

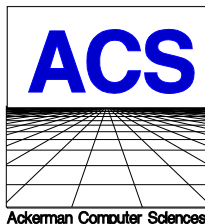
# RS-232

## *4 Input 8 Output Watchdog Module*

### User's Manual

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*On The Cutting Edge of Technological Evolution*

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## **Overview:**

Thank you for purchasing the **ACS RS-232 I4O8W1 Module**; be assured that it will provide you with thousands of hours of trouble free, solid-state operation.

The **ACS RS-232 I4O8W1 Module** provides an interface between a host computer, or device with an RS-232 serial port, and real world devices. The devices could be motors, lamps, solenoids, switches, sensors, etc... It can be used in broad range of applications.

## **Features:**

The **ACS RS-232 I4O8W1 Module** incorporates the following features:

- Uses industry standard DB-9 Female connector.
- Disk Drive style connector for external 5V & 12V DC power input
- Diagnostic LED to indicate open +12VDC fuse.
- Watchdog Timer with Open Drain output
- Eight Current Sink Outputs
- Four opto-isolated Current Inputs
- Intercommunication between two modules

## Connections

The ACS RS-232 I4O8W1 Module receives its power from the disk drive style connector **PS**.

The eight open collector outputs are located on the **Outputs** connector along with a fused +12V provided from the **PS** connector.

The four opto-isolated inputs along with the watchdog and spare outputs are located on the **Input** connector along with some grounds provided from the **PS** connector.

Communication with the host controller is performed at RS-232 signaling levels via the standard DB-9 connector labeled **RS-232**.

See the Mechanical section for connector location. Pin number 1 is denoted by the silkscreen markings and/or the use of a square copper pad for the pin.

## Power

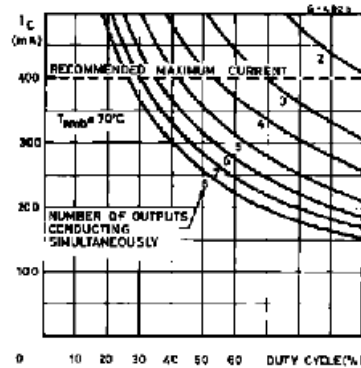
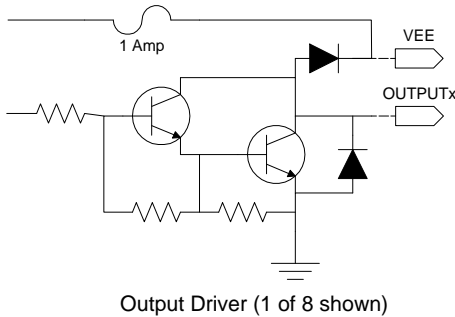
The ACS RS-232 I4O8W1 Module uses an external power supply. The required supply is 5 and 12 volts direct current provided via the PS input connector. The connector style is the mating connector for the PC power supply disk drive connections.

Pin #	DC Signal
1	+12VDC
2	GROUND
3	GROUND
4	+5VDC

## Outputs

The ACS RS-232 I4O8W1 Module provides eight current sink outputs. These current outputs are implemented with a ULN2803A Octal Darlington Transistor Array. Each output is individually capable of sinking up to 400mA, however driver package power dissipation limits the simultaneous total current drain for all eight outputs to 800mA. Multiple outputs may be paralleled to for higher output current capability as long as the total package power dissipation limit of 1100mW is not exceeded. Each output is fused at 350mA.

The outputs are open-collector, and each output has free wheeling clamp diodes for transient protection:



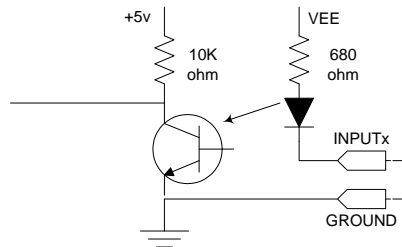
The cathodes of the upper clamp diodes are connected to the +12VDC input voltage (VEE) from the Power connector that is also provided on pins 1 & 2 of the Outputs connector. This supplied voltage may be used to drive external relays, indicators or other devices connected to the current sink outputs, and is fused at 1 amp.

The Outputs connector is a 10 pin, 2 piece terminal block style. The pinout is shown in the following table:

Pin #	Signal
1	OUT8
2	OUT7
3	OUT6
4	OUT5
5	OUT4
6	OUT3
7	OUT2
8	OUT1
9	VEE
10	VEE

### Inputs

The ACS RS-232 I4O8W1 Module provides four opto-isolated current inputs. The Cathodes of the LEDs in the optocouplers are connected to the Input connector port pins. The Anodes of the LEDs in the optocouplers are connected to the rectified, unregulated input voltage from the power connector PS, VEE, with a 680 ohm current limiting resistor in series. The output transistor of each optocoupler has a 10K pul-lup resistor on its collector, with the emitter connected to ground. The following diagram is representative of one input:



An input is activated by sinking current from the corresponding input pin to ground. A Ground connection is supplied on pins 1 & 6 of the Inputs connector for this purpose. With a +12vdc supply connected to the power connector PS, the input current sink requirement is approximately 15 mA.

