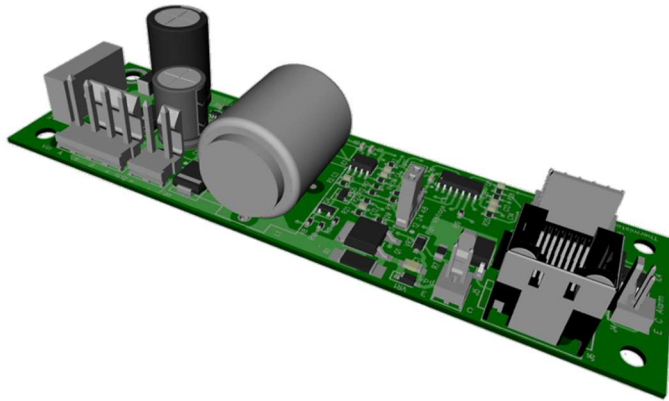


SmartFan® Multi-SD

Programmable DC Fan Speed Controller



Programmer PRG00-F



Multi-SD 042D440-01

Multi-SD is a programmable fan speed control and alarm designed for two and three wire 12V, 24V, and 48V DC fans and blowers rated up to 5 Amps. The Multi SD can regulate the speed of one or more fans by changing the fan supply voltage in relation to a control input (temperature or 0-4VDC PWM signal). The Multi-SD can be customized for your application using the **Navigator** hand-held programmer (pictured above). The Navigator can be used to create custom fan/motor speed control curves based on temperature or PWM input. Other programming variables include: on/off set points, start-up options, alarm trigger points and override speed settings. Simply plug the Navigator into a powered Multi-SD and scroll through the 11 variable menus, selecting the control inputs for your application. Programmed profiles can be saved and copied to multiple controllers with ease. Factory preprogramming available for orders of 50 or more.

Part Number	Current Rating (55°C) ¹		Supply Voltage Range ²	Isolated Alarm Sinking Current
	200 LFM	Still Air		
042D440-01	5.0A	4.0A	10 – 75 VDC	1 mA
042D440R-01	5.0A	4.0A	10 – 75 VDC	100 mA
PRG00-F	Navigator hand-held programmer, required to program (for sale or rent)			
Temperature Sensors (order separately, see www.controlresources.com/sensors)				
H118-F	Hardware Pack (recommended for lower volumes)			

1. See fig. 1 for derating above 55°C
2. Supply voltage must be between 10.5 – 75VDC during programming with the Navigator.

Specifications

- Power Source: 10-75VDC (single or Dual)
- Dimensions 5.0”(127) x 1.5”(38.1) x 1.0”(25.4) L x W x H (See Fig. 2)
- Weight: 1.9 oz. (54 grams)
- Operating Environment: -20 to 55°C, 0-95% RH noncondensing
- Storage Temp: -40 to 125°C
- Control Input:
 - Up to 3 P-series or S-series thermistor
 - 0-4VDC PWM input, must be isolated from input supply voltage

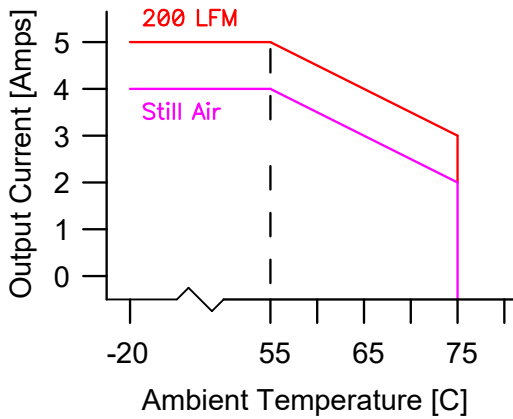


Fig. 1: Multi-SD Derating

Other Features

- Navigator Programmable variables
 - Control Input: up to 3 sensors or PWM
 - Min. & Max. fan speed
 - Override speed

