

# 8903/AI & 8903/EP

## Analogue Input Encoder Options

HA500891U001 Issue 3  
Technical Manual

aerospace  
climate control  
**electromechanical**  
filtration  
fluid & gas handling  
hydraulics  
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process control  
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# **8903/AI High Resolution Analogue Input Option**

## **8903/EP Encoder Option**

### **Technical Manual**

HA500891U001 Issue 3

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# Safety Information



## Requirements

**IMPORTANT:** Please read this information *BEFORE* installing the equipment.

### Intended Users

This manual is to be made available to all persons who are required to install, configure or service equipment described herein, or any other associated operation.

The information given is intended to highlight safety issues, EMC considerations, and to enable the user to obtain maximum benefit from the equipment.

Complete the following table for future reference detailing how the unit is to be installed and used.

INSTALLATION DETAILS	
<b>Model Number</b> (see product label)	
<b>Where installed</b> (for your own information)	
<b>Unit used as a:</b> (refer to Certification for the Inverter)	<input type="checkbox"/> Component <input type="checkbox"/> Relevant Apparatus
<b>Unit fitted:</b>	<input type="checkbox"/> Wall-mounted <input type="checkbox"/> Enclosure




### Application Area

The equipment described is intended for industrial motor speed control utilising DC motors, AC induction or AC synchronous machines

### Personnel

Installation, operation and maintenance of the equipment should be carried out by qualified personnel. A qualified person is someone who is technically competent and familiar with all safety information and established safety practices; with the installation process, operation and maintenance of this equipment; and with all the hazards involved.

### Product Warnings

 <b>Caution</b> Risk of electric shock	 <b>Caution</b> Refer to documentation	 <b>Earth/Ground</b> Protective Conductor Terminal
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# Safety Information



## Hazards

### **DANGER! - Ignoring the following may result in injury**

1. This equipment can endanger life by exposure to rotating machinery and high voltages.
2. The equipment must be permanently earthed due to the high earth leakage current, and the drive motor must be connected to an appropriate safety earth.
3. Ensure all incoming supplies are isolated before working on the equipment. Be aware that there may be more than one supply connection to the drive.
4. There may still be dangerous voltages present at power terminals (motor output, supply input phases, DC bus and the brake, where fitted) when the motor is at standstill or is stopped.
5. For measurements use only a meter to IEC 61010 (CAT III or higher). Always begin using the highest range. CAT I and CAT II meters must not be used on this product.
6. Allow at least 5 minutes for the drive's capacitors to discharge to safe voltage levels (<50V). Use the specified meter capable of measuring up to 1000V dc & ac rms to confirm that less than 50V is present between all power terminals and earth.
7. Unless otherwise stated, this product must NOT be dismantled. In the event of a fault the drive must be returned. Refer to "Routine Maintenance and Repair".

### **WARNING! - Ignoring the following may result in injury or damage to equipment**

#### **SAFETY**

**Where there is conflict between EMC and Safety requirements, personnel safety shall always take precedence.**

- Never perform high voltage resistance checks on the wiring without first disconnecting the drive from the circuit being tested.
- Whilst ensuring ventilation is sufficient, provide guarding and /or additional safety systems to prevent injury or damage to equipment.
- When replacing a drive in an application and before returning to use, it is essential that all user defined parameters for the product's operation are correctly installed.
- All control and signal terminals are SELV, i.e. protected by double insulation. Ensure all external wiring is rated for the highest system voltage.
- Thermal sensors contained within the motor must have at least basic insulation.
- All exposed metalwork in the Inverter is protected by basic insulation and bonded to a safety earth.
- RCDs are not recommended for use with this product but, where their use is mandatory, only Type B RCDs should be used.

#### **EMC**

- In a domestic environment this product may cause radio interference in which case supplementary mitigation measures may be required.
- This equipment contains electrostatic discharge (ESD) sensitive parts. Observe static control precautions when handling, installing and servicing this product.
- This is a product of the restricted sales distribution class according to IEC 61800-3. It is designated as "professional equipment" as defined in EN61000-3-2. Permission of the supply authority shall be obtained before connection to the low voltage supply.

### **CAUTION!**

#### **APPLICATION RISK**

- The specifications, processes and circuitry described herein are for guidance only and may need to be adapted to the user's specific application. We can not guarantee the suitability of the equipment described in this Manual for individual applications.

#### **RISK ASSESSMENT**

Under fault conditions, power loss or unintended operating conditions, the drive may not operate as intended.

