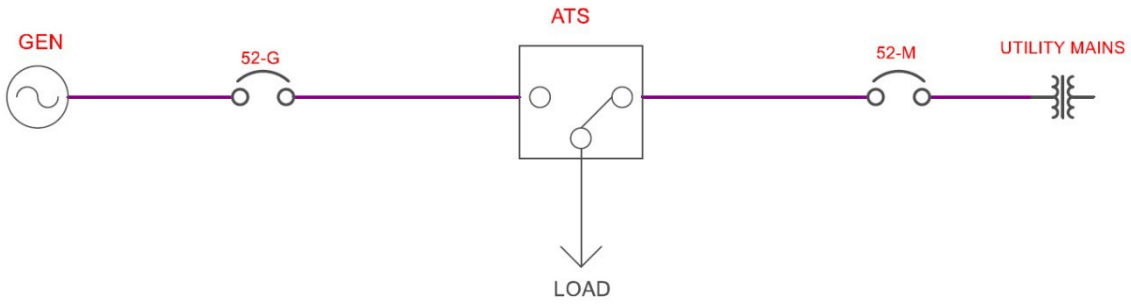
APPLICATION GUIDE

How to Set Up the DGC-2020HD 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-2020HD 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-2020HD. Users should always refer to the DGC-2020HD instruction manuals available at www.basler.com for further details.

About the Author

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Application Overview

In this application, the DGC-2020HD 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-2020HD can be implemented for genset control in such an arrangement. A single-line diagram is shown in Figure 1.

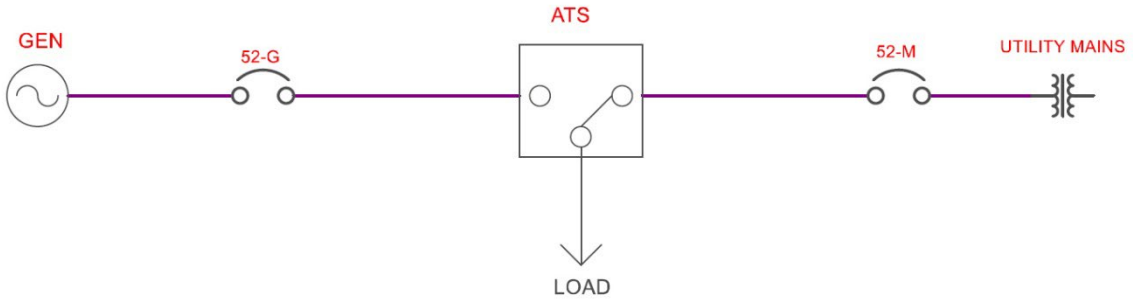

Figure 1. Single-Line Diagram

Figure 2 illustrates DGC-2020HD to generator wiring for single generator control with ATS.

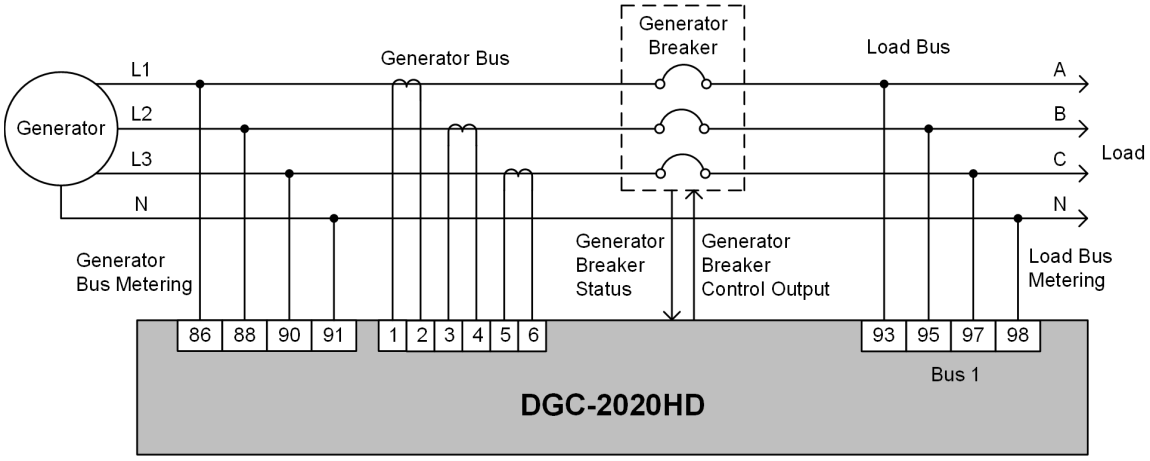

Figure 2. DGC-2020HD to Generator Wiring for Single Generator Control with ATS

Figure 3 illustrates a DGC-2020HD interface diagram.

