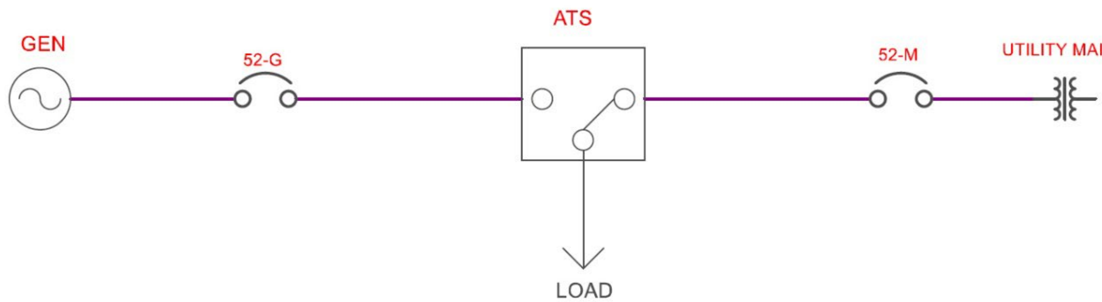
APPLICATION GUIDE

How to Set Up the DGC-2020 for Single Generator Operation with ATS

From a Single-Line Diagram:



To a Fully Functional System:

Purpose

This application guide is intended to be used as a quick start guide for implementing the use of a DGC-2020 in a single generator application with a digitally controlled ATS (Automatic Transfer Switch). The purpose is to provide users with direction on the minimum settings that need to be configured, and logic that needs to be created to achieve genset control. This application guide is not a comprehensive instruction manual that covers all features and functions of the DGC-2020. Users should always refer to the DGC-2020 instruction manual available at www.basler.com for further details.

About the Author

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Application Overview

In this application, the DGC-2020 should be set up to control the generator and the generator breaker only. The Automatic Transfer Switch (ATS) controller leads the sequence of operations. The ATS and the ATS controller are provided by other vendors. Some of the functions that are typically performed by the ATS controller include generator and mains sensing, sending start/stop requests to the generator, and initiating load transfer.

During each step of the sequence of operations, there are time delays that need to be observed, including a time delay before starting the generator when the utility power fails, and a time delay before transferring the loads back to the utility when power is restored. These time delays are typically programmed into the ATS controller.

In such applications, the genset controller is simply responding to instructions from the ATS controller. When the genset controller receives a remote start request, it will start the generator and get it up to rated speed and voltage as quickly as possible. Once the generator has started, the genset controller handles genset and breaker control operations. The DGC-2020 can be implemented for genset control in such an arrangement. A single-line diagram is shown in Figure 1.

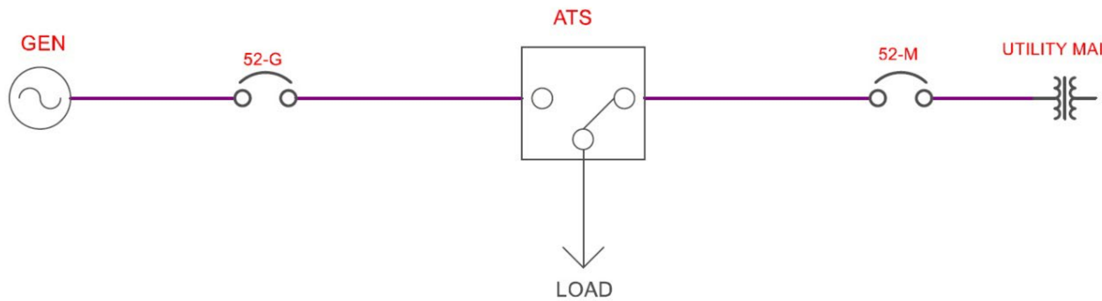

Figure 1. Single-Line Diagram

Figure 2 illustrates a DGC-2020 interface diagram.

