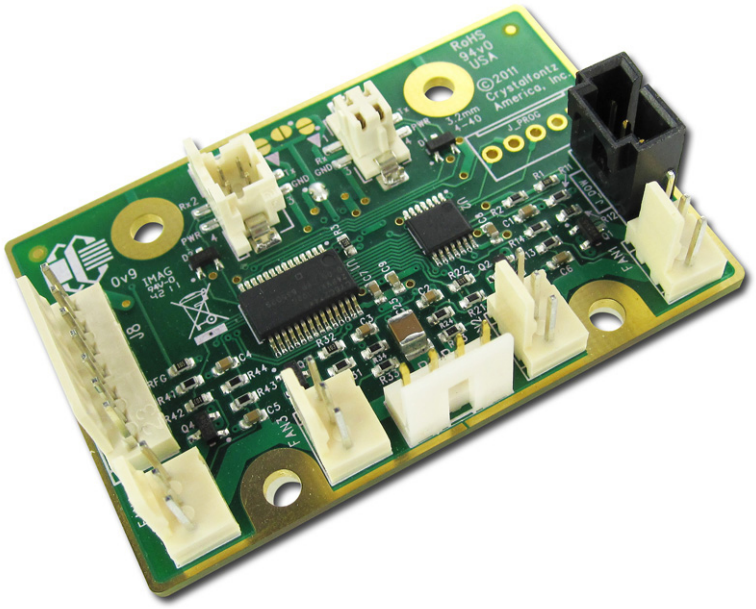
Crystalfontz America, Incorporated

FB System Cooling Accessory Board

CFA-FBSCAB DATA SHEET



Crystalfontz Model Number	CFA-FBSCAB
Hardware Version	**0v9, January 2012**
Data Sheet Version	**0v9 Preliminary, January 2012**

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REVISION HISTORY

HARDWARE	
2012/01/19	Current hardware version: **0v9** New optional accessory.

DATA SHEET	
2012/01/19	Current Data Sheet version: **0v9** New Data Sheet.

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INTRODUCTION / FEATURES

The CFA-FBSCAB (FB System Cooling Accessory Board) is an autonomous fan control board used with the CFA735 family of intelligent LCD modules CFA735-xxx-KR (USB and TTL “logic ‘level” serial interface) and CFA735-xxx-KT (USB and RS232 “”full swing” serial interface). Using the The CFA-FBSCAB+CFA735, you can:

- Connect up to four fans with RPM monitoring and variable PWM fan power control.
- Support up to 16 Crystalfontz WR-DOW-Y17 temperature sensors. The WR-DOW-Y17 uses a DOW (Dallas One-Wire) DS18B20 0.5°C absolute accuracy temperature sensor.

The combination of the CFA735+CFA-FBSCAB emulates most of the fan and temperature functions provided by the CFA633, the CFA631+SCAB, or the CFA635+SCAB. *Note: As of January 2012, the CFA635 reached EOL (End of Life).*

Key differences for the CFA-FBSCAB+CFA735 when compared to the CFA631+SCAB, and the CFA635+SCAB are:

Key Differences	CFA735 + CFA-FBSCAB	CFA631 or CFA635 + SCAB
Crystalfontz WR-DOW-Y17 temperature sensors.	Supports up to 16 sensors.	Supports up to 32 sensors.
Number of fans that can be used with a SCAB or CFA-FBSCAB.	Up to 4 fans.	Up to 4 fans for USB interface. Up to 3 fans for serial interface.
Fan speed when module is disconnected from the SCAB or CFA-FBSCAB.	Default fan speed in nonvolatile memory of CFA-FBSCAB, set by CFA735 command.	100% power.
GPIOs.	H1 connector on CFA735.	H1 connector on CFA631 or CFA635 passes through to J8 connector on the SCAB.
ATX for module with SCAB or CFA-FBSCAB.	H1 connector on CFA735 using Crystalfontz WR-PWR-Y25 cable.	J8 connector on SCAB using Crystalfontz WR-PWR-Y05 or WR-PWR-Y14 cable.
ATX for module without SCAB or CFA-FBSCAB.		H1 connector on CFA631 or CFA635 using Crystalfontz WR-PWR-Y25 cable.

