MODELS

PCIe-WDG-CSMA,
PCIe-WDG-CSM

Watchdog Timer –
Computer Status Monitor Cards
USER MANUAL

FILE: PCIe-WDG-CSMA.B2i

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ALWAYS CONNECT AND DISCONNECT YOUR FIELD CABLING WITH THE COMPUTER POWER OFF. ALWAYS TURN COMPUTER POWER OFF BEFORE INSTALLING A CARD. CONNECTING AND DISCONNECTING CABLES, OR INSTALLING CARDS INTO A SYSTEM WITH THE COMPUTER OR FIELD POWER ON MAY CAUSE DAMAGE TO THE I/O CARD AND WILL VOID ALL WARRANTIES, IMPLIED OR EXPRESSED.

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Chapter 1: Introduction

Two Models

- The PCIe-WDG-CSM card contains a watchdog timer and on-card RGB LED and speaker alarm to signal watchdog timeout. A DPDT relay, two LVTTL inputs and two outputs, and fused 3.3V general purpose outputs and ground are accessed via the DB25 female I/O connector on the card mounting bracket.

- An advanced model, the PCIe-WDG-CSMA, is also available which includes sensors to monitor the PCI Express Bus power supply, internal temperature and humidity, and ambient light, and comes with a remote temperature sensor on a 19" cable. A pair of opto-isolated outputs and four opto-isolated inputs are available for general purpose use.

Both of these models allow various "Actions" to be taken in response to "Events", which are changes in the status of the various sensors. An example Action, such as de-energizing the relay, can be tied to a particular Event, such as an input bit that isn't pulsing fast enough. All of this is configurable through an easy-to-use Windows Graphical Settings program, or under application control via the rich API provided in both Windows DLL and Linux Shared Object forms — with full source code provided, of course.

What is a Watchdog?

Watchdog Timers provide a last line of defense against system lockups that can cause real damage — physical damage, as when a closed-loop control system stops receiving or sending updates causing bearings to melt or boilers to explode — but also damage to a brand or to customer relationship, such as when a retail Kiosk application experiences intermittent BSoDs preventing the Kiosk from being used, and causing maintenance nightmares for the retail establishment.

These kinds of problems are eliminated when a Watchdog is on duty. The Watchdog monitors signals produced by the application or its environment. The ongoing recurrence of these signals, called a "Pet" or "Petting" of the Watchdog, keeps the Watchdog satisfied that all is well, and there's no need to raise an alarm. However, if the Watchdog is not Pet often enough it Growls, warning everyone present that something may be amiss. If the Growl doesn't successfully cause the Petting to resume, the Watchdog Barks.

In the case of the PCIe-WDG-CSMA the most common result of a Bark is to reset the host PC, rebooting it as if the Reset button had been tapped — but a wide variety of other Actions can be taken, either when the Watchdog Growls or Barks, but also in response to other Events.

Guard Dogs vs Patrol Dogs

The most robust Watchdogs are trained to respond to only *your* commands. You accomplish this by adding "Watchdog Pet" instructions (part of our API, see Chapter 5) to your application code, explicitly informing the PCIe-WDG-CSM(A) that your critical code hasn't locked up by Petting the Watchdog before it Growls. This can be likened to setting a Watchdog to Guard a specific valuable: if someone opens this safe, sound the alarm! :: If my application doesn't issue a Watchdog Pet instruction at least once a second, Growl!

Sometimes it isn't practical to modify a critical application, whether it be legacy code long lost, it was written by a 3rd party and not open-source, or it being simply too expensive to contemplate! In these cases the Watchdog can monitor the *environment* rather than waiting to be explicitly pet by code added to the application. For example, an external signal can be monitored: the Watchdog would Growl if a closed-loop control application stops sending digital output data, perhaps. In these cases, the Watchdog is "Pet" by the changing digital outputs, rather than explicitly by changes to the application code. This use of a Watchdog is akin to putting a Watchdog on patrol in the parking lot: it will not notice when the safe is opened, but would react to the breaking of a window…something that may not actually be related to protecting the safe at all (perhaps neighborhood kids hit a home-run ball through the window). Thus the "Patrol Watchdog" technique can lead to false-positives, and in the worst-cases some false-negative reports as well (maybe the safe cracking bad-guys came in through a basement tunnel, which the Patrol Watchdog didn't know existed!) On the other hand, when the critical application source code is not modifiable, putting a Watchdog on Patrol can cover most scenarios — and our PCIe-WDG-CSM(A) can monitor multiple sensors simultaneously, providing potentially overlapping zones of coverage.