- Min. & Max. control signal
- Motor ON/OFF set points
- Speed on signal loss (fail safe)
- Alarm trip points
- Temp. sensor series
- Start-up options
- High efficiency, >90% typical
- Soft start & current limiting at start up
- Noise reduction of 15 dB(A) or more typical at idle speed
- Compatible with TachScan speed alarms
- RoHS compliant
- Factory programming for orders of 50 units and up
- 2 year warranty
- Made in the USA
- UL recognized to UL508 and CSA-C22, File E100344 us

Advantages over 042D440-F & 042D440R-F Multi-SD controllers

- 0-4VDC PWM control capability
- Easy menu driven digital programming
- Wider & more detailed programming options for increased accuracy and flexibility
- Save and copy control variables from unit to unit.
- Compatible with more temp. sensors with tighter tolerance at lower cost
- Programmable motor on/off control

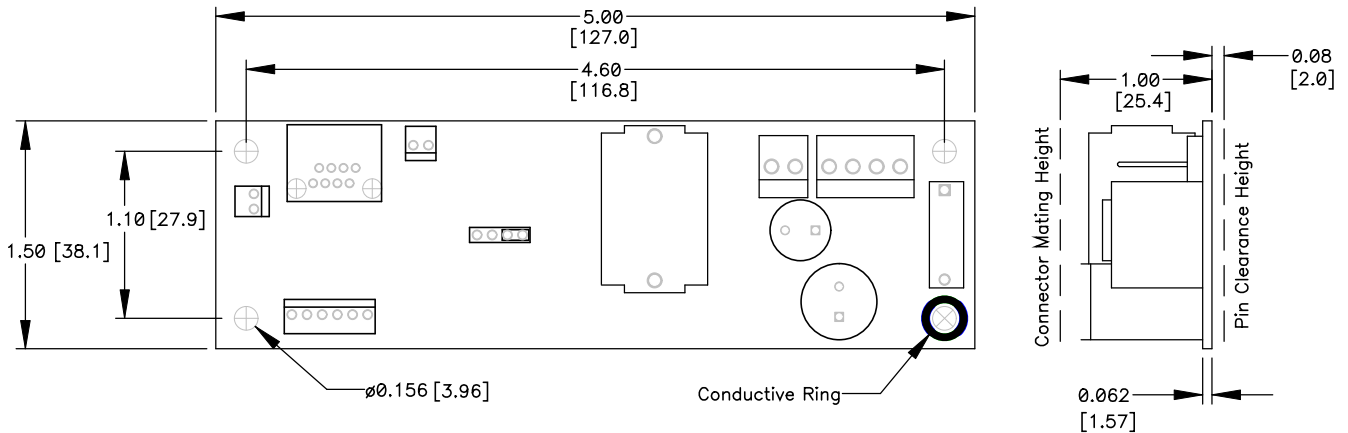


Fig. 2: Multi-SD Dimensions

MOUNTING



WARNING: The **SmartFan** Multi-SD is a non-isolated power product and generates heat. To maintain safety and reliability, mount in a ventilated enclosure and maintain an operating temperature of 55°C or less or provide airflow. See Fig. 1 for derating above 55°C. Protect user from contact with power connections, board surface, and components.

Using PCB support hardware in hardware pack H118-F, or equivalent, mount the unit on a flat surface using the four .156” (4.0mm) mounting holes. To minimize EMI, securely mount the unit on a grounded surface using a metal spacer and hardware at the conductive ring mounting (ref. fig. 2) **Note:** To meet UL safety recommendations without using an insulator, the unit must be mounted using spacers of a least 0.15” (3.8mm) from a conductive surface.

Connections

Connector Pin Assignments

A description of the function of each connector pin and location is listed in Table 1.