MECHANICAL SPECIFICATIONS

PHYSICAL CHARACTERISTICS

Item	Size
Overall Outline (includes clear plastic backing)	61 (W) x 41 (H) mm
Maximum Thickness (approximate)	16.50 mm
Weight	14 grams (typical)

OUTLINE DRAWING

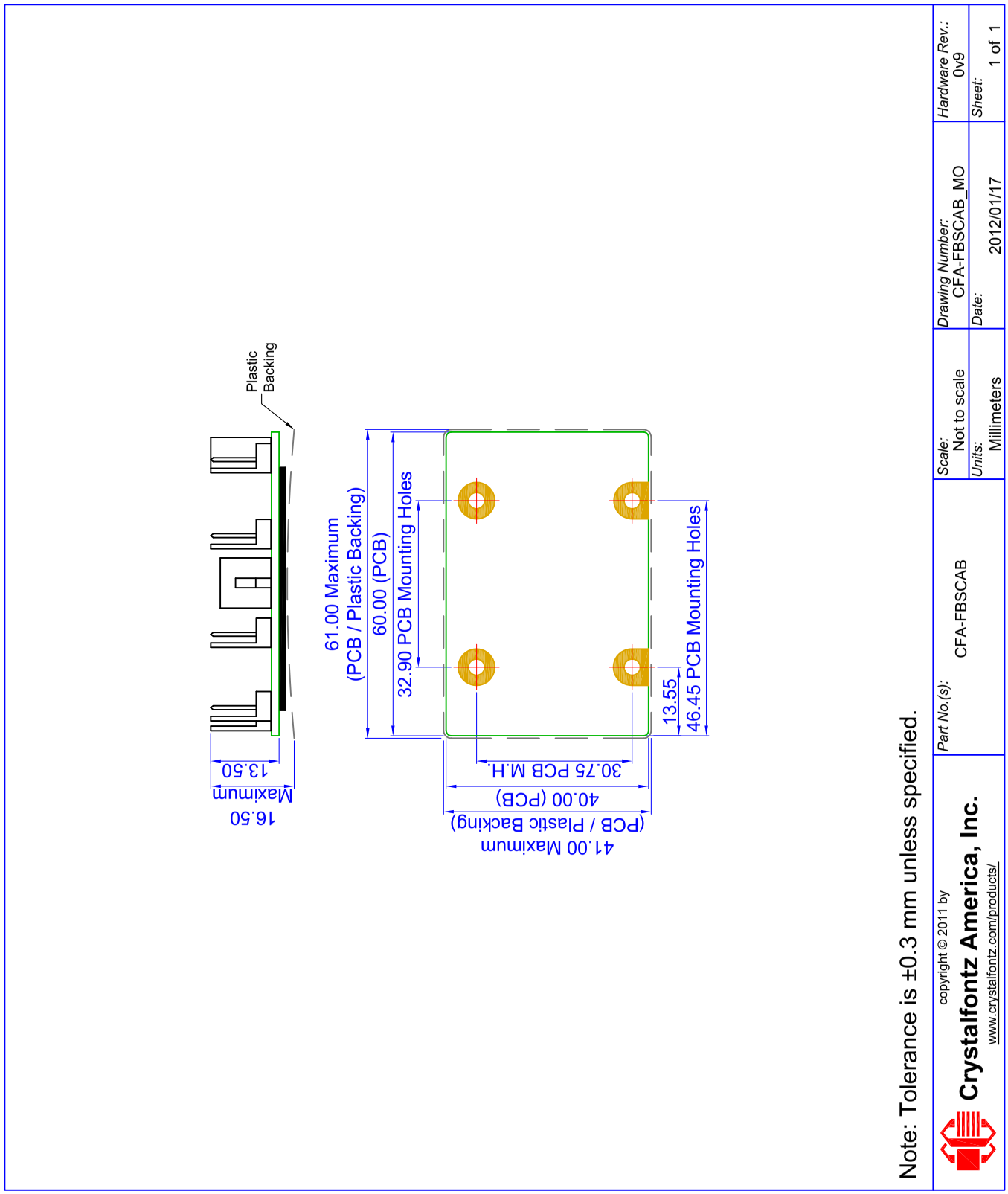


Figure 1. Outline Drawing

ELECTRICAL SPECIFICATIONS

SYSTEM BLOCK DIAGRAM

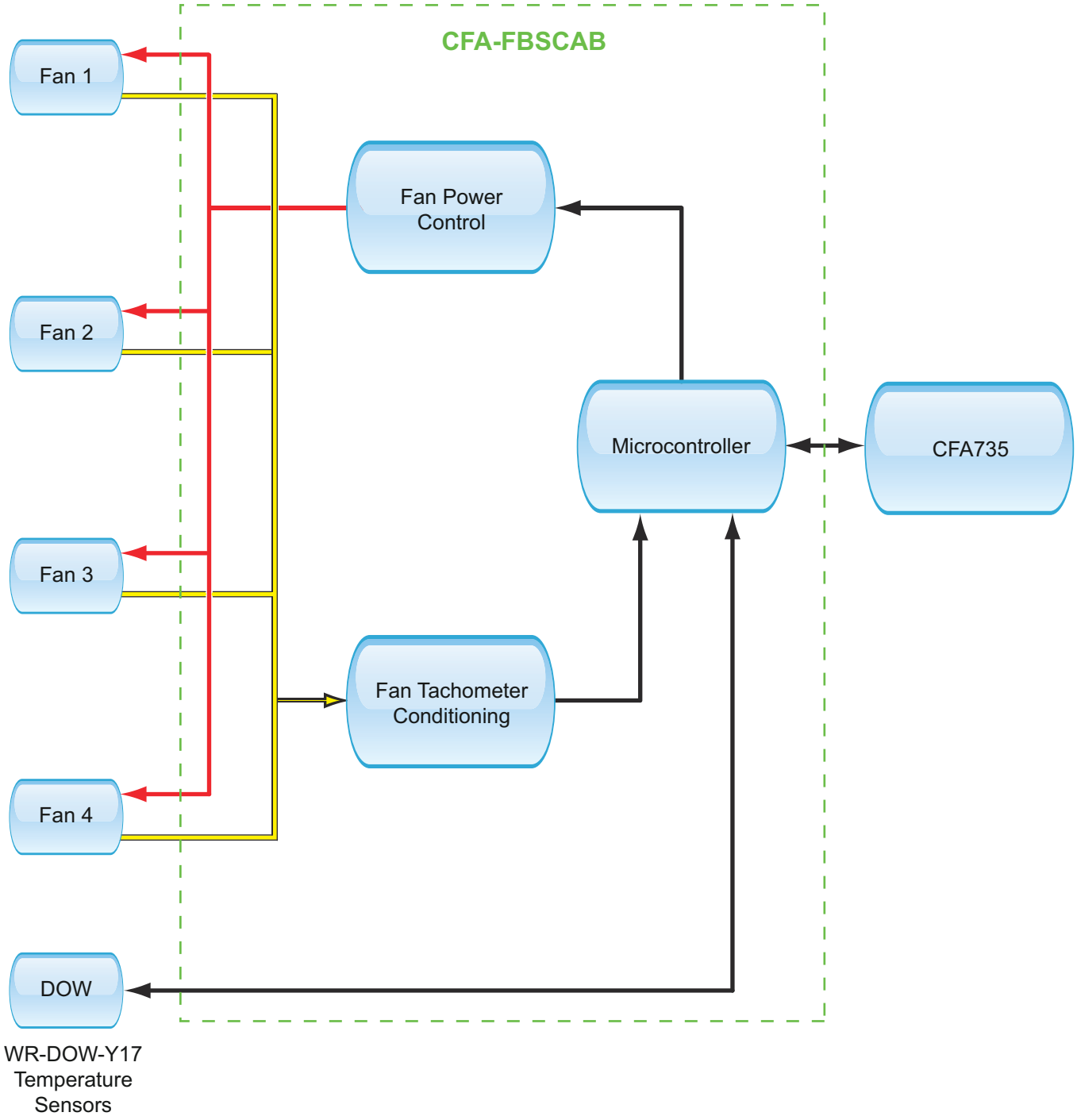


Figure 2. System Block Diagram

REQUIRED VOLTAGE

- *+5v (logic):* +4.75v minimum, +5.0v nominal, +5.25v maximum
- *+12 v (fans)*: +4.75v minimum, +12v nominal, +13v maximum (not required if the fan connectors are not used)

CURRENT CONSUMPTION

FAN1 through FAN4 +12v current will vary depending on load being used.

Maximum continuous current draw must be no more than 1.5 A per fan connector, no more than 4 A total. Pulsed current may be up to 5 A per connector, the pulse width must be less than 50 mS. This pulse specification allows for the fan's start-up current spike.

FAN TACHOMETER SPEED RANGE

Fan Tachometer Speed Range	Specification
Fan Tachometer Speed Range (assuming two PPR)	600 RPM to 3,000,000 RPM
PPR is *Pulses Per Revolution*, also written as p/r.	

ESD (ELECTRO-STATIC DISCHARGE)

The circuitry is industry standard CMOS logic and is susceptible to ESD damage. Please use industry standard antistatic precautions as you would for any other PCBs. Ground your body, work surfaces, and equipment.

TEMPERATURE RANGE

Item	Size
Operating Temperature	0°C minimum, 50°C maximum
Storage Temperature	-10°C minimum, 60°C maximum

HOST CONNECTIONS

HOW TO SUPPLY COMMUNICATIONS

The CFA-FBSCAB is designed to connect to a CFA735 LCD module. The CFA735 will provide the correct signals to operate the CFA-FBSCAB.

