

Contents

Preface

Safety

Product Overview

Unpacking

Electrical
Connection

Software
Installation

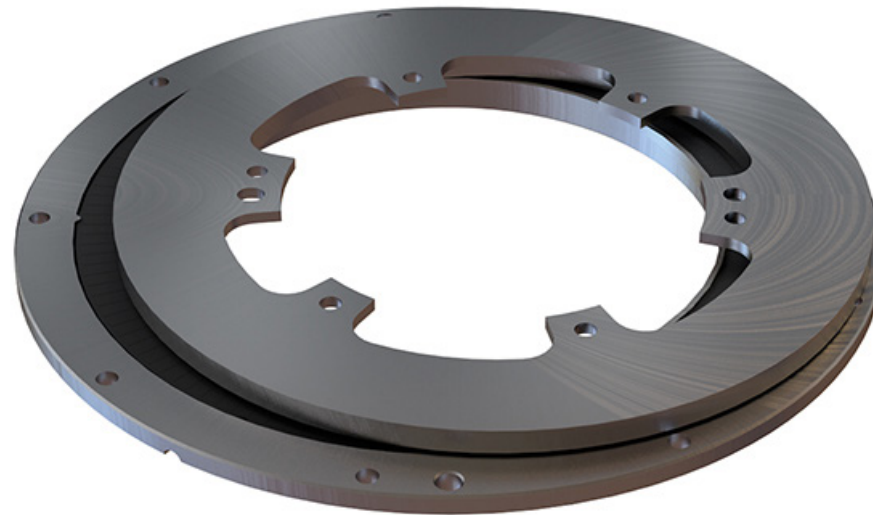
Mounting
Verification

Calibration

Mechanical ICD

Mounting options

Absolute Position Encoder



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Contents

Preface
Safety
Product Overview
Unpacking
Electrical Connection
Software Installation
Mounting Verification
Calibration
Mechanical ICD
Mounting options

1.1 TABLE OF CONTENTS

1.	Preface	3
1.1	Version : 1.0 April 2016	3
1.2	Applicable documents	3
2.	Safety	3
2.1	Safety issues	3
2.2	ESD notes	3
3.	Product Overview	4
3.1	Overview	4
3.2	Installation flow chart	4
3.3	Encoder Mounting	5
4.	Unpacking	7
4.1	Standard Order	7
5.	Electrical interconnection	8
6.	Software Installation	9
6.1	Minimum Requirements	9
6.2	Installing the Software	9
7.	Calibration	12
7.1	Offset Calibration	12
8.	Mounting Verification	13
8.1	Starting the Encoder Explorer	13
8.2	Mechanical Installation Verification	13
8.3	CAA Calibration	14
8.4	Setting the Encoder Zero Point	15
8.5	Jitter test	15

Contents

Preface

Safety

Product Overview

Unpacking

Electrical
Connection

Software
Installation

Mounting
Verification

Calibration

Mechanical ICD

Mounting options

1. PREFACE

1.1 VERSION : 1.0 APRIL 2016

1.2 APPLICABLE DOCUMENTS

- [DF-150 Electric Encoder data sheet](#)

2. SAFETY

2.1 SAFETY ISSUES

2.2 ESD NOTES

Although the DF-150 Electric Encoder is insensitive to ESD and parasitic capacitive coupling from adjacent AC voltages, we highly recommend to enable a discharge path with $<20\text{ k}\Omega$ between the machine shaft and the electronics ground. Shielding: the Electric Encoder housing material is non-conductive polymer – ULTEM, the internal ground (return) path of the 5V power supply IS NOT CONNECTED to the cable shielding. We highly recommend grounding the cable shielding through the connector body or by other means.

Note: During high-speed rotation, bearings may isolate the shaft from its grounding. It is essential the shaft remain grounded using a sustainable method during such high-speed operations.

Contents

- Preface
- Safety
- Product Overview
- Unpacking
- Electrical Connection
- Software Installation
- Mounting Verification
- Calibration
- Mechanical ICD
- Mounting options

3. PRODUCT OVERVIEW

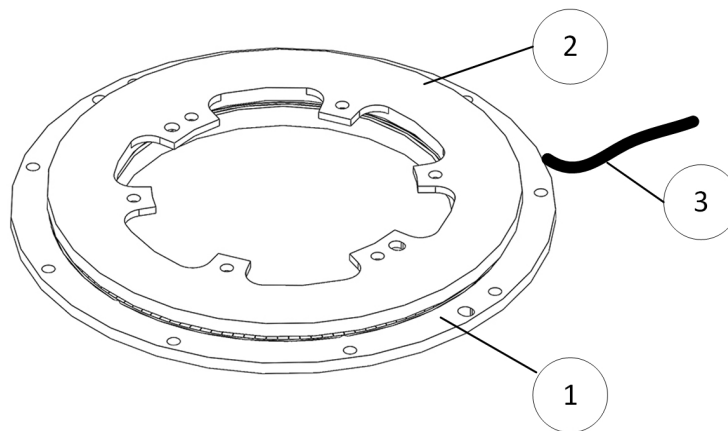
3.1 OVERVIEW

The DF-150 absolute position Electric Encoder™ is a revolutionary position sensor originally developed for harsh environment critical applications. Currently it performs in a broad range of applications, including defense, homeland security, aerospace, and medical and industrial automation.