In particular:

- Stored energy might not discharge to safe levels as quickly as suggested, and can still be present even though the drive appears to be switched off
- The motor's direction of rotation might not be controlled
- The motor speed might not be controlled
- The motor might be energised

A drive is a component within a drive system that may influence its operation or effects under a fault condition.

Consideration must be given to:

- Stored energy
- Supply disconnects
- Sequencing logic
- Unintended operation

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# 8903/AI - 8903/EP OPTION

## Introduction

The high resolution Analog Input Option adds a sixth analogue input to the 890 drive. This input can be used, as the other inputs, within a configuration or directly as the speed setpoint for a fast response time.

In addition to this Analog Input the 8903/AI option provides an incremental encoder input as well as an incremental encoder output.

The 8903/EP Encoder Option has the same functionalities of the 8903/AI except the analogue input.

## Product Features

- -10/+10V optically isolated analogue input with a resolution of 15 bits + sign (not available on 8903/EP)
- Incremental encoder input with optically isolated differential inputs on channel A, B and Z.
- All input channels are compatible with RS422/RS485 encoders as well as encoders that provide output voltages as high as  $\pm 30V$ .
- Decoding logic to interface the encoder input to the drive's microprocessor
- Three non-isolated differential digital outputs used for synthesizing an encoder output. These outputs require a supply input. The magnitude of this supply defines the output voltage of these outputs.

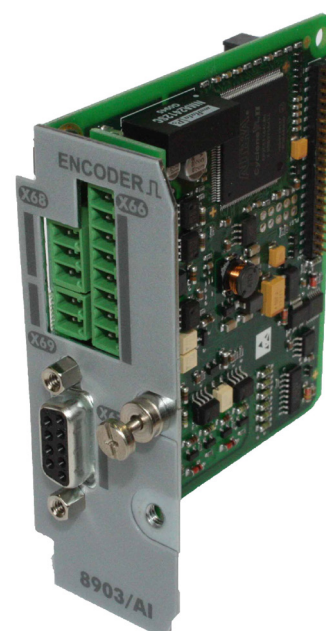


Figure 1 8903-AI Option

## Product Order Code

Not fitted order code:

**8903-AI-00** High resolution analogue input option

**8903-EP-00** Encoder option

Factory fitted order code: (Fitted to slot B)

High resolution analogue input option: 890xx-xxxxxxxx-xxx-xxxx**R**

Encoder option: 890xx-xxxxxxxx-xxx-xxxx**E**

## Compatible Firmware

This option will work with the following version of 890 firmware:

Version 2.5 onwards

Version 3.5 onwards

Not compatible with Version 20.X.

## Used On

These options can be fitted to all 890SD and 890CD drives. The drives have the following product codes:

890SD      890SD Standalone Drive

890CD      890CD Common Bus Drive

Refer to the 890 Engineering Reference Manual, Appendix E for Product Code details.



## Specifications

### Analogue Input (not available on 8903/EP)

Resolution	15 bits + sign
Input Voltage Range	$\pm 11\text{V}$
Input Format	Differential
Input Impedance	14K $\Omega$
Input low pass filter	3KHz
Terminal Wire Size (maximum)	16 AWG
Terminal Type	3-way pluggable 3.5mm terminal block
Terminal Tightening Torque	0.4Nm (3.5 pound-inches)

### Encoder Input

Maximum Pulse Rate	250kHz
Receiver Current	$\leq 10\text{mA}$ per channel
Input Format	Two differential channels in quadrature, clock/dir or clock only
Input Voltage Range	$\pm 30\text{V}$ (differential) 0-30V (single-ended)
Input Voltage Threshold	3V $\pm$ 1V (differential) 8V $\pm$ 1V (single-ended)
Terminal Type	9-way, D-type socket

### Encoder Supply

Terminal Type	2-way pluggable 3.5mm terminal block
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### Encoder Output

Operating Input Supply Voltage ( $V_s$ )	5V to 24V
Absolute Maximum Supply Voltage	30V
Maximum Output Current	$\pm 100\text{mA}$ per output
Output Voltage (low logic level)	$< 3\text{V}$ at 100mA
Output Voltage (high logic level)	$> V_s - 4\text{V}$ at 100mA
Overload and short circuit duration	Indefinite
Maximum Output Frequency	250kHz on each output
Terminal Type	8-way pluggable 3.5mm terminal block
Maximum cable length	150 metres. Screened cable is recommended for all lengths, but essential if over 30 metres in order to comply with EMC regulations.

## Recommended Spare Parts

We recommend that one Option is kept as a spare to reduce down-time.