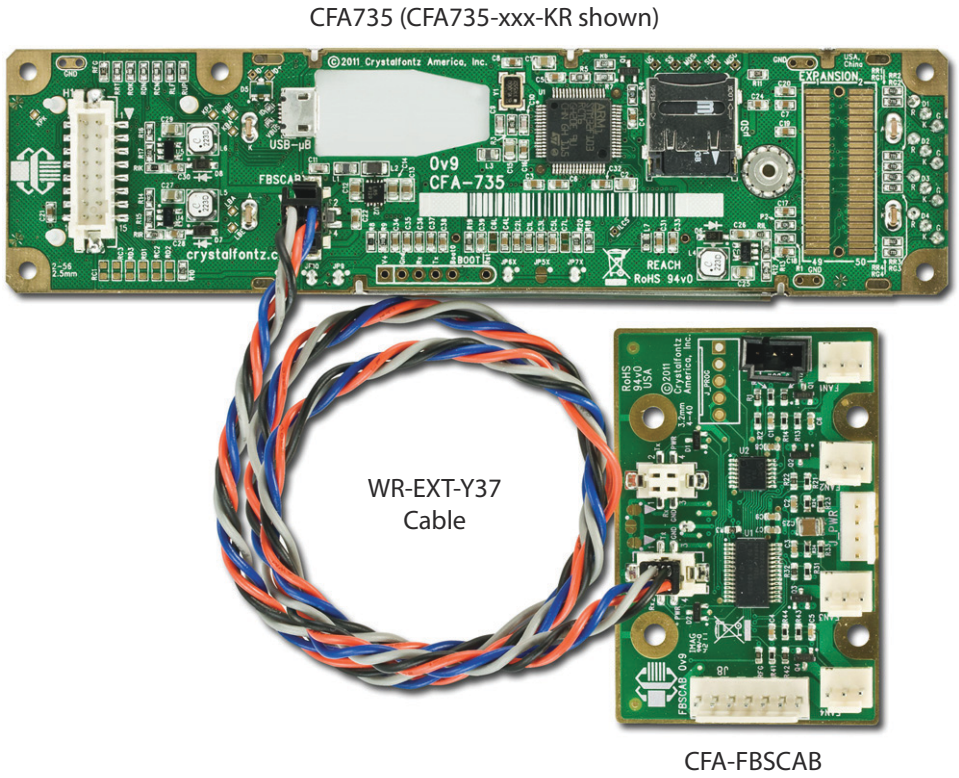


Figure 3. CFA735 Connected to a CFA-FBSCAB Using a WR-EXT-Y37 Cable

You can buy a Crystalfontz WR-EXT-Y37 (18 inches). Connect the cable's 4-pin male connector to the CFA735's connector labeled CFA-FBSCAB. Connect the cable's 4-pin female connector to the CFA-FBSCAB.

HOW TO SUPPLY POWER

The CFA735 does not supply power to the CFA-FBSCAB. The CFA-FBSCAB requires external power, typically supplied by a 4-pin 3.5-inch floppy drive power connector. The CFA-FBSCAB power connector is labeled J_PWR.

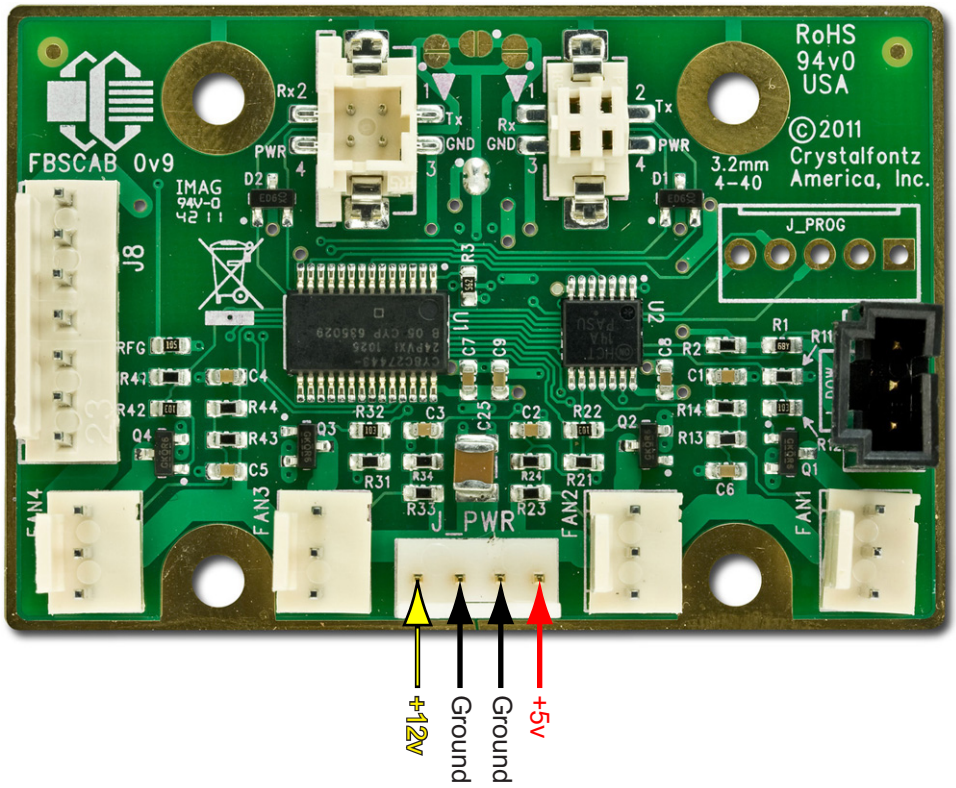


Figure 4. Location of Power Connection (J_PWR)