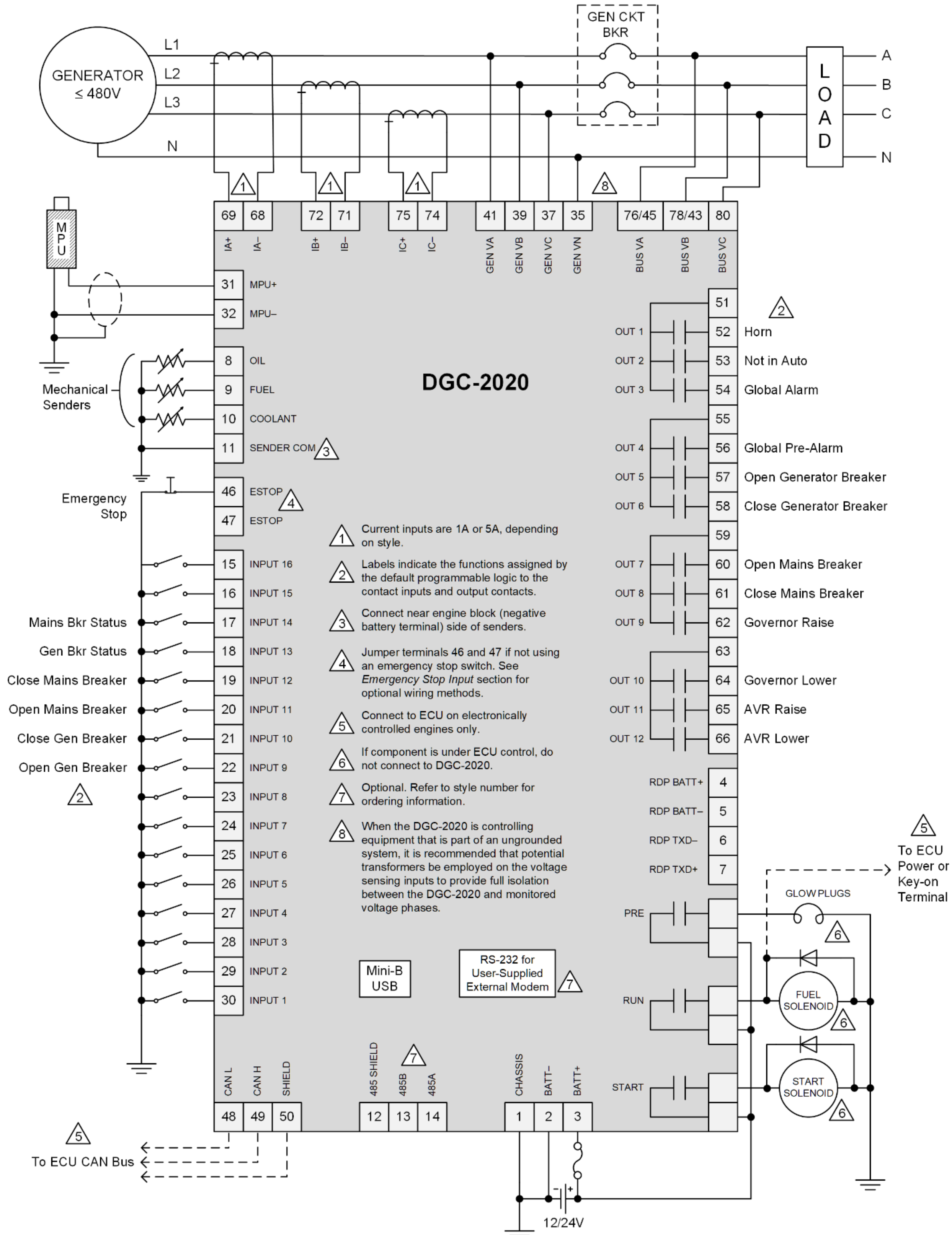

Figure 2. DGC-2020 Interface Diagram

Style Number

The style number in Figure 3 is sufficient for an ATS standby application. Note that overcurrent protection using inverse time curves is not available with the standard protection option.

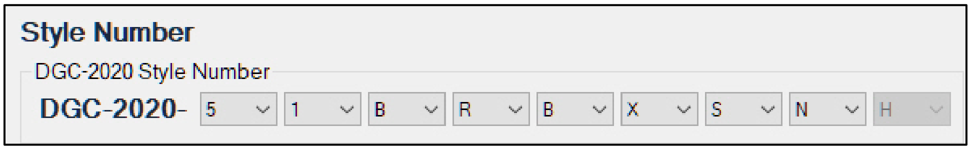

Figure 3. DGC-2020 Style Number

The DGC-2020 is capable of numerous functions through the configuration of several settings in BESTCOMS*Plus*® and implementation of logic in BESTlogic™*Plus* Programmable Logic. However, with only a few settings, and minimal logic, the DGC-2020 can be programmed to achieve basic genset control.

The following sections discuss some of the key settings that need to be configured.

CAN Bus Setup

In order to avoid communications errors, it is important to first ensure that CAN Bus network installations are done correctly. The following list summarizes the CAN Bus installation requirements for all DGC controllers:

- If the DGC is providing one end of the J1939 bus, a 120-ohm 1/2 watt terminating resistor should be installed across the CAN2 L and CAN2 H terminals. Refer to the appropriate DGC instruction manual for terminal numbering.
- If the DGC is not part of the J1939 bus, the stub connecting the DGC to the bus should not exceed 914 mm (3 ft) in length.
- The maximum bus length, not including stubs, is 40 m (131 ft).
- The J1939 drain (shield) should be grounded at one point only. If grounded elsewhere, do not connect the drain to the DGC.

On the CAN Bus Setup page shown in Figure 4, ECU support needs to be enabled if the DGC-2020 will communicate with an engine ECU. DTC support must be enabled if the DGC-2020 will receive DTCs sent to it from the engine ECU. Four (4) is the most common SPN conversion method, but it should be changed if necessary. Some engine manufacturers specify a J1939 ECU address for transmitting requests to the engine ECU. These include RPM requests to run the engine at a specific speed, engine start requests, and engine stop requests. Engine control parameter transmit needs to be enabled if the controller will send control requests to the engine ECU. On the list shown in Table 1, the CAN Bus address is user selectable for some ECUs. The standard ECU is listed for ECU types that are not included in Table 1.