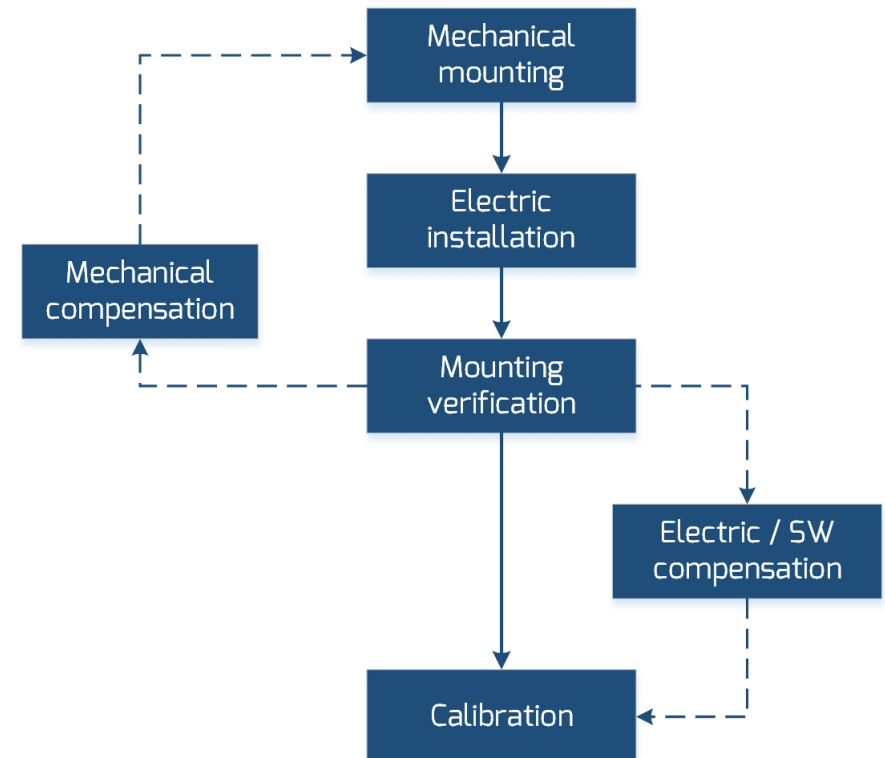
The Electric Encoder™ non-contact technology relies on an interaction between the measured displacement and a space/time modulated electric field.

The DF-150 Electric Encoder™ is semi-modular, i.e., its rotor and stator are separate, with the stator securely housing the rotor.

- (1) Encoder stator
- (2) Encoder rotor
- (3) Encoder cable



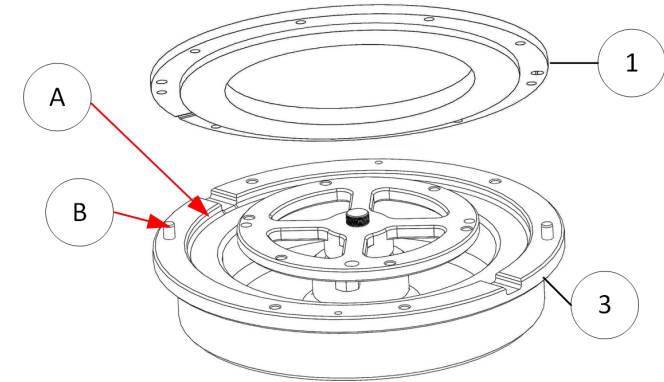
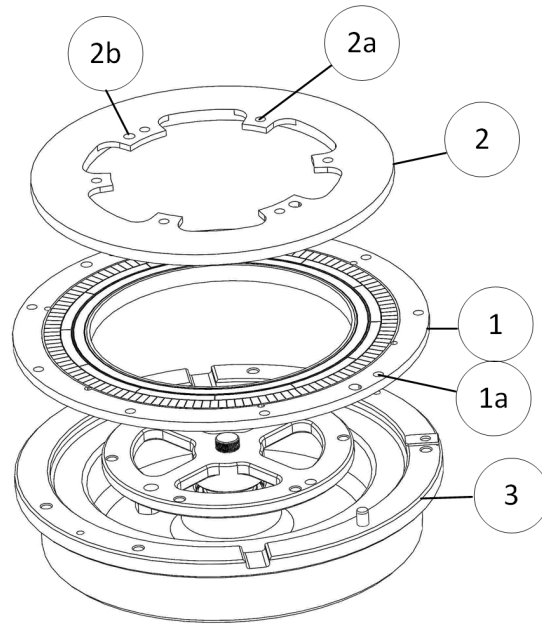
3.2 INSTALLATION FLOW CHART



Contents

- Preface
- Safety
- Product Overview
- Unpacking
- Electrical Connection
- Software Installation
- Mounting Verification
- Calibration
- Mechanical ICD
- Mounting options

3.3 ENCODER MOUNTING



Typical encoder installation includes

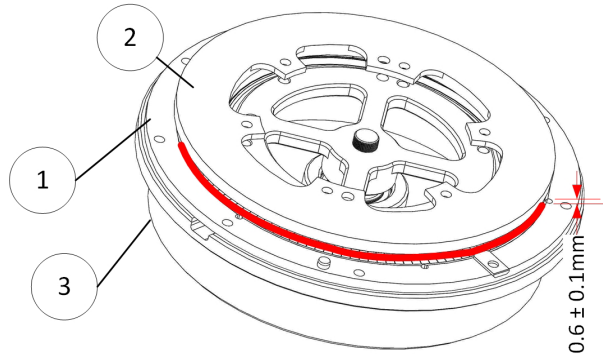
- **Encoder stator (1)** – Encoder stator , mounting centralization holes **(1a)**
- **Encoder rotor (2)** –Encoder rotor ,shaft mounting hole **(2a)** and centralization hole **(2b)**
- **Encoder Seating / stator (host machine) (3)** - with appropriate

The encoder stator is connected to the application static section and should be centralized by the circumference step **(A)** , 2 pins **(B)** fixed by [6] six screws (1a), the encoder rotor should be fixed by [4] four screws and centralized by 2 pins (2b).