## Installation

### WARNING!

Before installing, ensure that the drive wiring is electrically isolated and cannot be made "live" unintentionally by other personnel. Wait 5 minutes after disconnecting power before working on any part of the system or removing the covers from the drives.

#### To Remove the Control Board

1. Remove the blanking plates, each secured by a single screw, that fits over the option slots(1).
2. Loosen the top and bottom screws from the handles on the Control Board (2).
3. Pull gently on the handles and slide the Control Board (2) out of the drive.

**Note:** Save the blanking plate and screw for future use. The drive should not be operated without either an option or a blanking plate fitted. When fitted, these maintain the drive's IP20 rating.

#### Caution

This Option contains ESD (Electrostatic Discharge) sensitive parts. Observe static control precautions when handling, installing and servicing this Option.



Figure 2. 890 showing Control Board withdrawn with Options fitted

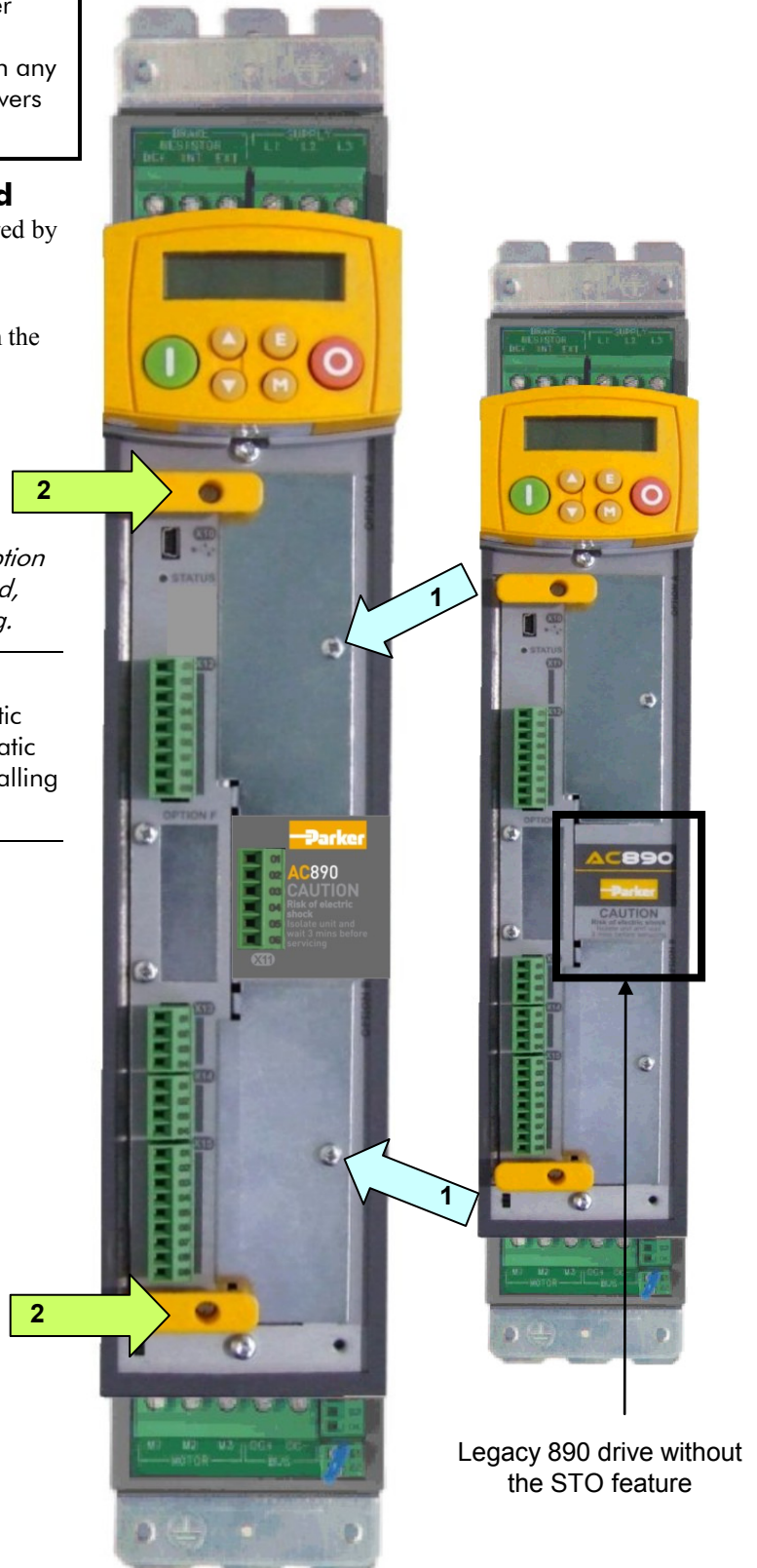
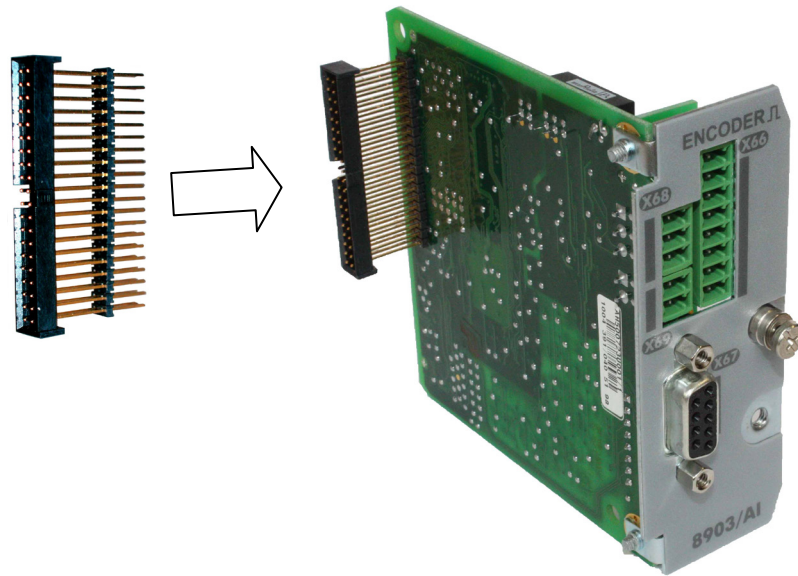