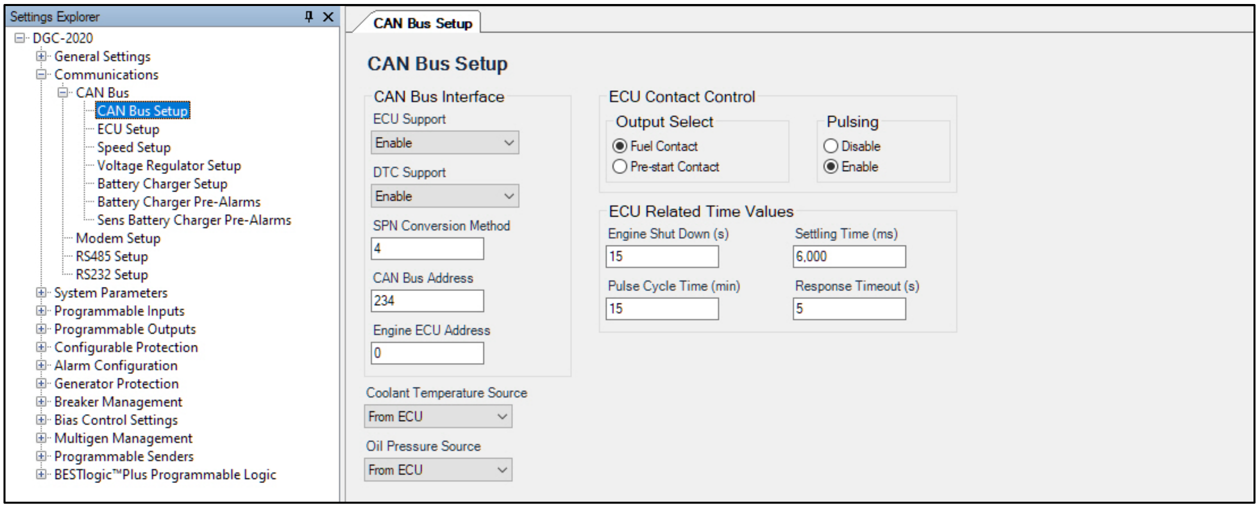

Figure 4. CAN Bus Setup

Table 1. CAN Bus Address per ECU Type

ECU Type	CAN Bus Address
Cummins	220
Daimler CPC4	User-selectable
GM/Doosan	User-selectable
Isuzu	User-selectable
John Deere	User-selectable
mtu ADEC	1
mtu ECU7/ECU8	6
mtu MDEC	6
mtu Smart Connect	234
Scania	39
Standard	User-selectable
Volvo Penta	User-selectable
Yanmar	User-selectable

On the CAN Bus Setup page shown in Figure 4, there are settings for ECU Contact Control, ECU Related Time Values, Coolant Temperature Source, and Oil Pressure Source. The default settings are typical for an ECU controlled engine, but they can be changed if necessary.

ECU Setup

For ECU controlled engines only, there are settings to be selected on the ECU Setup page shown in Figure 5. The ECU type can be selected on this page. There are additional settings that apply to specific ECU types. Standard ECU is an available selection for ECU types that are not listed on the drop down list of ECU types.

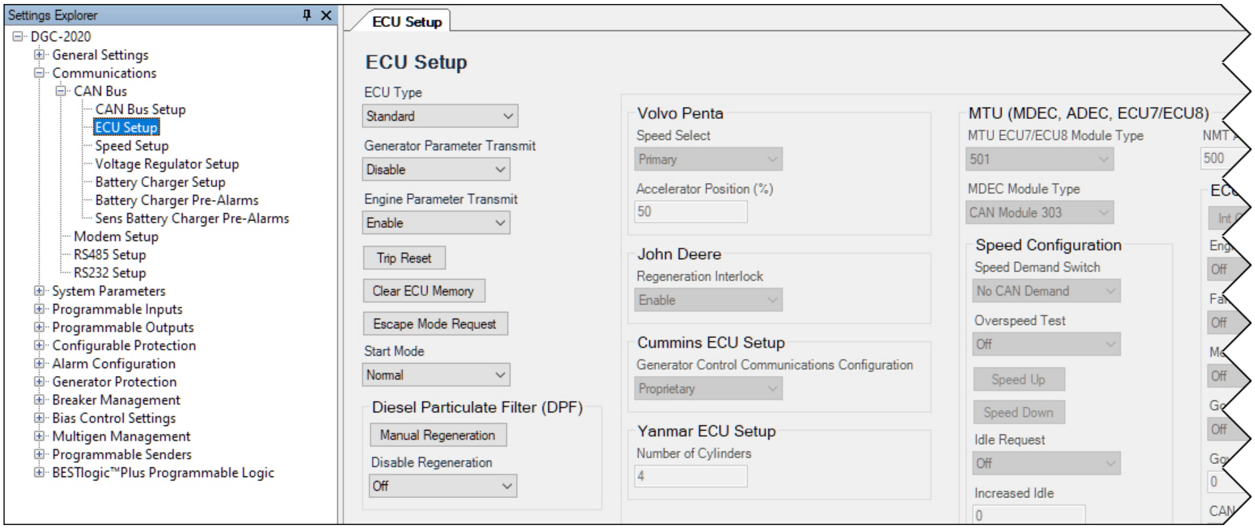

Figure 5. ECU Setup

Speed Setup

For J1939 controlled engines that are receiving RPM requests from the genset controller, CAN Bus RPM request must be enabled on the Speed Setup page shown in Figure 6. The remaining settings on this page can be adjusted as needed for the application.