The Watchdog's patience — that is, how many seconds or minutes the Watchdog will wait between Pets before Growling, and eventually Barking — is configurable through API calls or as part of the Windows Settings program, and is stored with all other Event / Action configuration data in non-volatile memory on the device.

Special Options

The onboard µController provides amazing flexibility allowing a vast array of Events and Actions to be configured with no code needed. However, we also offer Special tweaks to our firmware and device: if you ordered such a Special your device will be labeled as such, and you should have received an addendum to this manual.
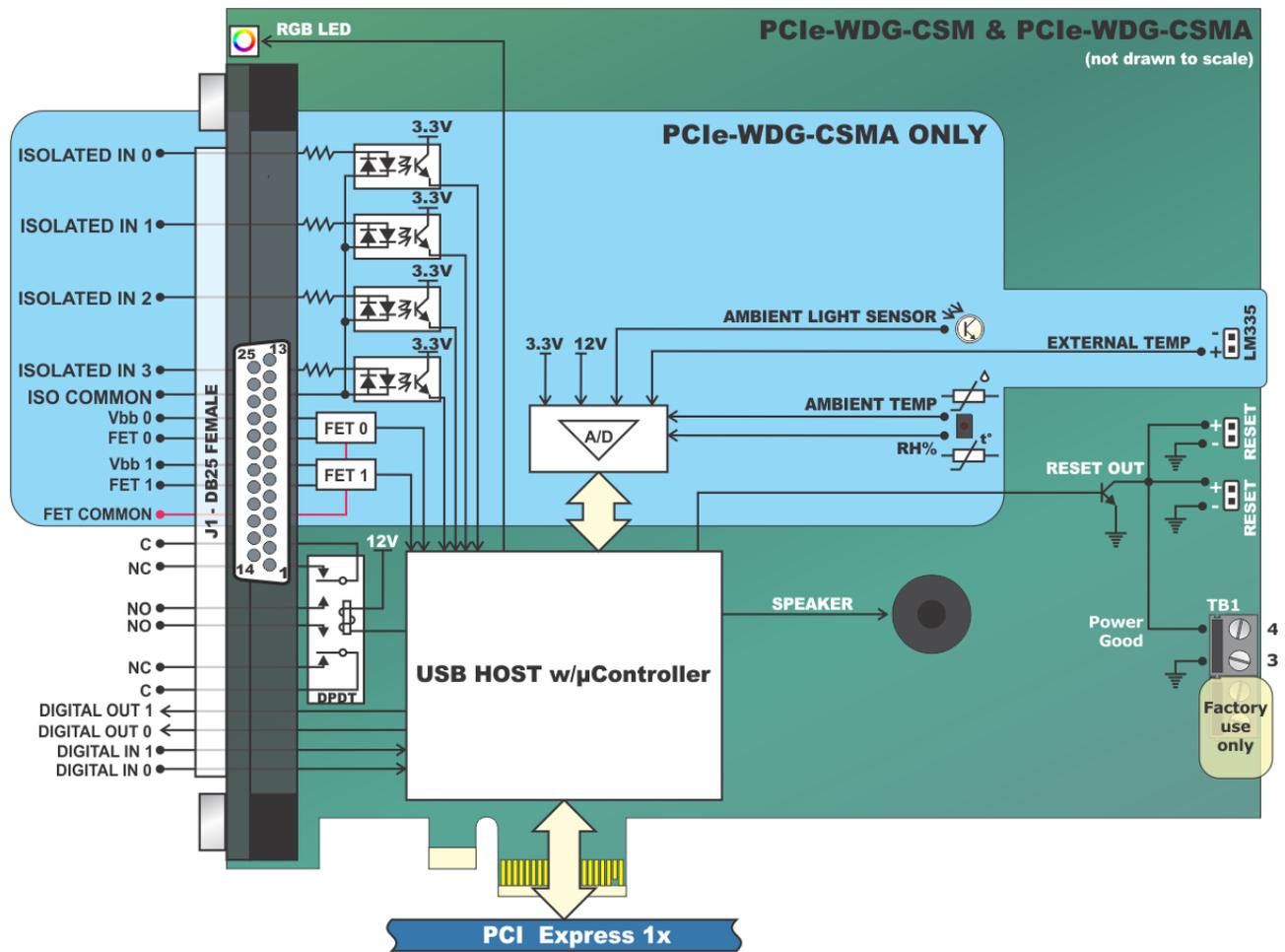
Figure 1-1: Block Diagram