Table 1: Connector Pin Assignments		
Header	Label	Description
J1	A	Power Supply A
	+	Power Supply A Reference
	B	Power Supply B
	+	Power Supply B Reference
J2	+	Fan Power
	-	Fan Power Reference
J4	C	Temperature Alarm Output, Collector Terminal (+)
	E	Temperature Alarm Output, Emitter Terminal (-)
J5	C	Speed Override Input (+)
	E	Override Speed Input Reference (-)
J8	T1	Temperature Sensor 1 Input
	T1	Temperature Sensor 1 Input
	T2	Temperature Sensor 2 Input
	T2	Temperature Sensor 2 Input
	T3	Temperature Sensor 3 Input or PWM Signal Input
	T3	Temperature Sensor 3 Input or PWM Signal Reference

Suggested Connecting Hardware

Table 2: Recommended Hardware				
Ref. Des.	Header Mfg. & Part No. ¹	H118-F Hardware Pack		
		Qty	Description	Mfg. & Part No. ¹
J1	Molex No. 26-60-4040	1	Housing	Molex No. 09-50-8041
		4	Terminal (Tin)	Molex No. 08-50-0106
J2	Molex No. 26-60-4020	1	Housing	Molex No. 09-50-8021
		2	Terminal (Tin)	Molex No. 08-50-0106
J4	Molex No. 22-29-2021	1	Housing	Molex No. 22-01-2027
		2	Terminal (gold)	Molex No. 08-55-0102
J5	Molex No. 22-29-2021	1	Housing	Molex No. 22-01-2027
		2	Terminal (gold)	Molex No. 08-55-0102
J8	Molex No. 22-29-2061	1	Housing	Molex No. 22-01-3067
		6	Terminal (gold)	Molex No. 08-55-0102
Mounting Hardware		4	PCB Support	Richco No. CBS-4-19
		1	Aluminum Spacer	Richco No. ALSS6-2
		1	Screw, 6-32x5/8”	
		1	Nut, 6-32	

¹ Or equivalent

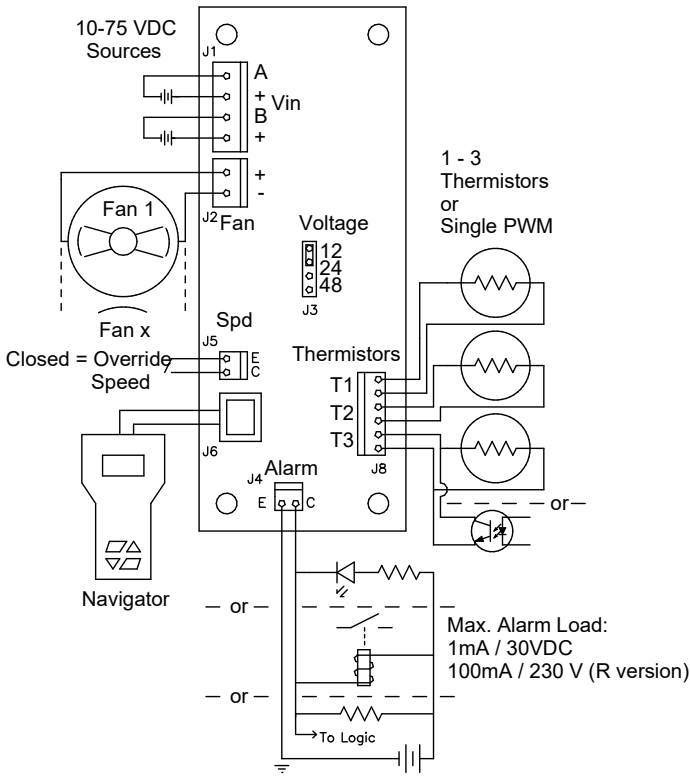


Fig. 3: Multi-SD wiring diagram

Input Power (J1)

Refer to Fig. 3 for input power wiring. One or two power supplies in the range of 10 to 75 VDC should be connected at header J1. If two power supplies are used, they are logically OR'd on the Multi-SD so that the operating voltage is equal to the higher of the two supplies.

