

GB1 Auxiliary Event Relay User Guide

Digitry Company, Inc.

449 Forest Avenue, Suite 9
Portland, ME 04101

©1980 – 2017 by Digitry Company, Inc.
All Rights Reserved

January 2017

GB1 Auxiliary Relay

The GB1 may be ordered with one or two optional auxiliary relays, sometimes called “event relays”. These relays can be used to control fans, dampers, extra heating coils, pneumatic actuators, small motors to open oven doors for crash cooling, *etc.*: any electrical device that can be actuated by a simple switch closure.

When a profile starts running, all relays are turned off, and again, when a profile ends (returns to IDLE), all relays are automatically turned off. Any step in the profile may be used to turn a relay on or off.

Programming

You program the auxiliary relays in the same fashion that you program the temperature. Each change of the relay requires one step. Since there are 15 steps per program, this should not present a problem. For the exceptional case where 15 steps is not enough, you can link profiles for a total of well over 100 steps¹ may be programmed.

When a profile starts, the auxiliary relay is always off. When a profile completes (i.e., when the idle light comes on), the GB1 always turns the auxiliary relay off. In the middle, you can program the auxiliary relay to turn on and off at specified points. Once a step turns it on, it stays on until another step turns it off or until the profile completes. You may turn it on and off as many times as necessary. This method of controlling auxiliary relays gives great flexibility in the criteria for their activation. It may be based on time, temperature, or both, depending on previous and subsequent steps.

Program the auxiliary relays using the HOLD key, which is in actuality, a multi-function key. Pressing HOLD once specifies a programmed hold. Pressing it twice specifies a link operation to link to another profile. Pressing it three or more times specifies that the auxiliary relay should turn on or off². Assuming the GB1 has only one auxiliary relay, the Time display will show -88- to denote that the auxiliary relay is being programmed. A -1- in the Temperature display indicates that the auxiliary relay should turn on, and a -0- that it should turn off. Each time you press HOLD after this, it will alternate between selecting on and off. The behavior of the HOLD key is shown in Figure 1. If you intended to select a hold or a link, but you pressed the HOLD key too many times, you can press the CLEAR key and start that step again.

If the GB1 has two auxiliary relays, programming is similar. Press HOLD three times to tell relay 1 to turn on, a fourth time, to tell it to turn off, a fifth time to tell relay 2 to turn on, and a sixth time to tell relay 2 to turn off. Subsequent presses go back to relay 1 and repeat the cycle. When relay 1 is being programmed, the TIME display reads -11-; when relay 2 is being programmed, it reads -22-. The behavior of the HOLD key for two relays is shown in Figure 2. As in the case of a single relay, if you do not want to program either relay, press the CLEAR key to restart the step.

Smart Cooling Option

When cooling the kiln, whether the relay is turning on a ventilating fan or a servo system to open the kiln door, it is desirable for this action to take effect only when the kiln is hotter than the desired target temperature. Accordingly, the GB1 may be ordered with auxiliary relay 1 having the “smart cooling” feature. (This feature is not available on relay 2.)

¹OK, it's 141; homework assignment: figure out where this number came from.

²Step one of the profile is special: Since linking is not permitted in this step, pressing HOLD twice accesses the relay functions.

Times Pressed	Time Display	Temperature Display	Action
1	HHHH	hold temperature	Program Hold
2	LLLL	profile number	Link to profile in Temperature Display[*]
3	-88-	-1-	Turn Auxiliary Relay On
4	-88-	-0-	Turn Auxiliary Relay Off
5	-88-	-1-	Turn Auxiliary Relay On
6	-88-	-0-	Turn Auxiliary Relay Off
⋮	-88-	-1- or -0-	Alternate between Relay On (-1-) and Off (-0-)

[*] Step 1 of a profile does not permit a Link, so when entering Step 1, LLLL will not appear; the display will go directly from HHHH to -88- at the second press.