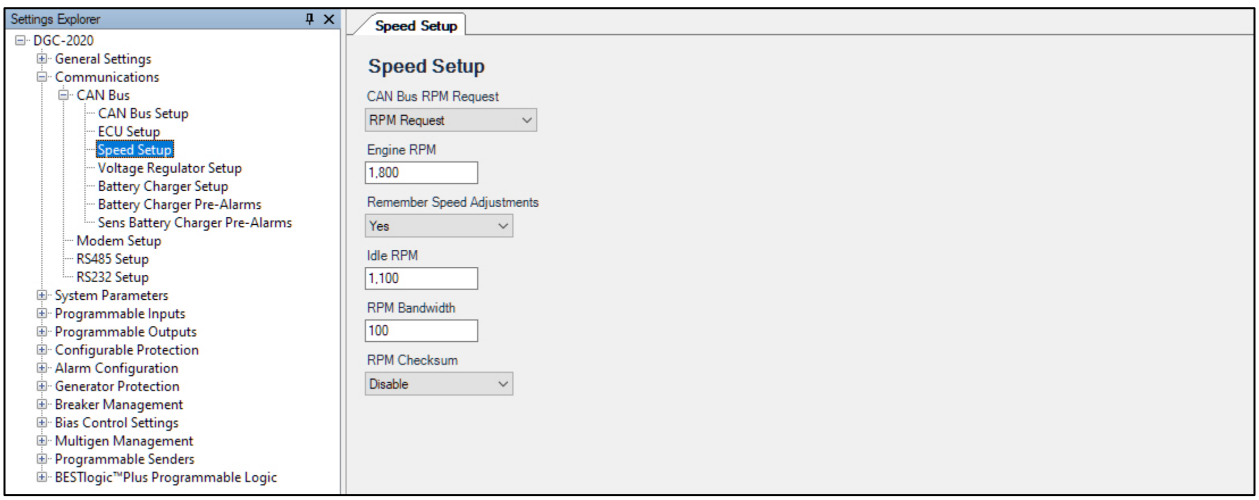

Figure 6. Speed Setup

System Settings

On the System Settings page shown in Figure 7, the system type should be set to Single Generator. The other settings should be adjusted as needed.

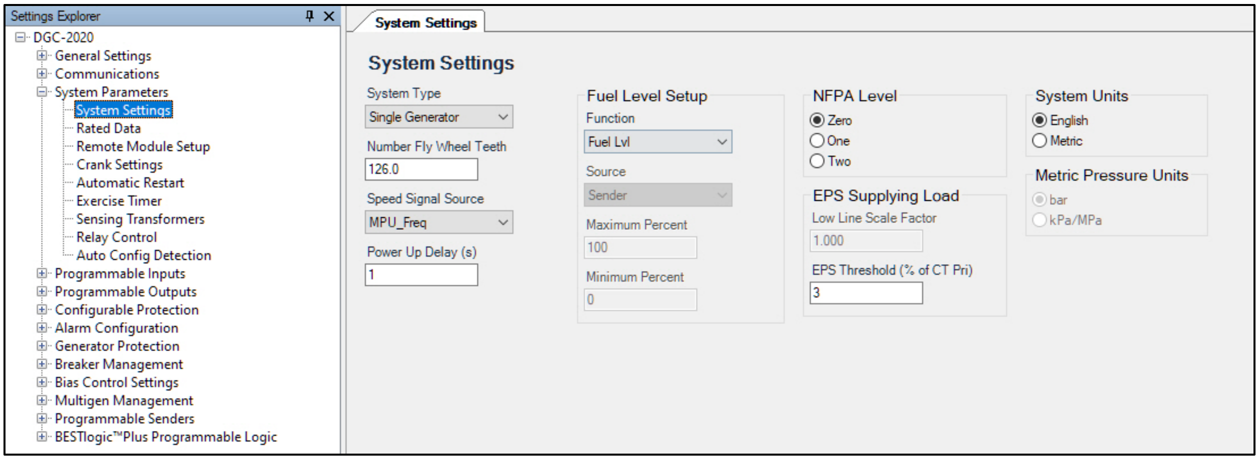

Figure 7. System Settings

Rated Data Settings

Rated data settings for the generator and the bus need to be entered on the Rated Data Settings page. In the example shown in Figure 8, the generator is rated for 100 KW, 0.8 pf, 208/120 Vac wye, 60 Hz. The current transformers (CTs) have a 400:5 turns ratio. Potential transformers (PTs) are not needed because the DGC-2020 is capable of sensing up to 576 Vac directly.

