

Creo Optical Encoder Alignment Procedure

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CREO Products Inc.

Creo Optical Encoder Alignment Procedure

Installation and Performance Evaluation Procedures

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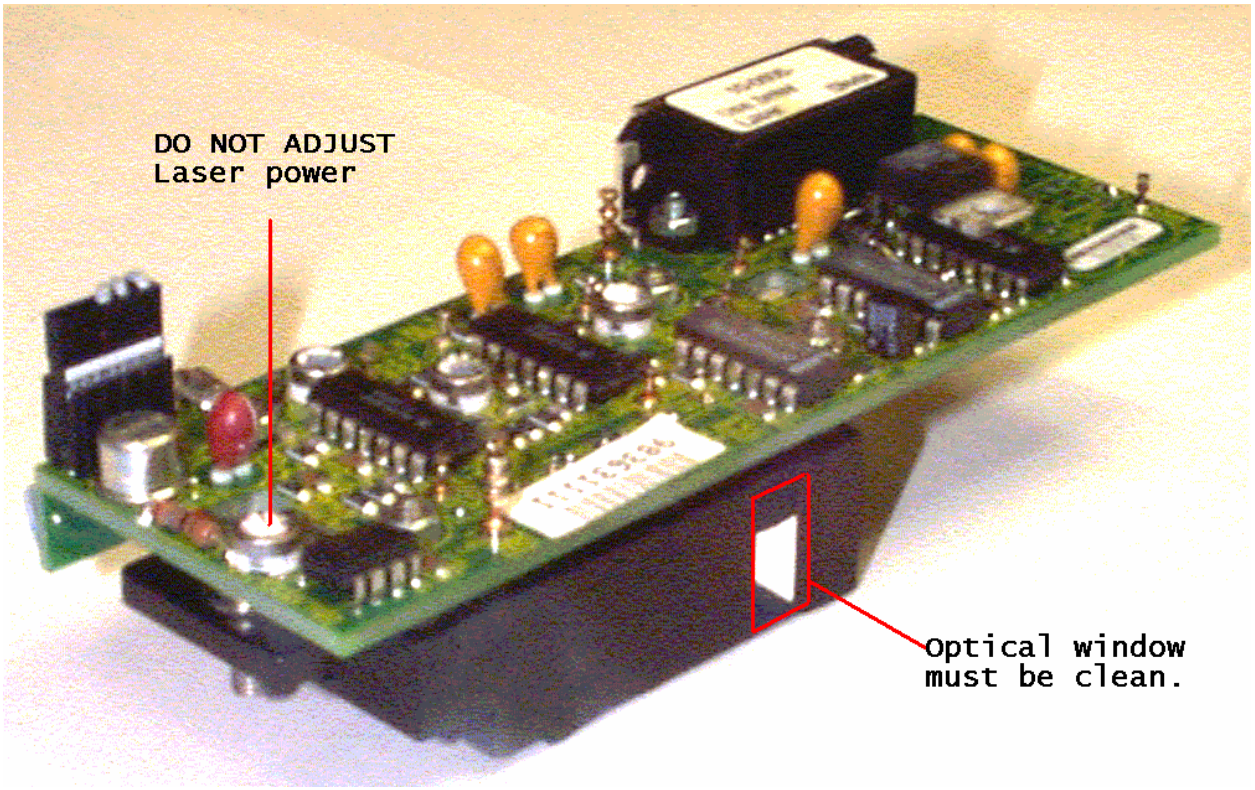
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1. Scope

This document describes the procedures for:

- Installing an encoder on an engine
- Trouble-shooting encoder-related problems
- Evaluating the performance of an encoder

The theory of operations is in Section 4.



1.1. First Check

Check that you have the correct encoder block: 32-3011 can only be used on 3244 engines and has been superceded by 32-4047 which is required for VLF. 32-4047 encoders have an extra voltage regulator that steps the voltage up from 4.5 to 5V.

For Platesetters older that C115, check the dimensions of the encoder casting (see paragraph 2.3.2) If the encoder is being replaced or re-aligned, then replace the casting with a special one for these machines only.

Check the voltage on TP13 – less than 4.75 can cause problems.

1.1.1 **Field Replacements**:

a) If the machine is not hard down, first do an inch grid plot (plot 0 or plot 100 or grid.ps) before removing the old encoder. When the new encoder is installed and aligned you will have to adjust mssa so that the image is in the same place as it was on your initial reference plot.

b) If you are not able to make an inch grid plot, then immediately obtain from the customer the most recent available plate that has not yet gone to press, and the file that made it, you will need this later to compare the image position in the main scan direction which may shift up to 2mm during the alignment of the encoder.

2. Replacing or Re-aligning the Encoder

This section applies to all engine types including CTP, VLF, LPE, DDCP, EDR and DHR.

2.1. Tools

- M2.5 Allen Key
- M3 Allen Key – Ball end required
- M3 Allen key tool (with machined shank, 90-1059A)
- Flat head Screw Driver 2.5mm
- Anti-static wrist strap
- Oscilloscope, Tektronix TDS210 or Fluke 99 (more skill required for Fluke)
- Dumb terminal or computer with terminal emulator program
- Encoder cleaning kit 04-0012A and Procedure 73-3289A
- Inch Jig 92-0043A

2.2. Setup

You must wear an anti-static wrist strap when touching the engine or the encoder as any static discharge may damage the encoder.

Never connect or disconnect the encoder cable with the machine power on.

a) Ensure the test jig (or platesetter) and computer are plugged into a wall outlet or power bar for proper grounding. Connect your anti-static wrist strap to a properly grounded location.

b) Connect all necessary cables: drum motor, carriage motor, encoder, and carriage home-away board. On CTP engines, also connect the LUE's power, control and SPI cables.

c) If you need access to the encoder block, move the carriage to the away position with a "**`carriage away`**" command.

d) Use an M2.5 Allen Key to loosen the two screws on the cover of the encoder block. You do not need to remove the screws. Slide the cover up and out to remove.

e) Clean the optical window with a Luminex cloth.

f) Ensure that the encoder disc is clean and dust free.

g) Install the encoder in the casting. Partially tighten the screws so that the encoder can only be moved if pushed.

Refer to the following diagram to find the testpoints:

2.3. Precautions

DANGER: This procedure requires that the drum be spun with service access panels open. To prevent death or serious injury always keep your hands and other body parts out of the danger zones and follow the standard safety policies for field engineers. For more information, see http://techplanet.creo.com/output/computer_to_plate/all_ctp/nav/safety.htm**.**

a) Ambient visible light such as flashlights or trouble lights cause the encoder signals to be affected. Over head lighting is normally not a problem. Low light should be used while adjusting the pots.

b) Encoders emit 3mW of 780nm Invisible infrared light whenever the machine power is on. Do not look into beam. Note that newer version encoder blocks, 32-4047C, use a 680nm laser diode which is red visible light.

c) You must wear an anti-static wrist strap when touching the engine or the encoder as any static discharge may damage the encoder.

d) Never connect or disconnect the encoder cable with the machine power on.

