RAPID CONTROLS

SAB-Q2
USER MANUAL

LDT to Quadrature Converter

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Contents

1 Introduction **2**
1.1 Description
1.2 Features and Specifications
1.3 Models and Ordering Information

2 Installation **4**
2.1 Connections

3 Configuration **7**
3.1 Jumpers
3.2 Setup Menu
3.3 Setup Considerations

4 General Operation **15**
4.1 Startup
4.2 Sensor Processing
4.3 Status
4.4 Digital IO

1 Introduction

1.1 Description

The SAB-Q2 converts two channels of linear or rotary position data to two channels of differential ABZ quadrature. To achieve accurate, low-latency output, the conversion is implemented using a micro-controller and EPLD.

The SAB-Q2 continuously interrogates the sensors at a configurable rate. Quadrature data is output to maintain a quadrature position equal to the position interrogated from the sensors. The SAB-Q2 maintains a record of the current quadrature output and works to output a stream of quadrature states needed to equalize the quadrature output and the sensor position.

Becuase quadrature is inherently limited to presenting relative changes in position, two methods are available for synchronising the absolute position of the magnetostrictive sensor and the quadrature position.

- A marker position may be configured. Whenever the sensor position equals the marker position, the quadrature Z-lines are active. This can be used to set the host quadrature counters to a known value, effectively homing the system.
- The Send-All inputs may be used. When the Send-All input is activated, the SAB-Q2 will send all position data immediately. If the host quadrature counters are zeroed before the Send-All event, this will have the effect of homing the system.

Sensor update rate, sensor type, scaling, offsetting, maximum quadrature output rate, and analog output scaling are configurable using a text-based menu accessible via an RS-232 serial port. Status LEDs provide visual confirmation of proper sensor operation. A *Sensor OK* output for each channel allows an external device to monitor sensor interface status.

Although the SAB-Q2 was designed for use with magnetostrictive linear displacement transducers, it can be used with other types of sensors such as glass scales or lasers. To be used with the SAB-Q2, a sensor must be compatible with the one of the sensor protocols supported by the SAB-Q2 – SSI, Start/Stop digital pulse, or PWM digital pulse.

1.2 Features and Specifications

- Two channels of 24-bit position from Start/Stop, PWM or binary SSI magnetostrictive transducers
- Two channels of 5-volt differential A, B, and Z outputs (RS-422 level)
- Fast quadrature output of up to 112 inches per second with 0.001 inch resolution
- Quadrature outputs are speed proportional with selectable maximum frequency
- Marker (Z) outputs identify a unique position on each sensor
- Send-All inputs cause absolute position of each channel to be output
- Supports arbitrary SSI sensor resolution

- 56 MHz oscillator provides 0.002 inch base resolution with no recirculations with Start/Stop or PWM sensors
- Maximum SSI transducer length of 165 inches for 2 μm resolution, 412 inches for 5 μm
- Maximum quadrature output rate selectable from 40k,72k or 112k states per second on each channel
- Two channels of 5-volt differential A, B, and Z outputs (RS-422 level)
- Transducer OK output and LED signals valid transducer operation
- Software selectable sensor length, update rate, gradient, offset, scale, and output frequency
- Interactive setup menu available via RS-232 serial interface
- System LED indicates good operation of SAB-Q2
- Non-volatile memory for storage of setup parameters
- Two electrically isolated DC inputs for Send All (12-24 VDC)
- Two electrically isolated DC outptus for Sensor OK (0-24VDC at 50 mA)
- Removable screw terminal connections
- Power requirements: 7.5 - 26 VDC at $<$ 300 mA (optional features may consume more current)
- 4.64 $\times$ 5.31 $\times$ 1.77 (D$\times$H$\times$W) inch DIN rail mount enclosure
- Model SAB-Q2-ANA analog outputs:
  - Resolution is 16-bit (0.3 mV) with –10.0V to +10.0V output range
  - Output current: +/-5 mA

1.3 Models and Ordering Information

Table 1.1 shows the available SAB-Q2 models. SAB-Q2 units are available with 2 or 4 sensor channels. Two channel models are available with optional analog voltage outputs. Sensor support varies by model. SAB-Q2s are available with support for SSI sensors, digital pulse output Start/Stop and PWM sensors, free-running (internally interrogated) PWM sensors, and single-ended (non-differential) Start/Stop output sensors.