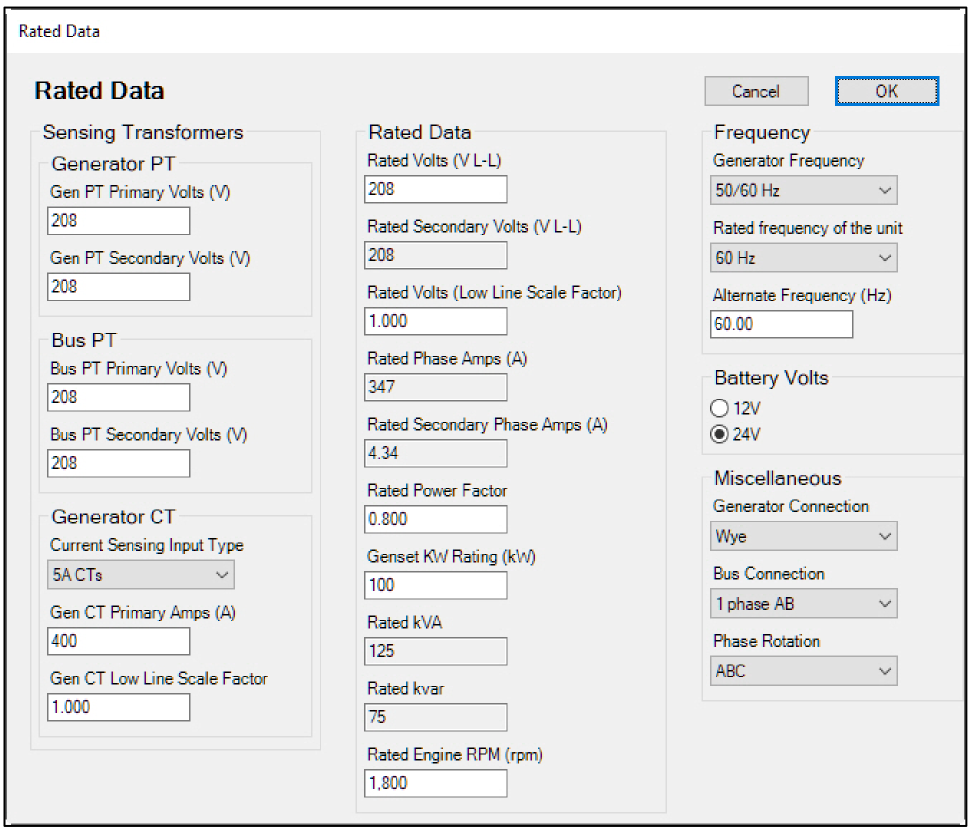

Figure 8. Rated Data Settings

Crank Settings

On the Crank Settings page shown in Figure 9, a time setting can be entered for a pre-crank delay. The pre-start relay can be used to control a circuit to power equipment that needs to be turned on before the engine cranks. Examples include glow plugs, coolant heaters, pre-lube pumps, etc.

The cranking style can be set to continuous or cycle. If cycle is chosen, the number of crank cycles, crank time, and the rest time can be changed. The crank disconnect limit can be set as a percentage of engine rated speed. Alternatively, the oil pressure crank disconnect setting can be enabled and an oil pressure threshold can be set for crank disconnect.

The DGC-2020 can be configured to allow the genset to cooldown before shutting down. A time setting can be entered for the “No Load Cool Down” Time setting. During cooldown, the generator runs at rated speed, with no load.

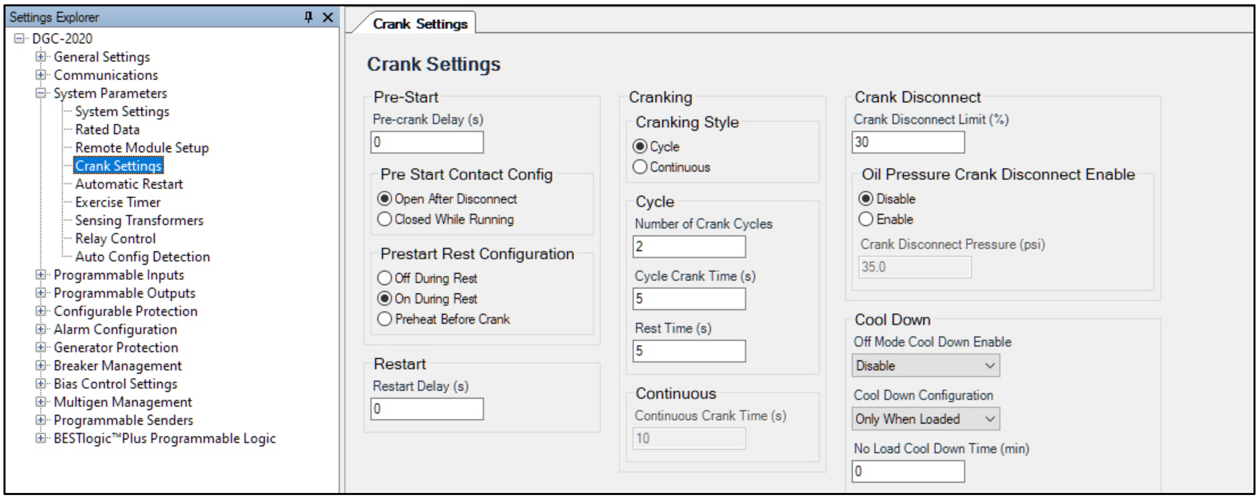

Figure 9. Crank Settings

Programmable Inputs

The 16 programmable inputs on the DGC-2020 can be used in logic as desired. Inputs have been designated as follows for consistency with the interconnect diagram shown in Figure 2 and the logic diagram shown in Figure 15.

- Input 1 – Remote start
- Input 9 – Generator breaker open request
- Input 10 – Generator breaker close request
- Input 13 – Generator breaker status feedback

Programmable Outputs

The programmable outputs can be used in logic as desired. Outputs have been designated as shown in Figure 10, consistent with the interconnect diagram shown in Figure 2, and the logic diagram shown in Figure 15.