–48 VDC Telecomm Power System Note: When a –48 VDC power system is used to supply power to the Multi-SD, connect –48 VDC Power Return to J1:+ and –48 VDC Power to J1:A or J1:B

Fan(s) (J2, J3)

Move the voltage shunt at J3 to match the nominal fan voltage of the fans being connected. Fans are connected to header J2. Refer to Fig. 3 for details of fan power wiring. More than one fan can be connected in parallel to header J2 as long as the total current draw of the fan load does not exceed the rating of the Multi-SD. The maximum voltage to the fans is regulated by 3 factors: the jumper setting at J3, the input voltage at J1 and the total fan current. The Multi-SD does not boost output voltage, the output will limit to between 0.5 – 1.0 volts below the supply voltage depending on fan load current.

Table 3: Full Speed Voltage		
J3 Jumper Setting	J2 Fan Voltage at Full Speed (54 VDC Vin @ 1A Fan Load)	
	Min.	Max.
12	11.5	14
24	23	27
48	47	51

Temperature Control Option (J8)

Up to 3 thermistor sensors can be connected to the Multi SD to provide temperature-based fan speed control and alarming. Connect Control Resources P-series or S-series sensors(s) found at www.controlresources.com/sensors to header J8, there is no polarity consideration when connecting the sensor(s), however all sensors connected must be from the same series (S or P). The thermistor reading the highest temperature is used for speed control and alarming.

PWM Control Option (J8)

The Multi SD can control fan speed based on an isolated PWM control signal. Referring to Fig. 4, connect the PWM signal to header J8:T3. Header J8:T3 is internally pulled up to 4 VDC with a 10.0k Ohm resistor. Isolation of PWM signal is required because the circuitry at J8:T3 is referenced to a floating voltage on the Multi-SD. When a PWM signal is applied to J8:T3, no connections should be made to T1 or T2.

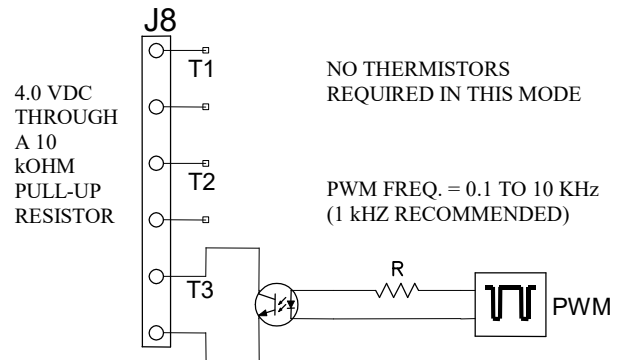


Fig. 4: Connection for PWM control signal input.

Temperature Alarm (J4)

The Multi-SD can provide an optically isolated open collector output when the sensor input (J8) is open or above the programmed “Alarm Trip” threshold. The maximum output for the 042D440-01 is 1mA @ 30VDC. The 042D440R-01 can provide up to 100mA @ 230 VDC/VAC. Fig. 3 shows typical connections for a green LED, an external power relay, or a logic signal.

Speed Override (J5)

A non-isolated input is located at J5 that allows the user to override the fans to a programmed speed when a closed contact is placed across the two header pins.

Connecting an Optional Fan Speed Alarm (J5)

When using fans with a 3rd wire tach output, an optional fan speed alarm, Control Resources Tachscan 3 or TachScan 9 can be connected at J5 and J3. An example of how this input can be interfaced with the Tachscan-3 is shown in Fig. 5. In this case, the normally open isolated alarm output (J8:2A, 2B) from the Tachscan-3 is connected to header J5 on the Multi-SD. When the Tachscan-3 senses that the speed of one or more fans drops below the trigger speed, the output closes and the Multi-SD increases the speed of the fans to full. See the Tachscan-3 or Tachscan-9 product pages at www.controlresources.com for additional details.

