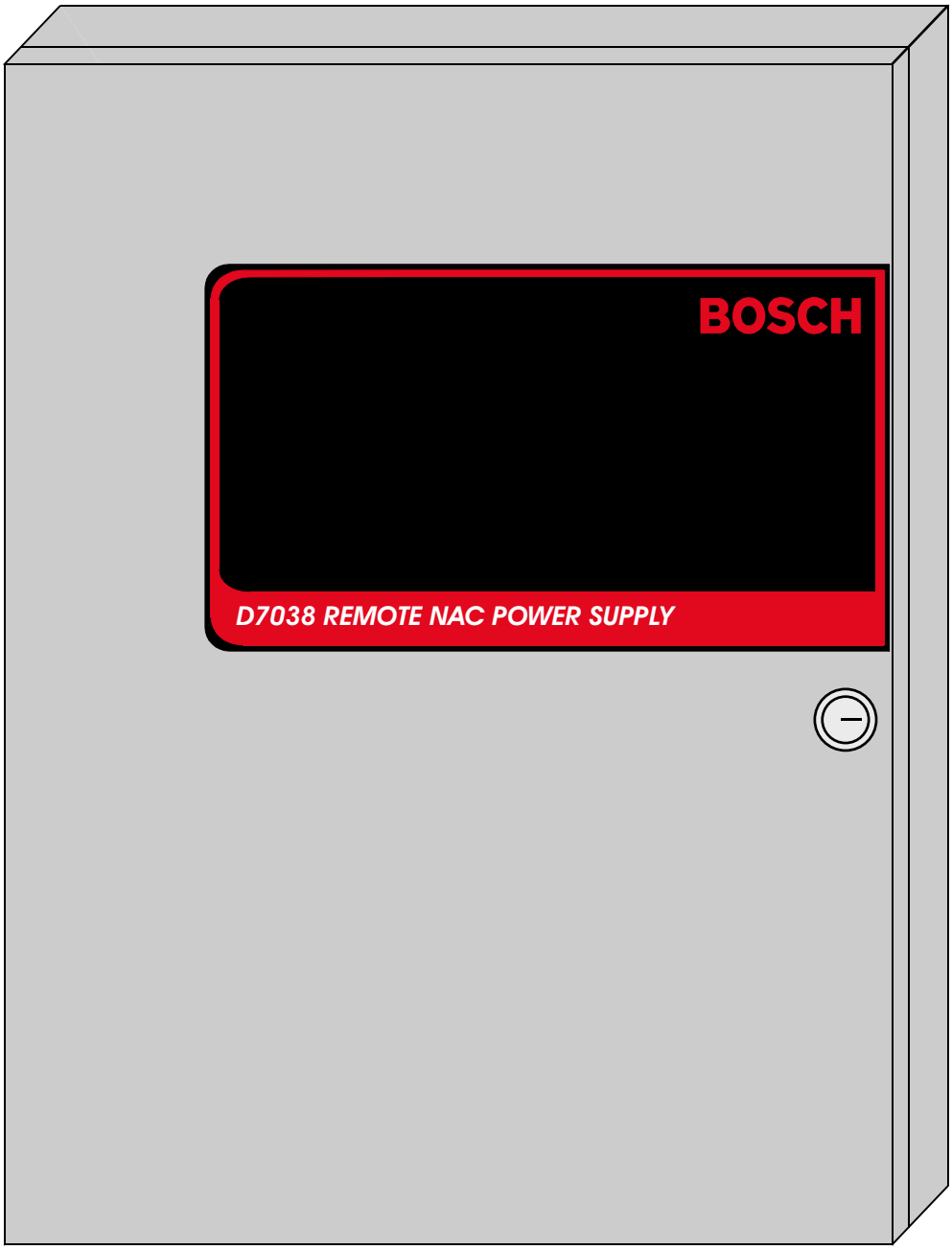
Remote NAC Power Supply D7038

Operation and Installation Guide



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1.0 Overview

The D7038 is a Remote Notification Appliance Circuit (NAC) Power Supply designed to add four additional NACs (NFPA 72 Class B, Style Y) to a Fire Alarm Control Panel (FACP).

It is supervised by the control panel. It consists of the controller board, backup batteries, and enclosure.

The D7038 is also compatible with any UL Listed control unit utilizing reverse polarity supervised notification outputs, using 24 VDC regulated outputs. It can be configured for constant auxiliary power.

1.1 Module Control

1.1.1 Option Bus Control

The D7038 can connect to the Option Bus of the D7024 Fire Alarm Control/Communicator.

See *Section 4.3 Option Bus Connections* on page 15 for information on firmware version and panel compatibility.

1.1.2 Conventional NAC Input Control

For conventional panels, the D7038 connects via the FACP's NAC outputs that conform to NFPA 72 Class B. Please refer to the control panel's NAC compatibility information.

1.2 Pulsed Bell Operation

The D7038 can generate two pulsed bell patterns on command when connected via the option bus in addition to steady activation of the output. The patterns are Pulsed and NFPA Temporal.

- **Pulsed:** 60 PPM (0.5 sec. On, 0.5 sec. Off)
- **NFPA Temporal:** In compliance with ANSI standard S3.41: 0.5 sec. On, 0.5 sec. Off, 0.5 sec. On, 0.5 sec. Off, 0.5 sec. On, 1.5 sec. Off, etc.

1.3 Power Management

The controlling section of the board has un-interruptible power. The bulk 27.4/24 V output drops out for no more than 3 sec. upon the loss of the AC Line voltage.

1.4 Low AC Line Detection

Sensing circuitry will detect a line input voltage below 96 VAC, then switches from the primary AC Line voltage to battery backup.