Model Number	Channels	Sensor Interface	Analog Output
SAB-Q2-2-RPM	2	Start/Stop & PWM	—
SAB-Q2-2-SSI	2	SSI	—
SAB-Q2-2-PF	2	Free Running PWM	—
SAB-Q2-2-RPM-ANA	2	Start/Stop & PWM	2× 16-bit
SAB-Q2-2-SSI-ANA	2	SSI	2× 16-bit
SAB-Q2-2-PF-ANA	2	Free Running PWM	2× 16-bit
SAB-Q2-4-RPM	4	Start/Stop & PWM	—
SAB-Q2-4-SSI	4	SSI	—
SAB-Q2-4-PF	4	Free Running PWM	—

Table 1.1 Models and Ordering Information

2 Installation

2.1 Connections

Figure 2.1 shows the location of the connectors on the SAB-Q2.

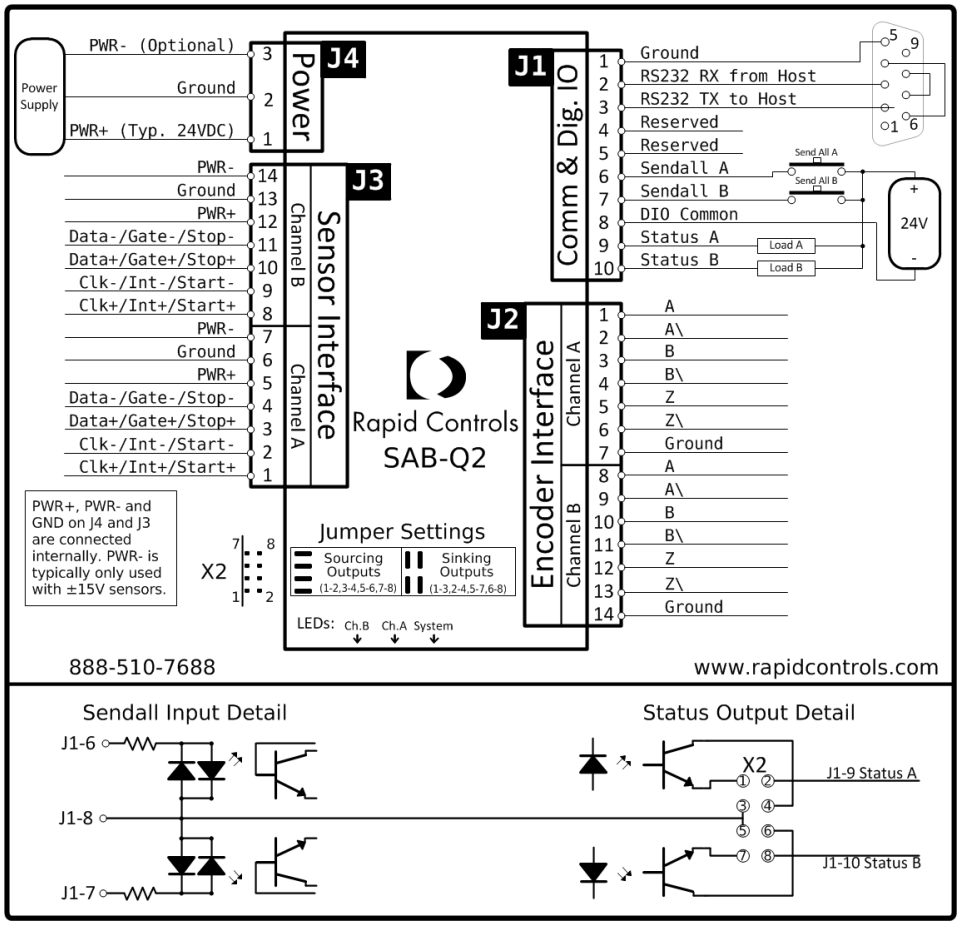

Figure 2.1 SAB-Q2 Connector Placement

2.1.1 Connector J1

Connector J1 provides the connections for communications and digital IO. The pinout of J1 is shown in Table 2.1.