Most systems will have a spare 4-pin 3.5-inch floppy drive power connector available. If there is not a spare connector in your system, you can use a Crystalfontz WR-PWR-Y12 (~13 inches).

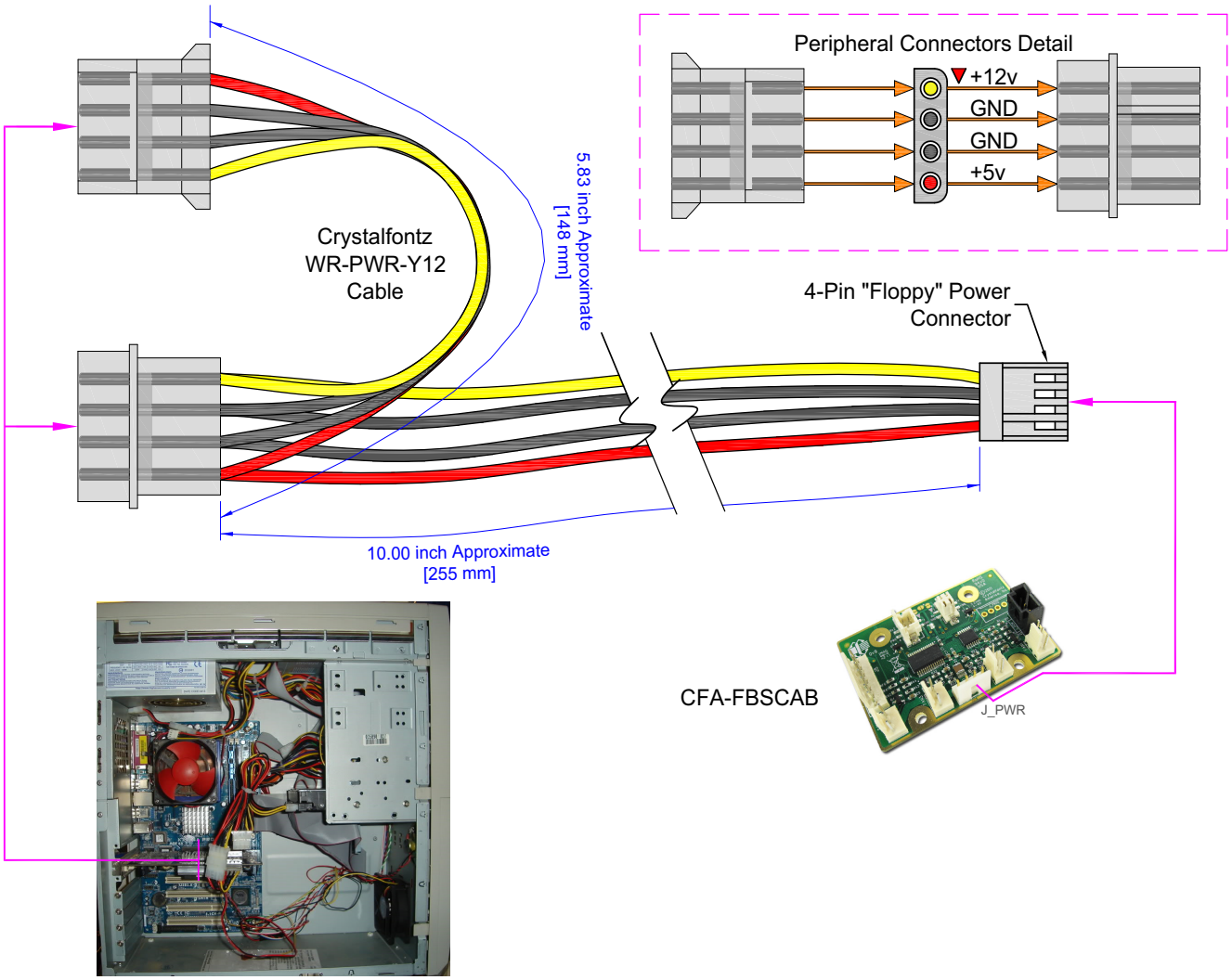
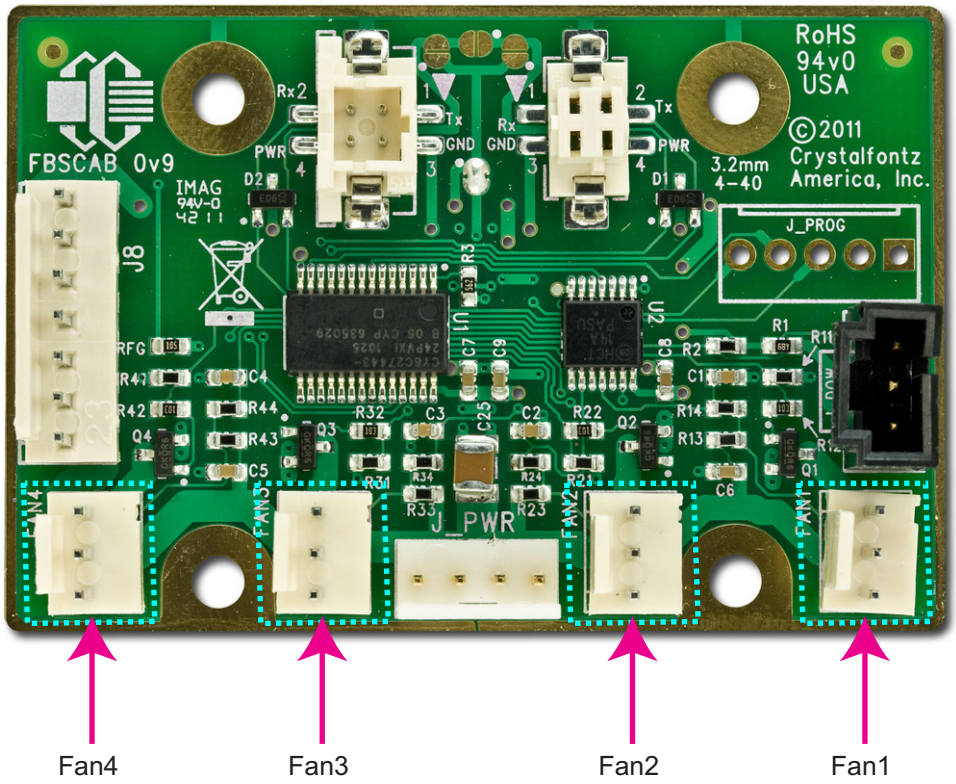