Ordering Guide

PCIe-WDG-CSMA   PCI Express Advanced Features Watchdog Timer Card
PCIe-WDG-CSM   PCI Express Watchdog Timer Card

Model Options

-T   Extended operating temperature (-40° to +85°C)
-L   Low Profile mounting bracket installed
-RoHS   RoHS compliant card
-CC   Conformal coating for high humidity and dusty environments

Included with your board

The following components are included with your shipment. Please take time now to ensure that no items are damaged or missing.

Model PCIe-WDG-CSMA

- Watchdog Timer Board with on-card integrated temperature and humidity sensor
- Remote LM335 temperature sensor on a 19" twisted pair cable and header
- Splice Wire connected to screw terminal for power good connection reset
- Reset jumper cable to connect watchdog card to reset push button from the PC
- Packing Slip

Model PCIe-WDG-CSM

- Watchdog Timer Board
- Splice Wire connected to screw terminal for power good connection reset
- Reset jumper cable to connect watchdog card to reset push button from the PC
- Packing Slip

Optional Accessories

CAB25MF-18 Ribbon cable, male to female 25-pin connectors, 18"
CAB25MF-xx Ribbon cable, male to female 25-pin connectors, xx = length in inches
STB-25   Screw terminal board
DIN-SNAP-6 6" SNAP-TRACK with DIN-Clips for mounting STB-25
ADAP25M   Screw terminal board with no ribbon cable required

Chapter 2: Installation

Configure Card Options via Jumper Selection

Before installing the card into your computer, carefully read Chapter 3: Option Selection of this manual, then configure the card according to your requirements. Our Windows Settings Program can be used in conjunction with Chapter 3 to assist in configuring jumpers on the card, as well as provide additional descriptions for usage of the various card options.

Determine Reset Connections Specific to your PC

Open the case of your PC to inspect the power supply type and whether any reset push-button wires exist, and are accessible. Make planning notes for your connection types as you proceed with hardware installation (covered on the next page).
If there is no reset push button, or you can't access these wires, you can use the power good line connection method.

Windows

1.   Visit the product web page at http://acces.io/PCIe-WDG-CSMA
2.   Download the PCIe-WDG-CSMA Family Software Package from the Downloads tab
3.   Run the Install program and follow the on-screen prompts to install the software for this board

Linux

1.   Please visit http://github.com/accesio for information on installing under Linux.

*Caution! * ESD*   *A single static discharge can damage your card and cause premature failure! Please follow all reasonable precautions to prevent a static discharge such as grounding yourself by touching any grounded surface* *prior to touching the card.*

Hardware Installation

1. Make sure to set switches and jumpers from either the Option Selection section of this manual or from the suggestions of the Windows Settings Program.
2. Do not install card into the computer until the software has been fully installed.
3. Turn OFF computer power *AND* unplug AC power from the system — System Standby power is active on the PCI Express slots until the AC is physically disconnected, and could cause ESD failures!
4. See the "Connecting the Reset Line" section following in this chapter for more information. Open the computer cover. Locate and gain access to the pair of wires from your reset push-button and disconnect them from your motherboard. For connecting the reset button cable, skip to step 6.
5. For Power Good connections, connect the splice connection wire that is shipped connected to the card screw terminal, to the power good line from your power supply, then crimp with pliers and close the crimp cover. Skip ahead to step 7.
6. Disconnect the reset button from the motherboard-make note of where you remove it from, and which side is "red"-and connect it instead to either of the two-pin RESET connectors on the watchdog card-make sure the red wire goes to the side of RESET labeled "+". Then, connect one end of the provided 18" twisted-pair reset cable to the available RESET connector on the watchdog card, and the other end to the recently-vacated reset connection on your motherboard.
    *Note: if the PC fails to boot, you may have the connection reversed.
7. Carefully install the card in an available PCI Express slot (you may need to remove a backplate first).
8. Inspect for proper fit of the card and tighten the bracket screw firmly, making sure the card has a positive chassis ground.
9. Install an I/O cable onto the card's bracket mounted connector if applicable.
10. Replace the computer cover, reconnect AC power, and turn ON the computer which should auto-detect the card and automatically finish installing the drivers.
11. Run one of the provided sample programs to test and validate your installation.