1.5 Ground Fault Indication

The Option Bus and Polarity Reversal Inputs are electrically isolated from the local power supply and indicating circuits. The D7038 supervises itself for grounded field connections and indicates a fault condition if one is found.

1.6 Circuit Supervision

Each NAC is supervised for short circuit and open conditions using a 2.2 kΩ resistor at the end of the loop. Devices on these loops must have a blocking diode on their input so that the 2.2 kΩ EOL supervision resistor can be read when the polarity of the output is "backwards" when in the standby state. The devices activate when the polarity is switched to "forward" when in alarm.

1.7 Over Voltage Supervision

The power supply output is monitored for over voltage conditions. If over voltage condition exists (30 V or more on battery leads without the battery connected) the trouble relay and EOL relays will open. In addition, the trouble LED will be lit. On the option bus, AC fail, ground fail and NAC troubles will be initiated.

1.8 Expander Supervision

A "watchdog" supervises the operation of the D7038 processor and attempts to restart it if it fails. If the processor fails to restart, or power fails entirely, the installer supplied EOL device disconnects from the input to report the trouble condition. If power is available, the Trouble LED lights if the processor fails to operate.

1.9 Auxiliary Power Supply

The D7038 can be wired to supply constant auxiliary power through its NAC outputs. See *Section 4.7.2 Auxiliary Circuits* on page 18 for additional information.

Notes:

2.0 Specifications

Enclosure	
Dimensions (HxWxD)	14.75 in. x 12.75 in. x 3.5 in. (37.5 cm x 32.4 cm x 89 mm)
Material	18 Ga. Cold-rolled steel
A keyed lock and mounting hardware are included.	
Environmental	
Storage and Operating Temperature	+32°F to +120°F (0°C to +49°C)
Power	
Input Power	120 VAC (+10%/-15%), 60 Hz, 2.5 A
Brown-out Voltage	96 VAC
Battery	24 VDC nominal (20.2 to 28.0 VDC range)
Battery Capacity	6.5 Ah to 38 Ah
Output Voltage	27.4 VDC +/- 0.1 VDC @ +77°F (+25°C) Battery = 24.1 +/- 0.6 VDC @ +77°F (+25°C)
Output Current	6.0 A
Load Regulation	400 mV
Line Regulation	200 mV
Ripple Voltage	≤250 mV pp
Standby Current Draw	150 mA
NAC Input	
Non-polarized Input Voltage	9 to 30 VDC/VRMS
Input to Output Response Time	≤ 50 ms
Minimum Impedance of Source	1.7 kΩ
Compatible with NFPA 72 Class B NAC	
Option Bus Input	
Interface Level	0 to 12 V
NAC Outputs (x4)	
Standby Voltage	5.0 VDC
EOL Resistor	2.21 kΩ Bosch Security Systems P/N: 25899
Output Voltage	24.1 or 27.4 VDC
Rated Output Current (per output)	1.5 A
Max. Output Current (per output)	2.5 A
NFPA 72 Class B, Style Y NAC	
Note: The total current draw of all NAC outputs and the auxiliary output cannot exceed 6 A.	
Auxiliary Output	
Output Voltage	24.1 or 27.4 VDC
Max Output Current	850 mA
Trouble Relay Output	
Contact Type	Form “C”
Contact Rating	1.5 A, 30 VDC resistive load

Notes:

3.0 Installing the D7038

The D7038 board and the enclosure are shipped together. The board, however, still needs to be mounted into the enclosure. Hardware for mounting the board to the enclosure is located in the hardware pack.