Figure 3. Front of 890 drive showing Control Board fitted

## Fitting the 8903/AI – 8903/EP Option

The Option fits onto the Control Board in the OPTION A (TOP) or the OPTION B (bottom) position. (Only one option of this type permitted).

1. Insert the connector into the Option as shown. The legs of the connector will protrude through into the connector on the other side of the Option.
2. Press the assembly into the TOP connector on the Control Board. Ensure that the front panel of the Option overlaps the front of the Control Board. Ease the connector at the Option so that the two PCB's are parallel when viewed on edge.



**Figure 4. Fitting the connector to the Option**

### Re-fitting the Control Board

1. Slide the board into the drive, engaging the edges of the boards into the slots. Push until the back edge of the Control Board PCB locates with the connectors in the drive.
2. Tighten in position using the top and bottom screws in the handles of the Control Board.
3. Screw the Option in position using the captive screw on the front of the Option.

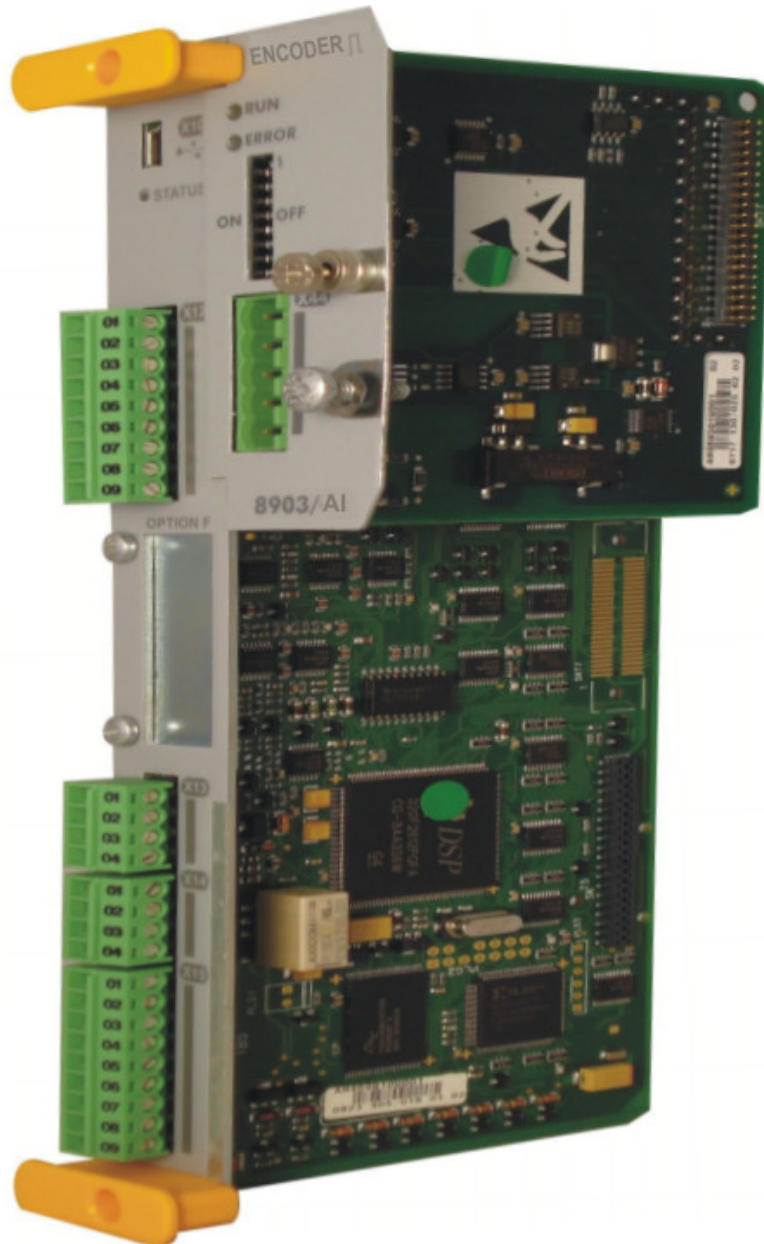


Figure 5. 890 Control Board with an example of an Option fitted

## Wiring the System

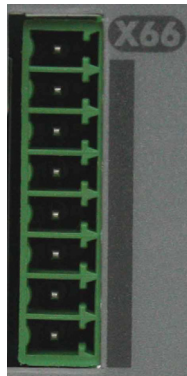
### WARNING!

Disconnect all sources of power before attempting installation.

### Caution

This Option contains ESD (Electrostatic Discharge) sensitive parts. Observe static control precautions when handling, installing and servicing this Option.

## Encoder Output - X66



Pin Number	Description
1	Channel A retransmit output
2	Inverse of Channel A retransmit output
3	Channel B retransmit output
4	Inverse of Channel B re-transmit output
5	Channel Z retransmit output
6	Inverse of Channel Z retransmit output
7	Positive Supply for Encoder Output (Vs)
8	Negative Supply for Encoder Output. It is connected internally to drive 0V

Output voltage dependant on Vs.

## Encoder Input – X67

Take special care wiring the encoders to the Options due to the low level of the signals.

- Use twisted-pair, screened cable with an overall screen and a screen over each individual pair. The signal pairs should have characteristic impedance of  $120\Omega \pm 20\Omega$ .
- To ensure compliance with the EMC Directive connect the overall cable screen to the encoder body and to the cable clamp.
- Use the encoder manufacturer's recommended cable.
- The maximum cable length is 150 metres.
- The encoder power supply should be provided using an external power supply connected to X69.