RGB LED Operation

*   When the Watchdog is ready to begin its guard duties the onboard LED will turn **steady GREEN**, from OFF.
*   Each time the Watchdog is Pet the onboard LED will **flash CYAN**.
*   When the Watchdog hasn't been pet recently enough it will GROWL, and the LED will turn **steady AMBER**.
*   If the Watchdog still hasn't been pet after another timeout interval it will BARK, and the LED will turn **steady RED**.

Input / Output Connections

Field wire connections are made via a 25-pin FEMALE connector on the card mounting bracket. Internal connections include a two position terminal block and two "reset" headers for connecting to the reset line or power good line, as well as a two-pin header for the remote LM335 temperature sensor. Signal assignments are listed in Chapter 6 of this manual.

To minimize susceptibility to EMI and reduce RF emissions, it is important that the card mounting bracket be properly screwed into place and that there be a positive chassis

ground. Also, proper EMI cabling techniques (cable connect to chassis ground at the aperture, shielded twisted-pair wiring, etc) should be used for the input/output wiring.

Connecting the Reset Line

If your computer is equipped with a reset button you must connect reset button wires across the RESET posts at the rear edge of the Watchdog card as shown in Figure 2-1. Then, using the cable, connect the second set of RESET header pins to the Reset pins on the mother board.

If there is no reset push button and your computer is equipped with an ATX power supply, connect the power good line to TB1 top terminal on the Watchdog card as shown in figure 2-1. To make a connection, insert the cable into the clamp, compress the metal bar with pliers and close the protective cover.
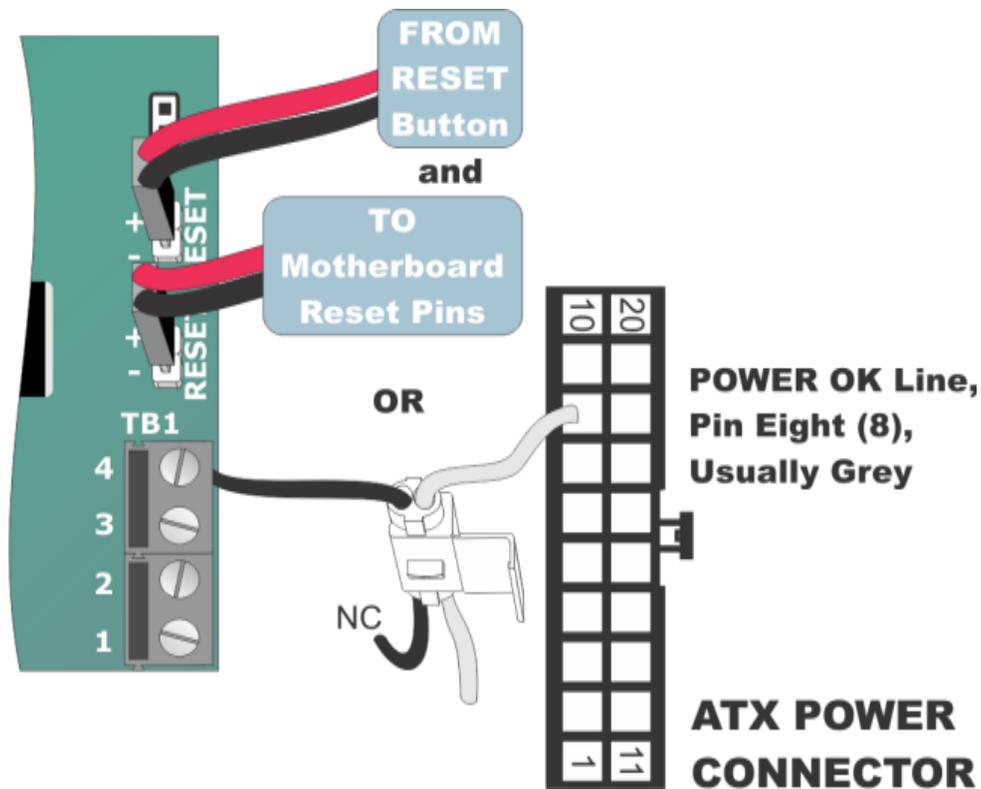