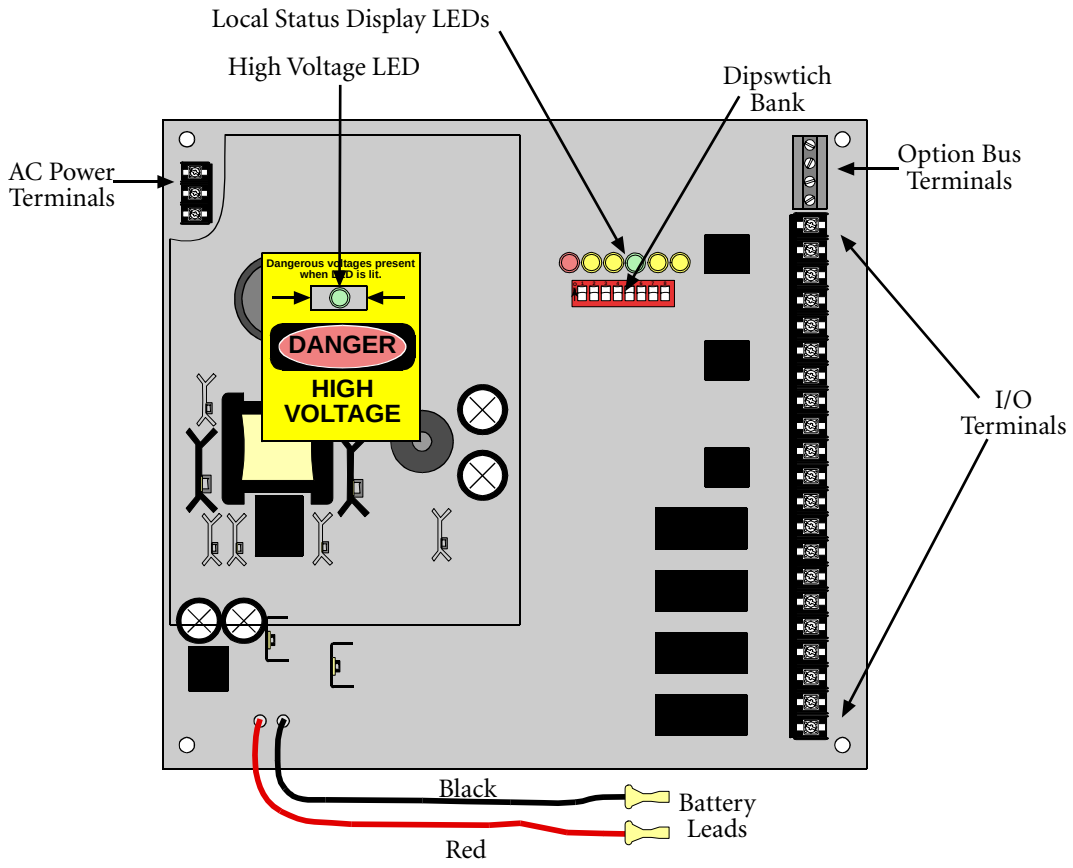


Figure 1: D7038 Remote NAC Power Supply Board

3.1 Enclosure Installation

1. Use the enclosure as a template and mark the top mounting holes on the mounting surface. Be sure there is enough clearance to open the door for maintenance.
2. Pre-start the mounting screws for these two holes. Slide the enclosure onto these mounting screws so that the screws move up into the thinner section of the holes. Tighten the screws.
3. Screw in the remaining two screws in either set of bottom mounting holes.
4. Knock out the desired wire entrances on the enclosure.

See *Figure 2* on page 10 for details.

3.2 D7038 Board Installation

NO STATIC

The D7038 board is static-sensitive. Make sure you touch ground before handling the board. Doing so will discharge any static electricity in your body.

1. Connect the ground wire.
2. Insert the two support posts into the control retainer holes as shown in *Figure 2*.
3. Slide the top of the board into the retainer tabs (the slots under the top of the frame). Once in the retainer tabs, the board will rest on the two support posts.
4. Secure the bottom of the board by screwing the two bottom corners through the support posts and through to the enclosure.

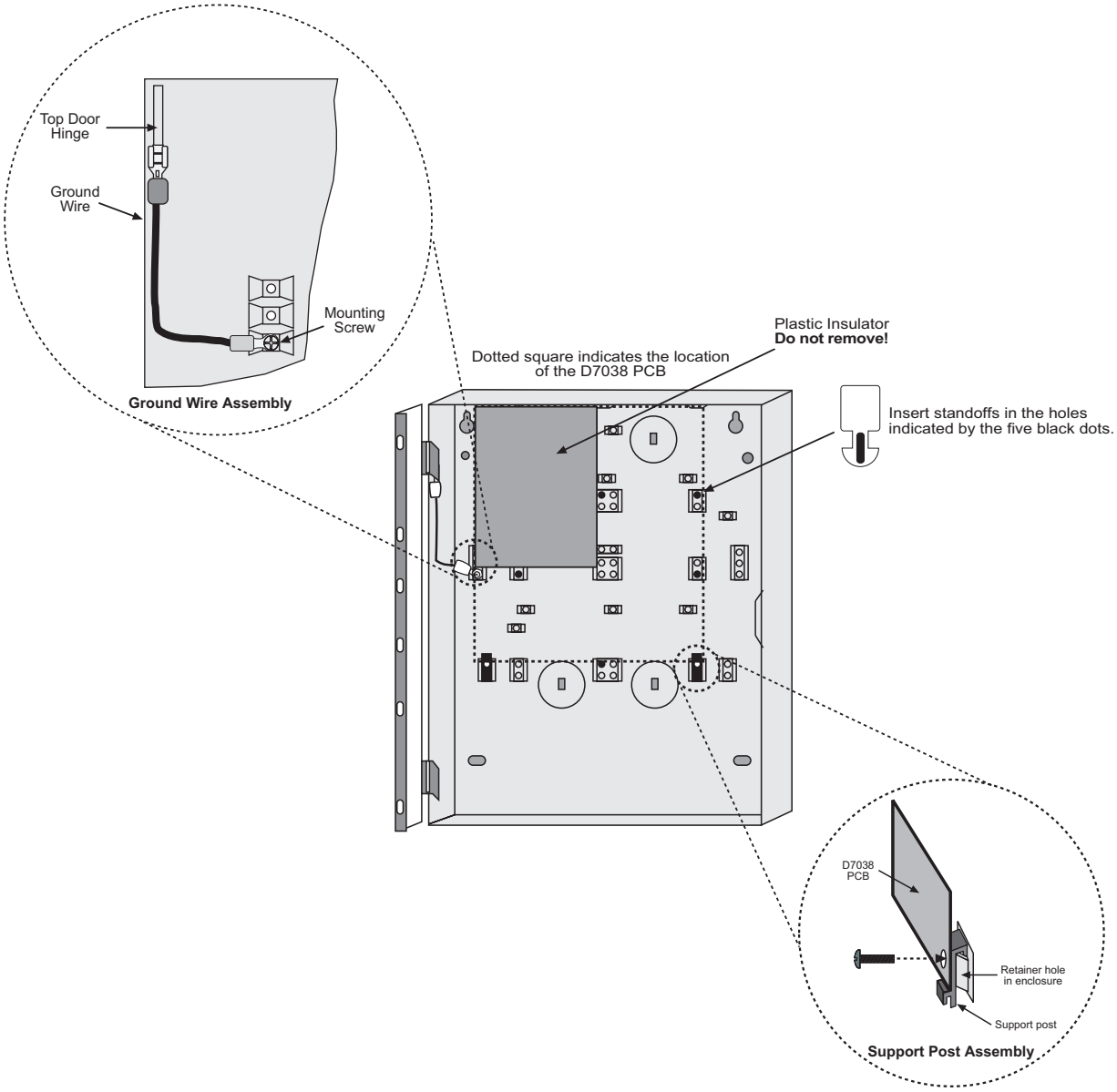


Figure 2: D7038 Enclosure and Board Installation

4.0 Wiring the D7038

Note: All terminals are fully protected against ESD and lightning transients.

