

# **8902/E1**

# **Sin/Cos Speed Feedback**

# **Option**

Technical Manual

HA469252U001 Issue 1

Compatible with Version 1.x Software

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# Safety Information



## **WARNING!**

During commissioning, remove the fuses (or trip the circuit breaker) on your 3-phase supply.  
Make sure the power is OFF, and that it cannot be switched on accidentally whilst you are working.

**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, and to enable the user to obtain maximum benefit from the equipment.

## **Application Area**

The equipment described is intended for industrial motor speed control utilising 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.

## **REFER TO YOUR MAIN PRODUCT MANUAL FOR SPECIFIC SAFETY INFORMATION ABOUT THE DEVICE YOU ARE CONTROLLING**

## **WARRANTY**

SSD Drives warrants the goods against defects in design, materials and workmanship for the period of 12 months from the date of delivery on the terms detailed in SSD Drives Standard Conditions of Sale IA058393C.

SSD Drives reserves the right to change the content and product specification without notice.



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# SIN/COS SPEED FEEDBACK OPTION

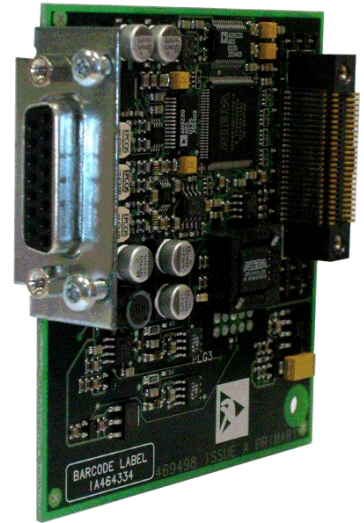
## Description

The Sin/Cos Speed Feedback Option allows 1V p-p (point-to-point) Sin/Cos encoders to be connected directly to the motor controller to provide highly accurate speed feedback measurement.

### Features

The Option has the following features:

- Interpolates each encoder line with 12-bit accuracy giving 4 million counts per revolution on a 1024 line encoder
- Decoding logic to interface the encoder to the microprocessor
- Supplies 5V or 10V to the encoder
- Will decode Heidenhain Endat 2.1 Absolute Position Encoders



**Figure 1 Sin/Cos Speed Feedback Option**

### Part Number

The part number for the Sin/Cos Speed Feedback Option is :

8902/E1/00/00

8902/E1/00/FF (indicates a factory-fitted Option)

### Used On

- This Option can be used on 890 drives with 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

Maximum Pulse Rate	250kHz
Receiver Impedance	120Ω
Input Format	Two differential 1V p-p signals in quadrature
Encoder Supply	Maximum load = 250mA Voltage adjustable: 5V/10V
Terminal Type	15-way, D-type socket

### Recommended Spare Parts

We recommend that you keep one Option as a spare to reduce down-time.

# 2

## Installation

### Fitting the Option

If the Option is not factory-fitted, follow the procedure given below.

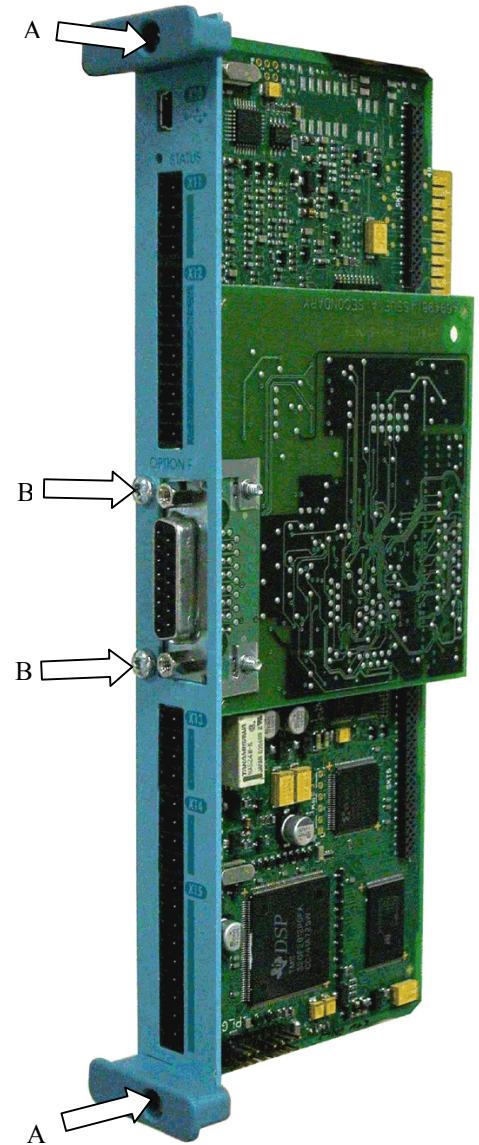
#### **WARNING!**

Disconnect all sources of power before attempting installation.