Figure 2-1: Reset Button and Alternate Power Good Line Connections

Chapter 3: Option Selection

Refer to Figure 1-1, Block Diagram and Figure 3-1, Option Selection Map when reading this section of the manual. Card operation is determined by jumper installation as described in the following paragraphs.

Screw Terminals

Screw terminals located on the right-hand side of the card provide the means for connections of the watchdog output to points inside the computer chassis. The top terminal (TB1-4 in the Block Diagram) provides the active-low watchdog output. The next terminal provides a ground. The remaining terminals will not normally be populated and are for factory use only.

ATX/Reset Button Header

For ATX supplies, the right-hand side of the card has two each two pin headers to provide a ground to reset the computer.

SEL-A & SEL-B Option Headers
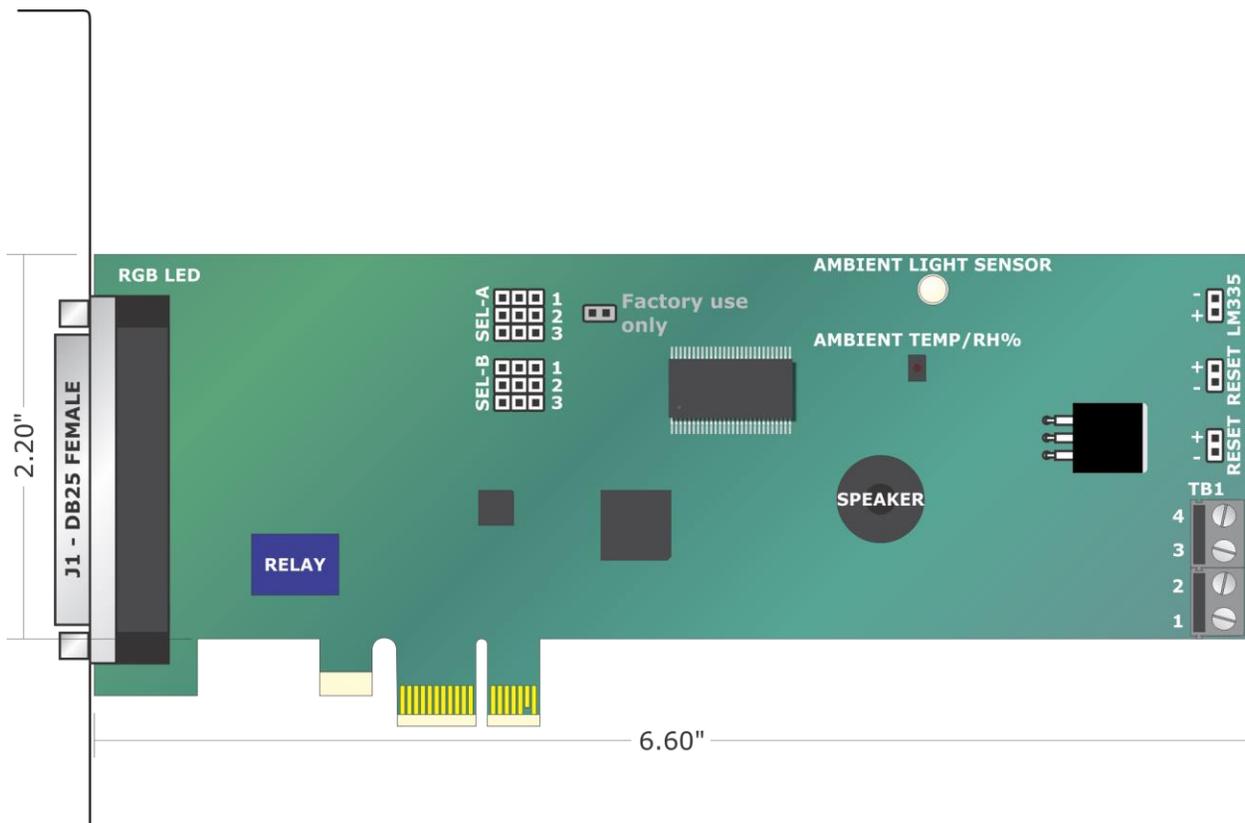
These jumper blocks are for future flexibility.

