

GSM Commander Case Studies

Refrigeration / Generator

Case Study 3: Monitoring a Cold Room and controlling a back-up Generator



Background information

Devine Foods, has a walk-in freezer which needs to be functional 24/7 to keep their raw food items fresh. The restaurant has experienced huge financial losses in the past due to power failures occurring in the middle of the night when no one is at work to switch on the generator.

Goal

To install a GSM Commander unit at the restaurant inside the generator housing. When the mains power fails the generator should start. Ben(Owner) and Alex(Manager) want be notified both when the mains power has failed and been restored. When the mains power is restored the generator should be stopped. They also want to be notified that the generator has indeed started and when the generator's diesel is running low. Their walk-in freezer is set to maintain a constant temperature of 5°C, so they would also like to be informed immediately if the temperature goes above 8°C, so that they could prevent their raw food items from going off.

GSM Commander Wiring

The GSMC unit is installed inside the generator housing, and its **output 1** is connected such that it will pulse the electric starter when activated, which in turn will switch on the generator.

Output 2 is connected to the solenoid valve which controls the diesel supply to the engine.

When **output 2** is active it allows the supply of diesel to the engine and when deactivated it stops the supply of diesel. **Output 3** controls a 3 phase contactor with a 12VDC coil, such that when the output is active it closes the contacts, thus allowing the main supply to flow through to power the walk-in cold room. The GSMC unit is powered from a simple 12V linear power supply that in turn is powered from the mains supply. The 12V battery of the electric starter is connected to the GSMC unit to serve as back-up when the mains power fails. The generator is connected to **input 2** of the GSMC unit via another 12V linear power supply such that **input 2** will remain active while the generator is on. A (4 - 20 mA) pressure sensor(submerged in the diesel tank) is connected to the **analog input** of the GSMC unit to monitor the diesel level. Lastly, a **temperature probe** is connected from the Expansion unit (via a Temperature Interface Module) to the inside of the walk-in cold room. Have a look at the wiring diagram on page 2 to give you a better idea of the required connections.



GSM Commander Setup

The following statements were implemented. The statements speak for themselves, but we have included a bit of a commentary with each statement.

Name	Lockout Time*	Behaviour Text
St.1	none	IF Start THEN Activate Output 3
This statement will activate output 3 as soon as the unit starts up, and leave it activated. This will in effect close the contacts of the 3ph contactor, thus allowing the main supply to flow through to power the walk-in cold room.		
St.2	Z = 0	IF Power is OFF for longer than 5 Seconds THEN change outputs: ON[2]; OFF[3]
This statement will activate output 2(and leave it activated) and deactivate output 3(and leave it deactivated) when the mains power is off for longer than 5 seconds. This will in effect activate the solenoid valve, thus allowing diesel to be supplied to the motor and it will too deactivate the 3ph contactor, thus cutting off the mains supply.		
St.3	Z = 0	IF Power is OFF for longer than 5 Seconds THEN send "Power Failure" via SMS To Ben, Alex
This statement will send a message containing the text "Power Failure" to both Ben and Alex when the main power is off for longer than 5 seconds. Note that it will only do this if the mains power remains off for 5 seconds. This helps to be certain that the mains power is indeed off.		
St.4	Z = 30sec	IF Power is OFF for longer than 5 Seconds THEN Activate Output 1 for 1 Sec
This statement will send a 1 second pulse to the electric starter of the generator in an attempt to get it up and running. Note that the lockout time is set to 30 seconds which means that it will activate the output every 30 seconds provided that the mains power has been constantly off. This helps in the event that the generator failed to start the first time.		
St.5	none	IF "St.4" Triggers THEN Increment Variable A
This statement will increment variable A everytime St.4 triggers. This will in effect increment the variable A(which also can be seen as a counter) everytime the GSMC unit tries to start the Generator.		
St.6	Z = 0	IF Input 1 Becomes Active, remaining Active for longer than 5 Seconds, THEN send "Generator has st... " via SMS To Ben, Alex
This statement will send a message containing the text "Generator has started" to both Ben and Alex when input 2 becomes active and remains active for longer than 5 seconds. Note that it will only do this if input 2 remains active for longer than 5 seconds. This helps to be certain that the generator has indeed started up.		
St.7	none	IF "St.6" Triggers THEN disable statement(s) ["St.4"]
This statement will disable St.4 when St.6 triggers (when the generator has started). This statement is very important otherwise St.4 will continuously trigger every 30 seconds, which would in effect could badly damage the electric starter. We only want St4 to trigger continuously while the generator fails to start.		
St.8	none	IF Variable A goes above 4 THEN disable statement(s) ["St.4"]
This statement is similar to the previous statement in that it will also disable St.4, but only when the variable A goes above the value 4. In effect it will stop the GSMC unit from activating the electric starter after 5 attempts. This is important as it prevents the GSMC unit of continuously trying to start the generator which would cause the 12V battery to run completely flat.		
St.9	none	IF Variable A goes above 4 THEN send "Problem starting... " via SMS To Ben, Alex
This statement will send a message containing the text "Problem starting generator" to both Ben and Alex when the variable A goes above 4. In effect when the GSMC unit tried starting the generator 5 times.		