Use wire gauge based on *Table 1* and *Table 2*. The terminals can accommodate up to two #12 AWG (2.3 mm) wires.

1. Guaranteed min. NAC voltage at full load.		23.5 V
2. Largest value for all notification appliances' min. operating voltages.		
3. Max. wiring voltage drop.	*Subtract Line 2 from Line 1*	
4. Total load for a given NAC.		
5. Max. allowable line resistance.	*Divide Line 3 by Line 4*	
6. Total wiring run length.		
7. Total wire needed.	*Multiply Line 6 by Line 2*	
8. Max. wire resistance per foot.	*Divide Line 5 by line 7*	
9. Choose a wire size with a resistance per foot less than Line 7.		

Table 1: Wire Gauge Calculations

AWG B&S Gauge	Ohms per Foot
12 (2.3 mm)	0.00158
14 (1.8 mm)	0.00253
16 (1.5 mm)	0.00402
18 (1.2 mm)	0.00639

Table 2: Wire Gauge Table (based on solid wire)

Note: NFPA 72 requires the use of #18 AWG (1.2 mm) or larger in fire applications.

4.1 AC Power Connections

Disconnect all power (AC and battery) before servicing the D7038. Wait until the High Voltage LED is off before handling any connections.

AC Power runs to the L1 (120 VAC), GND and L2 (Neutral) terminals.

102 VAC to 132 VAC with 6 A capacity should feed the local power supply. The output voltage is a filtered 27.4 VDC (500 mV ripple max.) under all conditions.

The D7038 supports surge currents up to 8 A for several seconds. Devices with large inrush currents will not cause a power supply shutdown.

A trouble condition is registered, but not indicated, if AC power falls below 102 V for over 5 sec. A programmable time delay (see *Section 5.3 AC Fail Time Delay* on page 20) allows the indication of AC Failure to be delayed by 1, 6, 12, or 24 hrs. The default is 6 hrs.

See *Figure 3* for wiring details.

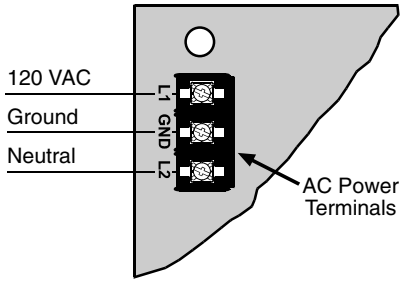


Figure 3: AC Power Connections

4.2 Battery Connections (24 VDC Only)

The backup battery plugs into the terminal marked B+/B- at the lower left corner of the board (see *Figure 4*). The D7038 requires two backup batteries in series.