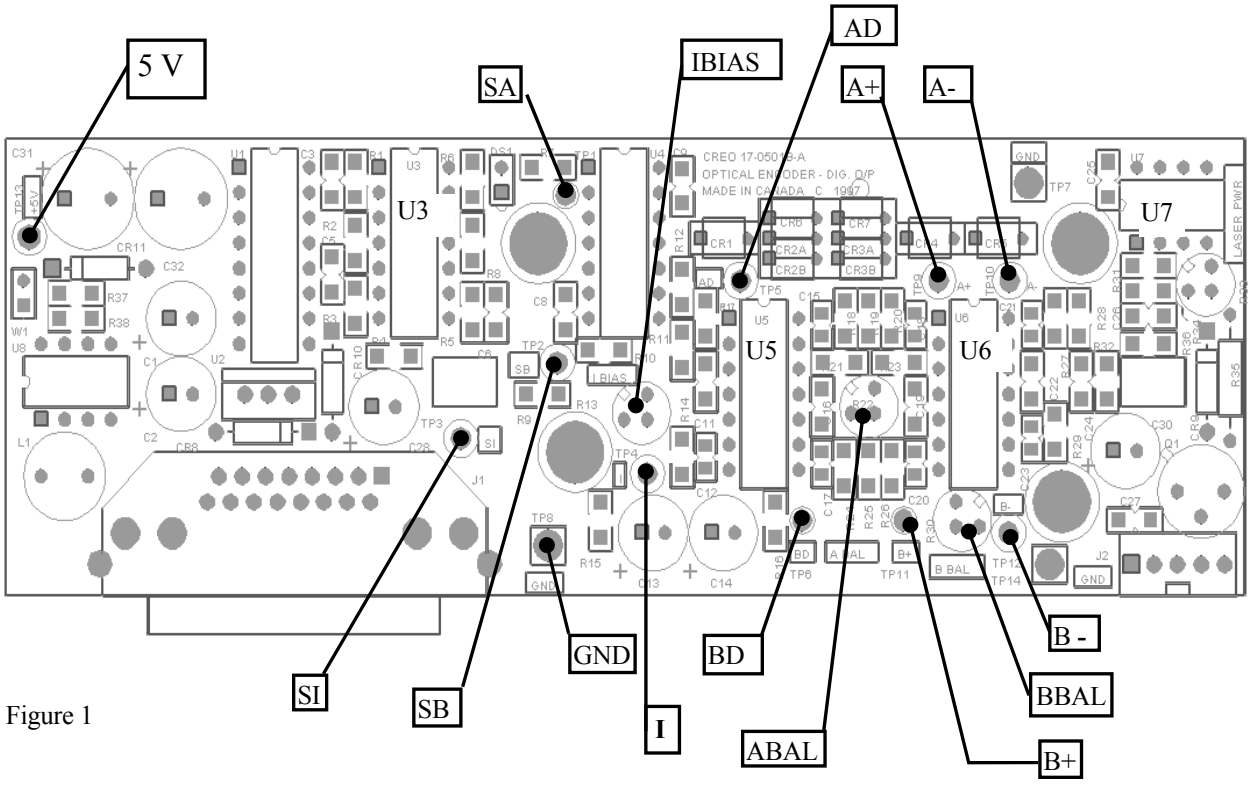


Figure 1

2.4. Integrity check

2.4.1 Voltage.

a) First check the 5V test point relative to the GND test point.

(i) 3244 engines using 32-3011 must be at least 4.75V

(ii) 3244 engines using 32-4047 must be at lease 4.9V and at most 5.3V

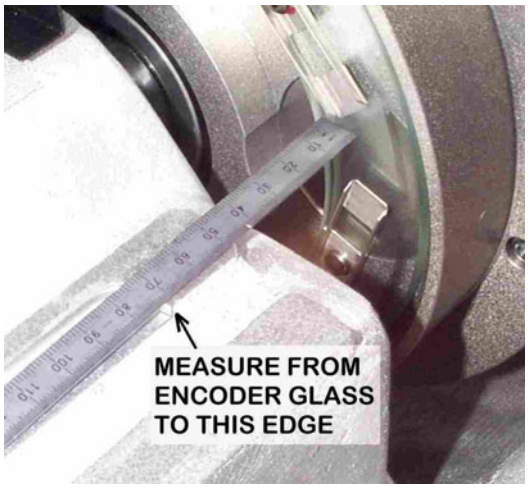
(iii) VLF engines must all be at least 4.9V and at most 5.3V

2.4.2 Dimensional Check

Measure the distance between the encoder disc and the alignment edge shown in the picture.

This should be 72mm, if it is not then check that the drum pin is pressed all the way into the engine casting.

If the dimension measured is 70.8 (with the drum pins properly seated into the clamp), then a new encoder casting (57-6078A) should be ordered that has that compensation built in. The compensated casting has an extra hole in the middle of the mounting holes for identification.



- Clean mounting surface of engine casting and mounting surface of encoder casting.

2.5. Alignment

2.5.1 Encoder Positioning

b) Power up the oscilloscope, connect probes to **A+** (TP9) and **A-** (TP10) and set the scope as follows:

(Tek TDS 210 users: press **Save/Recall**, select **Setups** and select **Setup 1**, press **Recall** – these settings should appear)

1. CH1 & CH2: 0.2V per div on vertical scale (20mV if you have x10 probes)
2. CH1 & CH2 inputs: AC coupled
3. For analog scopes set display mode to ALT
4. Horizontal time base: 20µS/Div (50µS/Div for VLF)
5. Triggering mode: Auto (Fluke99 make sure "free run" is on)
6. Ground reference: CH1 & CH2 mid screen. Use (↕ pos)
7. Triggering source: CH1
8. Triggering coupling: AC, Select EDGE triggered
9. Triggering slope: Pos (rising edge, +)
10. Trigger delay: Set delay to 5 div or to mid screen (For Tek TDS210 use Horizontal Position)
11. Trigger level: Set to 0V or until wave stands still.
12. *For Tek TDS210, make sure that ACQUIRE is set to "Sample".

(Tek TDS 210 users: If you are sure your settings are correct then you can save them for the next person as follows: press **Save/Recall**, select **Setups** and select **Setup 1**, press **Save**)

c) Display **A+** and **A-** by attaching probe 1 to the **A+** test pin (which corresponds to pin 1 on the chip labeled U6**)** and probe 2 to the **A-** test pin (which corresponds to pin 14 on the chip labeled U6).

d) Power up the engine and type "**`drum spin 120 c`**". The drum will spin without feedback. For VLF, type "**`drum spin 60 c`**". For DH, type "**`drum volts`**". For the Renaissance Scanner, type "**mpe drum spin 30 c**".

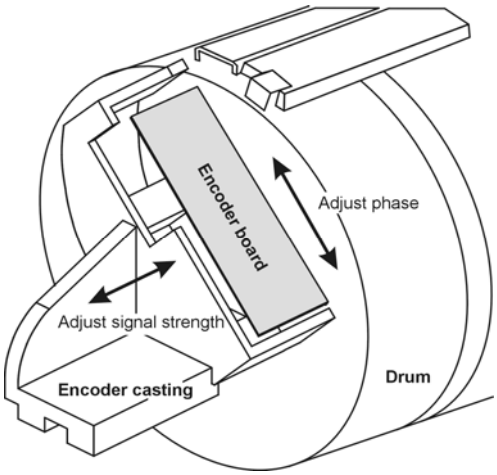


Figure 2

e) Position the encoder to get the biggest possible signal while trying to get the points at which **A+** intersect **A-** relatively horizontal to each other. The signal strength should be at least 300 mV peak to peak, and they should be about the same size (within 20%). (See the scope trace in Figure 3.) Move the board along the main-scan axis (around the drum) to adjust the phase, and along the sub-scan axis (along the axis of the drum) to maximize the signal (see Figure 2). Do not rotate the encoder.

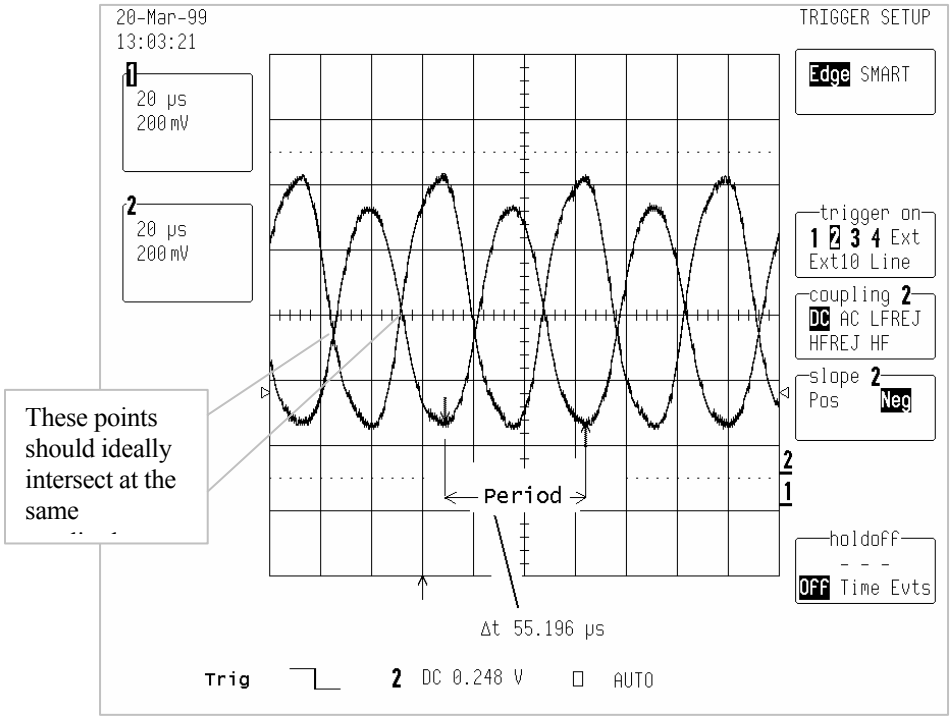


Figure 3 Note: signals may be slightly flat at the bottom (or top if signalsare

f) Tighten the screws while holding the encoder.

