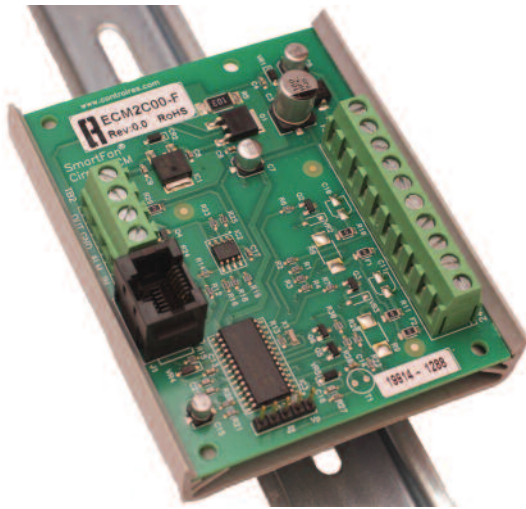
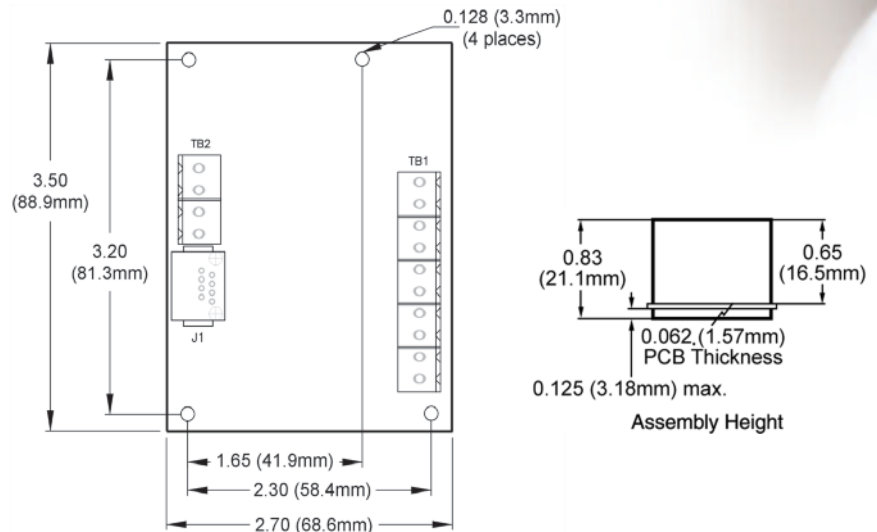


SmartFan® Cirrus-ECM

Speed Control and Alarm for ECM Motors



P/N ECM2C00-F
with DIN350-F DIN rail kit (sold separately).



DC Controls

SmartFan Cirrus-ECM is a compact, microprocessor based motor speed control and alarm designed to control ECM motors that accept Open Collector PWM or 0-12 VDC PWM speed control inputs. Motor speed is regulated based on a control signal input (0-10 VDC, 0-20 mA, remote transducer or thermistor). Cirrus-ECM can be configured with specialized speed control settings including idle speed, full speed, off and alarm trip points. An alarm can be provided to indicate motor failure, over temperature or loss of control signal input. Operating parameters are programmed using the CRI Navigator Remote Programmer or can be configured at the factory to meet your requirements.

SPECIFICATIONS

- Power source: 24 VAC (+/- 10%)
- Motors: One or two ECM motors
- Four settable PWM frequencies:
 - 80Hz, 2.5kHz, 10kHz and 20kHz.
- PWM sink current: 20mA (typical)
- PWM supply current: 20mA (typical)
- Controls motors from four control inputs:
 - 0-20mA control signal
 - 0-10VDC control signal
 - Remote transducer (temperature, humidity, pressure, flow)
 - Remote thermistor (sold separately)
- Operating Temperature: -25°C to 70°C
- Storage Temperature: -40°C to 125°C
- Relative Humidity: 95% non-condensing
- Weight: 1.4 oz. (40 grams)
- RoHS (6/6) compliant

FEATURES

- Mounting Options: PCB mount or DIN Rail mount
- Tach alarm with 3 selectable alarm trigger speed settings
- Remaining motor can be switched to full speed upon motor failure
- Motor failure, temperature & loss of control input signal alarm
- Hard coded or programmable parameters include:
 - Max and Min speeds
 - Max and Min control signal
 - Motor off setting
 - Alarm trip setting
 - 0-18VDC supply voltage to drive external transducer or alarm
- Compatible with Open Collector PWM and 0-12 VDC PWM ECM motors.