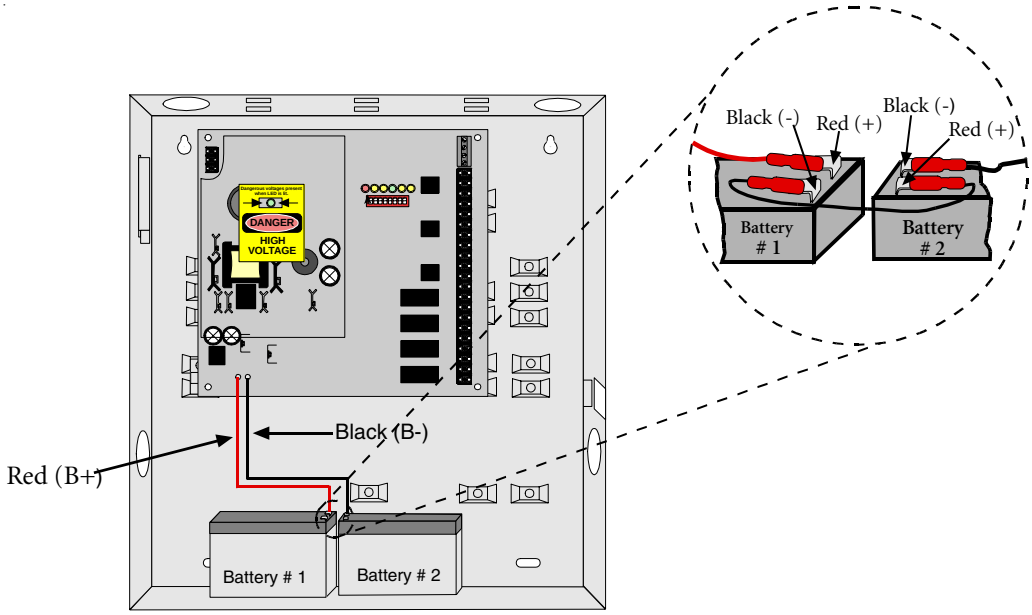


Figure 4: Battery Connections Inside D7038 Enclosure

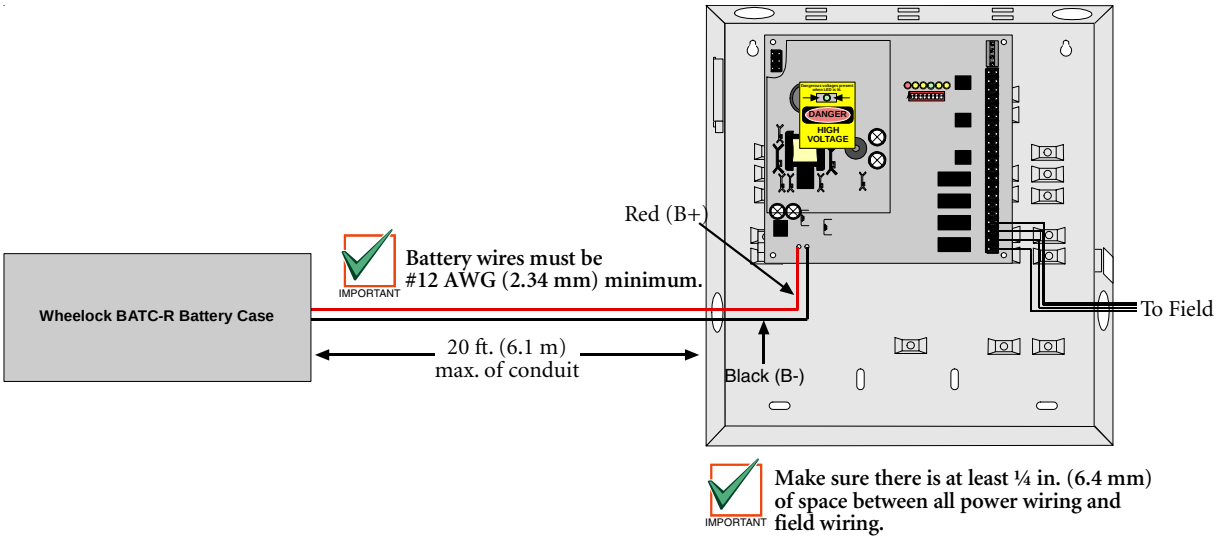


Figure 5: Battery Connections Using an External Battery Case

To determine the standby battery requirements, refer to *Table 3*.

Device	Quantity	Standby Current per Device	Total Standby Current per Device (Quantity x Standby Current per Device)	Alarm Current per Device	Total Alarm Current per Device (Quantity x Alarm Current per Device)
D7038 Remote NAC Power Supply	1	150 mA	150 mA	150 mA	150 mA
		Grand Total Standby Current		**Grand Total Alarm Current**	

Table 3: Standby Time Calculation

The required battery size to support the system can be calculated using the format shown in *Table 4*. *Table 5* and *Table 6* on page 14 can also be used to estimate the required battery size.

Grand Total Standby Current (in amps)	CS	
Total Hours of Standby Required (usually 24 or 60)	HS	
Total Standby Capacity (multiply CS x HS)	TS = CS x HS	

Grand Total Alarm Current (in amps)	CA	
Divide by 0.6	CAA=CA ÷ 0.6	
Total Hours of Alarm Time Required (usually 0.083 or 0.25)	HA	
Total Alarm Capacity (multiply CAA x HA)	TA = CAA X HA	

Total Alarm Capacity Required (add TA + TS)	TC = TA + TS	

Required Capacity with 20% Derating (TC x 1.2)	C = TC x 1.2	

Table 4: Calculating the Required Battery Size

	Capacity Required for 24 hrs.	Capacity Required for 48 hrs.	Capacity Required for 60 hrs.	Capacity Required for 72 hrs.	Capacity Required for 80 hrs.
Grand Total Standby Current					
100 to 200 mA	5.8	11.5	14.4	17.3	19.2
201 to 300 mA	8.6	17.3	21.6	25.9	28.8
301 to 400 mA	11.5	23.0	28.8	34.6	38.4
401 to 500 mA	14.4	28.8	36.0	X	X
501 to 600 mA	17.3	34.6	X	X	X
601 to 700 mA	20.2	X	X	X	X
701 to 800 mA	23.0	X	X	X	X
801 to 900 mA	25.9	X	X	X	X
901 to 1000 mA	28.8	X	X	X	X
1001 to 1100 mA	31.7	X	X	X	X
1101 to 1200 mA	34.6	X	X	X	X

Table 5: Standby Load Battery Size (in amp-hours)

	Capacity Required for 5 min.	Capacity Required for 10 min.	Capacity Required for 15 min.	Capacity Required for 30 min.	Capacity Required for 45 min.
Grand Total Standby Current					
250 to 500 mA	0.1	0.1	0.2	0.3	0.5
501 to 999 mA	0.1	0.2	0.3	0.6	0.9
1.0 to 1.5 A	0.2	0.3	0.5	0.9	1.4
2.6 to 2.0 A	0.2	0.4	0.6	1.2	1.8
2.1 to 2.5 A	0.3	0.5	0.8	1.5	2.3
2.6 to 3.0 A	0.3	0.6	0.9	1.8	2.7
3.1 to 3.5 A	0.4	0.7	1.1	2.1	3.2
3.6 to 4.0 A	0.4	0.8	1.2	2.4	3.6
4.1 to 4.5 A	0.5	0.9	1.4	2.7	4.1
4.6 to 5.0 A	0.5	1.0	1.5	3.0	4.5
5.1 to 5.5 A	0.6	1.1	1.7	3.3	5.0
5.6 to 6.0 A	0.6	1.2	1.8	3.6	5.4

Table 6: Alarm Load Battery Size (in amp-hours)

For batteries larger than 7.0 Ah, the addition of Wheelock's BATC-R Battery Case will be necessary to hold the batteries. Connections between the batteries in the Wheelock BATC-R Battery Case and the control panel need to be in conduit and no more than 20 ft. (6.1 m) from the control panel. All power wiring must exit from the left side of the D7038 enclosure.