- Contents**
- Preface
- Safety
- Product Overview
- Unpacking
- Electrical Connection
- Software Installation
- Mounting Verification
- Calibration
- Mechanical ICD
- Mounting options

ENCODER STATOR / ROTOR RELATIVE POSITION

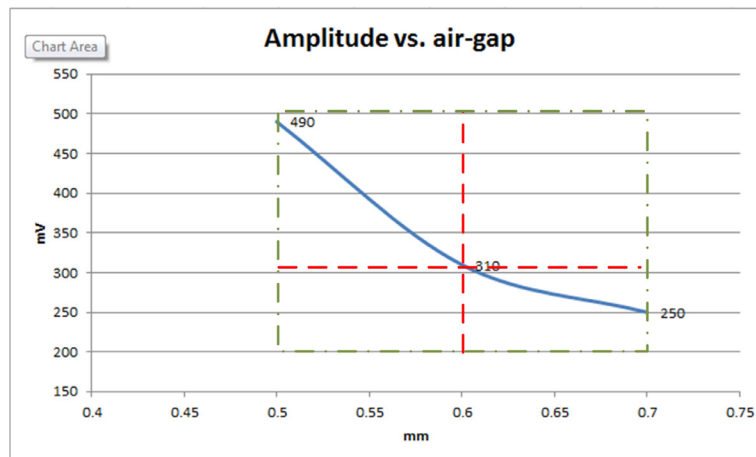
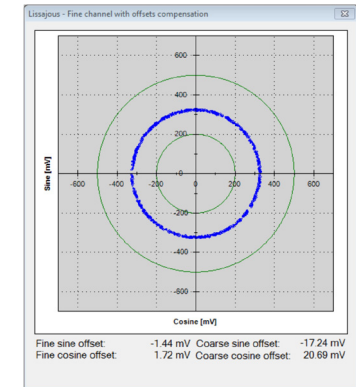
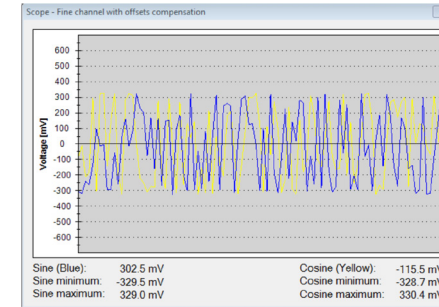
For proper performance the air gap should be 0.6mm +/- 0.1mm.



Proper mounting will ensure correct amplitude level of

Fine channel	200 - 500mV
Coarse channel	200 - 500mV

Proper rotor mounting can be verified by using the Encoder Explorer tools "signal analyzer" or "Mechanical installation verification"



Contents

Preface

Safety

Product Overview

Unpacking

Electrical
Connection

Software
Installation

Mounting
Verification

Calibration

Mechanical ICD

Mounting options

4. UNPACKING

4.1 STANDARD ORDER

The package of the standard DF-60 contains the encoder with 250mm shielded cable AWG30.

OPTIONAL ACCESSORIES:

- (1) **MP-01014** , DF-150 ,0.6mm filler gauge
- (2) **RJ-DF-150** , DF-150 demo jig
- (3) **EAPK008** , Kit , encoder mounting screws (3 screws M2x6)
- (5) **CNV-0003** , RS-422 to USB converter (with USB internal 5V power supply path)

Contents
Preface
Safety
Product Overview
Unpacking
Electrical Connection
Software Installation
Mounting Verification
Calibration
Mechanical ICD
Mounting options

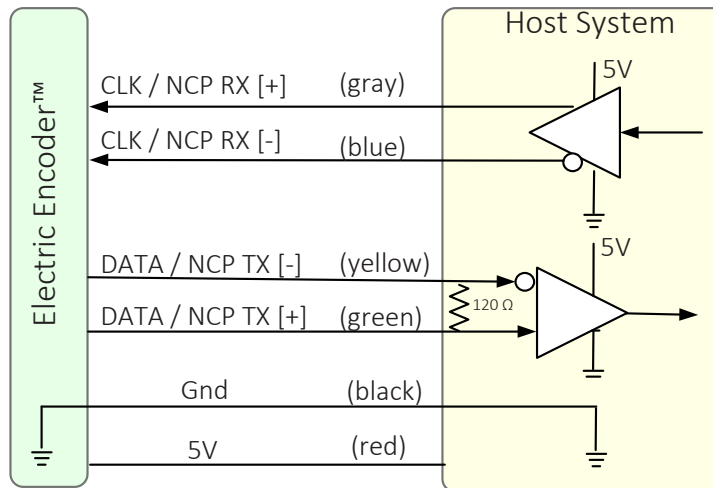
5. ELECTRICAL INTERCONNECTION

This chapter reviews the steps required to electrically connect the DF-150 with digital interface (SSi or BiSS-C).

CONNECTING THE ENCODER

The DF-150 operates has two operational modes:

(i) i. Absolute Position over SSi or BiSS-C: This is the power-up default mode.