g) Display **B+** and **B-** by attaching probe 1 to the **B+** test pin (which corresponds to pin 7 on the chip labeled U6), and probe 2 to the **B-** test pin (which is pin 8 on the chip labeled U6). Check that these signals are more or less the same as **A+** and **A- (**see Figure 3).

h) If the intersecting points of **B+** and **B-** are not at a horizontal level (i.e., the peaks and valleys do not line up), re-position the encoder to bring them closer. Since re-positioning the encoder affects the alignment between **A+** and **A-**, repeat the previous steps until the **A** and the **B** signals are equally well aligned. (Compromise between the alignment of **A+** to **A-**and **B+** to **B)**. Tighten the screws completely.

i) Connect probe 1 to TP5 (**AD**) and probe 2 to TP6 (**BD**). Check that the signals are roughly sinusoidal and 90° out of phase (see Figure 4). If not, re-align the encoder.

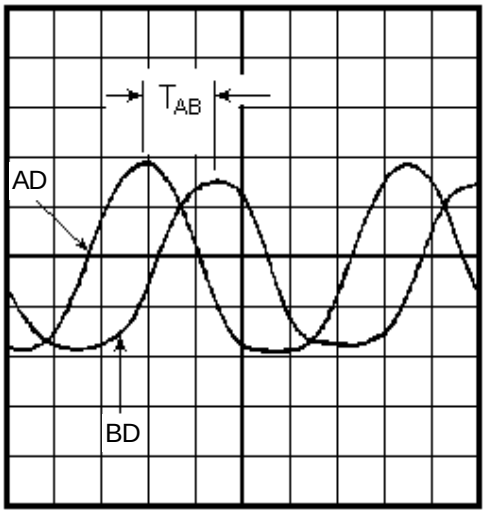


Figure 4

2.5.2 Setting **SA** & **SB** Duty Cycle

a) Connect probe 1 to TP1 (**SA**) and probe 2 to TP2 (**SB**).

b) Set the scope as follows:

(Tek TDS 210 users: press **Save/Recall**, select **Setups** and select **Setup 2**, press **Recall** – these settings should appear)

1. CH1 & CH2: 2V per division on vertical scale
2. CH1 & CH2 inputs: DC coupled
3. Ground reference: CH1mid screen, CH2 one block up from the bottom. Use (↕ pos)
4. Horizontal time base: 10 or 25 µS/Div as preferred. (25 or 50µS/Div for VLF)
5. Triggering mode: Normal (Fluke99 make sure "free run" is off)
6. Triggering source: CH1
7. Triggering coupling: DC, Select EDGE triggered
8. Triggering slope: Pos (rising edge, +)
9. Trigger level: Set to 2V or 1 devision above Ch1 gnd ref.
10. Trigger delay: Set delay to 5 divisions or to mid screen (-5 for fluke99, for Tektronix TDS210 use Horizontal Position)Trigger level: Set half way up **SA** (CH1) or at about 2.5V.

(Tek TDS 210 users: If you are sure your settings are correct then you can save them for the next person as follows: press **Save/Recall**, select **Setups** and select **Setup 2** , press **Save**)

The signals **SA** and **SB** may look something like Figure 5.

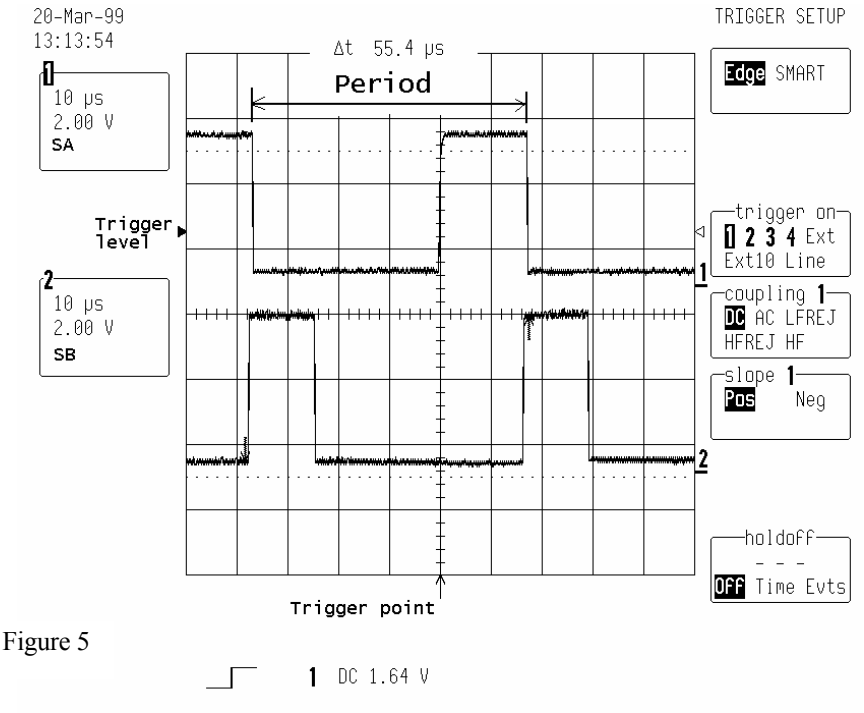


Figure 5

c) Measure and write down the period of **SA** (see in Figure 5). Use cursors if available. Although not recommended, you can simply count the number of divisions on the display.

PERIOD = _____

d) Adjust the pot labeled **ABAL** so that both the top and bottom segments of **SA** are equal in length. That is a 50% duty cycle. **SA,** properly adjusted, is the top trace in Figure 6:

e) Change scope trigger source to CH2 (that is trigger on **SB** falling or rising edge in the center of the screen).

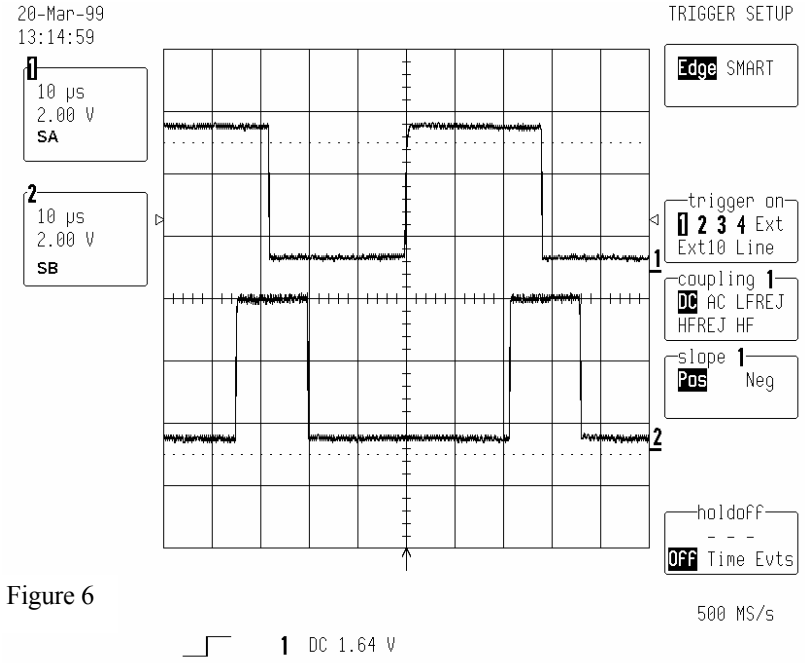


Figure 6

f) Adjust the pot labeled **BBAL** to achieve 50% duty cycle on **SB**.

g) Check that **SA** leads **SB** by 90°±30° (i.e. **SA** is on the left of **SB** and their edges are separated by 1/4 of the period. Referring to the following diagram, if they do not have this relation, redo 2.5.1 e & f and check that you have the probes & channels the right way round.