Figure 5. Crystalfontz WR-PWR-Y12 Power Cable

FANS CONNECTION CRYSTALFONTZ CABLE WR-FAN-X01

The CFA-FBSCAB supports up to 4 standard “3-pin” fans. The fan connectors are compatible with industry standard “3-pin” fans.

Four Fan Connectors



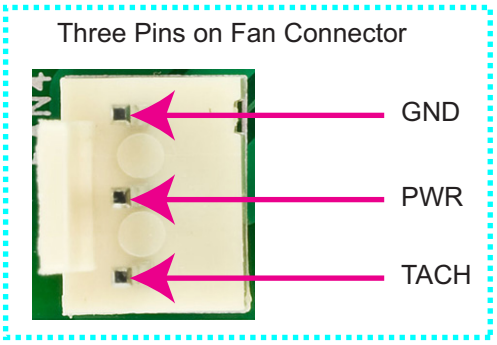


Figure 6. Location of Fan Connectors (FAN1 to FAN4)

Connect up to four Crystalfontz WR-FAN-X01 cables (~16 inches) to connect up to four fans. Connect cable’s 3-pin male connector to CFA-FBSCAB’s connectors labeled FAN1, FAN2, FAN3, or FAN4. Connect cable’s 3-pin female connector to a fan’s connector. (Fans are not sold by Crystalfontz.)

The average power delivered to each fan may be set to any level between 0% and 100% through firmware command of the connected LCD module. The power setting controls the PWM duty cycle of a high-performance open-drain FET connected between the system ground and the GND pin of each fan connector. The PWM frequency is nominally 18 Hz.

The CFA-FBSCAB can measure the frequency of the fan's tachometer signal and report the information needed to calculate the RPM to the host. If a fan's power is set to 100%, then the average frequency of each fan's tachometer signal is measured over a 1/8 second (125 mS) period of time. Each fan is measured in sequence, so updated fan speed information is available every 1/2 second (500 mS) for each fan.

The power to a fan must be on in order for the fan's tachometer signal to be valid. If a fan is configured to report its speed to the host, the power of the fan will be unconditionally set to 100% at the start of the 1/8 second period of time when the CFA-FBSCAB is measuring the frequency of the tachometer signal—overriding the PWM. The CFA-FBSCAB will leave the power to the fan on until the glitch delay has expired and two tachometer edges have been detected. (See command "26: Set Fan Tachometer Glitch Delay" in the CFA735 Data Sheets.) The normal PWM cycle will then resume.