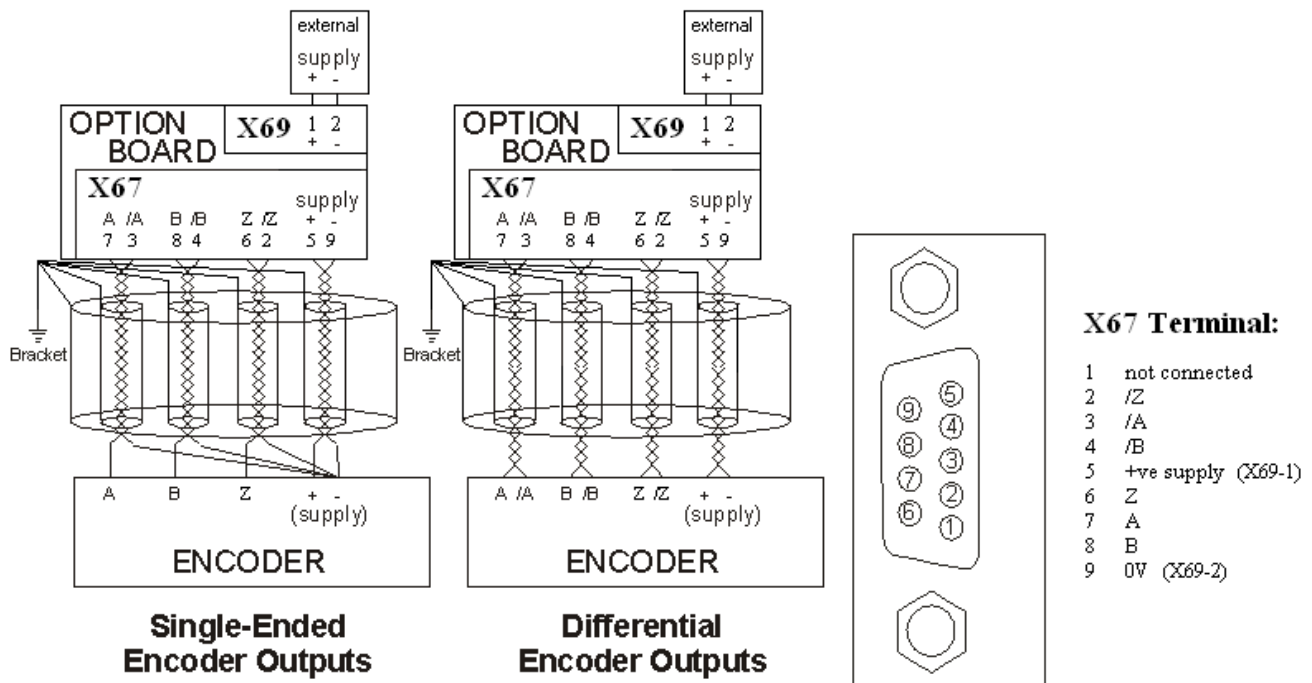


Figure 5 Wiring Diagram

## Parker SSD Drives Approved Encoders

Parker SSD Drives recommend the use of the following encoders:

Recommended Encoder (12mm bore)	Hengstler:	RI 58TD//2048ED.37IF
	Parker SSD Drives Part Number:	DD464475U012
Recommended Encoder (North America) (Hollow Shaft, Various Bores)	BEI(HS35 series):	924-01070-279, -283, -281
	Parker SSD Drives Part Number: Frame Designs: TENV, TEBC, TEFC	DD470666, DD470667, DD471123
Alternative Encoders (20mm bore)	Hengstler:	RI 76TD/2048ED-4N20IF
	Parker SSD Drives Part Number:	DD464475U020

Encoders are available from Hengstler or BEI in other accuracies such as 500 lines/rev or 2000 lines/rev to suit the application.

## Analogue Input – X68 (not available on 8903/EP)

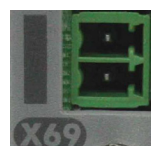
Note: Terminals X68 are electrically isolated from the drive electronics.



Pin Number	Description
1	Cable screen connection.
2	Analogue input negative terminal. It is the signal reference for X68/3.
3	Analogue input positive terminal. Voltage range is $\pm 10V$ relative to terminal X68/2.

Connections to X68 are recommended to be by screened twisted pair cable. Connect the cable screen to terminal X68/1.

## Encoder Supply - X69



Pin Number	Description
1	Positive Supply for Encoder Input X67 pin 5
2	Negative Supply for Encoder Input X67 pin 9



## Initial Set-up

### Configuring the 890 Drive

Use the DSE Configuration Tool to configure the ENCODER function block, as detailed below.

**Note:** The DSE Configuration Tool is Parker SSD Drives' Windows-based block programming software and is supplied with each drive.

### ENCODER / REFERENCE ENCODER Function Block

SETUP::MOTOR CONTROL::ENCODER (if no feedback card is fitted)

SETUP::PHASE CONTROL::REFERENCE ENCODER (if a feedback card is fitted)

This block allows Speed Feedback or a Reference Encoder to be measured using a quadrature pulse encoder.

#### Parameter Descriptions

Ignore the setting for this parameter

Ignore the setting for this parameter

**PULSE ENC VOLTS**    *PREF: 71.01*    *Default: 10.0 V*    *Range: 10.0 to 20.0 V*  
*PREF 158.01*

Set this approximately to the supply voltage required by the pulse encoder.

**SINCOS ENC VOLTS**    *PREF: 71.22*    *Default: 5.0 V*    *Range: See below*  
*PREF 158.22*

Set the supply volts required by the sin/cos encoder.

*Enumerated Value : SinCos Encoder Volts*

0 : 5V

1 : 10V

**ENCODER LINES**    *PREF: 71.02*    *Default: 2048*    *Range: 250 to 262143*  
*PREF 158.02*

Set the number of lines to match the type of encoder being used. Incorrect setting of this parameter will result in an erroneous speed measurement.

**ENCODER INVERT**    *PREF: 71.03*    *Default: FALSE*    *Range: FALSE/TRUE*  
*PREF 158.03*

Used to match the encoder direction to the motor direction. When TRUE, changes the sign of the measured speed and the direction of the position count. Setting the encoder direction should be done as part of the Autotune when running in Closed-loop Vector Mode.