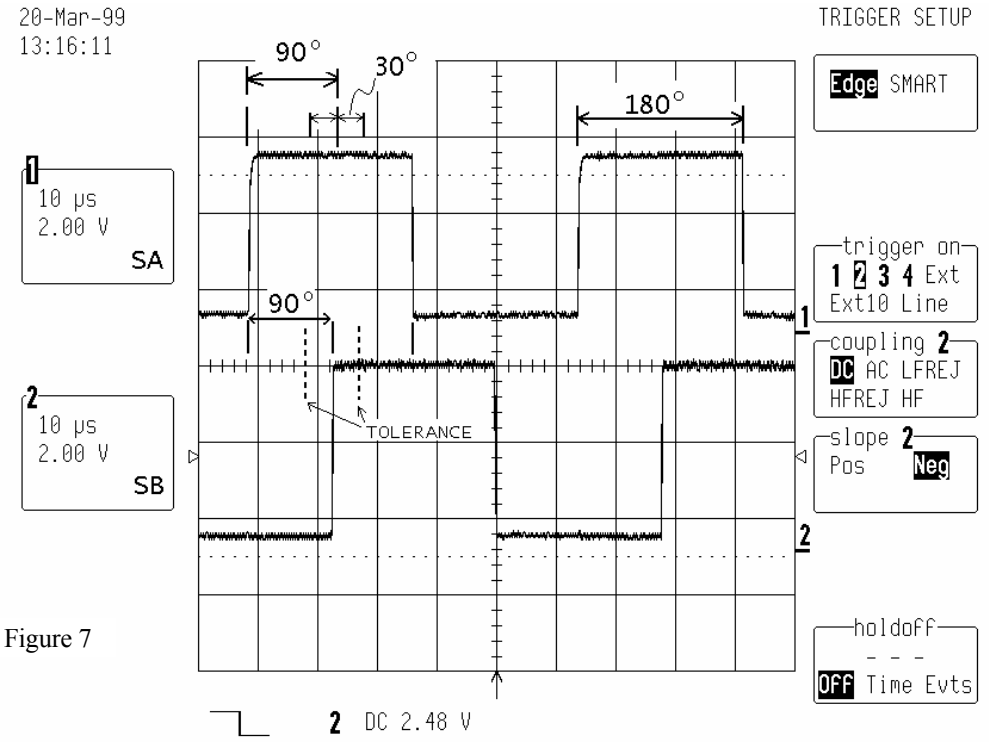


Figure 7

2.6. Check for Plug Reflections

a) Connect CH1 to **B-** (TP12) and CH2 to **I** (TP4). Set the scope as follows:

(Tek TDS 210 users: press **Save/Recall**, select **Setups** and select **Setup 3**, press **Recall** – these settings should appear)

1. CH1: OFF (TDS210 press CH1 Menu twice)
2. CH2: 0.2V per division on vertical scale. (0.5 V/div if the signal is strong)
   AC coupled (if available)
   Set ground reference (↕ pos) to one div from bottom of screen.
3. Horizontal time base: 50 **m**S/Div (100 mS/Div for VLF)
4. Timebase mode: TDS210 Set "ACQUIRE" to Peak Detect
   Fluke 99 select "sub menu", "glitch detect"
5. Triggering mode: Normal (Fluke 99 , make sure "free run" is off)

.

6. Triggering source: CH2
7. Triggering coupling: AC,
   AC not an option on Fluke99 use DC coupling.
8. Triggering Slope: Pos (rising edge, +)
9. Trigger level: AC: 300mV to 500mV or turn slowly from 200mV to 800mV until trigger occurs.
   DC: adjust from bottom of screen upwards till trigger occurs
10. Trigger Delay: Set delay to ½ division from the left of screen (-1 div for Fluke 99). (Tektronix TDS210 use Horizontal position)

(Tek TDS 210 users: If you are sure your settings are correct then you can save them for the next person as follows: press **Save/Recall**, select **Setups** and select **Setup 3** , press S**ave**)

a) Enter the monitor command: "**`drum spin 130 c`**" ("**`drum spin 65 c`**" for VLF).

b) You should see one **I** pulse at the left of the screen and the remainder of the trace should be more or less flat. If there are reflections from the vacuum plugs you may see bumps on the base line.

The maximum noise and effects caused by reflections from the vacuum plugs is dependent on the signal strength and should be less than 20% of the AC peak of the **I** pulse.

Only one plug is causing a significant reflection in this image.

Measure the height of the I pulse and calculate 20%. The noise on the base line should not be more that 20% of the I pulse.

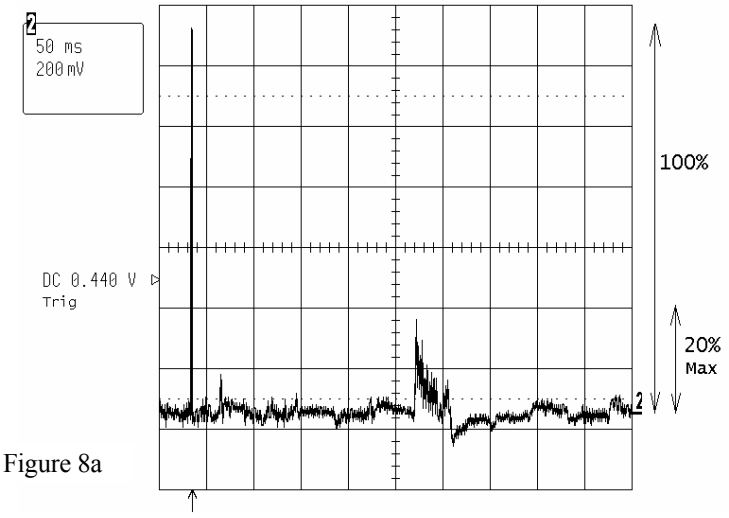


Figure 8a

Figure 8b shows unacceptable noise levels: the reflections from the vacuum plugs of this machine are too high.

If the noise caused by reflections is above 20% for all engines (3244 & VLF) then the system will not work reliably. If it is above 20% for 3244 engines then you must install decals on the vacuum plugs before proceeding with the procedure. If the noise is above 10% but below 20, then the system will work and the procedure may be continued, but decals must be installed at a later date.