This technique allows the fan speed to be measured with a very minimal effect on the speed of the fan. If the fan power is set to 100% or if the speed of the fan and length of the PWM on time are such that the speed can be measured without stretching the PWM, then this override will not change the speed of the fan at all. If the fan power is set to some level other than 100% and the PWM on time is short compared to the tachometer signal frequency, then the fan speed will "pulse" slightly every 1/2 second due to the stretching of the PWM on time. During tachometer measuring, the maximum width of a stretched on pulse is 1/8 second. For some fans, the result is not very noticeable, and this technique will allow you to monitor the average speed of the fan while controlling the average power of the fan. For other fans (particularly high torque, high RPM models) the pulsing effect may be undesirable.

Since the on-time is dynamically stretched by the CFA-FBSCAB to force the fan to produce two tachometer edges, the result is that the fan will resist stalling as power is reduced towards 0% and the RPM is being measured. Here is a graph of fan RPM vs. the fan power setting for a typical high-performance 80 mm fan (Delta FFB0812SHE):

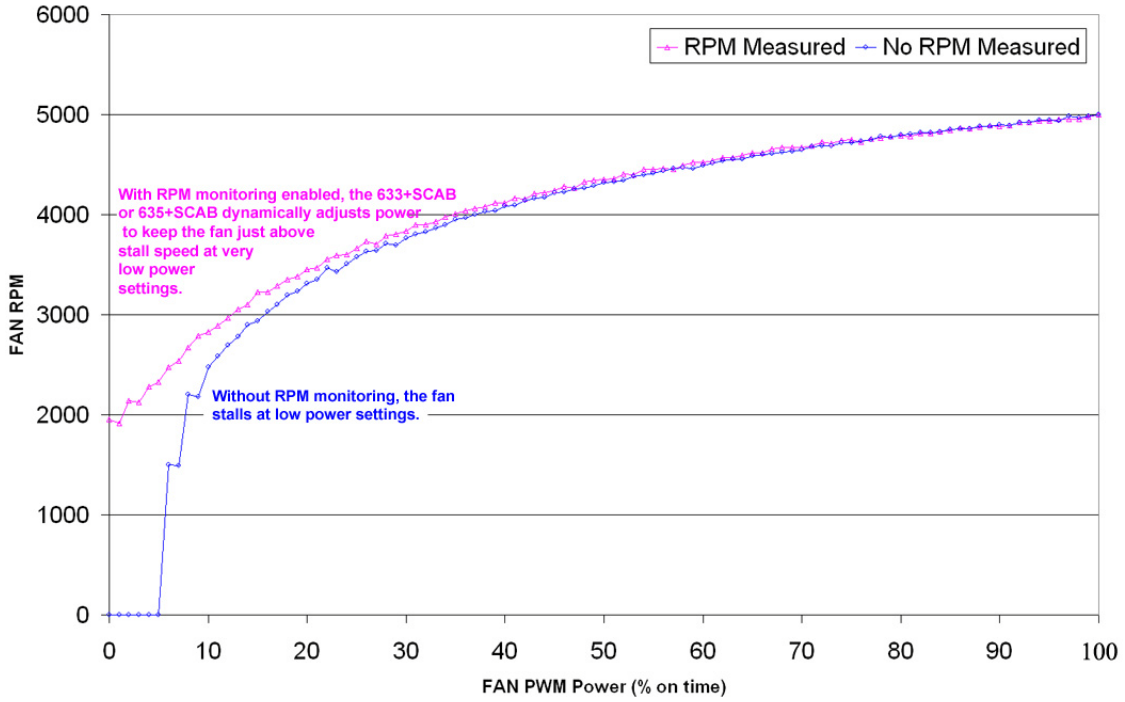


Figure 7. Graph Showing Fan PWM Power (% On Time) for Various Fan RPM

Typically, if the fan speed is not at 100%, then it should be controlled by the host software to drive a temperature sensor to a given reading in a closed-loop arrangement. In this case, the temperature, rather than the fan speed would be monitored for out-of-range conditions and the RPM monitoring would not be enabled.

If the temperature is within specification, you really do not care how fast the fan is turning. In an unattended system, it may be a good idea to set each fan to 100% for a few seconds during a test cycle—perhaps once a day or once a week—

and log the steady-state RPM attained by the fan. If that steady state RPM were higher than expected (this can be caused by a blocked airflow) or lower than expected (perhaps the fan's bearings are failing), a maintenance warning would be generated by the host software.