Figure 3-1: Option Selection

Chapter 4: Address Selection

The Vendor ID for these cards is 1605.
The Device ID for the PCIe-WDG-CSM is 8080h.
The Device ID for the PCIe-WDG-CSMA is 8081h.

Chapter 5: Programming

This section of the manual contains information to assist you in developing programs for use with the card.

Please note that many users will not need to write any code. Rather, the Windows Settings Program can be used to create a configuration file stored in the card's nonvolatile memory that replaces the need for software in these application environments.

Watchdog Programming

The primary function of the card is a Watchdog Timer that will reset the host computer when it expires. It is the job of application software to refresh the Timer before it expires in order to avoid the reset. It is the absence of the Timer refresh that indicates the monitored application or host computer is no longer running properly and the reset should occur. To continue the metaphor, the Watchdog Barks if it isn't Pet often enough, where the Bark causes a reset, and a Pet refreshes the Timer.

Because simply resetting a modern operating system is "a bad idea" the card actually contains two separate Watchdog Timers: the Growl timer, and the Bark timer.

When the Growl timer counts all the way down the card will perform its Growl Action. The default Growl Action includes chirping the onboard speaker, changing the LED color to Amber, generating an IRQ for application software to detect, and starting the Bark countdown. If the host computer successfully Pets the Watchdog before the Bark countdown elapses the Watchdog will stop Growling and return to patiently waiting.

AIOWDG.dll can be configured to respond to the Growl IRQ by shutting the computer down "cleanly". If the clean shutdown does not succeed in a timely fashion the Watchdog will Bark. Alternately, the DLL can simply pass the IRQ notification to the host application, which can respond as desired.

If no Pet occurs before the Bark countdown elapses the Watchdog will perform the Bark Action. The default Bark Action includes setting the LED to Red, playing an alarm tone through the Speaker, and asserting the WDG RESET line (which, if connected, will cause the computer to Reset as if the physical Reset button was pressed).

API Reference

The AIOWDG.dll API includes quite a few functions, a select few are shown here:
- WaitForWDG(CardNum) – Block the thread until a Growl occurs
- AbortWDGRequest(CardNum) – Unblock the blocked thread
- WDGSetTimeout(CardNum, Milliseconds) – Configure the Watchdog's "Patience" (How long between pets the Watchdog will wait before Growling or Barking)
- WDGPet(CardNum) – Pet the Watchdog, holding off a Growl until the Watchdog loses patience
- WDGReadTemp(CardNum, out TempF) – Read the ambient temperature

Many additional functions are provided; for additional details please refer to the AIOWDG Reference.html document in your installation directory (and Start Menu).

Programming examples are provided in several popular programming languages and can be found here: C:\Users\Public\Documents\ACCES\PCIe-WDG-CSMA\

Header files and lib files for both 32-bit and 64-bit application targets can be found inside the Win32\Driver.SRC\ subfolder of the programming examples folder.