Figure 1: HOLD Key Actions for a Single Relay

Times Pressed	Time Display	Temperature Display	Action
1	HHHH	hold temperature	Program Hold
2	LLLL	profile number	Link to profile in Temperature Display[*]
3	-11-	-1-	Turn Auxiliary Relay 1 On
4	-11-	-0-	Turn Auxiliary Relay 1 Off
5	-22-	-1-	Turn Auxiliary Relay 2 On
6	-22-	-0-	Turn Auxiliary Relay 2 Off
⋮	-??-	-1- or -0-	Alternate between Relay 1 and 2 as above

[*] Step 1 of a profile does not permit a Link, so when entering Step 1, LLLL will not appear; the display will go directly from HHHH to -11- at the second press.

Figure 2: HOLD Key Actions for Two Relays

You program this relay just as you would an ordinary one. The only difference is that when it is programmed to be on, it repeatedly checks the oven's current temperature, and whenever this is below the target temperature, the relay will turn off.

If your GB1 has this smart cooling option, it will show "SASA" briefly in both time and temperature displays before it begins the startup countdown.

Examples

Preamble and disclaimer: These examples may be incorrect or foolish insofar as proper glass technique is concerned. They are merely for study purposes to show how one can program the Auxiliary Relay in various situations.

1. The auxiliary relay controls auxiliary high power heating elements on the top door of a slumping oven to heat work rapidly.

It is desired to ramp from a hold at 900° to 1100° in one hour and then rapidly heat the work to 1500°, hold at 1500° for 5 minutes and the ramp down to 1000° in 30 minutes.

Step	Temperature	Time
1	900	Hold
2	1100	1:00
3	AUX	ON
4	1500	0:01
5	AUX	OFF
6	1500	0:05
7	1000	0:30

2. The relay controls the crash cooling of a *pâte de verre* kiln by means of an auxiliary venting fan. After soaking at 1300° for 20 minutes we want to crash cool to 900° and then soak for 1 hour. Let's assume that the first 3 steps of the program have used 2 hours as we start the soak cycle.

Step	Temperature	Time
4	1300	0:20
5	AUX	ON
6	900	0:01
7	AUX	OFF
8	900	1:00

3. We have a high temperature auxiliary fan in an annealing oven to insure even temperatures throughout the oven. Assume that the kiln is to rise to 900° over the course of one hour. Then, starting at step 2, it begins a 2 hour soak during which we want the fan to come on for 5 minutes after half-an-hour, and again after a whole hour and finally for the last 15 minutes of the soak.

Step	Temperature	Time
1	900	1:00
2	900	0:30
3	AUX	ON
4	900	0:05
5	AUX	OFF
6	900	0:25
7	AUX	ON
8	900	0:05
9	AUX	OFF
10	900	0:45
11	AUX	ON
12	900	0:15
13	AUX	OFF

4. You have a venting fan connected to an auxiliary relay. After a firing is complete, you want to keep venting the kiln for another 45 minutes. If the program ends, the vent fan will turn off, so you want to extend the program for another 45 minutes without heating the oven. Use a “coasting step” to accomplish this. For example, if your original program had 6 steps, you would continue with the following three steps:

Step	Temperature	Time	Action
7	AUX	ON	turn fan on
8	350	5:00	cool to 350° while venting
9	0	0:45	delay 45 minutes without heating

At the end of the 45 minute delay, the program ends and the fan automatically turns off.

If desired, you could put these three steps into a separate profile as steps 1–3 and link to it from any profile that needs to have this final venting.

5. You are annealing a casting. You want it to cool down to 500° in 15 hours, at which point you must examine the mold before proceeding. Since this is a long procedure, you visit some friends in a nearby town while waiting. Because your kiln and mold are well insulated the cooling process may be retarded as you approach the 500° point, causing the auto-hold to come on, which in turn increases the time beyond 15 hours. If you arrive at your studio in 15 hours you may have quite a wait until the 500° point is reached. So, you connect the auxiliary relay to a phone that has been programmed to call your cell phone. Just in case the call didn’t go through, you want it to call twice more at 10 minute intervals. In addition, you want the kiln to hold at 500° until you have checked the mold. To actuate the phone dialer, the relay acts somewhat like a push button: you simply turn it on and then off again.

Step	Temperature	Time
1	500	15:00
2	AUX	ON
3	AUX	OFF
4	500	0:10
5	AUX	ON
6	AUX	OFF
7	500	0:10
8	AUX	ON
9	AUX	OFF
10	500	HOLD

Electrical Considerations

If you have only one auxiliary relay on the GB1 printed circuit board, it can be either an unfused mechanical relay, or a fused 12 VDC output, depending on what was ordered. The 12 Volt output may be used to run any external 12 VDC device that draws a maximum of 700 milliamps, such as an appropriate external relay with a minimum coil resistance of about 20Ω .