NOTE

For safety, enable the fan power fail-safe on any fans involved in host-based speed control. (See command “25: Set Fan Power Fail-Safe” in the CFA735 Data Sheets.) By enabling the fail-safe on a fan that is being used in closed-loop control through host software, the CFA-FBSCAB will turn that fan to 100% if the host fails to update the power of the fans within a given time interval. For instance, if the communications cable is dislodged, the host operating system hangs, or cooling control process is terminated, the CFA-FBSCAB will automatically force those fans to 100%, preventing potential equipment damage due to lack of cooling.

We tested the CFA-FBSCAB architecture with a large range of fans and had good results. However, you are responsible for determining if the control and monitoring methods employed by the CFA-FBSCAB are acceptable for your application. In particular, if a fan's power is set too low, it may stall or fail to start, providing no cooling. Using a PWM to control fan speed is generally accepted; however we make no claims that it is compatible with any particular fan or that it does not affect the lifetime of the fans.

Some higher torque fans (especially the ball-bearing models) may click, buzz, or growl at low power settings due to the torque in the fan going from positive to negative in each PWM cycle. If you limit the power setting to only 0% (off) or 100% (full speed) there should be no compatibility issues. We do not recommend operating a fan below 30% PWM duty cycle for an extended period of time. Limiting the minimum lower PWM duty cycle to 30% or 40% should reduce the mechanical and electrical stresses in the fan, avoiding premature failure.

When power is applied to the CFA-FBSCAB, it will set each fan's power to the factory default value of 100% or to the value that is stored in the boot state. To minimize peak current loading on the +12 v supply during start-up, the fans are started in sequence with a 0.5 second delay between any fans that are on.

TEMPERATURE SENSORS CRYSTALFONTZ WR-DOW-Y17

The CFA-FBSCAB supports Dallas Semiconductor 1-Wire (DOW) temperature sensors. Any combination of up to 16 DS1822 Econo 1-Wire Digital Thermometer (2°C absolute accuracy) or DS18B20 High Precision 1-Wire Digital Thermometer (0.5°C absolute accuracy) temperature sensors or other DOW compatible devices are directly supported.

Crystalfontz sells the WRDOWY17 cable, which contains a DS18B20 attached to a “daisy chain” cable. (“Daisy chain” means several devices connected in a linear series.) The mating connector for the WRDOWY17 is Molex 70543-0002 available from Digi-Key.

The CFA-FBSCAB has a 1 KW hardware pull-up on the DOW connector's I/O line.

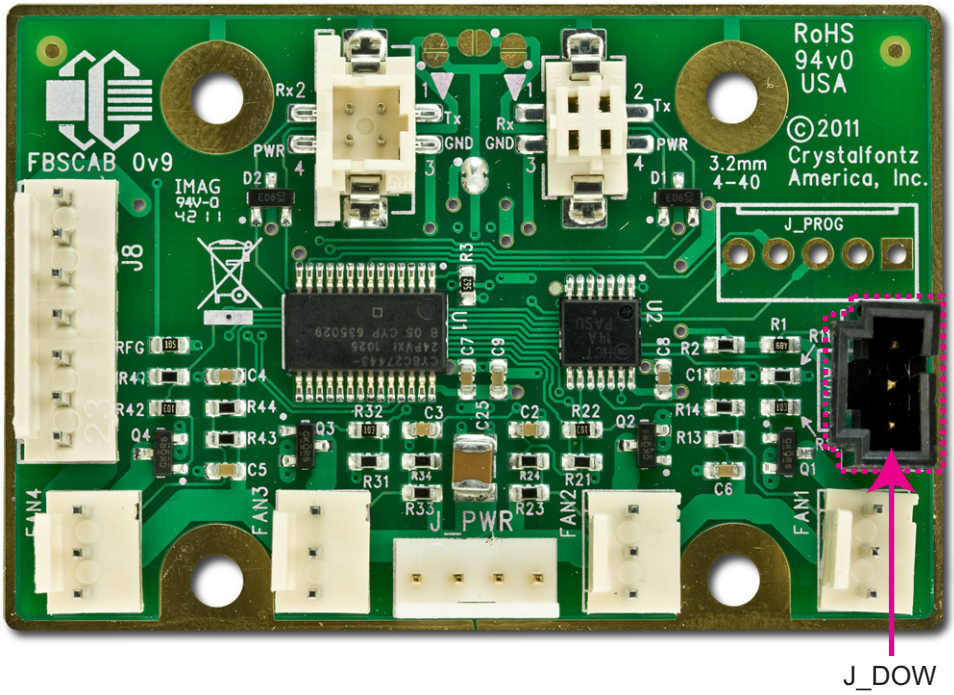


Figure 8. Location of Connection for Temperature Sensors (J_DOW)

RELIABILITY AND LONGEVITY

The expected lifetime of the CFA-FBSCAB is 50,000 to 100,000 hours under normal operating conditions.