If the host computer requires the use of hardware handshaking, the host's DTR line must be tied to the host's DSR line (pin 4 to pin 6 on a DB9), and the host's RTS line must be tied to the host's CTS line (pin 7 to pin 8 on a DB9).

Pin	Function
J1-1	Logic Ground
J1-2	RS-232 RX from Host
J1-3	RS-232 TX to Host
J1-4	RS-485 TxD−/RxD− (RS-485 A)
J1-5	RS-485 TxD+/RxD+ (RS-485 B)
J1-6	Channel A Send-All Input
J1-7	Channel B Send-All Input
J1-8	Input Common
J1-9	Channel A Sensor Status Output
J1-10	Channel B Sensor Status Output

Table 2.1 Connector J1 Pinout

2.1.2 Connector J2

Connector J2 provides connections for the quadrature outputs. Pins 1 through 7 are the connections for the Channel A encoder interface and Pins 8 through 14 are the connections for the Channel B encoder interface. The pinout of J2 is shown in Table 2.2.

Pin	Channel	Function
J2-1	A	Quadrature A Line
J2-2	A	Quadrature A\ Line
J2-3	A	Quadrature B Line
J2-4	A	Quadrature B\ Line
J2-5	A	Quadrature Z Line
J2-6	A	Quadrature Z\ Line
J2-7	A	Logic Ground
J2-8	B	Quadrature A Line
J2-9	B	Quadrature A\ Line
J2-10	B	Quadrature B Line
J2-11	B	Quadrature B\ Line
J2-12	B	Quadrature Z Line
J2-13	B	Quadrature Z\ Line
J2-14	B	Logic Ground

Table 2.2 Connector J2 Pinout

2.1.3 Connector J3

Connector J3 provides connections for the sensor interfaces. Pins 1 through 7 are the connections for the Channel A sensor interface and Pins 8 through 14 are the connections for the Channel B sensor interface. The pinout of J2 is shown in Table 2.3.

Pins 5 and 12 of J3 are connected internally to J4-1 and are intended to help with power distribution to the sensors. If the sensor is powered from an external power supply, Pins 5 and 12 of J3 may be left unconnected. Ensure that the sensor ground is connected to the SAB-Q2 ground at J3-6 or J3-13.

Pins 7 and 14 of J3 are connected internally to J4-3 and are intended to help with power distribution to the sensors. Some older sensors require two supply voltages (typically +15V and −15V). The second supply voltage may be distributed to these types of sensor through pins 7 and 14. If the sensor is powered from an external power supply or does not require a second supply voltage, leave pins 7 and 14 unconnected. Ensure that the sensor ground is connected to the SAB-Q2 ground at J3-6 or J3-13.

Pin	Channel	Function
J3-1	A	Clock+/Interrogate+/Start+ to Sensor
J3-2	A	Clock−/Interrogate−/Start− to Sensor
J3-3	A	Data+/Gate+/Stop+ from Sensor
J3-4	A	Data−/Gate−/Stop− from Sensor
J3-5	A	+ Power to the Sensor (internally connected to J4-1)
J3-6	A	Ground (connect to sensor ground)
J3-7	A	− Power to the Sensor (internally connected to J4-3, optional)
J3-8	B	Clock+/Interrogate+/Start+ to Sensor
J3-9	B	Clock−/Interrogate−/Start− to Sensor
J3-10	B	Data+/Gate+/Stop+ from Sensor
J3-11	B	Data−/Gate−/Stop− from Sensor
J3-12	B	+ Power to the Sensor (internally connected to J4-1)
J3-13	B	Ground (connect to sensor ground)
J3-14	B	− Power to the Sensor (internally connected to J4-3, optional)