Battery wires must be #12 AWG (2.3 mm).

The D7038 provides a regulated output voltage of 24.1 VDC (500 mV ripple max.) when operating from the standby batteries under all conditions, including when the batteries are nearly depleted.

A low battery condition is reported when the battery voltage drops below 20.4 V for the pair.

The D7038 fully charges depleted 6.5 Ah batteries within 48 hrs.

A disconnected battery will indicate within 1 min.

4.3 Option Bus Connections

The option bus (if used) runs to the terminals labeled TX, RX, RTN and +12 V (see *Figure 6*).

The Option Bus connection can be used with Bosch Security Systems D7024 Fire Alarm Control/Communicator with firmware revision 2.0 (or later). The D7038 is considered a new option module type that can indicate specific trouble conditions back to the control panel, such as AC, battery, etc.

See *Section 5.0 D7038 Dip Switch and Option Bus Settings* on page 19 to set the D7038's address for use with the Option Bus.

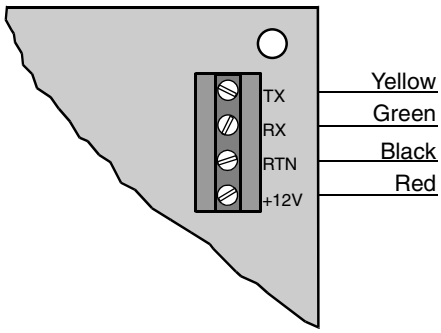


Figure 6: Wiring the Option Bus

4.4 NAC Input Connections

There are two inputs that can be used with 12 or 24 V polarity reversal outputs from a conventional panel that conform to NFPA 72, Class B (used instead of the option bus connection). Please refer to the control panels' compatibility information.

Polarity reversal on Input 1 activates NAC Outputs 1 and 2; Input 2 activates NAC Outputs 3 and 4. DIP switch settings allows NAC Input 1 to control all four outputs (see *Section 5.0 D7038 DIP Switch and Option Bus Settings* on page 19).

If the control panel detects a trouble condition on either set of outputs, the appropriate EOL device is disconnected from the reversal loop. These inputs are electrically isolated from the controlling section of the board.

The D7038 can be placed anywhere on a FACP's NAC circuit.

See *Figure 7* for wiring details.

Note: ***Connect either the D7038's Option Bus or NAC Input terminals to the FACP. Do not connect both.***

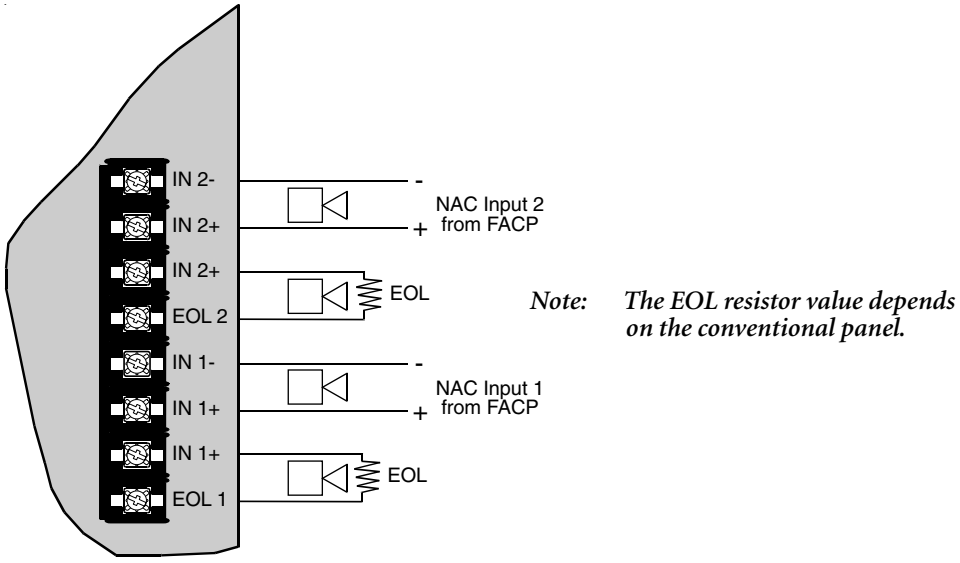


Figure 7: Wiring the NAC Inputs

4.5 Trouble Relay Connections

The trouble relay provides one set of Form "C" contacts for connection of an appliance of choice. It can be wired in series with the Auxiliary Output to provide power to the appliance.

The relay activates by the controlling section of the board to indicate a fault condition. See *Figure 8* for wiring details.

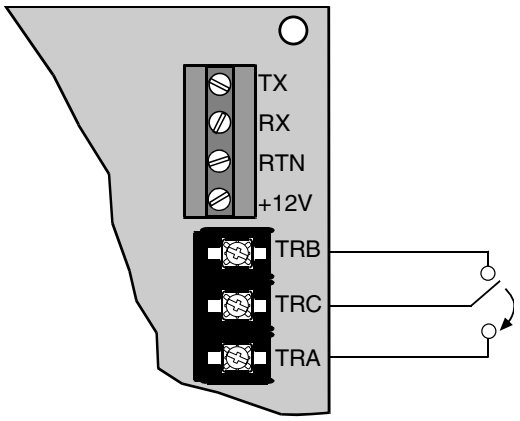


Figure 8: Wiring the Trouble Relay

4.6 Auxiliary Output Connections

The auxiliary output provides a continuous, unsupervised 24 V output to power external devices. It is rated at 0.85 A. It can be wired in series with the trouble relay to provide power to the associated appliance.