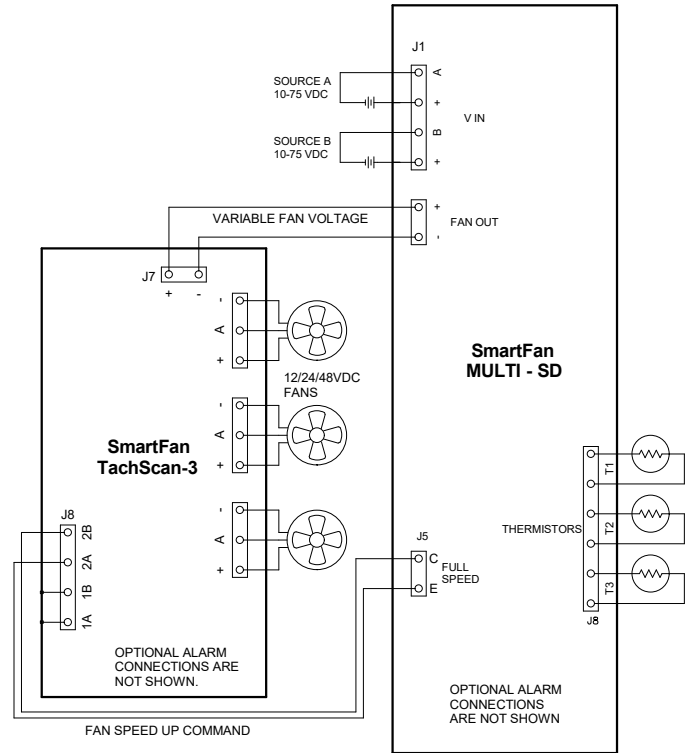


Fig. 5: Connection diagram for interface of Tachscan-3 and Multi-SD

Table 4: Multi-SD / Navigator Menu				
Select Input Type 1 Probe = default	1 – 3 Probe(s)		PWM	
	Default	Range	Default	Range
Select Probe	S - Series	S, P	n/a	n/a
Full Speed	100%	0 – 100%	100%	0 – 100%
Idle Speed	55%	0 – 100%	55%	0 – 100%
Override Speed	100%	0 – 100%	100%	0 – 100%
Full Input	40°C	-20 - 80°C	60%	0 – 100%
Idle Input	35°C	-20 - 80°C	55%	0 – 100%
On Input	Disabled	-19 - 80°C, Disabled	Disabled	1 – 100%, Disabled
Off Input	Disabled	-19 - 80°C, Disabled	Disabled	1 – 100%, Disabled
Alarm Trip	50°C	-20 - 79°C, Disabled	70%	0 – 99%, Disabled
Speed on Signal Loss	Full	Full, Idle	Full	Full, Idle
Start-up Option	Ramp w/o Pulse	Ramped & Pulsed	Ramp w/o Pulse	Ramped & Pulsed

PROGRAMMING

Initial Setup:

Connect the Navigator to the Multi-SD through the RJ45 connector using a CAT5 cable. Apply power to the Multi-SD to enable programming via the Navigator. Navigator will display its current revision briefly then show it is ready for programming. If the Navigator display flashes on an off repeatedly, check that the input voltage to the Multi-SD is 10.5VDC or greater.

Multi-SD
is ready

Pressing any of the four bottom keys will enter the Programming Menus.

- ❖ **Next:** Advances to the next menu
- ❖ **Previous:** Goes back to the previous menu
- ❖ **▲ or ▼:** Selects choices within a menu
- ❖ **Write Drive:** Saves all the settings currently programmed in the Multi-SD. All programmed settings will be lost if power is removed before the write drive key is set.
- ❖ **Read Drive:** Reads the settings from the connected Multi-SD.
- ❖ **Save and Recall Program:** Stores and retrieves profiles stored in the Navigator's internal memory.

Input Type:

Input Type
→ 1 Probes (s)

The first menu is used to select the control input type. Use the ▲ or ▼ keys to select the number of probes for temperature control or PWM control (PWM mode must use T3 input connection on J8). The Multi-SD will automatically switch to the control type selected in real time. **Note:** All programming menus will automatically adjust in real time, but will be lost during a power cycle unless the **Write Drive** key is selected. Press the **Next** key to continue.

Select Probe:

Select Probe
→ P-Series

When controlling fan/motor speed via temperature, the "Select Probe" menu will be

available. Using the ▲ or ▼ keys, select the probe series (S or P) you have connected to J8. All SmartFan compatible sensors can be found at www.controlresources.com/sensors.