Table 2.3 Connector J3 Pinout

2.1.4 Connector J4

Connector J4 provides connections for supply power. Pin 1 of J4 provides power to the SAB-Q2 and is connected internally to J3-5 and J3-12. Pin 2 must be connected to the return (ground) of the power supply. This ground is connected internally to J3-6 and J3-12. If seperate power supplies are used to power the SAB-Q2 and sensors, ensure that the sensor ground and SAB-Q2 ground are connected together. The pinout of J4 is shown in Table 2.4.

Pin	Function
J4-1	+7.5 to +26 VDC input power (minimum 300mA) for SAB-Q2 and sensors
J4-2	Power and signal Ground
J4-3	− Power passthrough to sensors (optional, for sensors requiring two supply voltages)

Table 2.4 Connector J4 Pinout

3 Configuration

3.1 Jumpers

3.1.1 Jumper X2

The digital outputs of the SAB-Q2 can be configured for sourcing or sinking operation. Jumper X2 selects this mode of operation. Jumper X2 is located on the side of the SAB-Q2, next to connector J3. The location of X2 is shown in Figure 3.1.

Figure 3.1 Jumper X2 Location (shown in Sourcing configuration)

The common voltage on J1-8 is used by the Send-All inputs as as well as the status outputs. The Send-All inputs are bidirectional and can work with sinking or sourcing inputs, but the common voltage at J1-8 must match the X2 setting.

If ground is applied to pin J1-8, the outputs will be sinking and the jumpers must be installed 1-3, 2-4, 5-7, and 6-8. If a voltage (12 to 24 VDC) is applied to J1-8, the outputs will source this voltage and X2 must be set 1-2, 3-4, 5-6 and 7-8.

Possible settings for jumper X2 are shown in Table 3.1 and in Figure 3.2.

Shunt Placement	Output Confiuration	J1-8 Common
1-2, 3-4, 5-6, 7-8	Sourcing	12 to 24 VDC
1-3, 2-4, 5-7, 6-8	Sinking	Ground

Table 3.1 Jumper X2 Settings

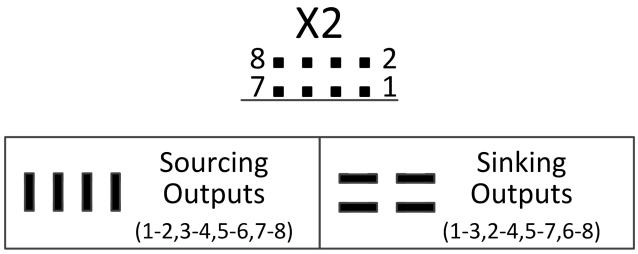

Figure 3.2 Jumper X2 Settings

3.2 Setup Menu

Configuration of the SAB-Q2 is accomplished through an interactive setup menu. The setup items accessable in this menu are stored in non-volatile memory.

The setup menu is used to configure operation of the SAB-Q2. To ensure that the quadrature output of the SAB-Q2 is correct, configuration must be completed during installation. The configuration must be updated if any of the following events occur:

- A digital pulse output sensor is replaced by a sensor with a different gradient
- A digital pulse PWM output sensor is programmed to have a different number of internal recirculations
- An SSI output sensor is replaced by a sensor with a different resolution
- An SSI output sensor is reprogrammed to have a different resolution
- The desired quadrature output resolution has changed
- The desired range of the analog output has changed (on SAB-Q2 -ANA models)

The setup menu can be accessed via an RS-232 serial connection using a computer or other terminal device connected to the J1 connector. The connection should be established using the parameters shown in Table 3.2. To access the setup menu, transmit (press a key) several characters quickly. The SAB-Q2 will detect this serial activity and display a setup menu with a prompt for further input.