Part Number	ECM Motor Control Options
ECM2C00-F	Open Collector PWM
ECM2V00-F	0-12 VDC PWM
DIN350-F	DIN Rail Kit
PRG00-F	Navigator Programmer

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DEFAULT CONFIGURATION AND SPECIAL OPTIONS

Programming: Cirrus-ECM can be programmed at the factory to your configuration requirements or can be programmed using a Navigator programmer from Control Resources. If you do not have a Navigator Programmer or to request factory programming, contact Control Resources' customer service for assistance.

Default Configuration: Without programming, Cirrus-ECM will default to the following operating parameters.

- Two ECM-Motors are connected
- ECM-Motor speed is determined by the 0 to 10 Vdc control signal as shown in Figure 1 below
- ECM-Motor alarm is set at 2000 PPM
- ECM-Motor control signal PWM frequency is 2.5kHz
- ECM-Motor control signal PWM output is 0-12V PWM for ECM2V00-F and open collector output PWM for ECM2C00-F

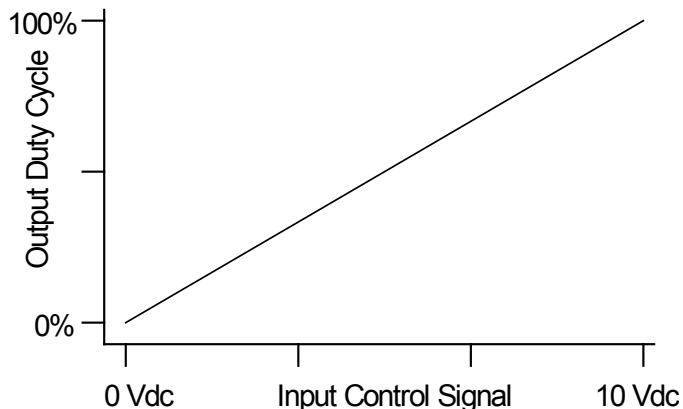


Figure 1: Default Analog 0-10 Vdc Control Curve

Available Special Options: Features available in specially ordered versions of the Cirrus-ECM.

- Hard coded operating parameters
- Can be modified to control virtually any speed controllable ECM-Motor with frequency and output drive parameters
- Relationship between sensed temperature and ECM-Motor speed control signal
- ECM-Motor speed control based on differential temperature
- Vout series resistor for pull-up or LED current limiting
- Individual ECM-Motor control circuit fusing
- On-board thermistor
- If your application requires more than 2 ECM-Motors, a special version of our SmartFan Cirrus-6 can control up to six ECM-Motors. Contact CRI customer service for assistance.

MOUNTING (See dimensional drawings on Page 1)

PCB Mount: A spacing of 1/4" (6.3mm) should be maintained between the circuit board and chassis ground and 5/16" (8mm) to any uninsulated secondary circuits to satisfy safety agency requirements.

DIN Rail Mount: The Cirrus-ECM may be mounted on a DIN rail using DIN rail kit CRI part number DIN350-F.

CONNECTIONS (See Figure 3 & Table 1)

Power Connections at TB1: Connect 24 VAC power to 24VAC and COM (polarity neutral).

ECM-Motor Connections at TB1: The Cirrus-ECM is designed to control and accept tach signals from one or two ECM-Motors. Connect the ECM-Motor control signal power lead to 24VDC, connect the ECM-Motor control signal negative lead to COM, connect the PWM signal lead to C, connect the tach signal lead to A.

Note: the tach lead need not be connected if the ECM-Motor speed alarm feature is not to be used.

Thermistor Control Input Connection at TB2: When controlling from a temperature sensor, choose an air, surface or liquid temperature sensor from the CRI catalog or website at www.controlres.com/sensors.php. Connect thermistor leads to IN and GND (polarity neutral).

Voltage or Current Control Input Connection at TB2: When controlling from a voltage or current signal, connect a 0 to 10 Vdc or 0 to 20 mAdc control signal + to IN and - to GND. **CAUTION: Reversing + and - may damage the control.**

Remote Transducer Connection at TB2: Cirrus-ECM can control ECM-Motor speed based on a remote transducer. Cirrus-ECM can power transducers that require 18 Vdc or less @ max. 20 mA. To connect and power a transducer, attach the supply voltage lead to OUT, attach the output voltage lead to IN, attach ground lead to GND.