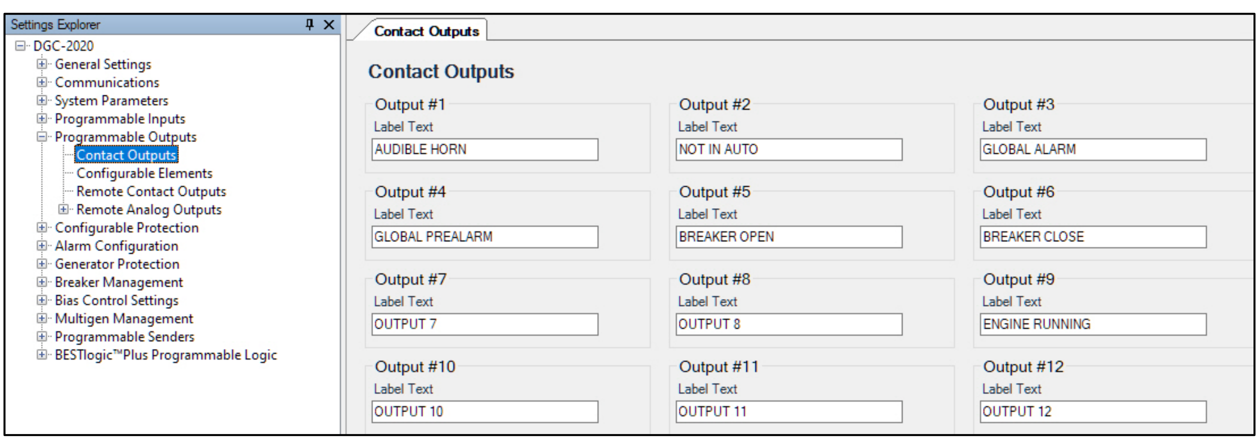

Figure 10. Programmable Outputs

Multiple protection elements are available for protecting the generator against fault conditions, depending on the style number of the controller. All protection elements are disabled by default. If the DGC-2020 controller is the device that is responsible for protecting the generator, appropriate protection settings should be selected for the application. Refer to the *Generator Protection* section in Chapter 4 of the *DGC-2020 Instruction Manual* for descriptions of each protection element and associated settings. **It is the responsibility of the person(s) commissioning the generator to ensure that it is adequately protected before running it.**

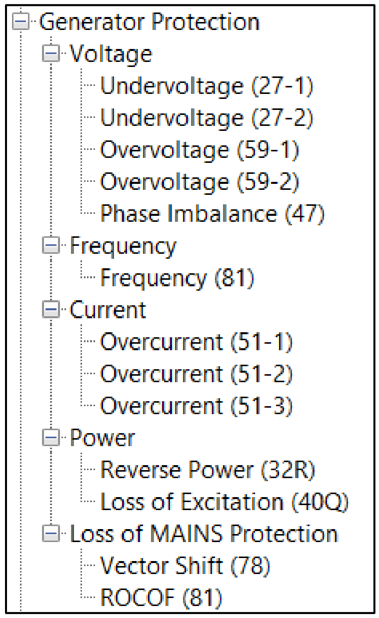

Figure 11. Protection Elements

Breaker Hardware Settings

In this application, since the DGC-2020 will be performing generator breaker control functions, the Breaker Hardware Configured settings should be set to “Yes” as shown in Figure 12. The Dead Bus Close Enable setting should be set to Enable because the generator breaker will close to a dead bus during a utility outage. The Mains Breaker Hardware Configured settings should be set to “No” because the DGC-2020 will not be controlling the mains breaker. The other settings on this page should be adjusted if necessary.

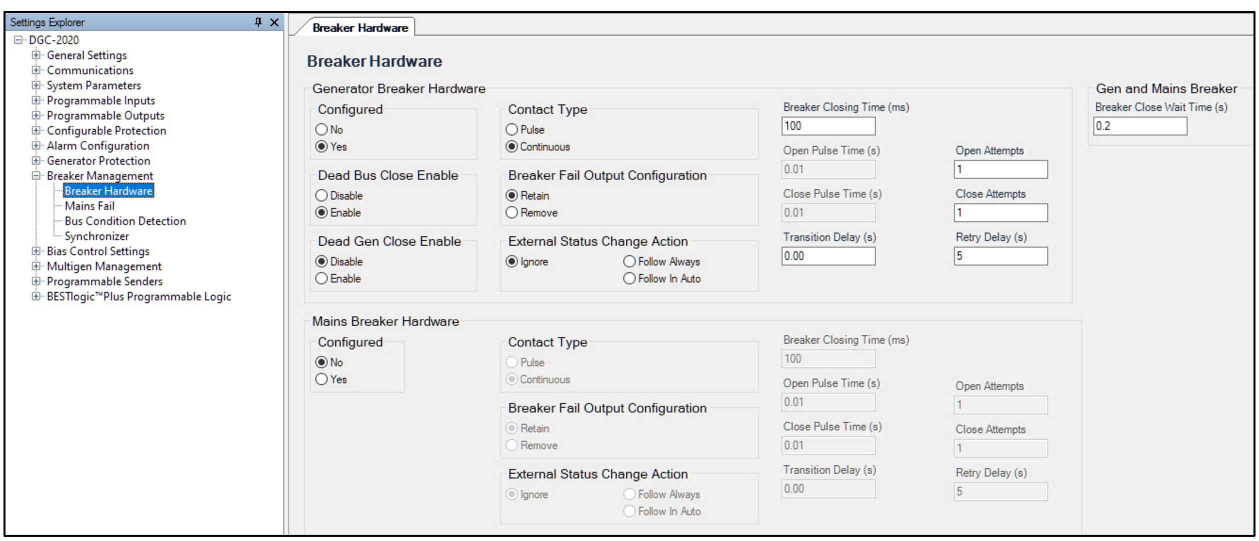

Figure 12. Breaker Hardware Settings

Generator and Bus Condition Detection

The genset controller will receive a Generator Stable Status only when the generator voltage and frequency are within the ranges entered in the Generator Condition Settings shown in Figure 13. Bus stability is determined using the same criteria. The controller will not issue a breaker close request until it receives a Generator Stable Status.