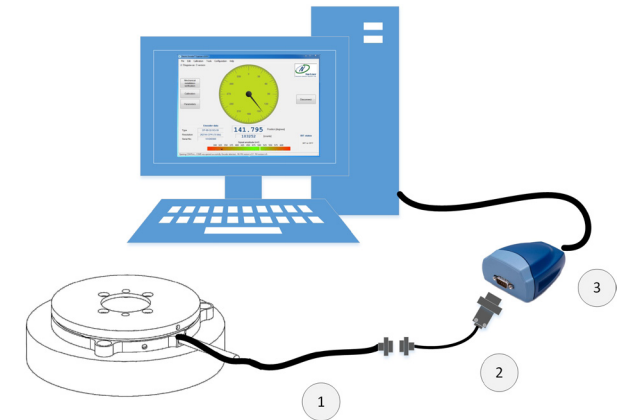


SSi / BiSS interface wires color code		
Clock +	Grey	Clock
Clock -	Blue	
Data -	Yellow	Data
Data +	Green	
GND	Black	Ground
+5V	Red	Power supply

(ii) Configuration and setup mode:

This service mode provides access via USB to a PC running Netzer Encoder Explorer application (on MS Windows 7/8). Communication is via Netzer Communication Protocol (NCP) over RS-422 using the same set of wires.

Use the following pin assignment to connect the encoder to a 9-pin D-type connector to the RS-422/USB converter CNV-0003.



(1) DF-60 encoder with SSi / BiSS interface.

(2/3) RS-422 / USB converter (CAT No. CNV-00003)

Electric Encoder interface , D Type 9 pin Female			
Description	Color	Function	Pin No
SSi Clock / NCP RX	Gray	Clock / RX +	2
	Blue	Clock / RX -	1
SSi Data / NCP TX	Yellow	Data / TX -	4
	Green	Data / TX +	3
Ground	Black	GND	5
Power supply	Red	+5V	8

Contents

Preface

Safety

Product Overview

Unpacking

Electrical
Connection

Software
Installation

Mounting
Verification

Calibration

Mechanical ICD

Mounting options

5.3 ELECTRICAL CONNECTION AND GROUNDING

The DF-150 does NOT come with specified cable and connector, however, do observe grounding consideration:

- [1] The cable shield does not connect to the power supply return line.
- [2] Ground the host shaft to avoid interference from the host system, which could result in encoder internal noise.

Note : 4.75 to 5.25 VDC power supply required

6. SOFTWARE INSTALLATION

The Electric Encoder Explorer (EEE) software:

- Verifies Mechanical Mounting Correctness
- Offsets Calibration
- Sets up general and signal analysis

This chapter reviews the steps associated with installing the EEE software application.

6.1 MINIMUM REQUIREMENTS

- Operating system: MS windows 7 , 32 / 64 bit
- Memory: 4MB minimum
- Communication ports: USB 2
- Windows .NET Framework , V4 minimum

6.2 INSTALLING THE SOFTWARE

Run the Electric Encoder™ Explorer file found on our website: [Encoder Explorer Sw Tools](#).

Contents

- Preface
- Safety
- Product Overview
- Unpacking
- Electrical Connection
- Software Installation
- Mounting Verification
- Calibration
- Mechanical ICD
- Mounting options

7. MOUNTING VERIFICATION

Perform mounting verification before calibration to ensure optimal performance by selecting [Verification] on the main screen of the Encoder Explorer or by using the signal analyzer under "Tools."

7.1 STARTING THE ENCODER EXPLORER

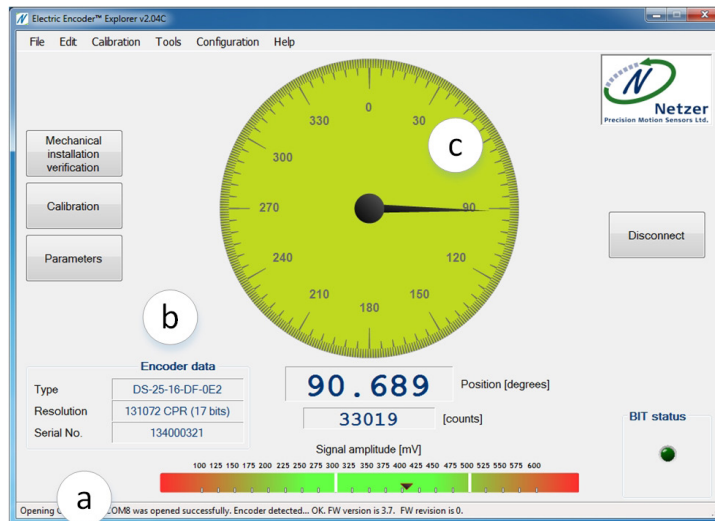
Make sure to complete the following tasks successfully:

- Mechanical Mounting
- Electrical Connection
- Connecting Encoder for Calibration
- Encoder Explore Software Installation

Run the Electric Encoder Explorer tool (EEE).

Ensure proper communication with the encoder:

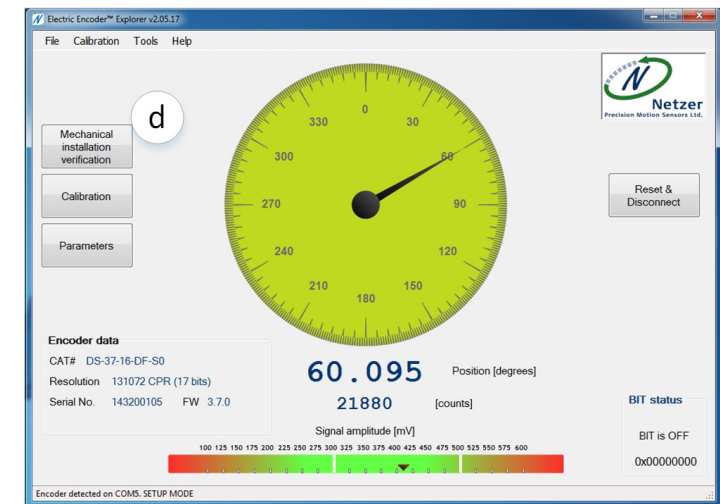
- (a) The status bar indicates successful communication.
- (b) Encoder data displays in the Encoder data area. (CAT No., serial No.)
- (c) The position dial display responds to shaft rotation.