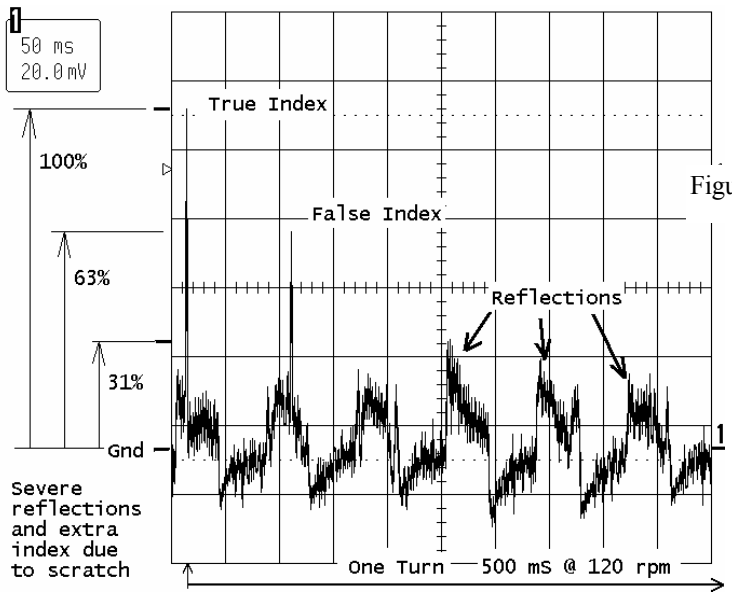


Figure 8b

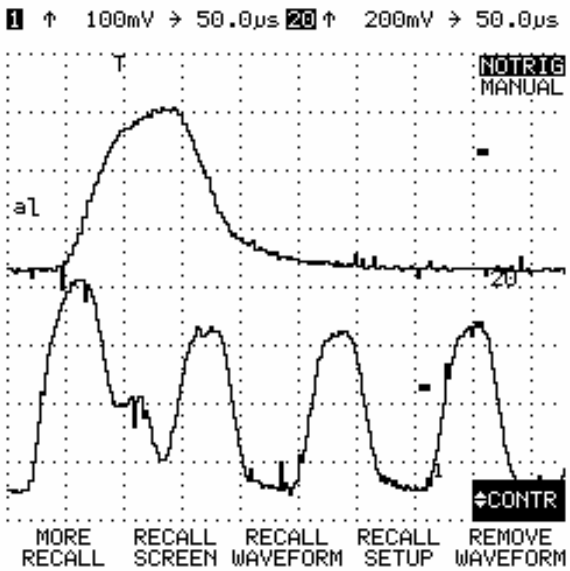
2.6.1 Check for Intermodulation

a) Connect CH1 to **B-** (TP12) and CH2 to **I** (TP4). Set the scope as follows:

1. Tek TDS210 users, move Horizontal trigger position to exactly mid screen
2. CH1: 0.2V per division on vertical scale. (0.5 V/div if the signal is strong)
   AC coupled (if available)
   Set ground reference (↕ pos) to center of screen.
3. CH2: 0.2V per division on vertical scale. (0.5 V/div if the signal is strong)
   AC coupled (if available)
   Set ground reference (↕ pos) to one div from bottom of screen.
4. Horizontal time base: 20 **u**S/Div (50 uS/Div for VLF)
5. Timebase mode: TDS210 Set "ACQUIRE" to Sample
   Fluke 99 select "sub menu", "glitch detect".
6. Triggering mode: Normal (Fluke 99 , make sure "free run" is off)
7. Triggering source: CH2
8. Triggering coupling: AC,
   AC not an option on Fluke99 use DC coupling.
9. Triggering Slope: Pos (rising edge, +)
10. Trigger level: AC: 300mV to 500mV or turn slowly from 200mV to 800mV until trigger occurs.
    DC: adjust from bottom of screen upwards till trigger occurs
11. Trigger Delay: Set delay to 3 division from the left of screen (Tektronix TDS210 use Horizontal position)

Look for evidence that **B-** is affecting the index or visa verse. An asymetrical **I** pulse can also be an indication of this, note the slope of the crest of the pulse.

If this does happen and causes a problem then you should first clean between the encoder casting and the engine casting, and try and reposition the encoder. If that doesn't help, try another encoder. The issue of radial adjustment is being looked into.



2.6.2 Setting **SI** Pulse Width

a) Enter the monitor command: "**`drum spin 120 c`**" ("**`drum spin 60 c`**" for VLF, "**mpe drum spin 30 c**" for Scanner).

b) Connect CH1 to TP3 (**SI**) and CH2 to TP4 (**I**). Set the scope as follows:

(Tek TDS 210 users: If you are sure your settings are correct then you can save them for the next person as follows: press **Save/Recall**, select **Setups** and select **Setup 4** , press S**ave**)

1. Tek TDS210 users, move Horizontal trigger position to exactly mid screen
2. Timebase Mode: Set "ACQUIRE" to "Sample" or Turn off Glitch capture.
3. CH1: 1V per division on vertical scale
   DC Coupled
   Set ground reference (↕ pos) to one div from bottom of screen.
4. CH2: 0.2V per division on vertical scale. (0.5 V/div if the signal is strong)
   AC Coupled
   Set ground reference (↕ pos) to one div from bottom of screen.
5. Horizontal position: Tek TDS210 – move marker arrow to 5 divisions (Mid screen)
6. Horizontal time base: 20µS/Div (50 µS/Div for VLF)
7. Triggering mode: Normal (Fluke 99 , make sure "free run" is off)
8. Triggering source: CH2
9. Triggering coupling: AC,
   AC not an option on Fluke99 use DC coupling. During the next step, you will have to constantly adjust the level as you move **IBIAS**, to keep the level half way up the I pulse.
10. Triggering Slope: Pos (rising edge, +)
11. Trigger level: AC: 0.3V or turn slowly from one extreme to the other.
    DC: adjust from bottom of screen upwards till trigger occurs
12. Trigger Delay: For digital scope, set delay to 3 divisions or about the first third of the screen (-3 div for Fluke 99). (Tektronix TDS210 use Horizontal position – this may be slow to move, watch number at top of screen)

(Tek TDS 210 users: If you are sure your settings are correct then you can save them for the next person as follows: press **Save/Recall**, select **Setups** and select **Setup 4** , press S**ave**)

- Note: read next page before jumping to conclusions.

NOTE: The Index pulse occurs once per revolution, so expect to see the screen update twice per second (at 120 rpm).

c) If you see the following (figure 9a), go to step f) :

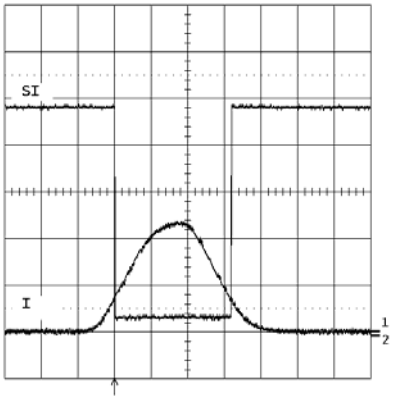


Figure 9a

It is possible that you may see this (figure 9b). If the **SI** signal (CH1) is 0V or 5V DC, then you need to do steps d) and e).

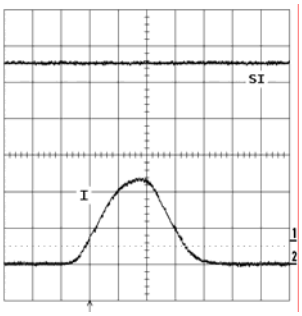


Figure 9b

➢ Do steps d) to e) only if the scope looks like Fig 9b

d) Turn **IBIAS** fully to one extreme. (If your trigger is DC coupled, you will need to adjust the level continuously to maintain triggering every half second). It is possible that **I** may be pulled dead at the extremes of the **IBIAS** pot.

e) Turn **IBIAS** slowly towards the opposite extreme until the **SI** square pulse occurs.

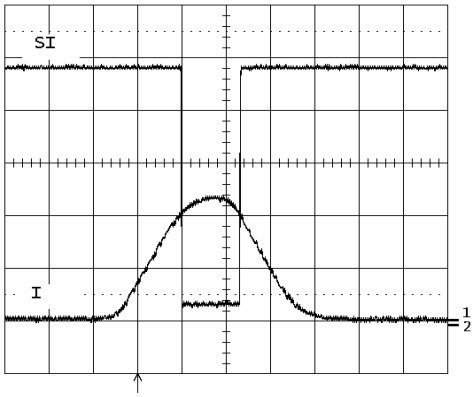
Note that the **IBIAS** pot appears to be very sensitive and to make the pulse width jump. However, the signal only updates every half second and you probably moved the pot quite a bit during that half second. Once you have found the pulse, set it by moving the pot a bit and waiting a second.

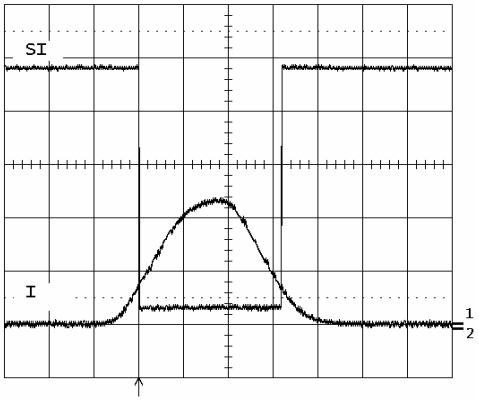
f) Adjust CH1 (**SI**) ground reference level (↕ pos) so that the edges of the **SI** pulse cross the **I** signal.