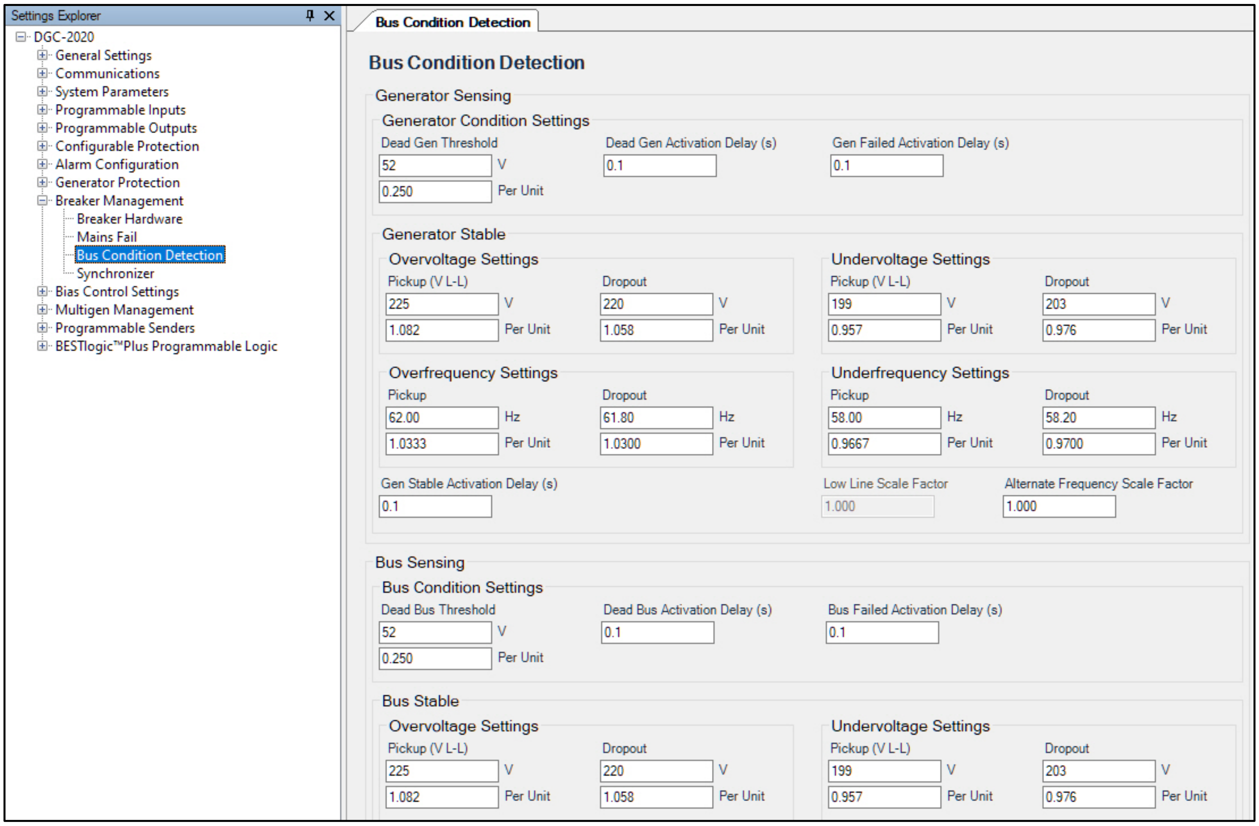

Figure 13. Bus Condition Detection Settings

Programmable Senders

Curves for specific coolant level, oil pressure, and fuel level sender part numbers are available in BESTCOMS*Plus* for the DGC-2020. See Figure 14. Coolant level sender curves can be selected by clicking the “Load Cool. Settings File” button. Curves for oil pressure and fuel level can be loaded in a similar manner. If the sender curve is not loaded in BESTCOMS*Plus*, a custom curve can be created by entering values for the 11 points in the table. The sender slope can be changed.

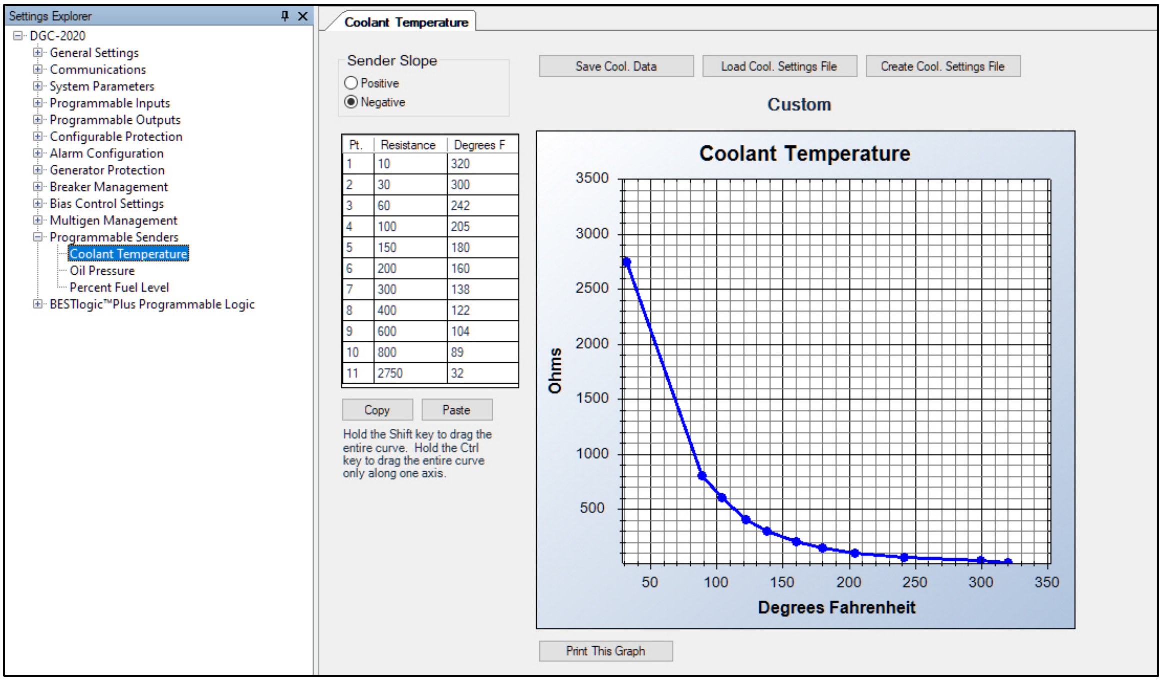

Figure 14. Programmable Sender Settings

So far, in this application guide, we have discussed the minimal settings that are needed for a DGC-2020 to interface with a single genset in a standby application with an ATS.