Alarm Conditions and Connections (See Figure 2): The alarm output is a normally open (NO), open collector referenced to isolated ground. When no alarm condition is present, the relay is closed and can conduct up to 100 mA DC of load current. When the alarm is triggered, the transistor opens and can support up to 100 VDC across its terminals.

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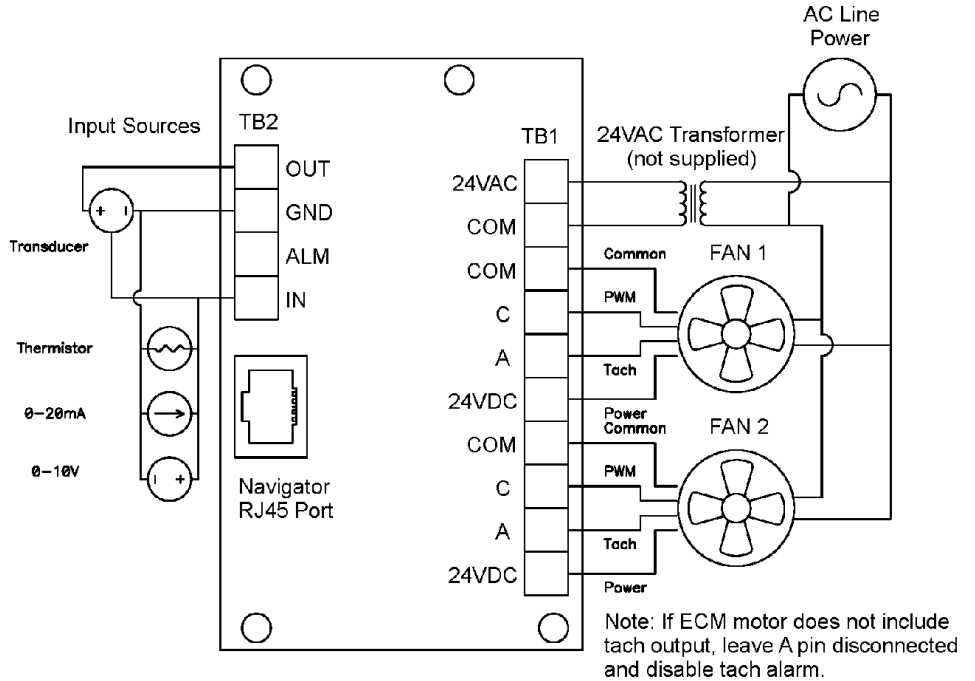
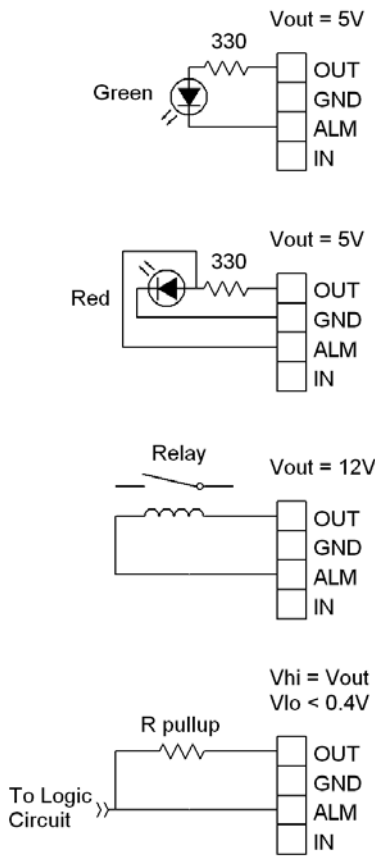


Figure 3: Wiring Diagram

Figure 2: Alarm Configuration Examples

Table 1: Connections			
Terminal Block	Label	Description	Terminal Block
TB1	24VAC	Power Supply Positive	16 – 26 AWG Screw Clamp
	COM	Power Supply Negative	
	COM	Motor Control Supply Negative	
	C	Motor Control Signal In	
	A	Motor Tach Signal Out	
	24VDC	Motor Control Supply Positive	
	COM	Motor Control Supply Negative	
	C	Motor Control Signal In	
	A	Motor Tach Signal Out	
TB2	24VDC	Motor Control Supply Positive	
	OUT	Transducer Supply Voltage	
	GND	Ground / Thermistor	
	ALM	Alarm Output	
	IN	Analog Control / Thermistor	