This shows the **SI** pulse set <u>too narrow</u> and crossing the **I** pulse <u>too high</u>.

This shows the **SI** pulse set <u>too wide</u> and crossing the **I** pulse <u>too low</u>.

Figure 11





g) Calculate the **maximum SI** pulse width = **0.9 x Period** that was measured in 0. (c).

h) Adjust **IBIAS** so that :

1. The edges of **SI** cross the **I** pulse half way up the **I** pulse.
2. Measure the pulse width of **SI**.
3. IF the width of **SI** is more that **0.9 x Period** THEN do the following steps a) and b)

   a) Adjust **IBIAS** so that **SI = 0.9 x Period.**

   AND:

   b) Check that edges of **SI** now cross the **I** pulse within 15% from the half way level of the **I** pulse, (as shown in Figure 10). If this is not within tolerance, then reject the encoder.

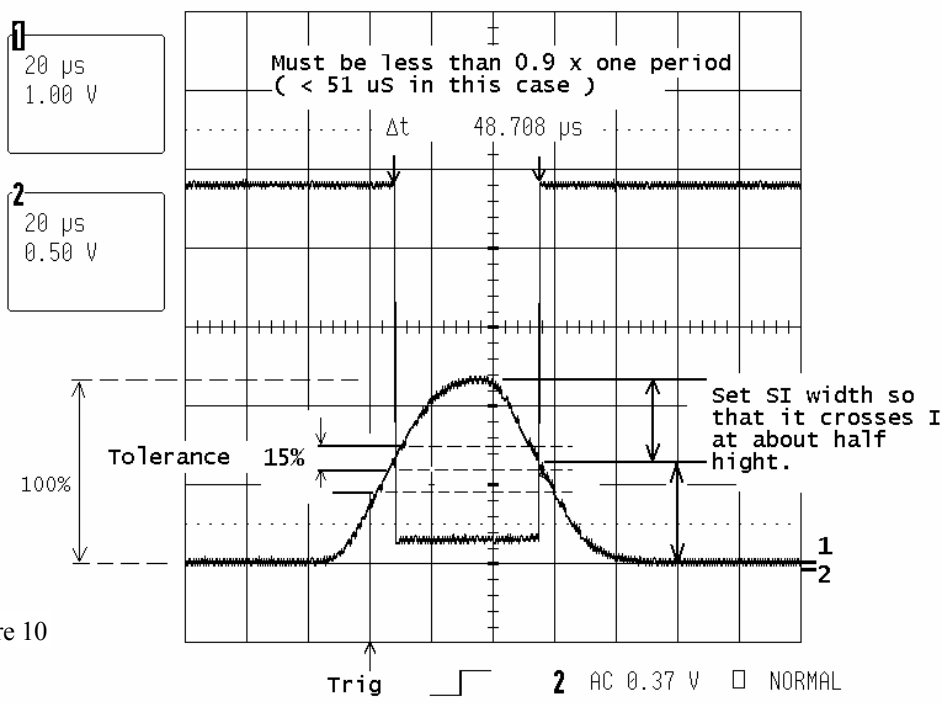


Figure 10

2.6.3 Checking **SI** / **SB** Phasing

a) Connect probe 1 to TP3 (**SI**) and probe 2 to TP2 (**SB**). Set the scope as follows:

(Tek TDS 210 users: If you are sure your settings are correct then you can save them for the next person as follows: press **Save/Recall**, select **Setups** and select **Setup 5** , press S**ave**)

1.	CH1:	2V per division on vertical scale DC Coupled Set ground reference to center of screen
2.	CH2:	2V per division on vertical scale DC Coupled Set ground reference to one block from the bottom of screen
3.	Triggering mode:	Normal (Fluke99: make sure "free run" is off)
4.	Triggering source:	CH1
5.	Triggering coupling:	DC, Select EDGE triggered.
6.	Triggering Slope:	Neg (Falling edge, -)
7.	Trigger Level:	Adjust to get trigger (about 2V should do)
8.	Trigger Delay:	For digital scope, set delay to 3 divisions or about the first third of the screen (-3 Div for Fluke99). (Tektronix TDS210 use Horizontal position)
9.	Horizontal time base:	20µS/Div (5 µS/Div for DH)

(Tek TDS 210 users: If you are sure your settings are correct then you can save them for the next person as follows: press **Save/Recall**, select **Setups** and select **Setup 5** , press S**ave**)

Expect the following waveform:

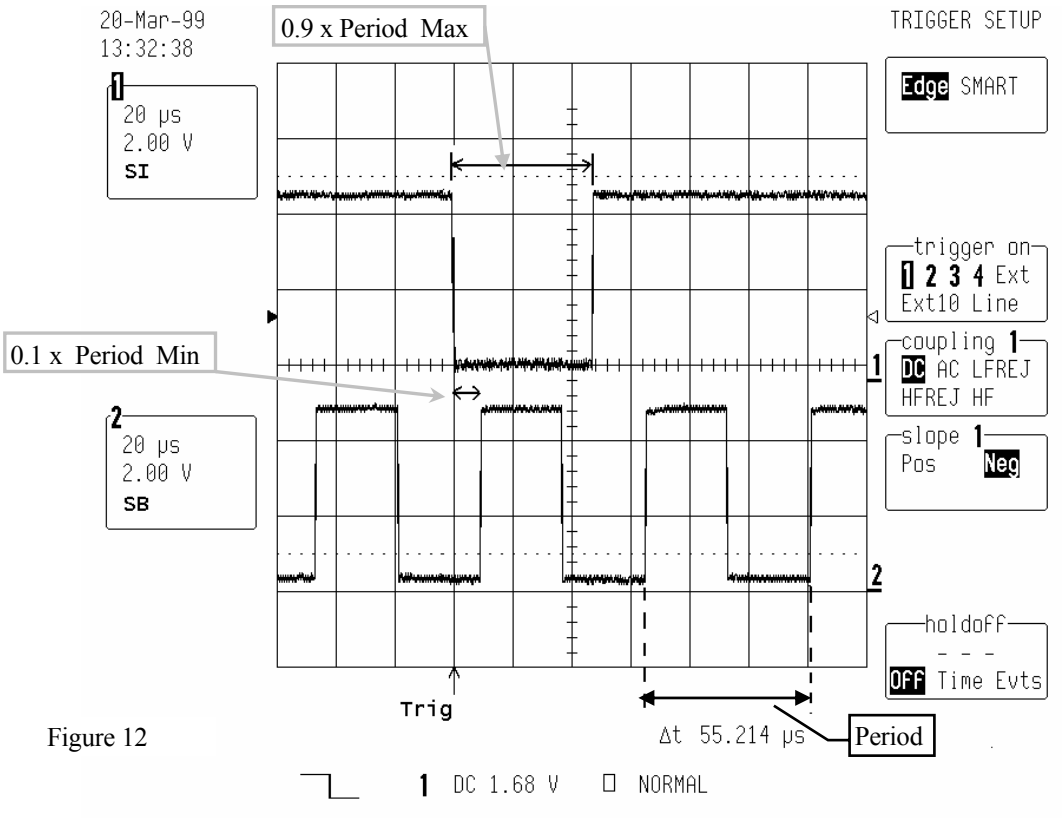


Figure 12

b) Calculate **0.1xPeriod** (measured in 0.c).

c) Measure the time between falling edge ↓ of **SI** and rising edge ↑ of **SB** : this must be more than **0.1xPeriod.** (or 5.5µS in this case).

In other words:
Check that the rising edge ↑ of **SB** is at least **0.1 x Period** after the falling edge ↓ of **SI**

d) Check that the width of **SI** is less than 0.9 **x Period**, that was measured in 0(d).

e) Check that the rising edge of **SI** is after the falling edge of **SB**.

f) If the phase is not as shown (**SB** overlaps the rising edge of **SI**), then you have two options, move the board or adjust **SI** pulse width.