With the ATS controller leading the sequence of operations, the genset controller only needs to respond to requests from the ATS controller. A typical sequence of operations for an emergency standby application is described next.

Sequence of Operations

Loss of Normal Power

- The utility is the normal source of power and it is available. The loads are being driven by the utility.
- Utility power is lost.
- The ATS controller issues an open request to the utility breaker.
- After the utility breaker is opened, the ATS controller sends a start request to the genset controller.
- The generator starts and gets up to rated conditions.
- The generator breaker closes.
- The ATS transfers the load to the emergency power source, which is the generator.

Restoration of Normal Power

- When the utility power is restored, the ATS controller waits for a set time delay to ensure that the mains bus is stable.
- Once the time delay has expired and the mains bus is stable, the ATS controller sends a request to the genset controller to shut down the genset.
- The generator breaker opens and the generator begins its cooldown cycle.
- Once the open transition delay has expired, the ATS controller transfers the load to its normal source of power.
- The generator shuts down once its cooldown cycle timer has expired.
- The generators remain in standby mode for the next power outage.

Implementing the logic scheme shown in Figure 15 will allow the DGC-2020 to control the genset and interface with the ATS controller, so that the system achieves the sequence of events described above.

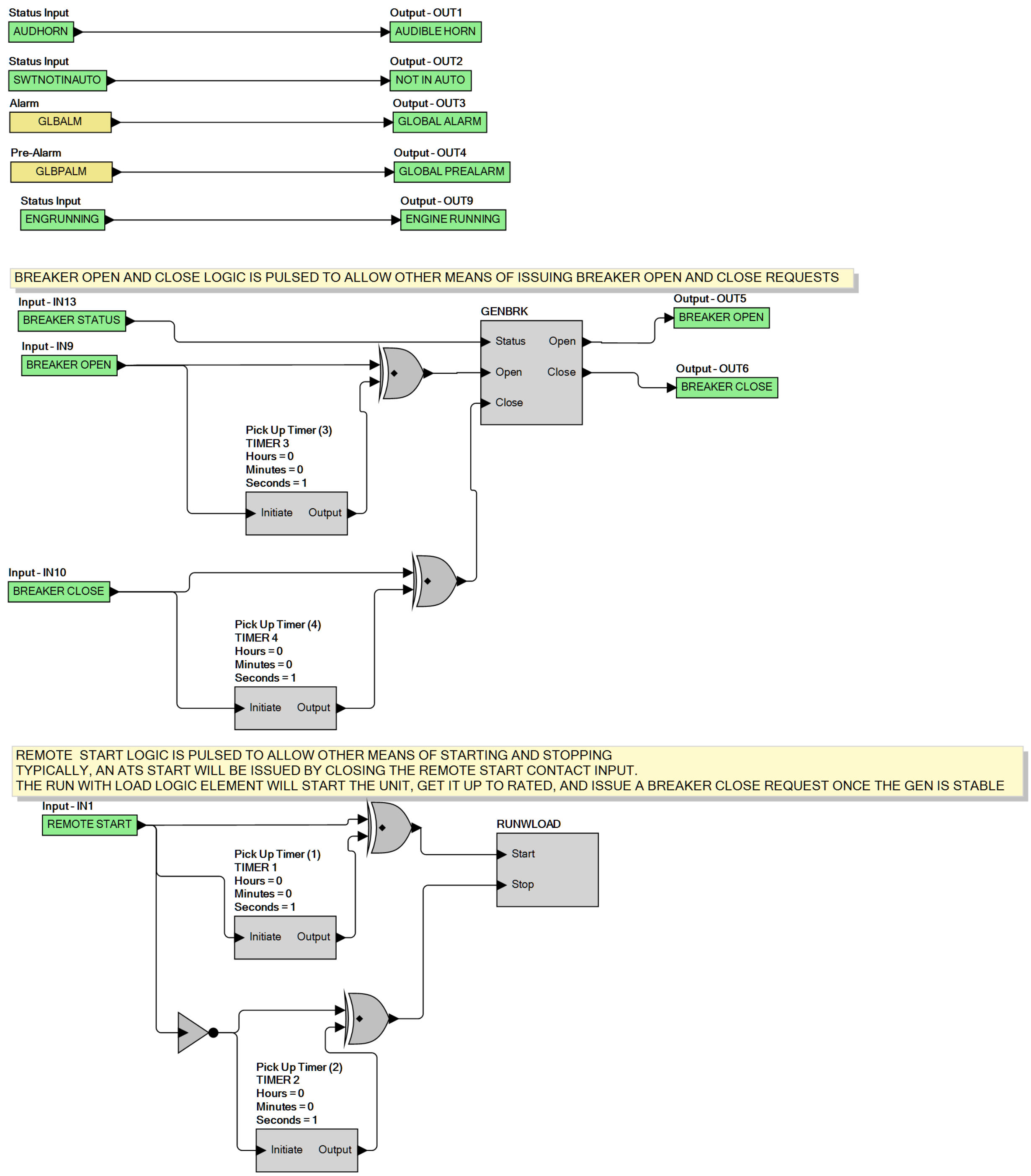

Figure 15. Logic Scheme

Once the installation of all equipment and the setup on the genset controller is complete, the controller should be placed in Auto mode to respond to remote start and stop requests.

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