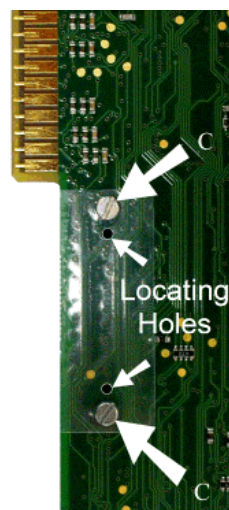
#### **Caution**

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

1. Undo the two screws securing Option A and Option B to the front of the drive. If Options are not fitted, completely remove the blank covers for the Option A and Option B slots.
2. Undo the screws (A) located in the top and bottom handles of the control board. Gently pull on the handles to withdraw the board from the drive, supporting any attached option boards. Note that the boards are sliding in top and bottom slots.
3. Offer up the Sin/Cos Option through the "OPTION F" cut-out as shown opposite.
4. Fit the two locating pegs of the large connector on the rear edge of the option board into the locating holes on the control board, as shown below.
5. Secure with the two screws (B) to the front of the control board.
6. Fit the two screws (C) at the rear edge of the Option.
7. Replace the control board (with attached Options) into the drive.
8. Tighten the Option A and Option B screws; or importantly, fit the blank covers and secure with the screws.



**Figure 2 Control board showing Option correctly mounted**



**Figure 3 Rear of Control Board**

# 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.

## D-Type Connections

Take special care wiring the encoders to the Option 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 120Ω. To ensure compliance with the EMC Directive the overall cable screen should be connected to the encoder body and to the cable clamp.

Use the encoder manufacturer's recommended cable.

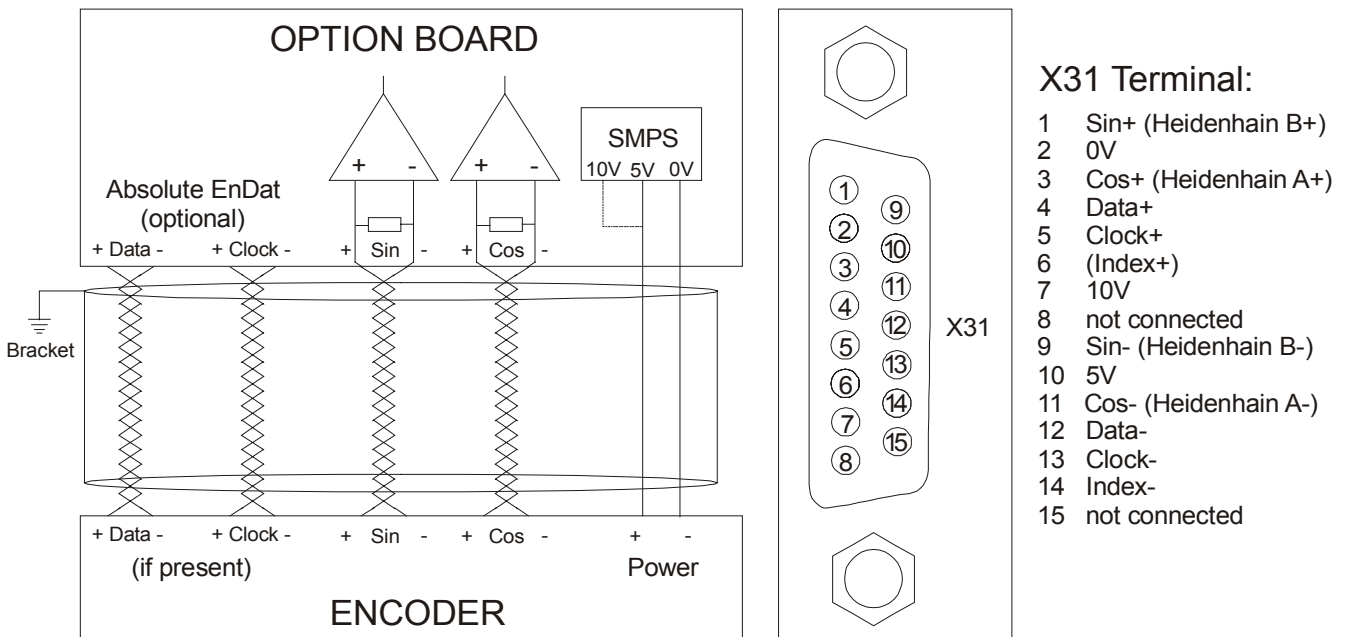


Figure 4 Wiring Diagram

## Initial Set-up

### Configuring the 890 Drive

Use the DSE 890 Configuration Tool to configure the ENCODER function block, as detailed below.