**LOAD G'BOX RATIO**    *PREF: 71.05*    *Default: 1*    *Range: 1 to 64*  
*PREF 158.05*

This parameter can be used to configure absolute position control applications. It must be an integer gear box ratio, e.g. 64:1. If there is a gearbox between the motor and the load, set the gearbox ratio via this parameter. "LOAD POSITION" i.e. the position of the load on the other side of the gearbox, will then be calculated.

**ENCODER MECH O/S**    *PREF: 71.06*    *Default: 0.0000 deg*    *Range: 0.0000 to 360.0000 deg*  
*PREF 158.06*

(encoder mechanical offset)

Use this parameter to enter a mechanical offset of between 0 and 360 degrees to allow the output shaft position to be correctly zeroed. This value is subtracted from the LOAD POSITION which is reported by the encoder.

To zero the shaft position: turn the shaft to the zero position; note the value of the LOAD POSITION parameter, and enter this value into the ENCODER MECH O/S parameter.

LOAD POSITION will now read zero.

Note that "load position" refers here to the shaft position on the other side of a gearbox which may be mounted on the motor output. It does not refer to the motor shaft position, unless the output gearbox ratio (LOAD G'BOX RATIO) is set to 1 (i.e. no gearbox fitted).

**ENCODER FBK %**    *PREF: 71.08*    *Default: —.xx %*    *Range: —.xx %*  
*PREF 158.08*

This parameter shows the mechanical speed of the motor shaft, calculated from the encoder feedback, as a percentage of the user maximum speed setting (MAX SPEED in the REFERENCE function block).

## Parameter Descriptions

**SHAFT POSITION**      *PREF: 71.09*      *Default: —.xx deg*      *Range: —.xx deg*  
*PREF 158.09*

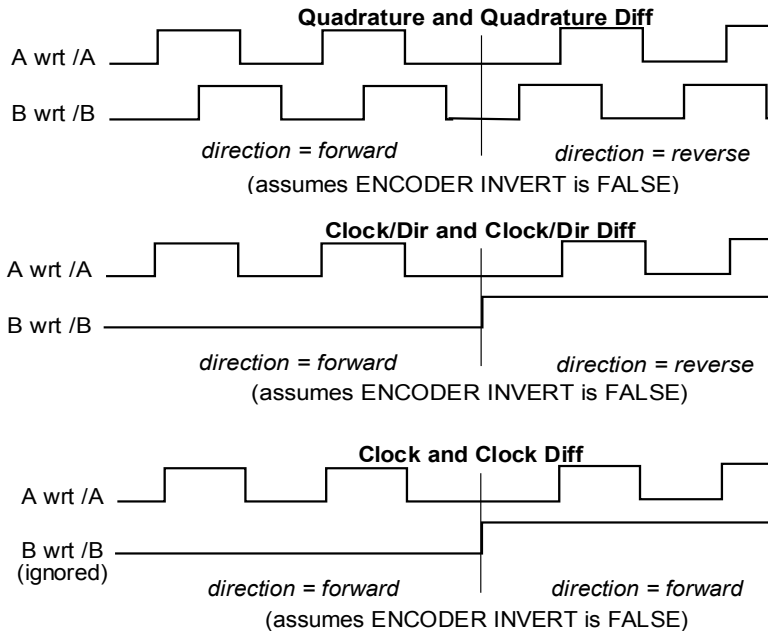
This diagnostic provides the motor shaft position (before the gear box).

**LOAD POSITION**      *PREF: 71.10*      *Default: —.xx deg*      *Range: —.xx deg*  
*PREF 158.10*

This is the position of a shaft on the other side of a gearbox attached to the motor. If a gearbox is not fitted, set LOAD G'BOX RATIO to 1. This variable is controlled by the position loop, i.e. the position loop will force the load position to equal the demanded position.

**ENCODER TYPE**      *PREF: 71.04*      *Default: 0*      *Range: See below*  
*PREF 158.04*

This parameter defines the type of encoder being used.



Enumerated Value : Type

0 : QUADRATURE	single-ended pulse encoder
1 : CLOCK/DIR	single-ended pulse encoder
2 : CLOCK	single-ended pulse encoder
3 : QUADRATURE DIFF	differential pulse encoder
4 : CLOCK/DIR DIFF	differential pulse encoder
5 : CLOCK DIFF	differential pulse encoder
6 : SINCOS INC	sin/cos encoder
7 : ABS ENDAT ST	single turn endat absolute encoder
8 : ABS ENDAT MT	multi-turn endat absolute encoder



## SYNTHETIC ENCODER Function Block

### SETUP::PHASE CONTROL::SYNTHETIC ENCODR

This function generates A, B, and Z pulses, equivalent to an encoder following the either the virtual master or the motor shaft or the load position (see SOURCE parameter).