Table 2: Technical Data
<p>Control Accuracy and Hysteresis: Temperature Mode: Low Temperature Alarm = -20°C Temperature Alarm Hysteresis = ±1°C Temperature Accuracy = ±1°C 0-50°C = ±2.5°C -20-80°C</p> <p>Voltage/Current/Transducer Mode: Signal Loss Alarm Hysteresis = ±1% Idle Off Hysteresis = ±3% Input Accuracy = ±5%</p> <p>Tachometer Hysteresis = ~100 PPM Accuracy = ±1%</p> <p>Input/Outputs OUT: 0-18V @ 20mA max ALM: 100VDC max blocking 100mA max sinking</p>

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SETTABLE OR PRE-PROGRAMMED OPERATING PARAMETERS

ECM-Motor Control Methods: Cirrus-ECM can be programmed to accept a voltage, current, or thermistor control signal. The control curve is configurable through the use of a Navigator Programmer or can be programmed at the factory. Control curve options are shown in Figure 4 below.

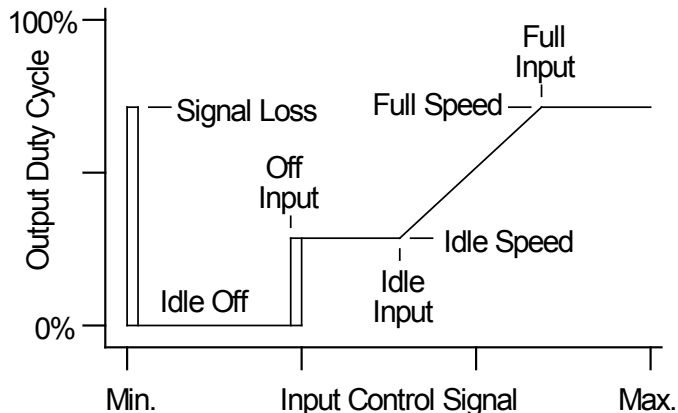


Figure 4: ECM-Motor Speed vs. Input Signal Configurable Options

1) Analog Input Control Selection: The speed control output applied to the ECM-Motor is determined by the analog control input. The input control signal ranges are: 0 to 10 Vdc for voltage mode, 0 to 20 mAdc for current mode, and -20 to 80 °C for temperature mode.

2) ECM-Motor Connected: Cirrus-ECM can set to control one or two ECM-Motors.

3) Signal Loss: If Cirrus-ECM loses the analog input signal (open wire or 0 V/mA applied), the ECM-Motor speed output can be set to run at idle and ignore the loss of signal or ramp to full speed and signal an alarm through the alarm output contact.

4) PWM frequency: Cirrus-ECM PWM frequency can be set to 80Hz, 2.5kHz, 10kHz, or 20kHz. Contact the motor manufacturer for the recommended frequency. Selecting a non-recommended frequency will not damage the motor but may affect motor performance while set at that frequency.

5) Tachometer Alarm: Cirrus-ECM can select between three trip points to signal a failed ECM-Motor alarm, at 1000, 2000, or 4000 PPM. If set to no alarm Cirrus-ECM will ignore the tachometer input and not generate any alarms due to ECM-Motor rotational failure. The tachometer inputs accept open collector/drain inputs or TTL level inputs.

6) Transducer Power: Cirrus-ECM can power a remote transducer or alarm pull-up. The output voltage can be set from 0 to 18 VDC and can supply up to 20mA.

7) Full Speed: The Full Speed setting is the duty cycle of the Cirrus-ECM speed control output when the analog input reaches or exceeds the Full Input setting. This duty cycle is also used for any alarm settings. Full Speed can be set from 0 to 100% PWM output. When set lower than the Idle Speed, Cirrus-ECM will have a control curve with a negative (downward) slope, useful for heating applications.

8) Idle Speed: The Idle Speed setting is the duty cycle of the Cirrus-ECM speed control output when the analog input is below the Idle Input setting. Idle Speed can be set from 0 to 100 %. When set higher than the Full Speed setting, the control curve will have a negative (downward) slope, useful for heating applications.