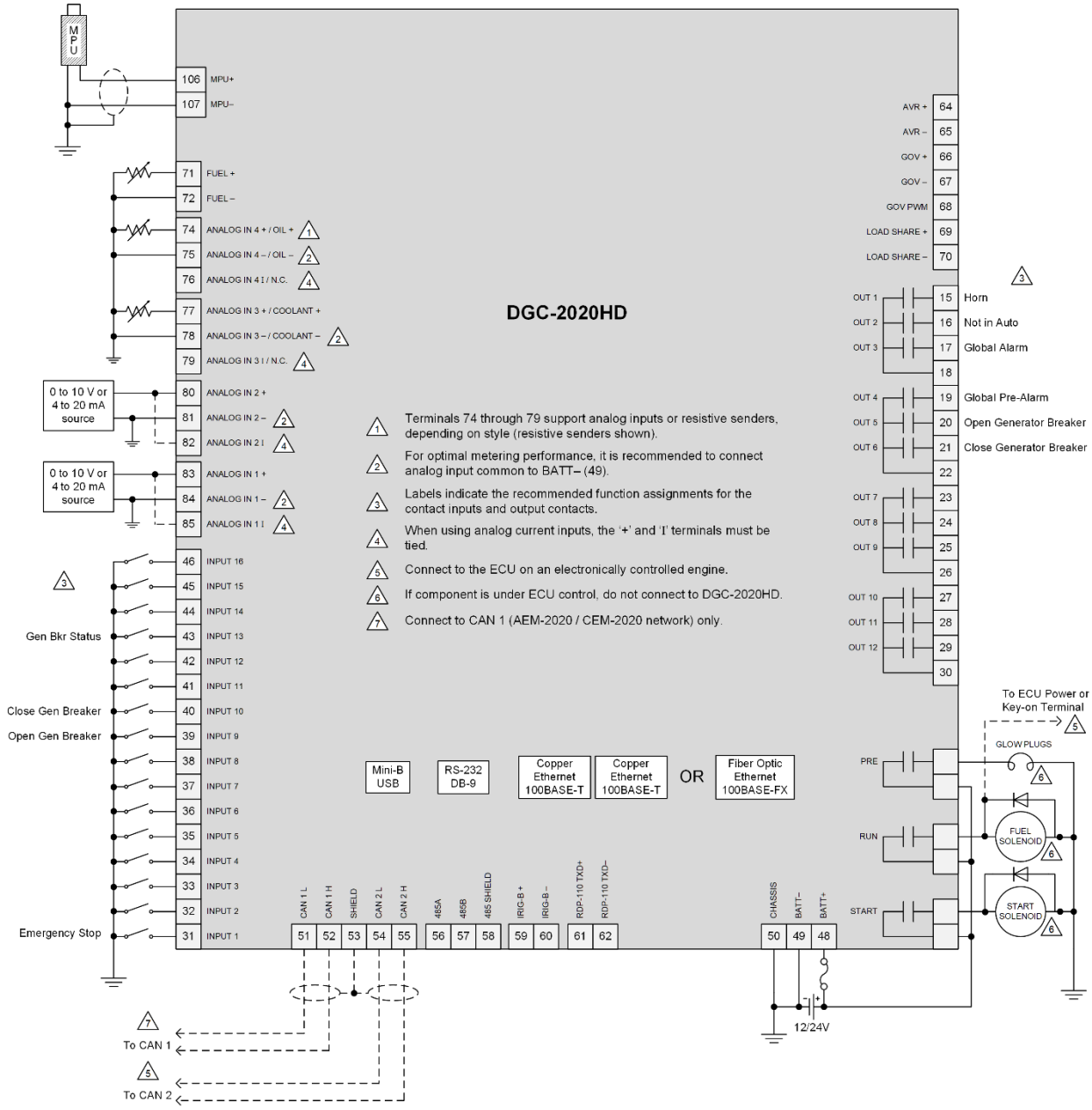

Figure 3. DGC-2020HD Interface Diagram

Style Number

A style number composed of base options is sufficient. However, if the generator being commissioned will be paralleled with other generators or a mains bus in the future, the Auto Sync option should be selected. Note that overcurrent protection using inverse time curves is not available with the standard protection option. Figure 4 shows the DGC-2020HD Style Number Selection.

Figure 4. DGC-2020HD Style Number

The DGC-2020HD 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-2020HD can be programmed to achieve basic genset control in an emergency standby application.

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 5, ECU support needs to be enabled if the DGC-2020HD will communicate with an engine ECU. DTC support must be enabled if the DGC-2020HD 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.

