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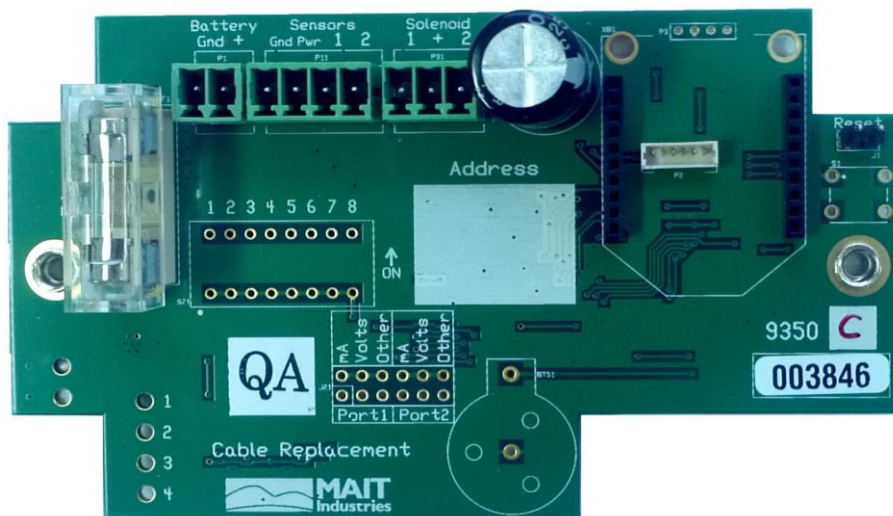
9350C
2 Port Analog Input Card and Single Port Solenoid Driver
## Technical Note

Introduction

The 9350C is a member of the 9350 "cable replacement" series of boards. The "C" version provides functionality to read two analog inputs and provides a single multifunction output port.

The analog inputs are capable of reading:

- Digital inputs,
- Voltage (0-1V, 0-2.5V, 0-3.3V),
- Current Loop (0-20mA, 0-50mA),
- Pulse width measurements,
- Asynchronous pulses, and
- SDI-12 and other serial protocols.

The single output port can;

- drive one 2 or 3 wire latching solenoid,
- control two 12V DC relays, or
- provide pump start or flood gate functionality.
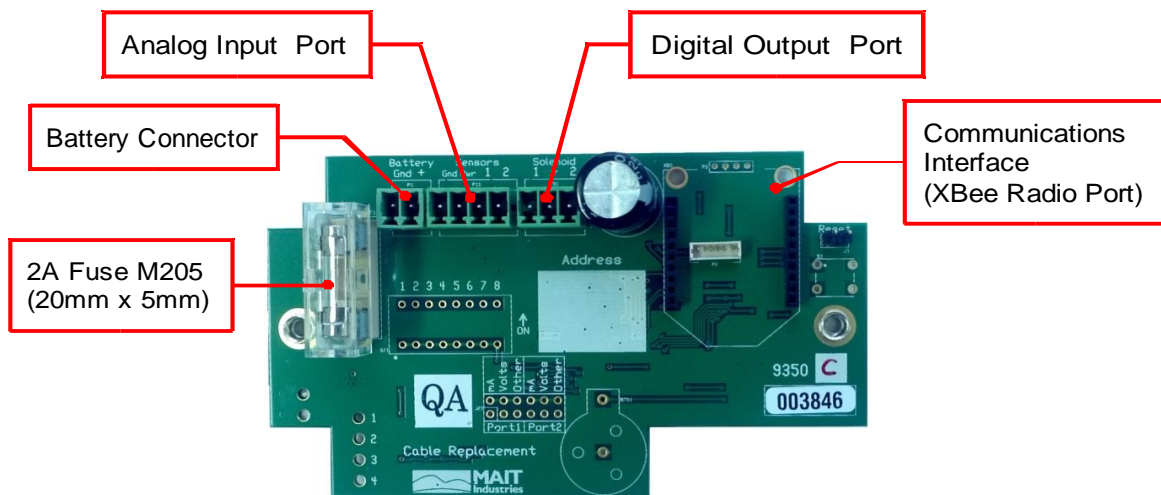
Communications Interface

Communications with the 9350C is performed via the XBee radio port. In the majority of cases an XBee radio module will be installed. In some instances adapters may be utilised to provide GSM/3G or RS485 communications.

Configuring the Board

The various board options are selected in firmware and configuration is performed via the communications interface using a laptop/PC and the iConfigure software utility.

External Connections

Three connectors are provided for external connections.

Power

The 2-Pin connector is used to provide power to the board and is normally connected to a 12V SLA battery or 10.8V rechargeable lithium pack. With a 12V supply, the 9350C requires approximately 10mA in idle and 60mA when transmitting. The power at this connector must be sufficient to power the board as well as any sensors, solenoids, relays, etc.

Analog Input Port

The analog input port has 4 pins labeled *Gnd*, *Pwr*, *1* and *2*.

The *Gnd* pin provides the common return path for the sensor power and sensor signals.

The *Pwr* pin provides a voltage to power the external sensors. The board is configurable to deliver the unregulated battery voltage or provide a 3V regulated supply. The current at this pin is limited to 400mA.

The output voltage is also configurable to be:

- Never on,
- On when sampling the sensors, or
- Permanently on

Note that either the battery voltage or the 3V regulated supply can be selected, but not both.