7.2 MECHANICAL INSTALLATION VERIFICATION

The Mechanical Installation Verification provides procedures to ensure proper mechanical mounting by collecting raw data of the coarse and fine channels during rotation.

- (d) Select [Mechanical Mounting Verification] on the main screen.



Contents

Preface

Safety

Product Overview

Unpacking

Electrical
Connection

Software
Installation

Mounting
Verification

Calibration

Mechanical ICD

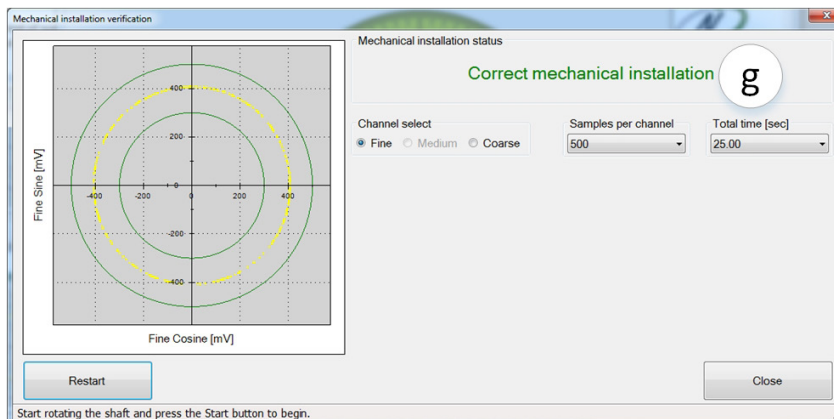
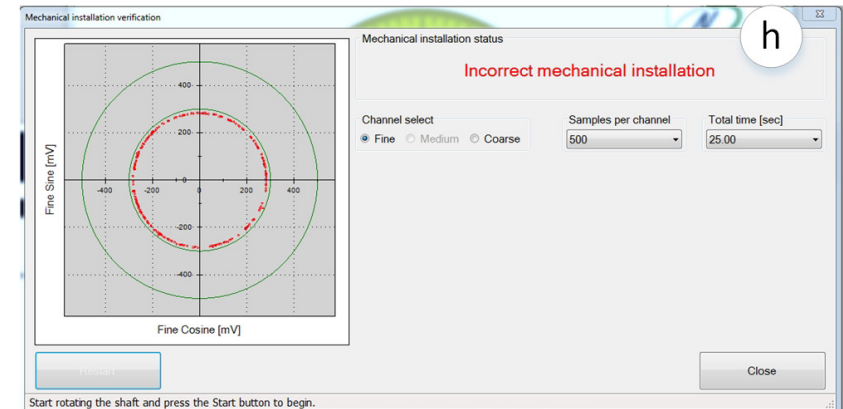
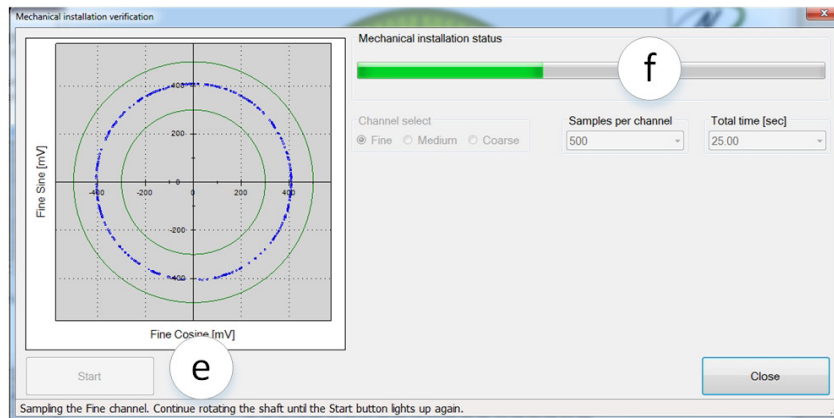
Mounting options

(e) Select [Start] to initiate the data collection.

(f) Rotate the shaft for data collecting of the fine/coarse channels.

(g) At the end of successful verification, SW shows "Correct Mechanical Installation."

(h) If SW indicates "Incorrect Mechanical Installation," place the mechanical shims below the rotor, as presented in paragraph 3.3 - "Rotor Relative Position."