Set Full Speed:

Set Full Speed
→ 100%

The Set Full Speed menu is used to select the voltage (as a percentage of max. output voltage) your motor will see at the full control input. Example: If you are controlling fan speed via temperature, your voltage setting is 48V and you want to run your fan at 40V when your system temperature reached 45°C and above. You would choose $40/50 = 80\%$ as the "Full Speed" setting and 45°C for the Full Input setting, Ref. fig. 6. Example 2: . **Note:** You can create a negative slope control curve by making your "Idle Speed" greater than your "Full Speed". **Note:** the Multi-SD has a slight overdrive to ensure maximum available fan speed, the max. voltages are 50V, 25V, and 13V nominal for settings 48, 24, and 12 respectively

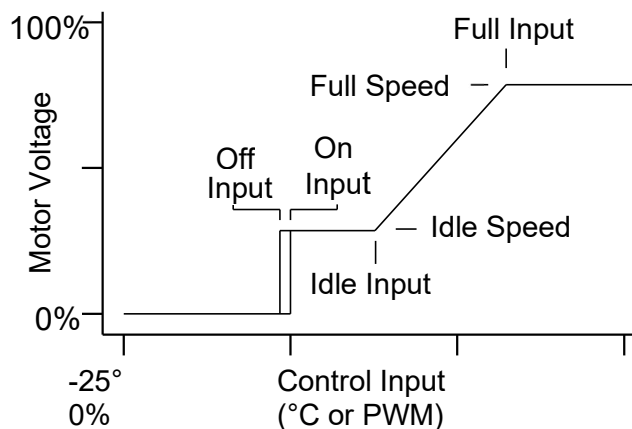


Fig. 6

Set Idle Speed:

Set Idle Speed
→ 55%

Select the voltage (as a percent of max. voltage) your motor will see at the "Idle Input" point. Ref. Fig. 6. **Note:** Most DC motors do

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not run consistently at or below 50% of their rated voltage, be sure you motor will run at the voltage you select here.

Set Override Speed:

```
Set Override Spd
→ 100%
```

Select the voltage (as a percent of max. voltage) your motor will see when the speed override jumper (J5) is shorted. **Note:** When J5 is shorted all other speed decisions including alarms are ignored. The speed can be set to 0% to provide an off function.

Set Full Input:

```
Set Full Input
→ 40°C
```

When controlling temperature, set the Full Input to the temperature at and above you want the fan/motor to run full speed.

When controlling via PWM, set the full input to the maximum input percentage. Ref. Fig 6.

Note: The Full Input cannot be set below the Idle Input.

Idle Input:

```
Set Idle Input
→ 35°C
```

When controlling temperature, set the Idle Input to the temperature at and below you want your fan/motor to idle. **Note:** In a closed loop system (controlling exhaust air), the difference between the Full and Idle temperature can often be as small as 3° - 5°C.

When controlling via PWM, set the Idle Input to the minimum input percentage. Ref. Fig 6.

Set On Input:

```
Set On Input
→ Disabled
```

The Multi-SD can be programmed to turn the motor on and off at a certain input temperature (temperature control only), voltage or current. In the default setting, this feature is disabled. When disabled, the motor will always run at the "Idle Speed" at or below the "Idle Input" setting. Use the ▲ or ▼ keys to select the temperature or PWM at which you want your motor to turn on. **Note:** When enabled, the On input must always be set at or below the Idle Input and above the Off Input. Ref. Fig. 6

Set Off Input:

```
Set Off Input
→ Disabled
```

To turn your motor off at a certain temperature, voltage or current, use the Off Input menu. **Note:** The Off input must always be set below the On input. In a closed loop system, avoid oscillation by increasing the separation between the On and Off inputs. Ref. Fig. 6.