*The DSE 890 Configuration Tool is SSD Drives' Windows-based block programming software and is supplied with each drive.*

### ENCODER Function Block

#### SETUP::MOTOR CONTROL::ENCODER

This block allows Speed Feedback to be measured using a Sin/Cos encoder.

Ignore the setting for this parameter



#### Parameter Descriptions

Parameter	PREF	Default	Range
<b>PULSE ENC VOLTS</b>	71.01	10.0 V	5.0 to 20.0 V
Set this approximately to the supply voltage required by the pulse encoder.			
<b>SINCOS ENC VOLTS</b>	71.22	5.0 V	See below
Set the supply volts required by the sin/cos encoder.			
<i>Enumerated Value</i> : SinCos Encoder Volts			
0 : 5V			
1 : 10V			
<b>ENCODER LINES</b>	71.02	2048	250 to 262413
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.			
<b>ENCODER INVERT</b>	71.03	FALSE	FALSE/TRUE
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.			
<b>ENCODER TYPE</b>	71.04	0	See below
This parameter defines the type of encoder being used.			
<i>Enumerated Value</i> : 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	
<b>LOAD G'BOX RATIO</b>	71.05	1	1 to 64
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.			

## Parameter Descriptions

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

(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 %*

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).

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

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

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

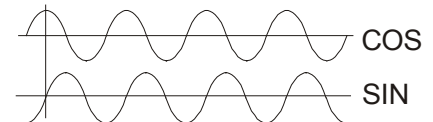
This is the position of a shaft on the other side of a gearbox attached to the motor. If a gearbox is not fitted, set LOAD G'BOX RATIO to 1. This variable is controlled by the position loop, i.e. the position loop will force the load position to equal the demanded position.

## 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.

## Functional Description

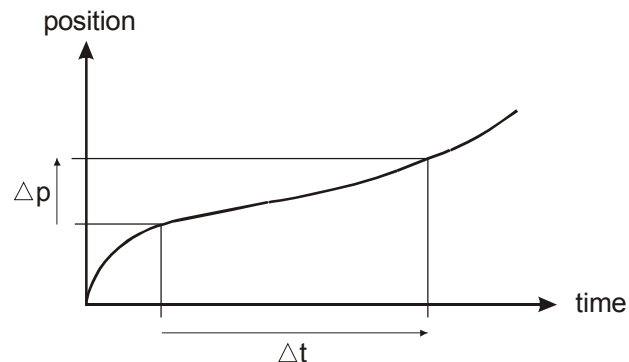
A Sin/Cos encoder uses 2 input signals, SIN and COS which by definition are offset by a quarter of a cycle (90°). Direction is obtained by looking to see if SIN is leading or lagging the COS signal.



A coarse position is obtained by incrementing or decrementing a counter when the polarity of the SIN signal changes with the COS signal high. This gives one count per encoder line.

The SIN and COS inputs are further sampled by a 12-bit ADC (analog-digital converter) so that encoder position can be interpolated within one line count, eg. for a 1024 line encoder this gives:

$$1024 \times 2^{12} \text{ counts per revolution} = 4,194,304 \text{ counts per revolution}$$



High resolution speed can now be calculated from this high resolution position:

$$\text{speed} = \frac{\Delta \text{position}}{\Delta \text{time}}$$


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## SSD Drives Approved Encoders

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SSD Drives recommend the use of the following encoders:

	1V p-p	EnDat 2.1	Single Turn ABS	Multi-turn ABS
<b>Heidenhain:</b>				
EQN425	✓	✓		✓
ECN413	✓	✓	✓	
ERN480	✓			
<b>Stegmann:</b>				
HG660 AKR(xxxx)S	✓			
HG660 DKR(xxxx)S	✓			
<b>Hengstler:</b>				
RIS58-H	✓			

ISS.	MODIFICATION	ECN No.	DATE	DRAWN	CHK'D
1	Initial Issue (HA469252U001)	17320	14/04/05	CM	SS
FIRST USED ON		MODIFICATION RECORD			
		DRAWING NUMBER			SHT. 1
		ZZ469252C001			OF 1