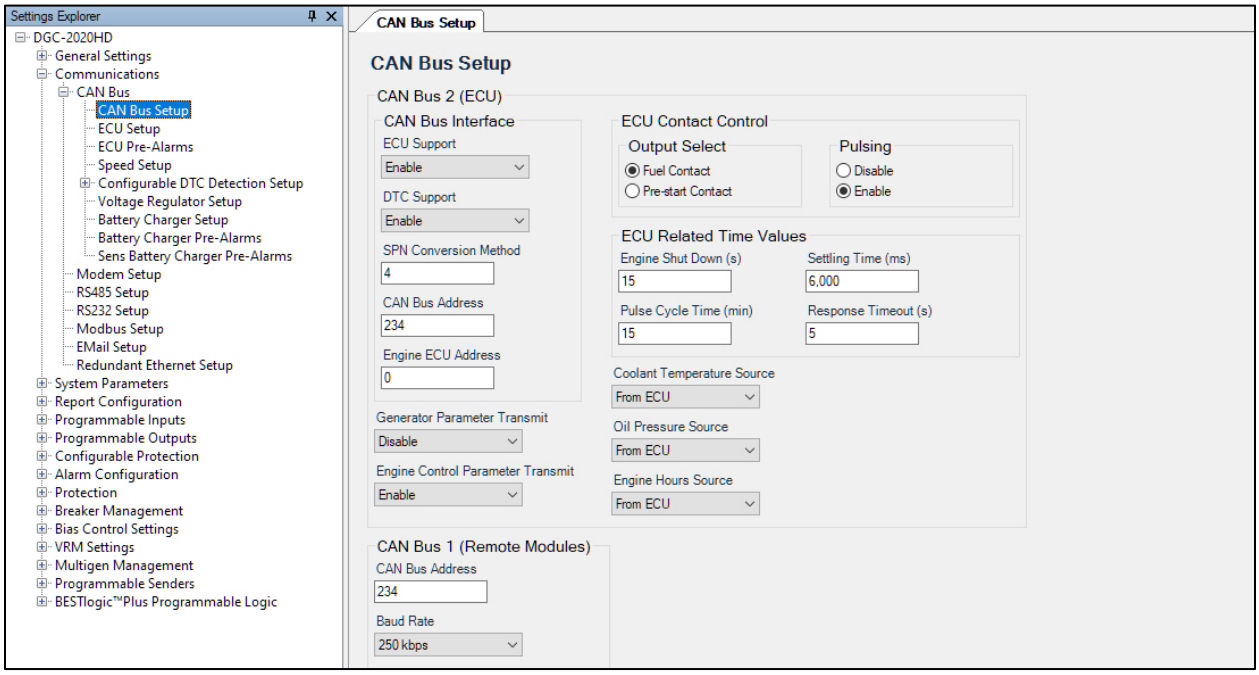

Figure 5. CAN Bus Setup

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
Woodward PG Plus	230

Note that the ECU CAN Bus wires need to be terminated on the DGC-2020HD's CAN 2 terminals. CAN 1 is dedicated for Basler Electric's accessory modules: the AEM-2020, CEM-2020, and VRM-2020. On the CAN Bus Setup page, 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 6. 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.

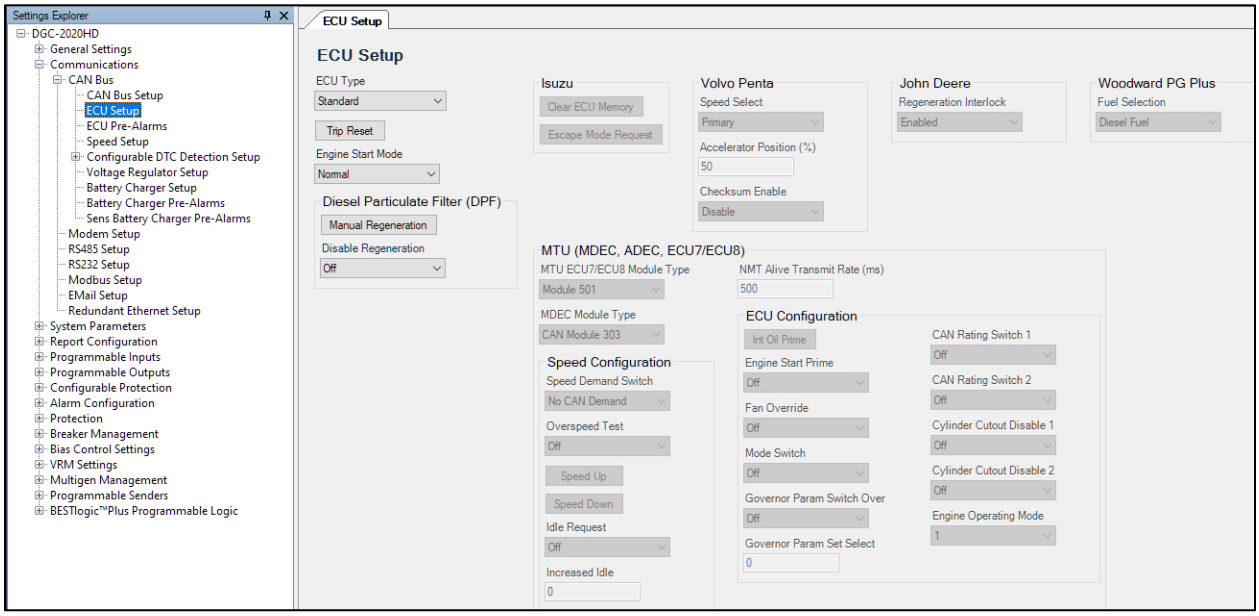

Figure 6. ECU Setup

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 7. The remaining settings on this page can be adjusted as needed for the application.