Contents

Preface

Safety

Product Overview

Unpacking

Electrical
Connection

Software
Installation

Mounting
Verification

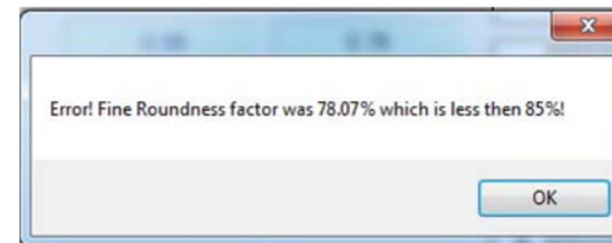
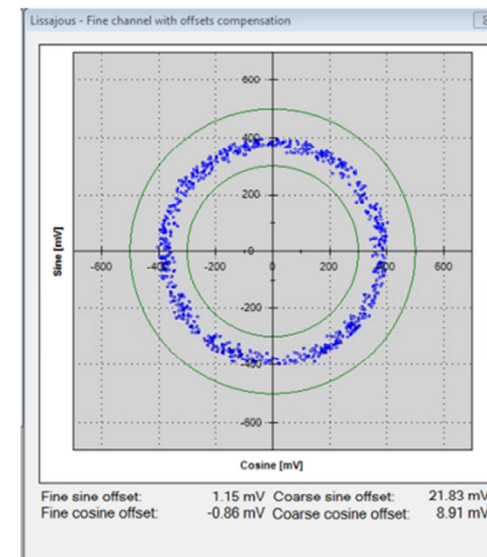
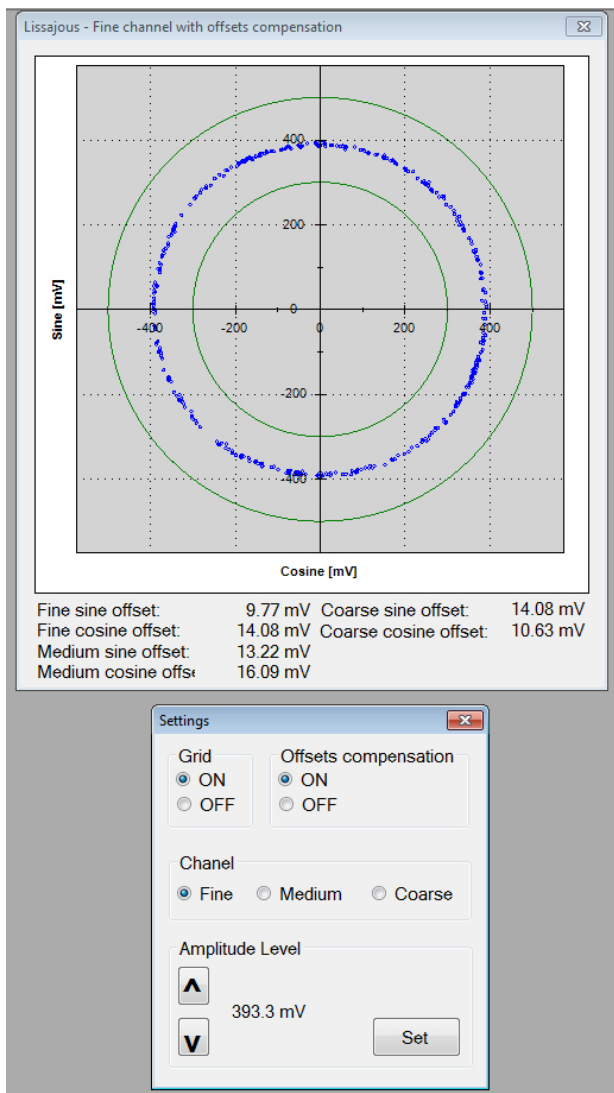
Calibration

Mechanical ICD

Mounting options

(i) Tools --> Signal analyzer , amplitude fine tuning option with the UP / DOWN keys to the nominal amplitude level , save the level by the "set" option. This process available for the fine / coarse and medium channels.

In case the reading data (blue dots) are not evenly distributed on a thin circle, you may experience "noise" in your installation (check shaft/stator grounding).



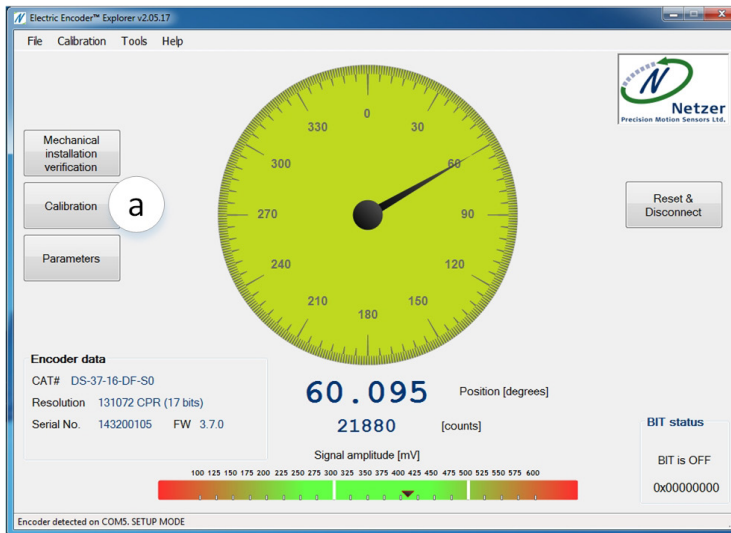
- Contents**
- Preface
- Safety
- Product Overview
- Unpacking
- Electrical Connection
- Software Installation
- Mounting Verification
- Calibration
- Mechanical ICD
- Mounting options