9) Idle Input: The Idle Input setting determines what analog input level is reached to begin the sloped portion of the general control curve. The Idle Input cannot be set below the Off Input nor above the Full Input. Navigator will not allow the setting to move outside this range. If Idle Input is set to the same value as Full Input then Cirrus-ECM will switch to a two speed mode with 3% hysteresis and the switch-over point will be at Idle Input.

10) Full Input: The Full Input setting determines what analog input level is reached to begin operating at the Full Speed setting. The Full Input cannot be set below the Idle Input. Navigator will not allow the setting to move outside this range. If Idle Input is set to the same value as Full Input then Cirrus-ECM will switch to a two speed mode with 3% hysteresis and the switch-over point will be at Idle Input.

11) Off Input: The Off Input setting determines what analog input level is reached to turn off the ECM-Motor output. The Off Input cannot be above the Idle Input. Navigator will not allow the setting to move outside this range. If Off Input is set to Disable, then the output will remain at the Idle Speed setting. When used, Off Input utilizes a 3% hysteresis to keep the ECM-Motor from rapidly cycling.

12) Alarm Trip: The Alarm Trip sets the analog input level that will trigger an alarm, for example a high temperature alarm or over analog input voltage or current alarm. If Alarm Trip is set to Disable, then no alarm will be generated. When used, Alarm Trip utilizes a 3% hysteresis to keep the alarm output from oscillating.

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NAVIGATOR PROGRAMMING INSTRUCTIONS

1) Connect Navigator to the Cirrus-ECM through the RJ45 connectors using the Ethernet cable supplied with the Navigator. Apply power to the Cirrus-ECM to enable programming via the Navigator. See page 4 for a description of each operating parameter.

```
Cirrus-ECM  
is ready
```

3) Press the **Next** key, then use the **▲** or **▼** keys to select which type of input source will be used.

```
Select input  
type →Vdc
```

Available options are: Vdc, mAdc, and °C for voltage, current, or temperature control respectively. Once the desired Input Type is displayed, press the **Next** key.

Note: At any time the **Previous** key can be used to go back to the previous menu and the **Write Drive** key can be used to save all the settings in the Cirrus-ECM.

4) Select the number of fans connected. Again, the value is adjusted with the **▲** or **▼** keys and the **Next** key will bring you to the next parameter.

```
Set # of fans,  
(1 or 2) →1
```

5) Use the **▲** or **▼** keys to adjust the speed of the fan or motor if the input signal is lost. The available options are idle speed or boost to full speed.

```
Speed on signal  
loss →Full
```

Once the desired speed is displayed, press the **Next** key.

6) Use the **▲** or **▼** keys to select the PWM frequency. The options are 80Hz, 2.5kHz, 10kHz, or 20kHz. Refer to the fan or motor specification for the recommended frequency. Once the desired frequency is displayed, press the **Next** key.

```
Set PWM freq.  
→2.50kHz
```

7) Use the **▲** or **▼** keys to select the tachometer alarm trip point. When the fan or motor falls below the trip point, the alarm output will be activated and the PWM will be forced to full speed. The options are No Alarm, 1000PPM, 2000PPM, and 4000PPM. (PPM = pulses per minute) No Alarm disables the tachometer alarm. Once the desired trip point is displayed, press the **Next** key.

```
Set tach trip  
point →No Alarm
```

8) Use the **▲** or **▼** keys to select the Transducer / Alarm output voltage source. The voltage is settable from 0.0 Vdc to 18.0 Vdc in 0.1 volt increments. Once the desired voltage is displayed, press the **Next** key.

```
Set Vout voltage  
→ 0.0 Vdc
```

9) Use the **▲** or **▼** keys to adjust the full speed for the fan or motor. This sets the PWM duty cycle in 0% to 100% in 1% increments. Once the desired output duty cycle is displayed, press the **Next** key.

```
Set full speed  
→100%
```

10) Use the **▲** or **▼** keys to adjust the idle speed for the fan or motor. Note the idle can be set higher than the full speed for heating applications or to compensate for fans or motors with reverse slope input control curves. This sets the PWM duty cycle in 0% to 100% in 1% increments. Once the desired output duty cycle is displayed, press the **Next** key.

```
Set idle speed  
→ 55%
```