A short circuit on this output will not affect the operation of the D7038 in any way. See *Figure 9* for wiring details.

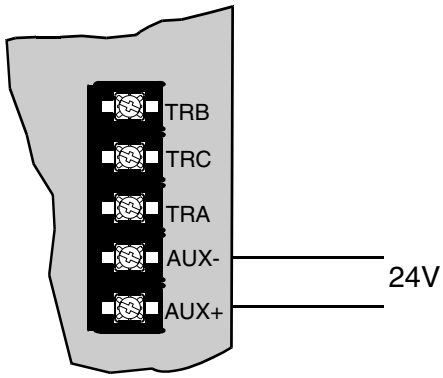


Figure 9: Wiring the Auxiliary Outputs

4.7 NAC Output Connections

Four outputs, consisting of two Form C relays, switch the load to the 24 V bus. Each output sources up to 2.5 A, limited by an overall 6 A capacity.

4.7.1 NAC Circuits

Overload protection will interrupt the circuit within five seconds given an overload of 8 A total. When de-energized, the relay switches a monitoring circuit across the output to verify EOL termination, allowing reporting of an open or shorted output condition. See *Figure 10* for wiring details.

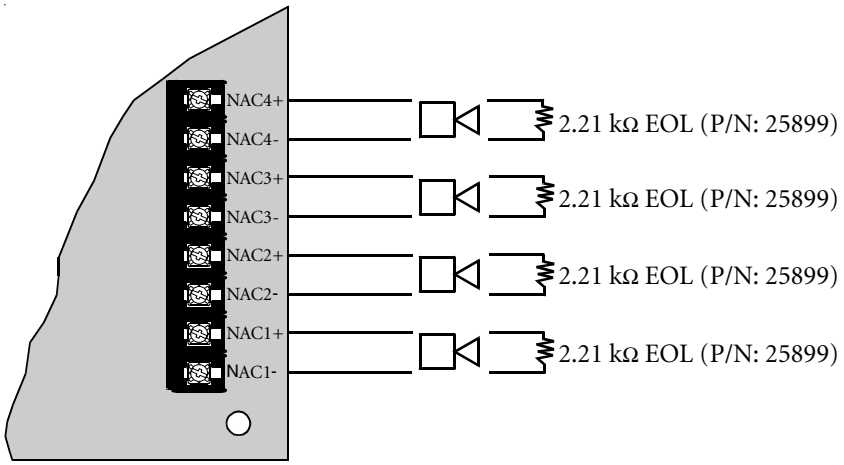


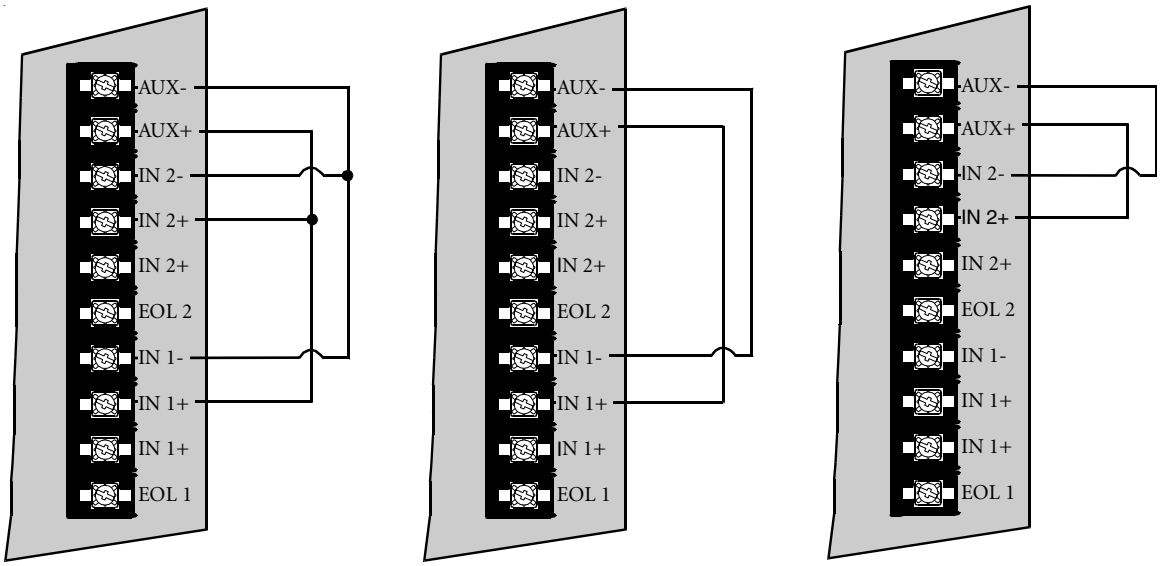
Figure 10: Wiring the NAC Outputs

4.7.2 Auxiliary Circuits

The D7038 can be wired to supply constant auxiliary power through its NAC outputs. See *Figure 11* for wiring details.

Note: Reverse polarity connections of some notification appliances may not be detected by the D7038 NAC supervision. Make sure that the notification appliances are connected properly and tested before installation is completed.

Figure 11: Auxiliary Power Circuit Configuration



All 4 NAC Outputs **NAC Outputs 1 & 2** **NAC Outputs 3 & 4**

5.0 D7038 DIP Switch and Option Bus Settings

The following options must be set with the DIP switches: Option Bus Address, NAC Input Variable and AC Failure Time Delay.

Please refer to *Figure 1* on page 9 for the location of the DIP switch bank on the D7038 board. See *Figure 12* and *Table 7* for proper DIP switch positioning and settings, respectively.