1. If you adjust **IBIAS** and are successful, go back and check that the level of **I,** where **SI** crosses it, is not too low or too high as shown in Figure 11.
2. The encoder board needs to be moved in the mainscan direction (around the drum) without moving it in the subscan direction (along the axis of the drum). See figure 3. This is no easy task, so it is advisable to obtain the jig for this.

   Loosen the screws and move the board as required, if the signals disappear or stop updating every half second, then move the board in the axial direction (amplitude) to try and regain the signal.

   NOTE: Even if you are successful in getting the phase as shown above, you MUST go back and check that the **A+** and **A-** signals are large enough (in focus):

   Check 2.5.1(e).

   Repeat 2.5.1 (h).

2.7. Final Checks

For CTP engines with an MPE board:

2.7.1 Drum Init Test.

a) Type "**drum init**". The drum should spin for a few seconds. The MPE returns "*** State message: Drum command (14) Complete".

2.7.2 PLL Test

a) Type "**drum spin <plot speed>**" where plot speed is that set in the HDM. Type "**plot on**". Go and inspect the eight yellow LEDs on the edge of the MPE board. The center two should be ON, and the next pair may jitter.

If the LEDs jump from the inner two ON to almost all ON every second or half second, then there is probably a dirty mark on the encoder disc.

2.7.3 MPE Tach Signals Test

a) Close the machine doors except for access to the card cage. Check at least Step 1 and Step 2 of the performance evaluation in section 3.2.

2.7.4 Adjust GC MSSA

a) Load a plate and do an inch grid plot (plot 0 or plot 100 or grid.ps). measure the position of the image from the leading edge (an inch jig 92-0043A may be useful) and compare with the initial inch grid plot that you did before removing the old encoder. Adjust GC MSSA so that the image is in the same position.

b) If it was not possible to do an initial inch grid plot, then you will have to work with the last good image that the customer was able to make that has not yet gone to press. Re-image the same file from the workstation and adjust GC MSSA to get the image as close as you can to the original.

2.7.5 .Adjust Drum positions

a) If the image shift was significant, then the following NVS positions will also have been affected: DRUM EPOS, AL LEPOS & AL PPOS.

b) Correct DRUM EPOS as follows. Load a plate onto the drum, disable the write laser (SET HEAD WENABLE 0) Type "PLOT EDGE CAL", check and see that the focus laser is near the center of the edge detect strip. If it is not then adjust "DRUM EPOS" and repeat the process. Clean the edge detect strip.

c) To correct the AL LEPOS, proceed as follows: Type "SET AL LEPOS", note the <lepos value> then type "DRUM MOVE <lepos value> H" then "DRUM SOFT" , now type "ACT LEC ON" for Platesetter_3244 or "LEC ON" for VLF, Trendsetter & VLF Trendsetter, followed by "DRUM IDLE". IF the LEC backbone is not in the leading edge clamp trough (dimple) then retract the LEC by unplugging the connector to the solenoid valve for the LEC backbone, position the drum and reconnect the solenoid valve. When the leading edge goes down it should contact the leading edge clamps in the trough of the clamp (dimple). Now type "DRUM and record the drum position. Set the AL LEPOS to this drum position +5.

d) To correct the AL PPOS, proceed as follows. Type "SET AL PPOS" and note the current setting. Change the setting to a number smaller by 100. Type "PUTCLAMP". Move the TEC's to the parked position. Type "GETCLAMP" if the machine does not retrieves the clamps cleanly, then increase AL PPOS by 10 and repeat the "GETCLAMP" until it retrieves the TEC's cleanly. Type "PUTCLAMP" and check that the clamps are 1-2mm from the parked position, if not then reduce PPOS to reduce the gap. NB: Check that "GETCLAMP" works for a fully parked set of clamps.

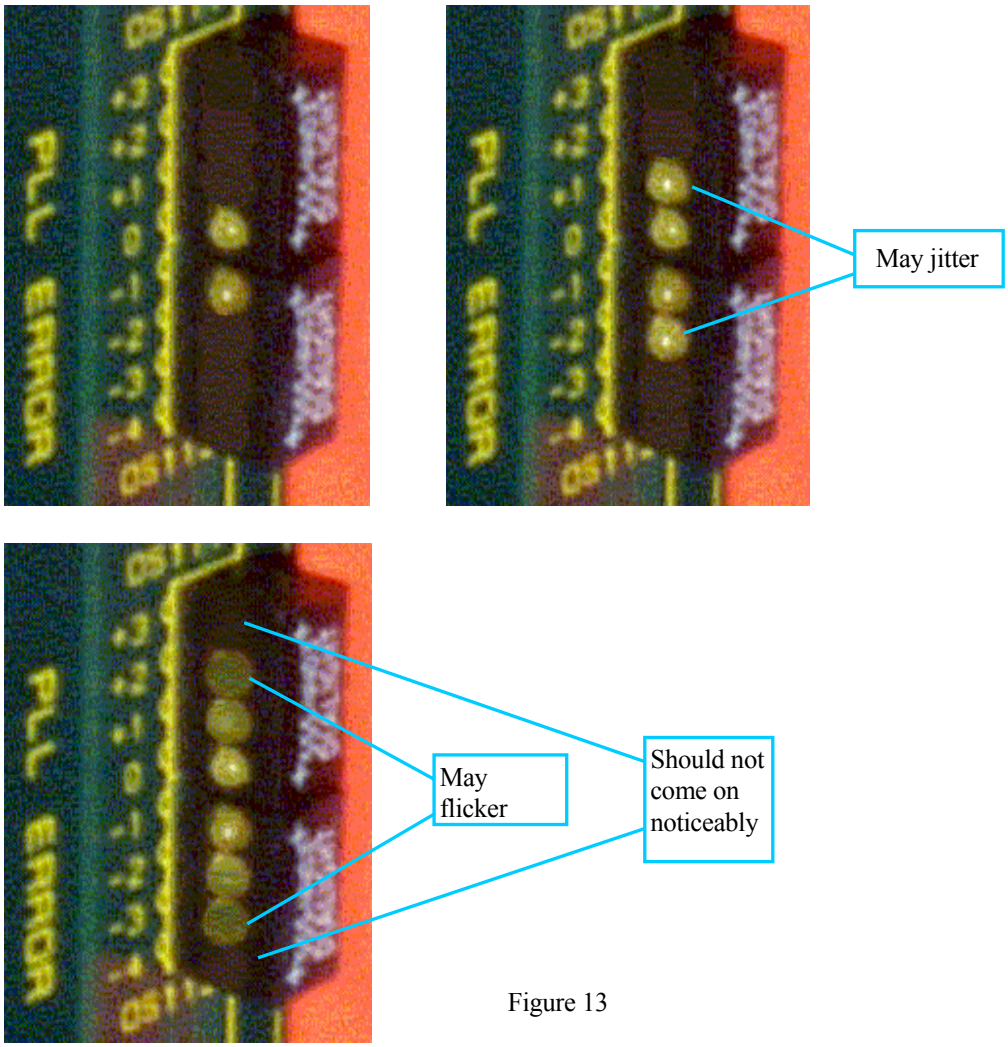


Figure 13

2.7.6 For OEM engines with an RCE board:

a) Type "**drum init**". The drum should spin for a few seconds. The RCE should return "drum status OK". If this is successful, type "**drum plot**". Again "drum status OK" should be returned. Type "**drum stop**" or "**q**" or "**A**" to stop the drum.

2.7.7 Seal

a) **Seal each of the four (4) potentiometers with a blob of red nail polish**.

b) Install the cover on the casting. Apply Loctite #222 (purple). Tighten screws.

3. Maintenance

a) This section describes some encoder-related problems for reference and trouble-shooting and the essential tests that are consistent with those used by optical assembly and engine integration. It may become necessary to realign or replace the encoder after final integration. If such is the case, refer to section **Error! Reference source not found.** for encoder installation procedure.

Note: Re-alignment or replacement of the encoder should be used as a last resort in troubleshooting. Both of these operations affect geometric correction.

3.1. Common Problems

The following is a short list of common problems related to and/or caused by faulty encoders.