11) Use the **▲** or **▼** keys to adjust the upper limit of the input signal for idle speed. Note the setting will scale depending on the input type setting. The ranges are 0.0 Vdc – 10.0 Vdc with 0.1 volt step for voltage mode, 0.0 mAdc – 20.0 mAdc with 0.1 mA step for current mode, and -20 °C – 80 °C with 1 ° step for temperature mode. Once the desired level is displayed, press the **Next** key.

```
Set idle input  
→ 0.0 Vdc
```

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NAVIGATOR PROGRAMMING INSTRUCTIONS

12) Use the ▲ or ▼ keys to adjust the input signal point for reaching full speed. Note this point must be greater than the Idle input. The ▼ key will not allow the setting to decrease below the Idle input setting. The setting will scale depending on the input type setting, The ranges are 0.0 Vdc – 10.0 Vdc with 0.1 volt step for Voltage mode, 0.0 mAdc – 20.0 mAdc with 0.1 mA step for current mode, and -20 °C – 80 °C with 1 ° step for temperature mode. Once the desired level is displayed, press the **Next** key.

Set full input
→10.0 Vdc

13) Use the ▲ or ▼ keys to adjust the input signal point for turning off the output. Note selecting Disabled will leave the input at idle speed through the entire idle range. If the Idle Speed is greater than the Full Speed setting, the duty cycle will ramp to 100% - assuming the fan or motor slope is reversed. The setting will scale depending on the input type setting, The ranges are 0.0 Vdc – 10.0 Vdc with 0.1 volt step for Voltage mode, 0.0 mAdc – 20.0 mAdc with 0.1 mA step for current mode, and -20 °C – 80 °C with 1 ° step for temperature mode. Once the desired level is displayed, press the **Next** key.

Set off input
→Disabled

14) Use the ▲ or ▼ keys to adjust the input signal level that will trip the alarm output and send the speed to the Full Speed Setting. **Note:** Selecting Disabled will leave the input alarm disabled. The setting will scale depending on the input type setting, The ranges are 0.0 Vdc – 10.0 Vdc with 0.1 volt step for Voltage mode, 0.0 mAdc – 20.0 mAdc with 0.1 mA step for current mode, and -20 °C – 80 °C with 1 ° step for temperature mode. Once the desired level is displayed, press the **Next** key.

Set alarm trip
→Disabled

15) Cirrus-ECM will now cycle back to the "Select Input" screen. To review the existing parameters of a programmed Cirrus-ECM, scroll through parameters using the **Next** or **Previous** keys. Parameters can be changed at any time using the ▲ or ▼ keys.

16) Once all parameters are correct, press the **Write Drive** key to save the settings in the Cirrus-ECM. Disconnecting power from the Cirrus-ECM before pressing **Write Drive** will discard any changes and reload the parameters from its previous memory.

Copy Program Operation

1) Connect Navigator to the Cirrus-ECM. Apply power to the Cirrus-ECM to enable programming via the Navigator.

2) Navigator will display its current revision and product type it is connected to as shown below.

Cirrus-ECM
is ready

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

Drive parameters
read

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

Drive parameters
written

5) Step 4 can be repeated for any number of Cirrus-ECM products.

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NAVIGATOR PROGRAMMING INSTRUCTIONS

Profile Memory Functions

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.

Saving a profile

To save a profile, connect Navigator to the Cirrus-ECM and apply power. Then 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.

Custom Names for a Profile

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

1) To recall a previously saved profile, connect Navigator to the Cirrus-ECM 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 profile listed or **Previous** to quit the recall operation.

2) 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 Cirrus-ECM.

Troubleshooting

Navigator automatically verifies the type and version of the connected Cirrus-ECM. 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 Cirrus-ECM revision is not compatible with Navigator.

```
Please update  
programmer.
```

Indicates the Navigator has found a Cirrus-ECM, but the Cirrus-ECM 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 Cirrus-ECM 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 Cirrus-ECM, or it may be possible to update the Cirrus-ECM to the newer version.

Control Resources has been a leading provider of off-the-shelf and custom motor controls and alarms since 1984. CRI provides AC Speed Controls, DC Speed Controls, Tach Alarms, Custom Fan Trays, Lab Test Equipment and complete custom design and manufacturing services. With in house ISO 9001 design and manufacturing capabilities, CRI is the One-Stop-Shop for all your thermal design needs. For information on other CRI products, see our website at www.controlresources.com.