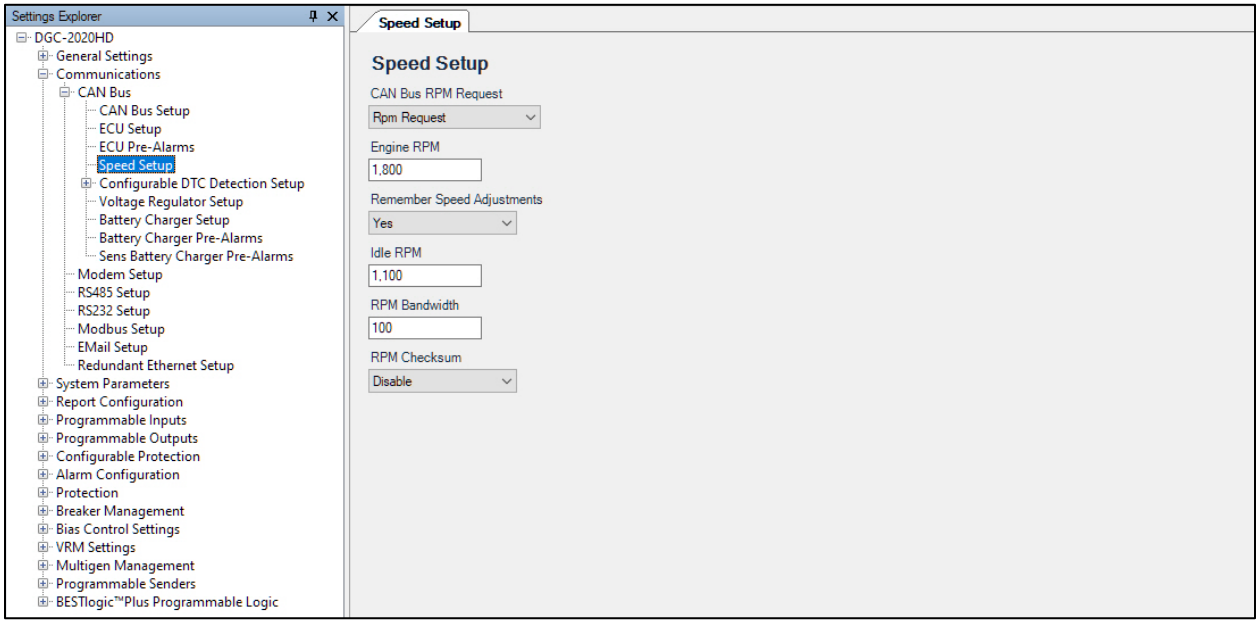

Figure 7. Speed Setup

System Settings

On the System Settings page shown in Figure 8, the system type should be set to Single Generator. The System Breaker Configuration should be set to Generator Breaker Control. The other settings should be adjusted as needed.

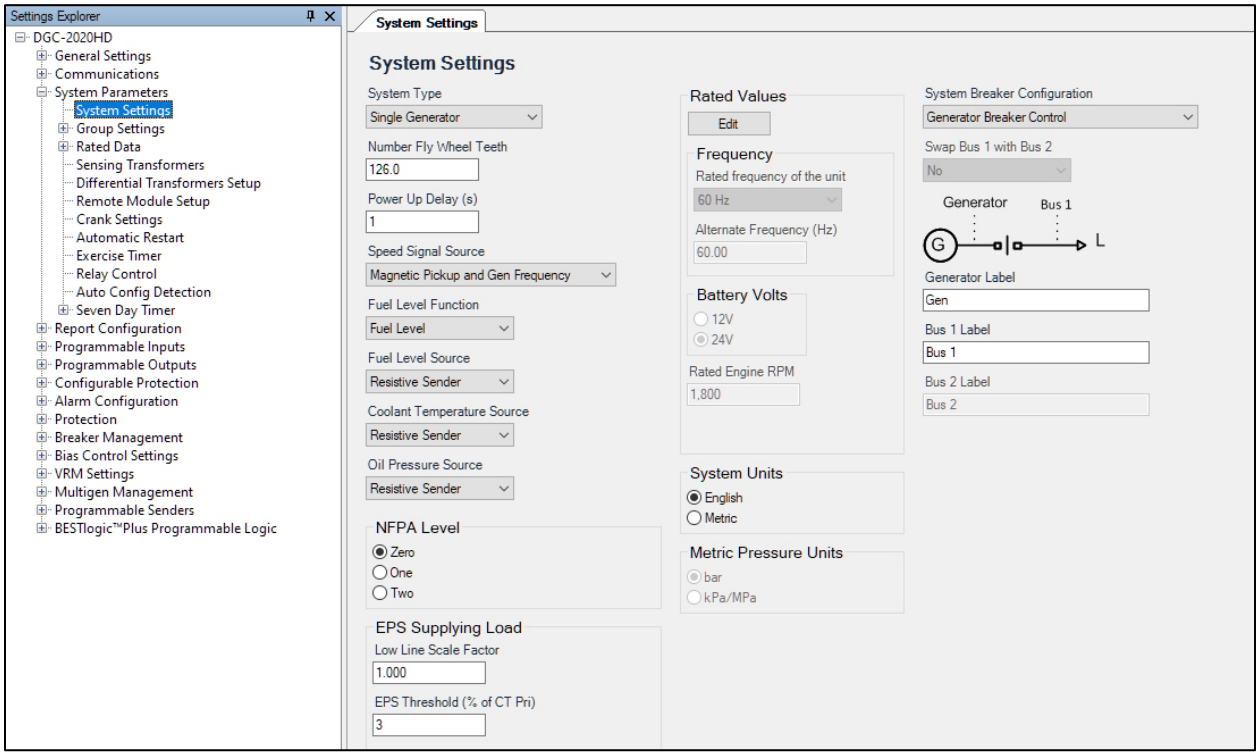

Figure 8. System Settings

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 9, 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-2020HD is capable of sensing up to 576 Vac directly.