Set Alarm Trip:

```
Set Alarm Trip
→ 50°C
```

The Multi-SD has a programmable alarm that will trigger a signal at Alarm output (J4). In an alarm condition, the motor will switch to "Full Speed". Use the ▲ or ▼ keys to select the temperature or PWM at which you want to trigger an alarm. The alarm will automatically clear once the alarm condition is removed

Speed on Signal Loss:

```
Speed on Signal
Loss →Full
```

The speed on signal loss menu is used to set a fail-safe motor speed in case the control signal is lost. Options are "Full" (simulating the programmed motor speed at "Full Input") or "Idle" (simulating a control input of -25°C in temperature mode, 0% (open) in PWM mode), Ref. Fig. 6. . Press the **Next** key to continue.

Start-up Options:

```
Start-up Option  
Ramp w/o Pulse  
- - -
```

The start-up option menu is used to set how the output behaves when power is applied. Ramp w/o Pulse is the default setting, the output will ramp from 0V to the value determined by the input control signal. Full Pulse will step the output to the Full Speed setting and hold it for approximately 4 seconds before ramping to the controlled output. Ramped Pulse will ramp to the full output in approximately 3 seconds and hold for 4 seconds before ramping to the controlled output. Use the ▲ or ▼ keys to select the desired mode and ensure to press **Write Drive** to save the setting before turning off power.

NAVIGATOR FEATURES

Copy Program Operation:

Connect Navigator PRG00-F to the Multi-SD. Apply power to the Multi-SD to enable programming via the Navigator. Navigator will display its current revision and product type it is connected to as shown below.

```
Multi-SD  
is ready
```

Press **Read Drive** and the display will indicate when it is ready with the screen below.

```
Drive parameters  
read
```

Disconnect the Multi-SD and connect the next Multi-SD to program. When the Navigator recognizes this unit, press **Write Drive**. Do not press any adjust keys or Navigator will upload the target Multi-SD parameters instead of loading the previously saved program. Once the Multi-SD has been programmed, the message below will appear.

```
Drive parameters  
written
```

Write Drive step above can be repeated for any number of units.

Profile Memory Functions:

The Navigator can save up to 16 separate profiles for each product type it supports for later use. Each profile can be named with a 12 character label.

To save a profile, connect Navigator PRG00-F to the Multi-SD and apply power, adjust the parameters to the desired settings and press **Save Program**.

```
Select program  
→Profile A
```

Navigator will ask which profile to save the settings in. Use the ▲ or ▼ keys to select which profile name to use. If custom names have been previously set they will also display as such in this list. Press **Next** to continue or **Previous** to quit the save operation.

Navigator will allow the profile names to be customized. Use the **Previous** and **Next** keys to select which character to modify and use the ▲ or ▼ keys to change the characters value. Once the label is correct, press **Save Program** again and Navigator will store the profile to its memory.

```
Set label  
→Profile A
```

Note: A blank character is between the ← and ! characters.

Recalling a profile:

To recall a previously saved profile, connect the Navigator PRG00-F to the Multi-SD and apply power. Then press **Recall Program**.

```
Select program  
→Profile A
```

Navigator will ask which profile to recall the settings from. Use the ▲ or ▼ keys to select which profile to use. Press **Next** to recall the

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profile listed or **Previous** to quit the recall operation.

Navigator is now ready to write to a drive or modify the recalled profile's parameters. Once all parameters are correct, press the **Write Drive** key to save the settings in the Multi-SD.

Navigator Troubleshooting:

The Navigator automatically verifies the type and version of the connected product. It can display prompts to help the user identify possible problems.

Can't connect
Pls check wiring

Indicates the Navigator cannot receive any valid data. It is possible some wires or contacts are damaged, or the revision of the Navigator is not compatible.

Please update
programmer.

Indicates the Navigator has found a Multi-SD, but the Multi-SD revision is newer than the Navigator firmware supports. Navigator includes an upgrade port for future updates.

Older drive need
previous codes

indicates the Navigator has found an older version of the Multi-SD that is no longer compatible with its current firmware. The upgrade port can be used to load an older version of firmware to update the Multi-SD, or it may be possible to update the Multi-SD to the newer version.