The setup menu will display a list of parameters and values. Each of these parameters may be changed by transmitting the letter shown next to the parameter. In addition to the setup parameters, the menu shows the position most recently gathered from the sensors.

After changes have been made, the changed parameters must be committed to non-volatile memory or they will be lost when power is removed from the SAB-Q2. Choose *Save to EEPROM* to save all parameters to non-volatile memory. To exit the setup menu and return to normal operation, choose *Quit* from the menu (transmit the letter 'Q') or cycle power to the SAB-Q2.

The SAB-Q2 does not output quadrature while the setup menu is in use. To indicate this condition, the System LED will stop blinking while the setup menu is in use. Do not attempt

to use any machine that relies on position information from the SAB-Q2 while using the setup menu.

Parameter	Configuration
Baud Rate	9600 bps
Data Bits	8
Parity	None
Stop Bits	1
Handshaking	None

Table 3.2 Serial Parameters

3.2.1 Default Configuration

A set of default parameters (see Table 3.3) are stored in the SAB-Q2 when it leaves the factory. The default parameters can be restored by selecting the *Factory Defaults* option from the setup menu.

Setup Item	Default Value
Recirculations	2
Marker Position	4000 counts
Transducer Type	Start/Stop
Transducer Length	84 inch
Scalar	1.0
Offset	0 counts
Gradient	8.928571 μs/inch
Maximum Quadrature Frequency	28 kHz
Analog Center	0 counts
Analog Range	32767 counts
Analog Force Flag	0 (Off)
Analog Voltage	0.0 Volts

Table 3.3 SAB-Q2 Default Configuration

3.2.2 Configuration Parameters

3.2.2.1 Transducer Type

The Transducer Type configuration parameter must be set to match the type of sensor being used with the SAB-Q2. Depending on the SAB-Q2 model purchased, only some of the options shown in the Transducer Type menu will be valid. For example, a SAB-Q2-2-SSI cannot be used with a Start/Stop sensor, but the Start/Stop option will still be present in the menu.

Several SSI Transducer Type options are presented. The options labeled SSI24/n divide the position returned from the sensor by n. This can be used to reduce the number of quadrature counts output when using a high-resolution sensor.

Menu Entry	Sensor Types Supported	SAB-Q2 Model Support	Notes
Start/Stop	Digital pulse Start/Stop protocol sensors	SAB-Q2-x-RPM	None
PWM	Digital pulse PWM protocol sensors	SAB-Q2-x-RPM	None
SSI24	24-bit SSI protocol sensors	SAB-Q2-x-SSI	None
SSI24/2	24-bit SSI protocol sensors	SAB-Q2-x-SSI	Position value is divided by 2
SSI24/4	24-bit SSI protocol sensors	SAB-Q2-x-SSI	Position value is divided by 4
SSI24/8	24-bit SSI protocol sensors	SAB-Q2-x-SSI	Position value is divided by 8
SSI24/16	24-bit SSI protocol sensors	SAB-Q2-x-SSI	Position value is divided by 16

Table 3.4 SAB-Q2 Transducer Type Options

3.2.2.2 SSI Protocol

The SSI Protocol configuration parameter is only used when the Transducer Type is set to one of the SSI selections. The SSI protocol selects the numerical format used by the sensor. SSI values are typically transmitted as a standard binary value or as a Gray-coded value. When Graycode is selected as the SSI Protocol, the position data is converted to binary before being used by the SAB-Q2.

Menu Entry	Sensor Protocol Supported
Binary	24-bit Binary Synchronous Serial Interface (SSI)
Graycode	24-bit Graycode Synchronous Serial Interface (SSI)

Table 3.5 SAB-Q2 SSI Protocol Options

3.2.2.3 Transducer Length

The Transducer Length configuration parameter should be set to the length of the sensor in inches. When using a magnetostrictive sensor, the maximum update rate is directly controlled by the length of the sensor and number of recirculations that are performed. Adjustments to the update rate to account for recirculations will be performed automatically if the Recirculations configuration item (see below) is set correctly.