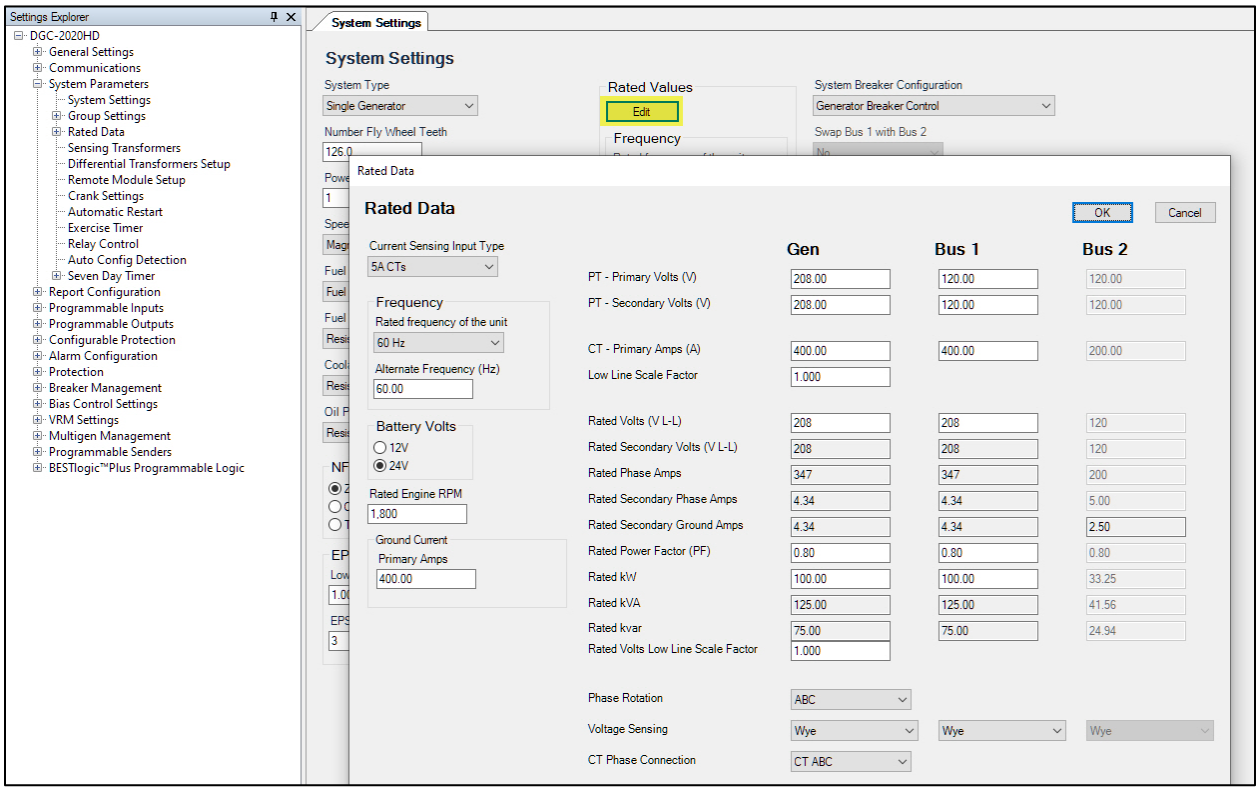

Figure 9. Rated Data Settings

Crank Settings

On the Crank Settings page shown in Figure 10, 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-2020HD 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.

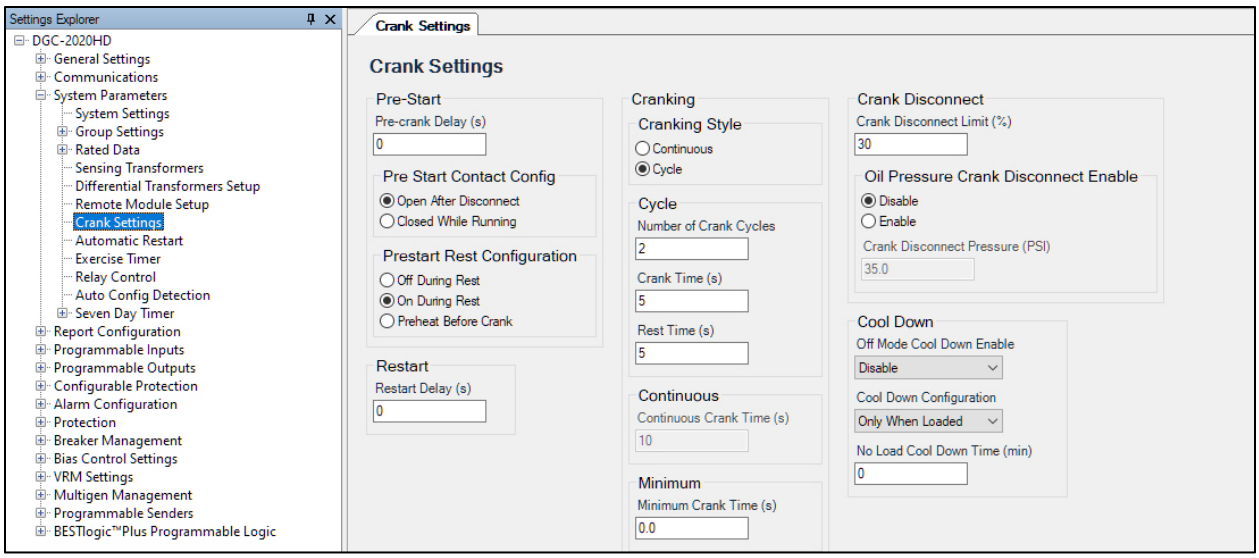

Figure 10. Crank Settings

Programmable Inputs

The 16 programmable inputs on the DGC-2020HD can be used in logic as desired. Inputs have been designated as follows, consistent with the interconnect diagram shown in Figure 3 and the logic diagram shown in Figure 17.

- Input 1 – Emergency stop
- Input 2 – 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 11 for consistency with the controller to engine interconnect diagram shown in Figure 3, and the logic diagram shown in Figure 17.