Chapter 6: Connector Pin Assignments

```
    13              1
   ┌─────────────────┐
 ○ │ ○○○○○○○○○○○○○ │ ○   DB-25 Female
   │  ○○○○○○○○○○○○  │
   └─────────────────┘
    25             14
```
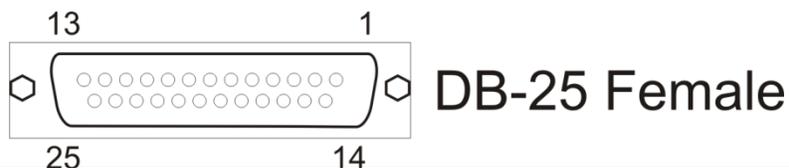
Pin Number	Function
1	Relay Pole 1, Common Contact (C)
2	Relay Pole 1, Normally Open Contact (NO)
3	Relay Pole 1, Normally Closed Contact, (NC)
4	Opto-Isolated Input Return*
5	Opto-Isolated Input 3*
6	Opto-Isolated Input 1*
7	Opto-Isolated Output 1 VBB*
8	Opto-Isolated Output 1 VOUT*
9	LVTTL IN 2
10	LVTTL IN 1
11	LVTTL OUT 2
12	LVTTL OUT 1
13	+3.3 VDC via 500mA polyfuse
14	Relay Pole 2, Common Contact (C)
15	Relay Pole 2, Normally Open Contact (NO)
16	Relay Pole 2, Normally Closed Contact (NC)
17	Opto-Isolated Input 4*
18	Opto-Isolated Input 2*
19	Opto-Isolated Output 2 VBB*
20	Opto-Isolated Output 2 VOUT*
21	Opto-Isolated Output RETURN*
22	GND
23	GND
24	GND
25	GND
*Indicates PCIe-WDG-CSMA version only	

Table 6-1: DB25F Connector J1 Pin Assignments

Terminal Label	Function
POWER GOOD	Open Collector Watchdog Output - Active Low
BAT-	Ground, General Purpose
BAT+ SPKR+	FACTORY USE ONLY
SPKR-	FACTORY USE ONLY

Table 6-2: TB1 Terminal Assignments

Chapter 7: Specification

Watchdog Timer (CSM version)

Time-out:	Configured for between 0.2 seconds and 12000 seconds
Output Pulse Width:	Time-out causes the BARK signal, generally used to reset the PC, which lasts until reset by the computer resetting the card or until commanded off by software
Relay Output:	DPDT, (Dual Form C), 1A at 30VDC, or 0.5A at 125VAC
Open Collector Out:	PWR GD (18" splice wire 20AWG*); RST (CAB-WDG-RST, 18" red & black twisted pair cable*) Active low, 200mA sink max (*supplied with card)
TTL Inputs:	Two inputs, LVTTL pulled up to 3.3V via 10k ohms Low =0 to 0.8V, High = 2.0 to 3.3V, 5V tolerant
Digital Outputs:	Two general purpose outputs, LVTTL source 24mA @ 2.5V typ., sink 24mA @ 0.6V typical
Speaker:	Software configurable audio alerts
LED Output:	RGB at card mounting bracket
Interrupt Output:	Via Software

Status Monitor (CSMA version, also includes all CSM functions)

Voltages	The +3.3V and +12V power supply voltages can be read
Temperature Sensor:	Internal / onboard -40 to +125°C (+/-0.3 – 0.7% typical)
Humidity Sensor:	Internal / onboard 0-100%RH (+/-3% typical)
External Temp.:	LM335A, -40 to +85°C (+/-1°C)
Light (Lux) Sensor:	Internal / onboard alert (enclosure opened)
Isolated Inputs:	Four, opto-isolated (shared return), 3-31VDC, 6mA typical at 12VDC (16mA max at 31V)
Isolated Outputs:	Two, software controlled opto-isolated high side FET open drain Outputs. 5 to 34VDC user supplied, 1A max load

Environmental

Operating Temp.:	0 °C. to +70 °C, optional -40° to +70 °C
Storage Temp.:	-40 °C to +85 °C
Humidity:	5% to 95% RH, non-condensing
Power Required:	+3.3VDC at 300mA max (not including external load on 500mA fused user output) +12VDC at 100mA max
Size:	6.6 inches long (167 mm) x 2.535 inches high (64.3 mm) MD2 Low Profile Specification

Customer Comments

If you experience any problems with this manual or just want to give us some feedback, please email us at: *manuals@accesio.com.* Please detail any errors you find and include your mailing address so that we can send you any manual updates.

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