* This is the time that after a behaviour statement has triggered, the same statement will not be allowed to trigger until this time has elapsed. A zero lockout time will only allow the behaviour statement to trigger once.

Name	Lockout Time*	Behaviour Text
St.10	none	IF "St.6" Triggers THEN Clear Variable A
This statement will reset the variable A back to zero when St.6 triggers(which means the generated has started). This is important as you want St.5 to start incrementing variable A from zero the next time a power failure occurs.		
St.11	none	IF "St.9" Triggers THEN Clear Variable A
This statement is similar to the previous statement in that it will also reset variable A back to zero, but only after St.9 triggers. In effect it will reset the variable after 5 attempts by the GSMC unit to start the generator. This is important as you want St.5 to start incrementing variable A from zero the next time a power failure occurs.		
St.12	Z = 0	IF "St.6" Triggers THEN enable statement(s) ["St.4"]
This statement will enable St.4 if St.6 triggers(which means the generated has started). This statement is very important otherwise St4 will never trigger again, which would mean that the generator would never be able to be started during a power failure.		
St.13	Z = 10min	IF Analog Input Stays Below 100 for Longer than 10 Seconds THEN send "Diesel is running... " via SMS To Ben, Alex
This statement will send a message(every 10 minutes) containing the text "Diesel is running low" to both Ben and Alex when the analog voltage is below 100 counts(4 volts) for longer than 10 seconds. Note that it will only do this if analog voltage remains below 4 volts for longer than 10 seconds. This helps to be certain that the diesel level is running low and in turn eliminating any false trigger due to vibrations caused by the generator.		
St.14	none	IF Message is received, containing "Diesel Status" from any listed number, THEN Send "Diesel level is:<Analog>" via SMS to Originating number
This statement will send a message containing the text "Diesel level is: 30L" to the person who send the sms. Note that it will only do this if the number is stored in the "Numbers List" of the GSMC unit. In this behaviour statement the user is able to calibrate the analog input by setting the maximum and minimum values.		
St.15	Z = 0	IF Temperature at Probe A Stays Above 8°C for Longer than 5 Seconds THEN Place Voice Call to Ben, Alex
This statement will place a voice call to both Ben and Alex when the temperature of the walk-in cold room goes and stays above 8°C for longer than 5 seconds. Note that the software allows setting the amount, duration and interval of the voice calls to be made and to whom.		
St.16	Z = 0	IF Power is restored (after power failure) THEN DeActivate Output 2
This statement will deactivate output 2 as soon as the GSMC unit has detected that the mains power has been restored. This will in effect it will deactivate the solenoid valve thus stopping the flow of diesel to the motor and stopping the generator.		
St.17	none	IF "St.16" Triggers THEN Activate Output 3[Delayed 5 Seconds]
This statement will activate output 3 five seconds after St.16 triggers. This will in effect close the contacts of the 3ph contactor 5 seconds later(giving the generator time to properly switch off), thus allowing the main supply to flow through to power the walk-in cold room again.		
St.18	Y = 0	IF Battery voltage is below 10.0V (only during power failure) THEN send Power Status Message via SMS to Ben, Alex
This statement will monitor the status of the battery and notify both Ben and Alex via sms if the battery is running flat. This power status message will display the current voltage level of the battery.		
St.19	Y = 0	IF Airtime is below 30 units THEN send Airtime Status Message via SMS to Ben, Alex
This statement will monitor the airtime and notify both Ben and Alex via sms if the airtime goes below 30 units.		

Further Clever ideas..

Obviously the exact setup will depend on the installation.

By adding a few additional bits and pieces, the installation can be made very clever indeed.

Some ideas include:

- Make use of more variables in your setup. *(only available with the 0641 and 1281 models)*
Everytime the mains power fails you can have the GSMC unit increment an internal variable which serves as a counter. Thus you will be able to keep count of how many power failures have occurred.
- Attach another temperature probe to the generator.
One could setup the GSMC to notify you via sms or missed call when the generator is overheating.