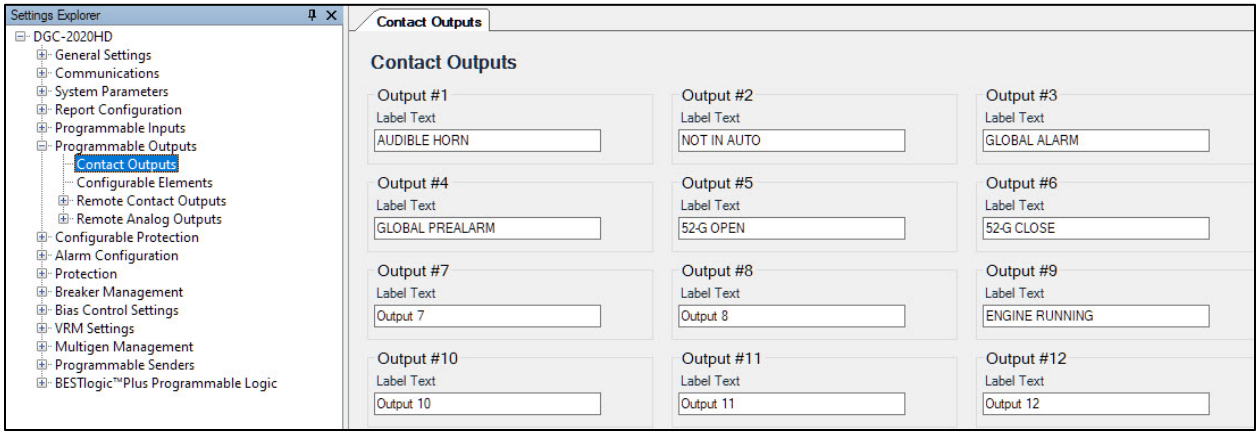

Figure 11. Programmable Outputs

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-2020HD controller is the device that is responsible for protecting the generator, appropriate protection settings should be selected for the application. Refer to Chapter 17 of the *DGC-2020HD Configuration 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.**

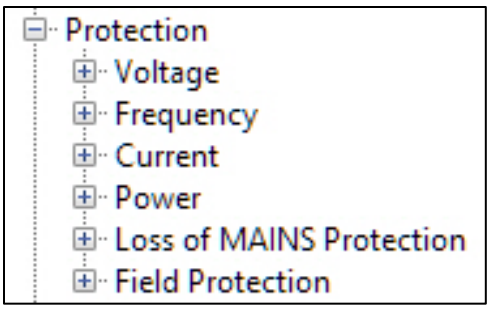

Figure 12. Protection Elements

Generator Breaker Settings

In a single generator standby application, the generator breaker will always close to a dead bus. Hence, the Dead Bus Close Enable setting must be enabled under Breaker Hardware, on the Gen Breaker settings page shown in Figure 13. The other settings on this page should be adjusted if necessary.

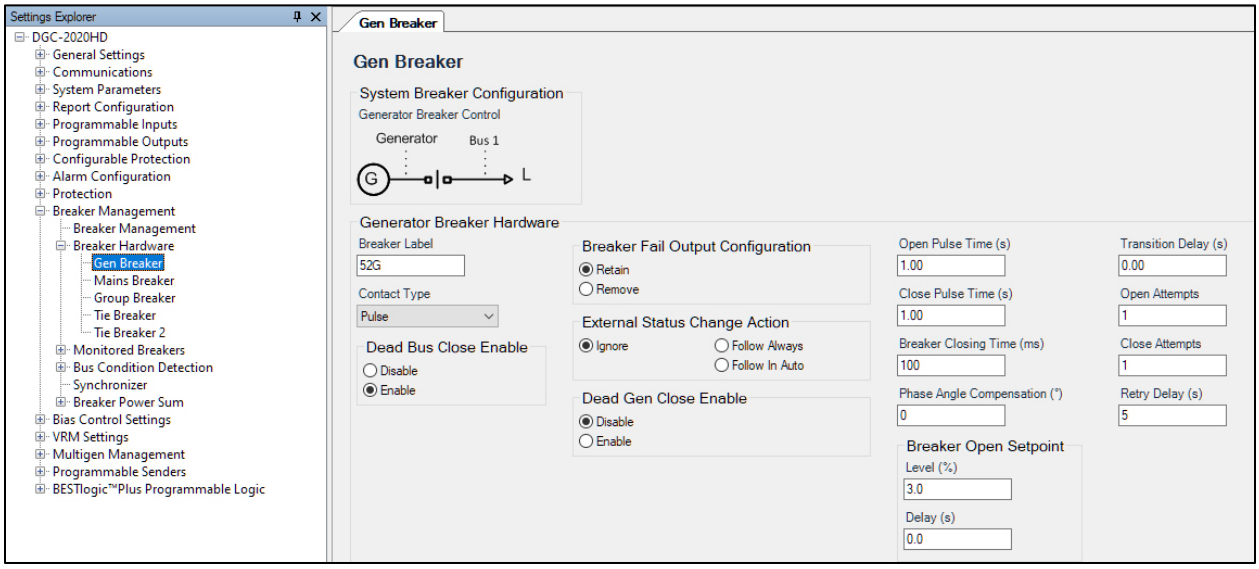

Figure 13. Generator Breaker Settings

Generator and Bus Condition Detection

The generator and bus condition detection settings are automatically updated when the rated data settings are updated. However, it is important to check these settings to ensure that they meet the application. The genset controller will receive a gen stable status only when the generator voltage and frequency are within the ranges shown in Figure 14. Bus stability is determined using the same criteria. The controller will not issue a breaker close request until it receives a generator stable status.