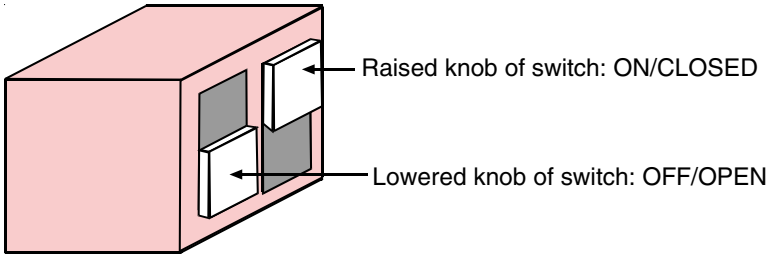


Figure 12: D7038 DIP Switch Orientation

	DIP Switches						
Option Settings	**1**	**2**	**3**	**5**	**6**	**7**	**8**
Option Bus Address 1	---	---	---	On/Closed	Off/Open	Off/Open	Off/Open
Option Bus Address 2	---	---	---	Off/Open	On/Closed	Off/Open	Off/Open
Option Bus Address 3	---	---	---	On/Closed	On/Closed	Off/Open	Off/Open
Option Bus Address 4	---	---	---	Off/Open	Off/Open	On/Closed	Off/Open
Option Bus Address 5	---	---	---	On/Closed	Off/Open	On/Closed	Off/Open
Option Bus Address 6	---	---	---	Off/Open	On/Closed	On/Closed	Off/Open
Option Bus Address 7	---	---	---	On/Closed	On/Closed	On/Closed	Off/Open
Option Bus Address 8	---	---	---	Off/Open	Off/Open	Off/Open	On/Closed
Option Bus Address 9	---	---	---	On/Closed	Off/Open	Off/Open	On/Closed
Option Bus Address 10	---	---	---	Off/Open	On/Closed	Off/Open	On/Closed
Option Bus Address 11	---	---	---	On/Closed	On/Closed	Off/Open	On/Closed
Option Bus Address 12	---	---	---	Off/Open	Off/Open	On/Closed	On/Closed
Option Bus Address 13	---	---	---	On/Closed	Off/Open	On/Closed	On/Closed
Option Bus Address 14	---	---	---	Off/Open	On/Closed	On/Closed	On/Closed
Option Bus Address 15	---	---	---	On/Closed	On/Closed	On/Closed	On/Closed
NAC Input Variable	On/Closed	---	---	---	---	---	---
AC Fail Time Delay (6 hr. Default)	---	Off/Open	Off/Open	---	---	---	---
AC Fail Time Delay (1 hr.)	---	On/Closed	Off/Open	---	---	---	---
AC Fail Time Delay (12 hr.)	---	Off/Open	On/Closed	---	---	---	---
AC Fail Time Delay (24 hr.)	---	On/Closed	On/Closed	---	---	---	---

Table 7: DIP Switch Settings

Dip Switch and Option Bus Settings

5.1 Option Bus Address

Note: To activate a new address, remove the AC and battery power from the D7038. Restore power once it has been removed. The new address becomes active once power is restored to the D7038.

If using the Option Bus connection, the D7038 needs its own address (1 to 15). Use switches 5 through 8.

Refer to *Figure 12* on page 19 for proper DIP switch positioning.

5.2 NAC Input Variable

Instead of having Input 1 drive NAC Output 1 and 2 and Input 2 drive NAC Output 3 and 4, Input 1 can be set to drive all four outputs. Set DIP Switch 1 to the ON/CLOSED position to select this option.

5.3 AC Fail Time Delay

A trouble condition is registered, but not indicated, to the panel if the AC falls below 102 V for over 5 sec. A programmable time delay allows the indication of AC Failure to be delayed by 1, 6, 12, or 24 hrs. The default value is 6 hrs.

Use DIP switches 2 and 3 for these settings.

6.0 D7038 Local Status Display

There are seven local status display LEDs on the D7038 board: High Voltage (located under clear plastic shield), Output Active, NAC Short, Low Battery, AC OK, Ground Fault and Loop Trouble.

See *Figure 1* on page 9 for the location of each LED on the board. See *Table 8* for the abbreviation, color, and function of each on-board LED.

There is a warning label on the clear plastic shield indicating high voltage device. The D7038 should not be serviced until power is removed (both AC and battery) and the High Voltage LED is off.

LED	Abbrev.	Color	Function
High Voltage	HVLT	Green	Warns of dangerous voltages when lit.
Output Active	OUT	Red	Indicates one of the NACs (1-4) is currently active.
NAC Short	SHRT	Yellow	Indicates that there is a short on one of the four NAC outputs.
Low Battery	LBAT	Yellow	Indicates that there is a missing or dead battery.
AC OK	ACOK	Green	Indicates that the input is OK and that the power supply is running from the AC line.
Ground Fault	GFLT	Yellow	Indicates that the NAC output wiring has been improperly connected to an external source or ground.
Loop Trouble	TBL	Yellow	Indicates that one, or both, NAC Input EOL device(s) has disconnected due to one or more of the following faults: faulty AC power (after a delay); low battery fault; ground fault; NAC output fault, EOL shorted, EOL open, NAC overcurrent; power supply over voltage condition.

Table 8: Local Status Display LED Functions

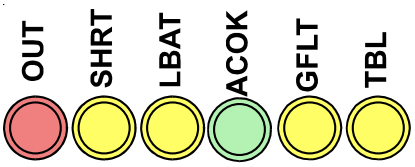


Figure 13: D7038 LEDs

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