3.2.2.4 Gradient

The Gradient represents the average speed that the magnetostrictive pulse travels down the sensing element. SSI sensors use this value internally to convert to the resolution specified when ordering the sensor. For digital pulse output sensors, this conversion must be performed externally. The SAB-Q2 uses the gradient value to normalize digital pulse output sensors to

Update Period	Sensor Length
500 μs	Length $\leq$ 50 inch
1000 μs	50 inch $<$ Length $\leq$ 100 inch
1500 μs	100 inch $<$ Length $\leq$ 150 inch
2000 μs	150 inch $<$ Length $\leq$ 200 inch
2500 μs	200 inch $<$ Length $\leq$ 250 inch
3000 μs	250 inch $<$ Length $\leq$ 300 inch
3500 μs	300 inch $<$ Length $\leq$ 350 inch
4000 μs	350 inch $<$ Length $\leq$ 400 inch

Table 3.6 SAB-Q2 Transducer Length and Update Period Relationship

0.002-inches per count (with no recirculations). The Gradient is only applicable when using a Start/Stop or PWM output sensor.

The Gradient value is typically printed on the sensor label and is different for each sensor. The SAB-Q2 expects the gradient to be entered in microseconds per inch. If your sensor lists the gradient value in meters per second, convert to microseconds per inch using Equation 3.1

$$G_{us/in} = \frac{25400}{G_{m/s}} \tag{3.1}$$

3.2.2.5 Recirculations

The effective resolution of a digital pulse output sensor can be improved using a technique called Recirculation. The sensor is rapidly interrogated multiple times in a row. The resulting value will have an effective resolution equal to the base resolution times the number of recirculations. For example, a PWM sensor using 4 recirculations will have an effective resolution of 0.0005 inches/count when used with a SAB-Q2.

Using recirculations causes the response time of the sensor to increase. Each recirculation requires as much time to complete as a single sensor reading. The SAB-Q2 will automatically adjust the update period to reflect recirculations used by the sensor.

The Recirculation parameter is only applicable to digital pulse sensors, and is typically used only with PWM sensors configured for internal recirculations.

3.2.2.6 Scalar

The position data received from the sensor is multiplied by the Scalar configuration value before being used by the SAB-Q2. The scalar is applied after SSI shifting and before offseting. All SAB-Q2 functions that use position data will use the scaled position value.

The scalar can only be used to reduce the resolution of the sensor. In other words, the scalar must be equal to or less than 1.0.

Example 1: A Start/stop sensor is being used. This sensor has a nominal resolution of 0.002 inches per count. The desired quadrature output is 20 counts per inch, or 0.05 inches per count. To find the required scalar, divide the sensor resolution by the desired resolution. In this case, $\frac{0.002}{0.05} = 0.04$, so a scalar of 0.04 is used.

Example 2: A 24-bit SSI sensor is being used. This sensor has a factory set resolution of 5 micron per count. A quadrature output of 0.001 inches per count (25.4 micron per count) is desired. To find the scalar, divide the sensor resolution by the desired resolution. In this case, $\frac{5}{25.4} = 0.19685$, so a scalar of 0.19685 is used.

Example 3: The same 24-bit SSI sensor from Example 2 is used, with a factory set resolution of 5 micron per count. The Transducer Type configuration value is set to SSI24/2, which divides the resolution of the sensor in half for an effective resolution of 10 micron per count before scaling. A quadrature output of 0.001 inches per count (25.4 micron per count) is desired. To find the scalar, divide the effective sensor resolution by the desired resolution. In this case, $\frac{10}{25.4} = 0.39370$, so a scalar of 0.39370 is used.

3.2.2.7 Offset

The Offset configuration value is entered in counts. This value is subtracted from the sensor position after scaling occurs. The offset value is used when the SAB-Q2 calculates marker output, analog output, and Send All.