Pins *1* and *2* are the sensor input pins. These inputs can be internally configured to read:

- Digital inputs,
- Voltage (0-1V, 0-2.5V, 0-3.3V),
- Current Loop (0-20mA, 0-50mA),
- Pulse width measurements,
- Asynchronous pulses, or
- SDI-12 and other serial protocols.

Digital Output Port

The digital output port utilises a three pin connector. The two outer pins are grounded when the respective output is turned on. The common center pin is connected to the battery connector via the on-board 2A fuse and, therefore, provides a permanent positive supply.

N.B. Solenoid and relay operating voltages must match the battery voltage for reliable operation.

The port can be configured to;

- drive one 2 or 3 wire latching solenoid,
- control two 12V DC relays, or
- provide pump start or flood gate functionality.

Two Wire Latching Solenoids

A two wire latching solenoid is wired between pins 1 and 2. To turn the solenoid on, pin 1 is pulsed to the battery voltage and pin 2 is pulsed to ground. Conversely, to turn the solenoid off, pin 1 is pulsed to ground and pin 2 is pulsed to the battery voltage.
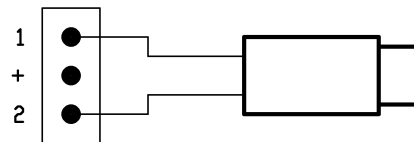
Three Wire Latching Solenoids

The common wire of a three wire latching solenoid is connected to the center (+) pin. Pin 1 is pulsed to ground to turn the solenoid on. Pin 2 is pulsed to ground to turn the solenoid off.
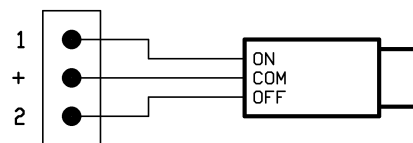
Relay Outputs

Two separate relays may be connected to this port. If polarity sensitive relays are used then connect the positive lead of the relay to the common center (+) pin and the negative lead to either pin 1 or 2 as required. To operate a relay, ground is applied to pin 1 or 2 as appropriate. To release the relay, ground is removed from the pin.
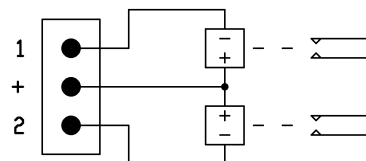
Pump Control

Pin 1 is grounded for the duration of the irrigation and goes high impedance when the irrigation is complete. Pin 2 is grounded for a few seconds at the start of the irrigation. Relays are normally used to interface with the pump controller.
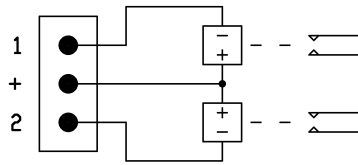
This relay activates for the duration of the irrigation.

This relay activates for a few seconds at the start of the irrigation.

Flood Gates

Pin 1 is grounded for the time required to open the flood gate. Ground is then removed from the pin. Pin 2 is grounded for the time required to close the flood gate. Ground is then removed from the pin. These pins are normally connected to a separate motor drive board which, in turn, drives the flood gate motor.
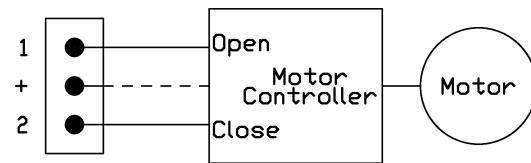
Disclaimer

In all cases involving fixed mains wiring, work must only be performed by a fully qualified and registered electrician.

Maximum Ratings

Battery Terminals (w.r.t. Gnd) [Note 1]	-15V to +15V
Sensor Input Voltage [Note 1]	0V to +15V
Solenoid Output Voltage	0V to +20V
Solenoid Output Current	3A (continuous)
Sensor Supply Output Current [Note 2]	400mA

Operating Conditions

Battery Voltage	+9V to +13.8V
Operating Current (12V supply, inputs open circuit, outputs off)	0.3mA (Radio sleeping, 12V sensor power disabled) 10mA (Radio awake, idle) 55mA (Radio transmitting)
Additional current with 12V Sensor Power enabled in "unregulated" mode	4mA approx.
Sensor Input Voltage [Note 3]	0V to 3.3V
Sensor Output Voltage [Note 4]	12V
Solenoid Output Current [Note 5]	3A pulsed <500mA continuous

Notes:

- Inputs are clamped for surge protection. Continuous DC inputs outside these extremes will cause overheating and possible destruction of the clamp diodes.

- The sensor output voltage is current limited and able to withstand a continuous short circuit.

- Voltages are generally not directly applied to the input pins. Each sensor input has a 10k pull-up resistor to +3.3V. This represents the OFF condition. The input is typically shorted to ground through a voltage free contact to represent an ON condition.

Applying a voltage outside these limits will cause the input protection diode to conduct, placing approx. 1k resistance between the input and ground.

- While the maximum sensor output voltage is limited to 12V it is derived from the battery voltage and, therefore, can never exceed the battery voltage.

- The charge current into the standard Lithium battery pack is limited to 1A. Regardless of the charging source, drawing a total of more than 1A of continuous current will cause the batteries to have a net discharge.