8. CALIBRATION

8.1 OFFSET CALIBRATION

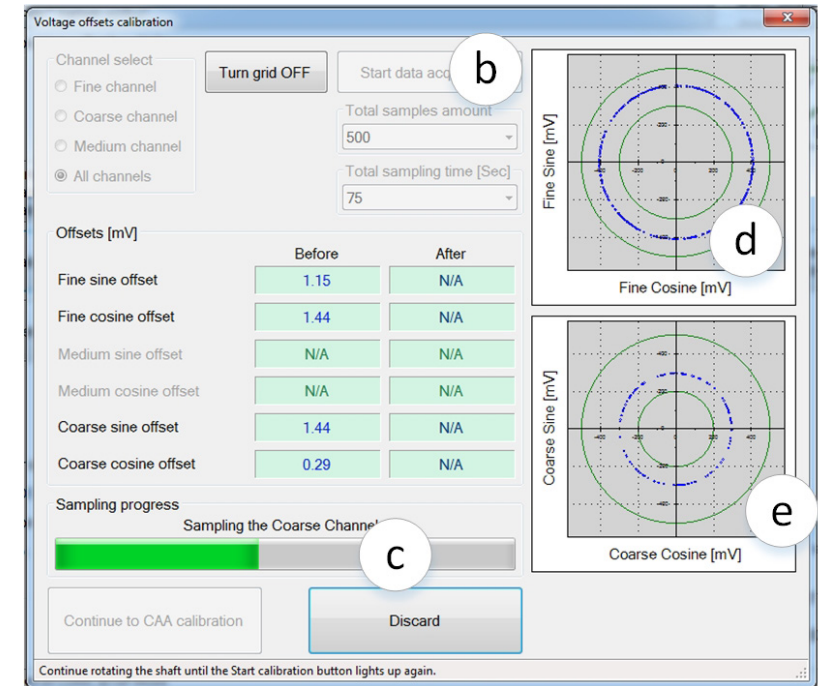
For optimal performance of the DF-150 Electric Encoder, the inevitable DC offset of the sine and cosine signals must be compensated over the operational sector. After successfully completing the Mounting Verification procedure:

(a) Select [Calibration] on the main screen.

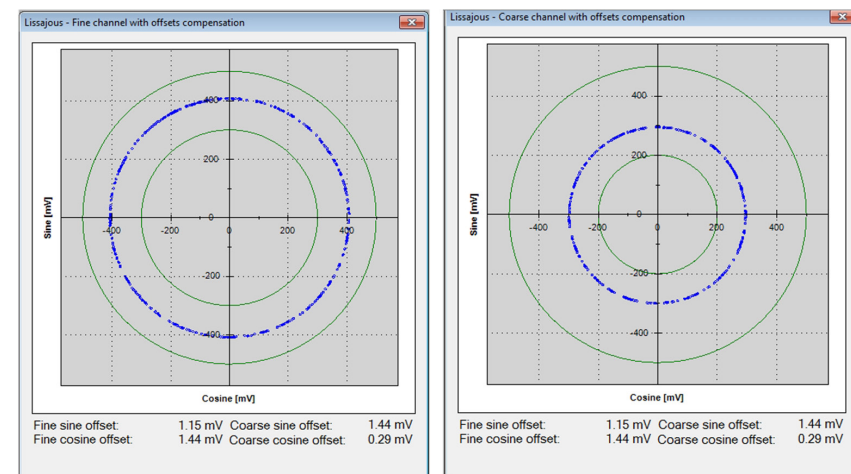


(b) Start the data acquisition while rotating the shaft.

The progress bar (c) indicates the collection progress. Rotate the axis consistently during data collection—covering the working sector of the application end to end—by default the procedure collects 500 points over 75 seconds. Rotation speed is not a parameter during data collection. Data collection indication shows for the fine/coarse channels, a clear “thin” circle appears in the center (d) (e) with some offset.



Offset compensated Fine / Coarse Channel



Contents

- Preface
- Safety
- Product Overview
- Unpacking
- Electrical Connection
- Software Installation
- Mounting Verification
- Calibration
- Mechanical ICD
- Mounting options

8.2 CAA CALIBRATION

The following calibration aligns the coarse/fine channel by collecting data from each point of both channels.

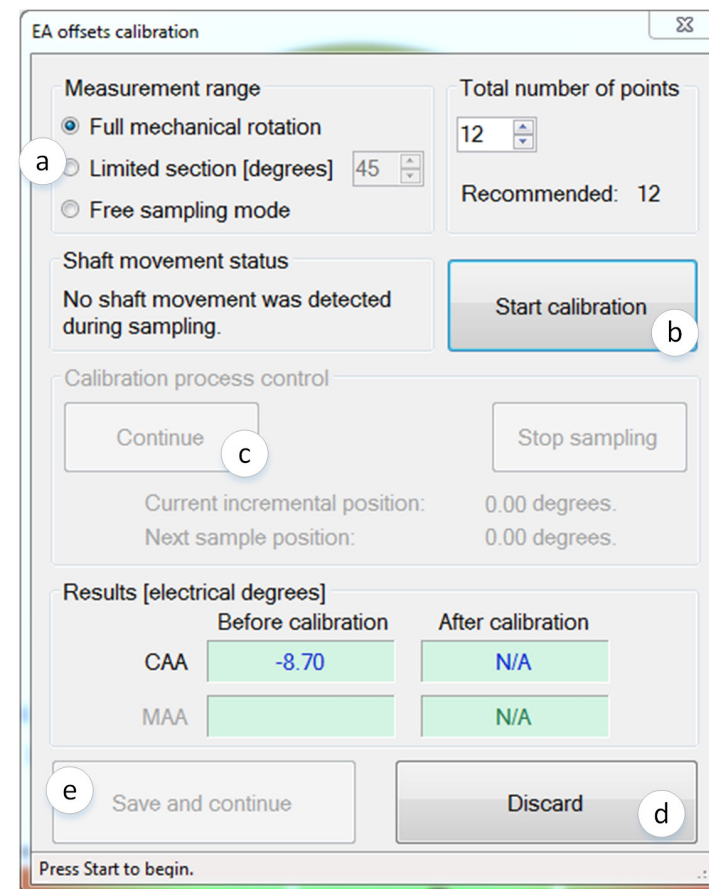
Select [Continue to CAA Calibration]

In the CAA angle calibration window, select the relevant option button from the measurement range options (**a**):

- **Full mechanical rotation** – shaft movement is over 10deg - recommended.
- **Limited section** – define operation of the shaft in a limited angle defined by degrees in case of <10deg
- **Free sampling modes** - define the number of calibration points in the total number of points in the text box. The system displays the recommended number of points by default. Collect a minimum of nine points over the working sector.