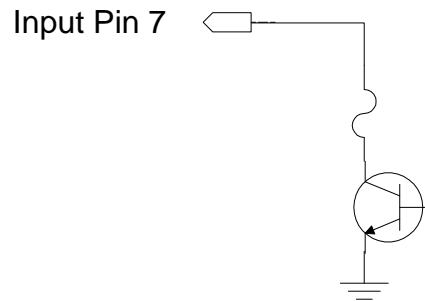
The Inputs connector is a 10 pin, 2 piece terminal block style. The pinout is shown in the following table:

Pin #	Signal
1	GROUND
2	INPUT1
3	INPUT2
4	INPUT3
5	INPUT4
6	GROUND
7	WATCHDOG OUTPUT

8	GROUND
9	SPARE OUTPUT
10	GROUND

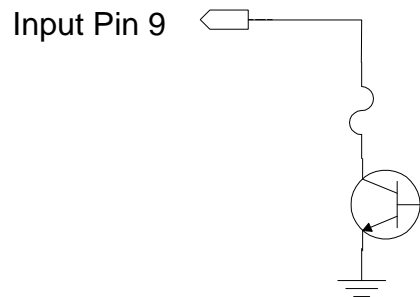
Inputs are debounced by the **ACS RS-232 I4O8W1 Module**. Debouncing takes the form of sampling the inputs every 20mSEC and keeping a history of the last input state. A closure is reported when there has been an open input read followed by a closed input.

### Watchdog Output



The watchdog feature of the **ACS RS-232 I4O8W1 Module** can be used to reset a computer or controller when it locks up or stops responding. Serial watchdog commands are continuously sent, within five seconds of one another, from the host to the module. When a serial watchdog command has not been received for five seconds, the open drain watchdog output is activated to ground. Connecting this output to the host computer/device reset switch or signal, causes the host device computer to reset. This feature is not activated until the first serial watchdog command has been received. This allows the host computer/device to boot/start operation before the watchdog timer starts. The output is rated to 25VDC and is fused at 350mA.

### Spare Output



The Spare Output is an open drain signal activated to ground that can be used as an auxiliary output and is controlled via a separate command message. It is rated to 25VDC and is fused at 350mA.

## RS-232

Communication with the host takes place over the RS-232 connector. A standard DB-9 pin female style connector is used. All communication is performed at RS-232 signaling levels. The following signals are used:

Pin #	Description	In/Out
1	DCD (tied to pin 6)	Out (driven high but not used)
2	TxD	Out from Module
3	RxD	In from Host
4	n/c	No connection
5	GND	Ground
6	DSR (tied to pin 1)	Out (driven high but not used)
7	RTS (tied to pin 8)	In (receiver connected but not used)
8	CTS (tied to pin 7)	In (receiver connected but not used)
9	n/c	No connection

## Software

The host computer communicates with the **ACS RS-232 I4O8W1 Module** via RS-232 level serial commands. All communication takes place at 9600 baud using 8 data bits and 1 stop bit. Communication takes the form of several short messages that are exchanged between the host and the module using a very simple ASCII character based protocol.

The message protocol format:

**<SOH> <Command Character> {<value>}<Checksum><ETX>**

Where:

**<SOH> = ASCII Start of Header = 01**

**<Command Characters>**

**I = Input closure sent to host or queried from host**

**P = Input opening sent to host**

**O = output - sent from host**

**W = Watchdog - sent from host**

**S = Spare output – any <value> other than 0 turns spare output on**

**R = RESET – sent on module power up**

**{<value>}**

**optional command dependent value is expressed as a two digit ASCII Hex number**

**<Checksum>**

**The value in two-digit ASCII hex of the sum of the preceding characters. The Watchdog message does not use a checksum.**

**<ETX> = ASCII End of Text = 03**

The module will autonomously send the RESET message upon power up. Receipt of the Reset message informs the host that the module has had power applied, and that its outputs and watchdog are disabled.

The module will autonomously send any input closure to the host. It will send a message for containing each debounced input closure. If two or more inputs are closed simultaneously the message will contain these multiple closures. e.g. – If inputs 2 and 4 are closed at the same time the message will be

<SOH> I 0C 10 <ETX> where “C” (binary 1010) represents inputs 2 and 4.

The module also autonomously sends input opens using the same protocol but with “P” as the command character.

The current state of the four Inputs may also be polled via receipt of the I command. A single ASCII Hex digit <value> is returned with the MSB = Input 4 and the LSB = Input 1.

Outputs are set to the corresponding bits of the 2-digit ASCII Hex value with the MSB = Output 8 and the LSB = Output 1.

Command	Description	In Out
Output	Sets the current output bit pattern for outputs 1 through 8 <SOH> "O" {Two Digit ASCII Hex Output Bit Pattern} Checksum <ETX>	I
Spare Output	Sets the current output bit state for the Spare Output <SOH> "S" {Two Digit ASCII Hex Output Bit State} Checksum <ETX>	I
Watchdog	Restarts the Watchdog Timer <SOH> "W"  Checksum<ETX>	I

Command	Description	In Out
Input Request	Requests an input status back with the current non-debounced input states <SOH> "I" <ETX>	I
Input	Sent out when ever an input is closed, open or current input status is requested: <SOH> "I" = closed or status "P" = open {Two Digit ASCII Hex Input Pattern} <ETX>	O
Reset	Sent out when the RS-232 I4O8W1 powers on or is reset <SOH> "R" <ETX>	O

**Module Intercommunication –**

Two modules can communicate with each other in such a way that the inputs of one module will set the corresponding outputs on the other module. The first four outputs of Module #2 will be set and cleared whenever inputs 1 thru 4 on Module #1 are set or cleared. The reverse is also true. Inputs on Module #2 will set the corresponding outputs on Module #1. For this to be possible the modules must be connected together with a NULL Modem serial cable.

**Mechanical**

