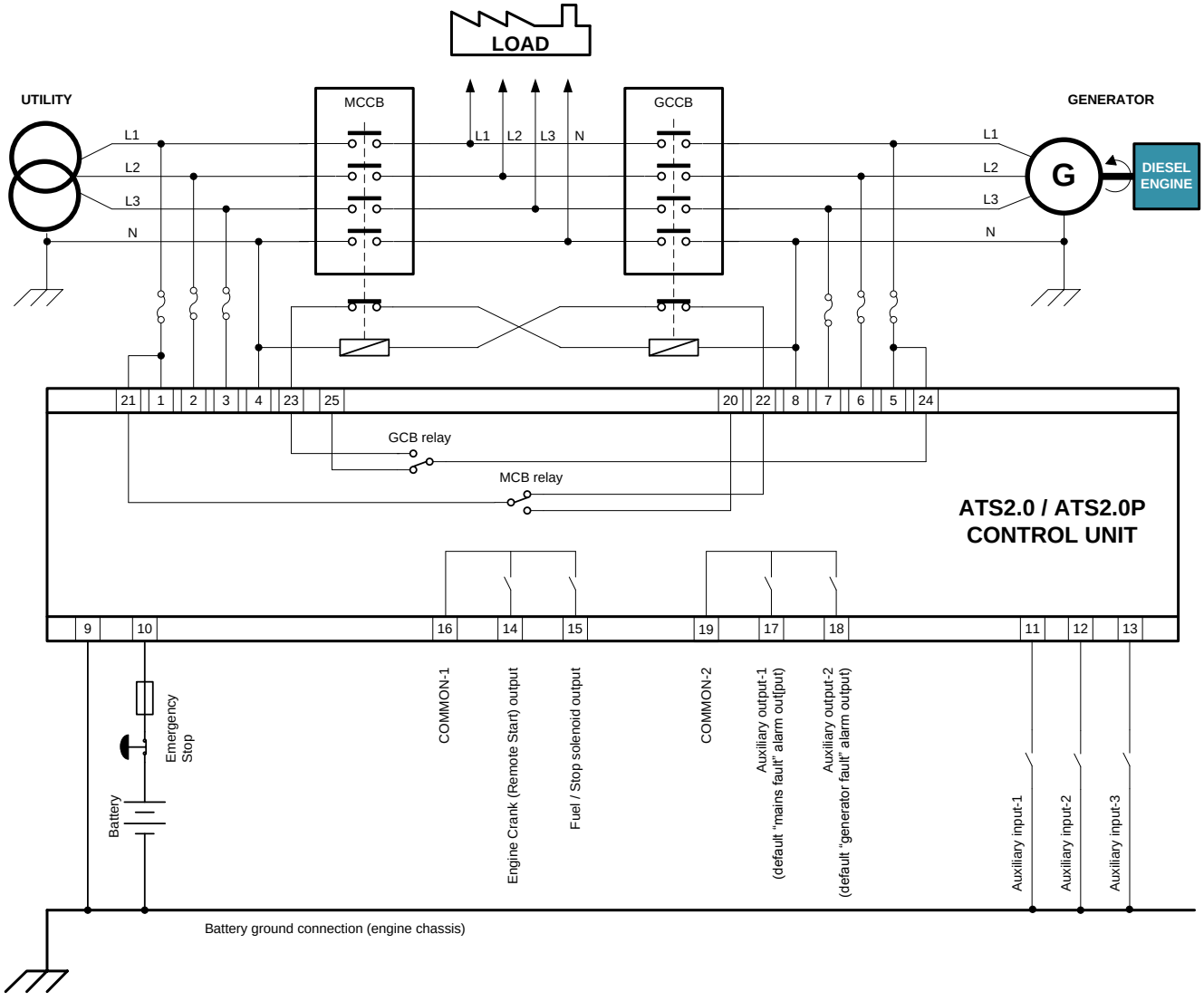


Figure: 8

15-USER CONFIGURATION FORM:

This parameter list form can be used for user defined parameter values. Just copy the list and use the empty column for user defined parameters before you start to enter parameters into controller memory.