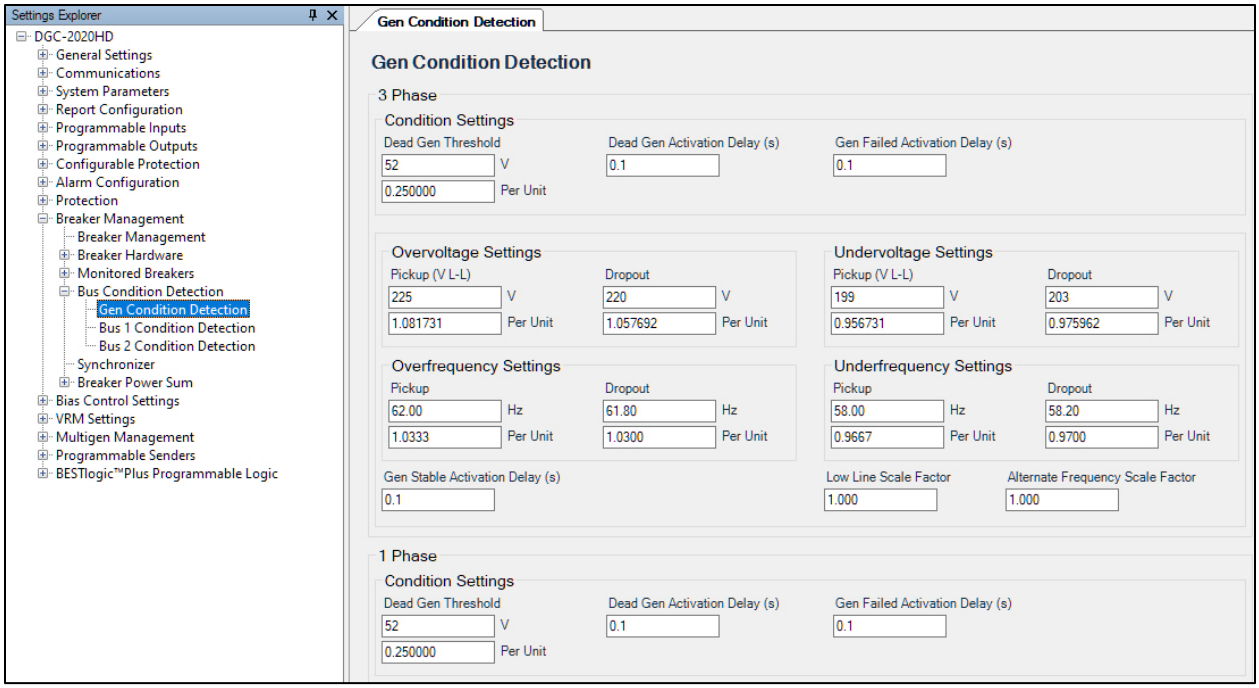

Figure 14. Generator Condition Detection Settings

Programmable Senders

A DGC-2020HD with a style number ending in “R” has resistive inputs for coolant temperature and oil pressure senders. For coolant level senders from the list shown in Figure 15, the sender curve 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. DGC-2020HDs with a style number ending in “R” have two resistive inputs and two analog inputs. The analog inputs can receive signals in the -10 Vdc to +10 Vdc range, or as a 4 to 20 mA current signal. DGC-2020HDs with a style number ending in "A" have four analog inputs and no resistive inputs. DGC-2020HD controllers with style numbers ending in “R” or “A” have a resistive input for a fuel level sender.

The resistance ranges of the following senders are compatible with the DGC-2020HD. A compatible Fuel Level sender is the Isspro model R8925. Oil pressure senders compatible with the DGC-2020HD include Datcon model 02505-00, Isspro model R8919, Stewart-Warner models 279BF, 279C, 411K and 411M, and VDO models 360025 and 360811. Compatible Coolant Temperature senders include Datcon model 02019-00, Faria model TS4042, Isspro model, R8959, and Stewart-Warner model 334P. Other senders with matching resistance ranges may also be used.

Figure 15. Plug-and-Play Programmable Senders.

(From Chapter 8 of the *DGC-2020HD Configuration Instruction Manual*.)

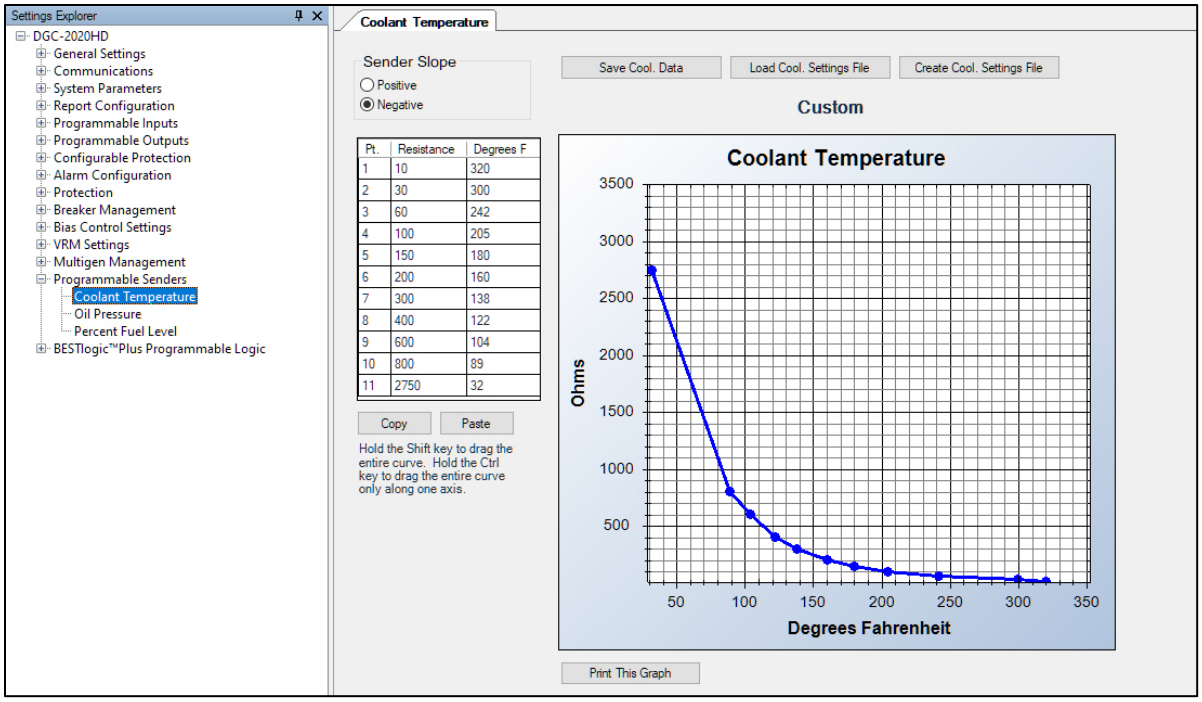

Figure 16. Programmable Sender Settings

So far, in this application guide, we have discussed the minimal settings that are needed for a DGC-2020HD 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 generator.