- Click the [Start Calibration] button (**b**)
- The status (**c**) indicates the next required operation; the shaft movement status; the current position, and the next target position to which the encoder should be rotated.
- Rotate the shaft/encoder to the next position and click the [Continue] button (**c**) - the shaft should be in STAND STILL during the data collection. Follow the indication/interactions during the cyclic process for positioning the shaft --> stand still --> reading calculation.
- Repeat the above step for all defined points. Finish (**d**)
- Click the [Save and Continue] button (**e**).

The last step saves the offsets CAA parameters, completing the calibration process.



Contents

Preface

Safety

Product Overview

Unpacking

Electrical
Connection

Software
Installation

Mounting
Verification

Calibration

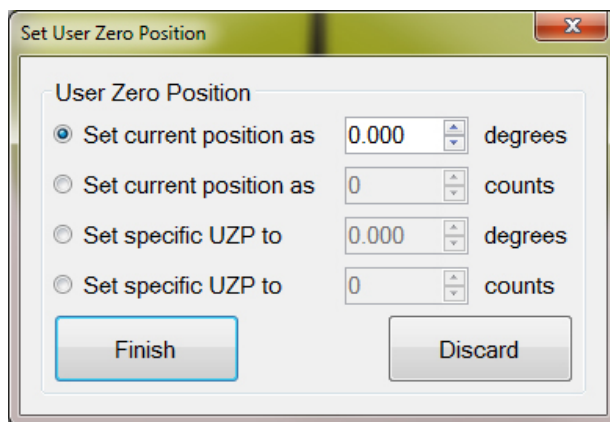
Mechanical ICD

Mounting options

8.3 SETTING THE ENCODER ZERO POINT

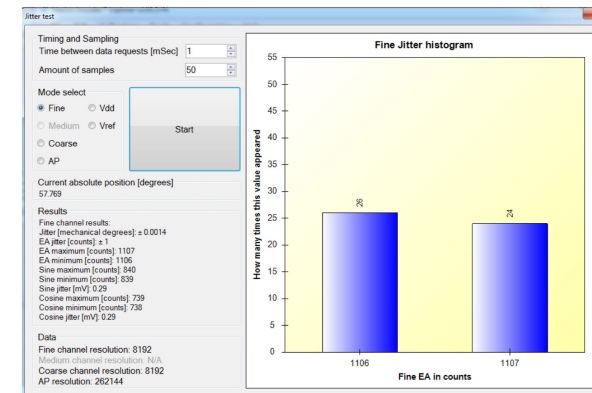
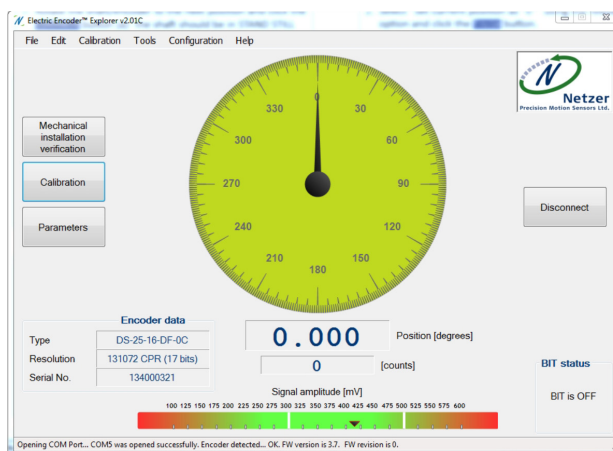
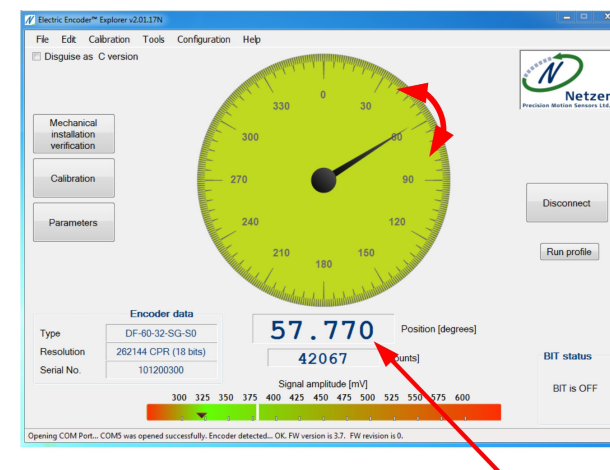
The zero position can be defined anywhere in the working sector.

- Rotate the shaft to the desired zero mechanical position.
- Select "Set Current Position" as zero by using the relevant option, and click [Finish].



8.4 JITTER TEST

Perform a jitter test to evaluate the quality of the installation; the jitter test presents the reading statistics of absolute position readings (counts) over time. Common jitter should be up +/- three counts; higher jitter may indicate system noise.



Contents

- Preface
- Safety
- Product Overview
- Unpacking
- Electrical Connection
- Software Installation
- Mounting Verification
- Calibration
- Mechanical ICD
- Mounting options