	ENGINEER NAME: **DATE:** **PROJECT NAME:**	**IT**	**CTORY SETTINGS**	**ER SETTINGS**	**IMUM VALUE**	**XIMUM VALUE**
PAR. NO	**CONFIGURABLE PARAMETER NAME**					
P00	Customer code (3 digit unique number)	-	0		0	200
P01	Generator Voltage Lower Limit	VAC	180		50	400
P02	Generator Voltage Upper Limit	VAC	240		50	400
P03	Generator Frequency Lower Limit	Hz	45		10	99
P04	Generator Frequency Upper Limit	Hz	55		10	99
P05	Mains Voltage Lower Limit	VAC	180		50	400
P06	Mains Voltage Upper Limit	VAC	240		50	400
P07	Mains Frequency Lower Limit	Hz	47		10	99
P08	Mains Frequency Upper Limit	Hz	53		10	99
P09	Mains Single Phase / Three Phase Selection	-	3		1	3
P10	Generator Single phase / Three phase selection	-	3		1	3
P11	Phase Sequence control enable / disable	-	0		0	1
P12	Mains Voltage Low level return Hysteresis	VAC	10		1	50
P13	Generator Voltage Fault condition control delay	sec	5		1	300
P14	Mains Voltage Transition time delay (15.2 = 912 seconds)	min	3		0.1	99.9

P15	Mains Voltage Fault condition control delay	sec	3		1	999
P16	Mains contactor energize delay time	sec	1		0	999
P17	Engine Warming Time	sec	30		0	900
P18	Generator Contactor Energize delay time	sec	9		0	999
P19	Engine Cool-down timer duration	sec	60		0	900
P20	Mains Frequency Control enable / disable	-	1		0	1
P21	Generator Frequency Control enable / disable	-	1		0	1
P22	Auxiliary Input-1 Function (choose one of 13 input characteristics)	-	8		0	13
P23	Auxiliary Input-1 sensing configuration (active low – active high)	-	1		0	1
P24	Auxiliary Input-2 Function (choose one of 13 input characteristics)	-	9		0	13
P25	Auxiliary Input-2 sensing configuration (active low – active high)	-	1		0	1
P26	Auxiliary Input-3 Function (choose one of 13 input characteristics)	-	10		0	13
P27	Auxiliary Input-3 sensing configuration (active low – active high)	-	1		0	1
P28	Fault Control delay timer after Engine Start	sec	8		0	300
P29	Engine Running Sense control delay	sec	30		1	120
P30	Engine Crank (Remote Start) signal output delay	sec	3		0	300
P31	Engine Crank (Remote Start) output selection (active low – active high)	-	0		0	1
P32	Engine Crank (Remote Start) signal type (Continuous / Pulse)	-	1		0	1
P33	Engine Crank (Remote Start) pulse duration	sec	6		1	300
P34	Engine Crank (Remote Start) wait period (between pulses)	sec	10		1	300
P35	Engine Crank (Remote Start) Pulse count	-	3		0	10
P36	Fuel / Stop solenoid function selection	-	0		0	1
P37	Auxiliary Output-1 Function selection (choose one of 10 operation characteristics)	-	2		0	9
P38	Auxiliary Output-1 active state selection (active low – active high)	-	0		0	1
P39	Auxiliary Output-1 signal type selection (Continuous – Intermittent - Pulse)	-	0		0	2

P40	Auxiliary Output-1 Pulse Duration (if P39 is selected as Pulse type)	sec	10		1	999
P41	Auxiliary Output-2 Function selection (choose one of 10 operation characteristics)	-	1		0	9
P42	Auxiliary Output-2 active state selection (active low – active high)	-	0		0	1
P43	Auxiliary Output-2 signal type selection (Continuous – Intermittent - Pulse)	-	0		0	2
P44	Auxiliary Output-2 Pulse Duration (if P43 is selected as pulse type)	sec	10		1	999
P45	Power-On operating Mode selection	-	1		0	3
P46	Mains Control in OFF mode (enable / disable)	-	0		0	1
P47	Start Fail control (enable / disable)	-	1		0	1
P48	Stop Fail control (enable / disable)	-	1		0	1
P49	Factory Default Parameter return selection	-	0		0	1
P50	Password	-	0		0	999
P51	Mains R – N voltage calibration constant	-	180		10	300
P52	Mains S – N voltage calibration constant	-	180		10	300
P53	Mains T – N voltage calibration constant	-	180		10	300
P54	Generator R – N voltage calibration constant	-	180		10	300
P55	Generator S – N voltage calibration constant	-	180		10	300
P56	Generator T – N voltage calibration constant	-	180		10	300