Restoration of Normal Power

Open Transition

- 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.

Closed Transition

- When the utility power is restored, the ATS controller waits for a time delay to expire to ensure that the mains bus is stable.
- Once the time delay has expired and the mains bus is stable, the ATS controller synchronizes the genset to the mains bus.
- Once synchronization has been achieved, the ATS controller closes the normal contacts while the emergency contacts are still closed to allow a soft transfer from the generators to the mains.
- Once the load has finished transferring to the mains, the generator breaker opens, and the generator begins its cooldown cycle.
- The generator shuts down once its cooldown cycle timer has expired.
- The generator remains in standby mode for the next power outage.

Implementing the logic scheme shown in Figure 17 will allow the DGC-2020HD to control the genset and interface with the ATS controller, so that the system achieves the sequence of events described above.

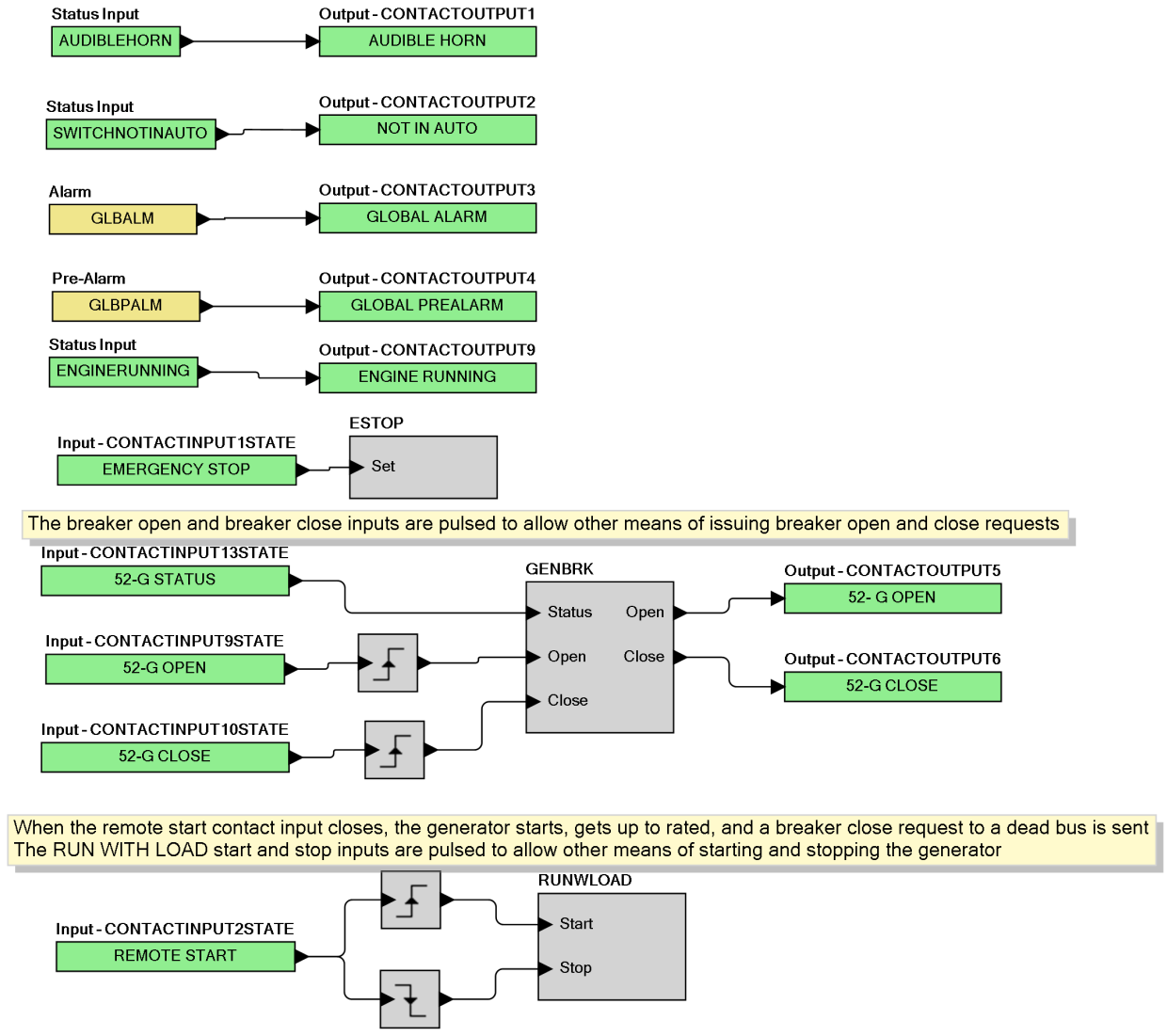

Figure 17. Logic Scheme

To Learn More

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