A second auxiliary relay, if present, will always be a fused 12 VDC output, as described above. Note however, if the GB1 is configured with two 12 VDC outputs, the combined external devices must draw under 700 ma total. This is limited by the GB1 power supply (wall adapter), so if additional power is needed, you could substitute a larger wall adapter³, but the maximum current remains 700 milliamps per 12 VDC output.

The GB1 cannot have both a mechanical auxiliary relay and an alarm relay, so if you want to retain the normal GB1 alarm feature, any auxiliary relays must be of the 12 VDC output variety.

Wiring

Attaching a device to the auxiliary output terminals is almost the same for both a mechanical relay and a 12VDC output. We describe them individually below.

When attaching wires to the auxiliary relay, follow the same general precautions outlined in the manual for installing the contactor. The terminals for the auxiliary relay are located at the right edge of the printed circuit board, just below the terminals for the contactor.

Mechanical Relay

When wiring an external device to an unfused mechanical relay, there are just a few things to keep in mind.

- This type of auxiliary relay is an on/off switch. When you are thinking about how to control the external device with the auxiliary relay, imagine what an on/off switch would do in the same place. For a “normally open” relay, when the relay is actuated (thus, pulled to the closed position), the switch is on; when the relay is open, the switch is off. It’s that simple.

One option for the GB1 provides a relay that has both “normally open” and “normally closed” terminals. The “normally closed” connections behave just the opposite of the “normally open” ones; thus the switch turns off when the relay is actuated and turns on when the relay is not not actuated.

³For this, use an adapter that supplies 12VDC with at least 2 Amps through a center positive, 2.1 mm jack.

- Respect the maximum current that the relay can handle. If you attach a larger load, it will ruin the relay. If you need to control a device that draws more current than the relay can handle, use a secondary relay with the appropriate rating to control the device, and use the auxiliary relay to control the secondary relay.
- You must provide a fuse for the circuit; there is no internal fuse. The rating of the correct fuse depends on what you're connecting to the relay, but of course, it must not exceed the rating of the relay.

12VDC Output

The 12VDC outputs are polarized, but many small DC relays work either way, without reference to polarity. However, if you use an LED to indicate when power is on, it will work only when connected with proper polarity.

Warning: For 12 Volt DC outputs, external power is neither required nor allowed. In particular, connecting any external power source will quickly blow the fuse in the output circuit and even then may cause further damage to the GB1.

Timed Relay Option

With an ordinary auxiliary relay, the shortest time between an on and an off is either instantaneous or one minute.

What if you were using a GB1 to control a special roasting oven and wanted to release steam into the oven at specific times, where the steam burst should be 15 seconds long. There is a special version of the GB1 with a timeable auxiliary relay that will let you do this. With this option, you don't have to specifically turn the relay off. When you turn the relay on, you can specify the number of seconds it should stay on. It then automatically turns off after that amount of time has elapsed. Note that this time is not affected by the time in any profile step, nor by the Auto-Hold function, though if the profile ends, the relay will be turned off. If no time is specified, the relay stays on until it is explicitly turned off in a separate step (or the program ends).

If your GB1 has this timed option, its display is slightly different. In the Temperature display, on is indicated by -1- instead of simply 1, and off is indicated by -0- instead of 0. You have the option of turning the relay on or off as in the case of the ordinary relay, meaning it will stay on indefinitely or turn off, whichever is chosen. However, whenever -1- or -0- appears, you can press the MODE key, and the Temperature display will change to blank and wait for you to enter a number (of seconds, not minutes). You can enter any number from 0 to 9999 (2 hours 43 minutes and 39 seconds). As always, if you make a mistake, press the CLEAR key and reenter the step.

If a time was specified, when the oven runs and the profile reaches this step, the relay will turn on, and the step will advance immediately to the next step. But the relay will remain on for the number of seconds you specified (unless the profile ends and the oven returns to idle, at which time, all relays will turn off). As remarked above, the relay's behavior is independent of the step, the temperature, Auto-Hold, *etc.*