The Offset is used to "Zero" the output of the SAB-Q2 for marker output, analog output, and Send-All.

3.2.2.8 Marker

The Marker is the position (in counts) where the Z quadrature lines will be active. Whenever the quadrature position is equal to the marker, the Z lines are asserted. If the controller supports a marker, it will reset the quadrature position counter to a preset value when the marker is asserted. This is one method of "homing" the system and achieving absolute positioning.

3.2.2.9 Maximum Quadrature Speed

The SAB-Q2 is capable of outputing quadrature data at 28 kHz pre-quadrature. Post-quadrature this is equivalent to 112 kHz. If the controller requires that quadrature data be kept below a certain speed, the Maximum Quadrature Speed configuration value can be used to adjust the quadrature frequency.

The values listed Table 3.7 show the pre- and post- quadrature frequencies available.

Menu Entry	Pre-Quadrature Frequency	Post-Quadrature Frequency
10 KHz	10 kHz	40 kHz
18 KHz	18 kHz	72 kHz
28 KHz	28 kHz	112 kHz

Table 3.7 SAB-Q2 Quadrature Output Speeds

3.2.2.10 Analog Center

The *Analog Center* is only applicable to SAB-Q2 -ANA models. The *Analog Center* is a position in counts that identifies the position where analog output is 0V. Positions below the *Analog Center* will result in a voltage below zero; positions above the center will result in a voltage above zero.

3.2.2.11 Analog Range

The *Analog Range* is only applicable to SAB-Q2 -ANA models. The *Analog Range* identifies the number of counts above and below the *Analog Center* position where analog output is at full scale (−10V or 10V). Positions greater than *Analog Center* + *Analog Range* result in 10V output. Positions less than *Analog Center* − *Analog Range* result in −10V output.

3.2.2.12 Analog Force Flag

The *Analog Force Flag* controls the analog force mode of the SAB-Q2. When analog force mode is enabled, the analog output is set to a user-entered voltage and normal position-based analog output is disabled. When the *Analog Force Flag* is set to 1, force mode is enabled; when it is set to 0, force mode is disabled.

3.2.2.13 Analog Force Voltage

The *Analog Force Voltage* is the voltage that is output when the *Analog Force Flag* is set to 1. Otherwise, *Analog Force Voltage* is ignored.

3.2.2.14 Save to EEPROM

Select *Save to EEPROM* to save the configuration values to non-volatile memory. Any configuration items changed will not be saved until this option is selected. Any changes made without saving will be lost when power is cycled.

3.2.2.15 Load from EEPROM

Select *Load from EEPROM* to load the values from the non-volatile memory. This will revert any changes made since the last time values were saved to non-volatile memory.

3.2.2.16 Factory Defaults

Select *Factory Defaults* to change all of the setup values to the factory defaults, as shown in Table 3.3. Defaults are not saved to non-volatile memory until the *Save to EEPROM* menu item is selected.

3.2.2.17 Quit

Select *Quit* to exit the setup menu and return to normal operation. The configuration values entered via the setup menu will be in effect at this point. Any values not saved to the EEPROM will be lost when power is removed.

3.3 Setup Considerations

The SAB-Q2 is limited to a maximum output rate of 112,000 quadrature output states per second. Together with the resolution of the sensor, a maximum travel speed can be calculated. If the maximum travel speed is exceeded, the SAB-Q2 will not lose track of position. Instead, the quadrature output will lag behind the sensor position until speed is reduced. It is recommended that the maximum travel speed not be exceeded during normal use.

3.3.1 Start/Stop and PWM

The maximum speed can be determined by multiplying 112,000 by the resolution of the sensor. When used with the SAB-Q2, Start/Stop and PWM sensors have a resolution of 0.002 inches per count (with no recirculation). The maximum travel speed for Start/Stop and PWM sensors with no recirculations is 224 inches per second. Divide this number by the number of recirculations when recirculations are used. For example, a PWM sensor with 4 recirculations will have a resolution of 0.0005 inches per count and a maximum travel speed of 56 inches per second.