#### Parameter Descriptions

<b>MODE SELECT</b>	<i>PREF: 160.01</i>	<i>Default: OFF</i>	<i>Range: See below</i>
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Enables or disables the function

*Enumerated Value :*

0 : OFF	disable the synthetic encoder
1 : RUN SYNTH ENCDR	enable the synthetic encoder
2 : REPEAT FBK ENCDR	(not functional with this option board)
3 : REPEAT REF ENCDR	(not functional with this option board)

<b>SOURCE</b>	<i>PREF: 160.09</i>	<i>Default: V</i>	<i>Range: See below</i>
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*MASTER POS'N*

Set the source signal that will drive the encoder output.

*Enumerated Value :*

0 : V MASTER POS'N
1 : FBK ENCDR SHAFT
2 : FBK ENCDR LOAD
3 : REF ENCDR SHAFT
4 : REF ENCDR LOAD

<b>ENCODER LINES</b>	<i>PREF: 160.02</i>	<i>Default: 1024</i>	<i>Range: 4 to 10000</i>
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Set the number of lines of the simulated encoder.

<b>DIRECTION</b>	<i>PREF: 160.03</i>	<i>Default: SAME AS</i>	<i>Range: See below</i>
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*SOURCE*

This parameter allows to invert the synthetic encoder direction regarding the source direction.

*Enumerated Value :*

0 : SAME AS SOURCE	set to this if the synthetic encoder follows the source's direction
1 : REVERSE OF SRCE	set to this if the synthetic encoder direction should be inverted

<b>Z PULSE OFFSET</b>	<i>PREF: 160.05</i>	<i>Default: 0.0000 deg</i>	<i>Range: 0.0000 to 360.0000 deg</i>
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This parameter sets the position in degrees at which the marker pulse (Z pulse) occurs.

## SPEED LOOP Function Block

### SETUP::MOTOR CONTROL::SPEED LOOP

In order to use the analogue input as a direct speed setpoint the following parameters must be set accordingly.

#### Parameter Descriptions

<b>DIRECT IP SELECT</b>	<i>PREF: 78.10</i>	<i>Default: NONE</i>	<i>Range: See below</i>
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The direct input to the speed loop is an analogue input which is sampled synchronously with the speed loop. This ensures that the speed loop always has the most up-to-date value of the input, allowing it to respond faster. Any one of the six analogue inputs can be selected as the direct input. If NONE is selected, the input is set to zero. If ANIN6 is selected but the 8903/AI board is not fitted, the input is set to zero. When not in use, it should be disabled by selecting NONE.

*Enumerated Value : Direct IP Select*

- 0 : NONE
- 1 : ANIN1
- 2 : ANIN2
- 3 : ANIN3
- 4 : ANIN4
- 5 : ANIN5
- 6 : ANIN6

<b>DIRECT RATIO</b>	<i>PREF: 78.11</i>	<i>Default: 1.0000</i>	<i>Range: -10.0000 to 10.0000</i>
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The Direct Input is multiply by this parameter.

<b>DIRECT IP POS LIM</b>	<i>PREF: 78.11</i>	<i>Default: 110.00 %</i>	<i>Range: -110.00 to 110.00 %</i>
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This parameter limits the upper value of the Direct Input.

<b>DIRECT IP NEG LIM</b>	<i>PREF: 78.12</i>	<i>Default: -110.00 %</i>	<i>Range: -110.00 to 110.00 %</i>
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This parameter limits the lower value of the Direct Input.

#### Save the Application

Remember to save your new configuration in DSE 890 and install it in the drive. In DSE 890, select "Command→Install At Selected" to install the currently opened configuration into a drive.

## Disposal

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This product contains materials which are consignable waste under the Special Waste Regulations 1996 which complies with the EC Hazardous Waste Directive - Directive 91/689/EEC.

We recommend you dispose of the appropriate materials in accordance with the valid environmental control laws. The following table shows which materials can be recycled and which have to be disposed of in a special way.

Material	Recycle	Disposal
metal	yes	No
plastics material	yes	No
printed circuit board	no	yes

The printed circuit board should be disposed of in one of two ways:

1. High temperature incineration (minimum temperature 1200°C) by an incinerator authorised under parts A or B of the Environmental Protection Act
2. Disposal in an engineered land fill site that is licensed to take aluminium electrolytic capacitors. Do not dispose of in a land fill site set aside for domestic waste.

### Packaging

During transport our products are protected by suitable packaging. This is entirely environmentally compatible and should be taken for central disposal as secondary raw material.







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