3.3.2 SSI

The maximum speed can be determined by multiplying 112,000 by the resolution of the sensor. SSI sensors are factory configured with a particular resolution, though it may be possible to program the sensor after purchase.

To determine the maximum travel speed, multply 112,000 by the resolution of the SSI sensor. For example, an SSI sensor with 1 micron resolution will have a maximum travel speed of 112,000 micron per second, or 4.409 inches per second. Table 3.8 shows maximum travel speeds for some common sensor resolutions.

Sensor Resolution	Maximum Travel Speed
1 micron per count	4.4 inches per second
2 micron per count	8.8 inches per second
5 micron per count	22 inches per second
10 micron per count	44 inches per second
25 micron per count	110 inches per second
50 micron per count	220 inches per second

Table 3.8 Maximum travel speeds for common resolutions

4 General Operation

4.1 Startup

At power-on, the board will print a sign-on message indicating the date of software in the board and the status of the retrieval of data stored in the non-volatile EEPROM. A message similar to the following will be displayed:

```
Rapid Controls Inc. SAB-Q2
Copyright(c) 1997-2010 Rapid Controls Inc. 03-01-2010
EEPROM load successful.
```

4.2 Sensor Processing

The SAB-Q2 interfaces with two magnetostrictive transducers and interrogates the sensors for position information at a configurable rate. Two quadrature outputs attempt to follow the position received from the sensors. A current quadrature count value is maintained by the SAB-Q2. After position is received from the sensor, the position is compared with the quadrature count. Any difference between the values will be output via quadrature during the next sensor update period.

The position data collected by the SAB-Q2 is also used for analog retransmission output on SAB-Q2 -ANA models.

Position data is scaled and offset before being used for quadrature or analog output.

4.2.1 Sensor Interface

Each sensor interface is capable of interfacing with a sensors supporting particular output protocols. SAB-Q2 -SSI models support Synchronous Serial Interface sensors with a 24-bit data word and binary- or gray-coding. SAB-Q2 -RPM models support differential digital pulse protocols common to magnetostrictive sensors: Start/Stop and Pulse Width Modulated (PWM).

The SAB-Q2 -PF models support free-running PWM sensors, sometimes called internally-interrogated PWM. These sensors do not wait for an interrogation signal from the SAB-Q2. Instead, the output signal is transmitted by the sensor without outside signalling. This model will also support PWM sensors that are interrogated by an external device.

4.3 Status

A red LED on the board blinks during operation. Two green LEDs indicate the status of the transducers. A lit LED indicates a good transducer, and a dim or dark LED indicates a missing or failing transducer or magnet. Sensor status may also be read via the digital outputs.

4.4 Digital IO

The SAB-Q2 is equipped with two digital inputs and two digital outputs. The digital inputs are used to control Send-All. The digital outputs indicate sensor status. Connector J1 (see Section 2.1.1 for pin-out information) contains the connections for the digital inputs and outputs.

4.4.1 Send All Inputs

The inputs signal send-all when activated. This causes the all position information to be transmitted over the quadrature interface. If the controller's quadrature counters are zeroed before send-all is activated, the quadrature counter will be synced with the sensor position (homed).

The inputs are bidirectional and can source or sink current depending on the voltage applied to J1-8. If the controller has a sinking output, apply +12 to 24 VDC to J1-8 and allow the controller to ground the send-all input to activate it. If the controller has a sourcing output, apply ground to J1-8 and allow the controller to source +12 to 24VDC to activate the input.

4.4.2 Status Outputs

The X2 jumper is used to configure the status outputs to match the common applied to J1-8 (see Section 4.4.1). If the common is grounded then the outputs must be jumpered to be sinking. If the common is connected to +12 to 24VDC then the outputs must be jumpered to be sourcing. See Section 3.1.1 for further information on Jumper X2.