3.1.1 PLL Error

a) Most often PLL problems are caused by dirt on the encoder disc.

b) PLL errors may be caused by the drum motor and/or motor amplifier. There are some cases where sub-standard encoder signals could cause the electronics to lose track of the drum or exacerbate any motor/amplifier problem.

c) Most encoder related PLL problems are caused by incorrect phase relationship of **SB** and **SI** or that the laser is weak.

d) Encoder cables have also been a cause of problems.

3.1.2 Index not Found

During Plotting or Drum Spin

Caused by misalignment of the encoder. The index signal comes in too late relative to the digital signals **SA** and **SB** and causes the counter in the MPE LCA to exceed 35999 which the firmware interprets as index not detected.
On MPE LCA E 0.03 (E series Xilinx) the counter rolls over at 35999 so the only time an index not detected should occur is during drum init.

During Drum Init

Index not found indicates that the MPE did not detect 3 indexes while rotating the drum in Hall mode. Most likely caused by a combination of misalignment of the encoder and oversight in tuning the encoder (particularly **IBIAS** and the phasing of the **SI** pulse) and/or drift. Refer first to section 3.2 on Performance Evaluation, before attempting re-alignment or replacement. Dirt on the encoder disc is a likely cause of missing index pulses.

3.1.3 Drum Positioning

Drum control is based on encoder signals. There is a drum position counter in the MPE LCA (Xilinx) that is read by the firmware. In MPE LCA & MPE LCA E 0.02 the counter is modulus 65536, while in MPE LCA E 0.03 it is a modulus 36000 counter. Type “fw dir” to list the LCA versions.

If you have MPE LCA E 0.03 and the LCA does not receive an index upon drum init to reset the counter, then it will start out in a random position and continue to be in the wrong position for loading, and the firmware has no way of knowing this. The cause is that the **SI** pulse phase is wrong; this may be caused by dirt on the disc or by misalignment.

Multiple indexes can also cause a positioning error on all MPE LCA versions. This may be caused by scratches on the vacuum plugs on sealed 3244 drums, or by the threshold of **IBIAS** being set too low, (see fig 10 and 11) or by glue or other reflective material on the disc in the region of the index ring (band inside of the ticks).

3.1.4 Microbanding

a) If there are bands in the sub-scan direction (perpendicular to the direction of most microbanding), the most likely problem is dirt on the encoder disk. Less probable is scratches on the encoder disk. Inspect the encoder disk. (Access to the encoder disc on a CTP engine requires the removal of the plate next to the encoder casting.) If necessary, clean the encoder. See 73-3289A.

b) On CTPs, gross error in plate thickness or drum diameter could result in microbanding in the sub-scan direction. Check for discrepancies between default and current values for *configuration* parameters in the NVS sub-system DRUM. Check plate type and media type, with the diagnostic monitor and on the workstation.

3.1.5 Geometric Accuracy

a) If the encoder has been moved or its optical or electrical output becomes distorted, the geometric accuracy of the recorder will be degraded. A geometric error caused by the encoder will be in the main scan direction and will be constant along the length of the drum (i.e. independent of sub-scan position). Check output signals as described in the next section.

3.1.6 Line Straightness

A line on the film/plate in the sub-scan direction is made up of many segments. If these segments do not line up, one of the possible causes is the encoder. To check for this problem, do a plot and check the PLL error lights on the RCE or MPE board. Most of the light should be contained in the two middle lights, with the side lights flickering. The two end lights should not be bright. Line straightness problems due to the encoder are rare.

The problem can also be caused by poor carriage tracks or coupling between the carriage and the ballscrew. Clean the tracks and inspect the coupling if this problem occurs.

3.2. Performance Evaluation

3.2.1 Tools

- Digital Oscilloscope with glitch capture or peak detect feature.

3.2.2 Step 1

a) Close all doors and service access panels.

b) Set both oscilloscope channels to 2V/div, timebase to 10µs/div for 3244 engines (25µs/div for VLF engines) (5µs/div for DH).

c) Attach probe 1 to the test pin labeled **TACH A** on the MPE board and probe 2 to the test pin labeled **TACH B**. Trigger on either channel.

d) Spin drum in Hall mode with "**drum spin 130 c**" for an 3244 engine or "**drum spin 65 c**" for VLF engines (or "**drum volts**" for an RCE).

e) The digital signals should look like those shown below. Ignore **TACH I** for now. Both signals should have a 50% duty cycle. **TACH A** should lead **TACH B** by 90° ±30°, center to center. The closer it is to 90°, the better. To adjust, refer to the Encoder Alignment Procedure.

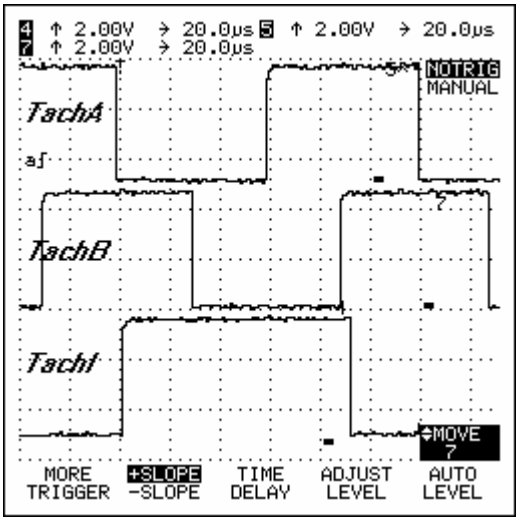


Figure 14

3.2.3 Step 2

a) Attach probes to **TACH B** and **TACH I**, trigger on **TACH I** in NORM mode.

b) Check that the rising edge of **TACH I** leads the closest falling edge of **TACH B** by 36° to 144° (or 0.1xPeriod to 0.4xPeriod).

c) Check that the pulse width of **TACH I** is less than 0.9xPeriod of **TACH B**.

d) Check that the rising edge of **TACH B** is before the falling edge of **TACH I.**

e) If the signals fail any of these criteria, adjust using the Encoder Alignment Procedure.

3.2.4 Checking for Multiple Index Pulses

a) Set the scope time base so that the time/division is less than 1/10 of the time that it takes for the drum to complete one revolution. Time per rev = 60 / rpm . Example, time base = 60/(130*10) = 46mS (typical is 50mS/div @ 120 rpm and 100mS/div @ 60 rpm). Set the trigger delay to 0 or set the horizontal position to close to the left of the screen. (Note: for Tek TDS 210- see next paragraph.) You should then see only two **TACH I** pulses one at the extreme left of the screen and one at the extreme right (460mS apart for drum speed of 130 rpm and 920mS apart for drum speed of 65 rpm). If you see any more than this, then you may be getting multiple indexes.

b) Tek TDS210 scopes have a peak detect feature; if you do not use this, the very narrow **SI** pulse will sometimes not be visible due to the resolution limit of the scope. Press "ACQUIRE" then select “Peak detect.

3.2.5 Check for Plug Reflections

a) See paragraph 2.5

3.2.6 Cleaning

a) Refer to Creo Encoder Cleaning Procedure document 73-3289A.

4. Theory of Operation

The encoder subsystem is used to measure the position of the drum. It consists of a glass disk (item 50 on dwg 50-1049A) mounted on the drum (item 10 on dwg 50-1049A) and an encoder block (item 620) used to read the pattern on the glass disk.

4.1. Encoder Disk

The encoder disk is a glass disk attached to the home end of the drum. It is mounted with a special flexible mount which allows for radial expansion of the disk with temperature, but does not allow the disk to shift or rotate.

9000 radial lines are printed on the encoder disk. Each line is 4 mm long and 50 microns wide. One of the lines extends toward the disk center and is broadened to 150 microns at its lower part. This line is the index line. All the lines are made of chrome and are reasonably durable to scratches.

4.2. Encoder Block

The encoder block is the electro-optical block mounted on the home end of the plotter. It reads the pattern on the encoder disk. This information is then used by the control electronics to determine the position and speed of the drum.

A laser diode emitting at a wavelength of 780 nm (near infra-red) is focused onto the encoder disk. Light from the laser diode is collimated and then focused by a 12.7mm cylindrical lens onto the disk, forming a long and narrow line 4.5 mm long and 5 microns wide.

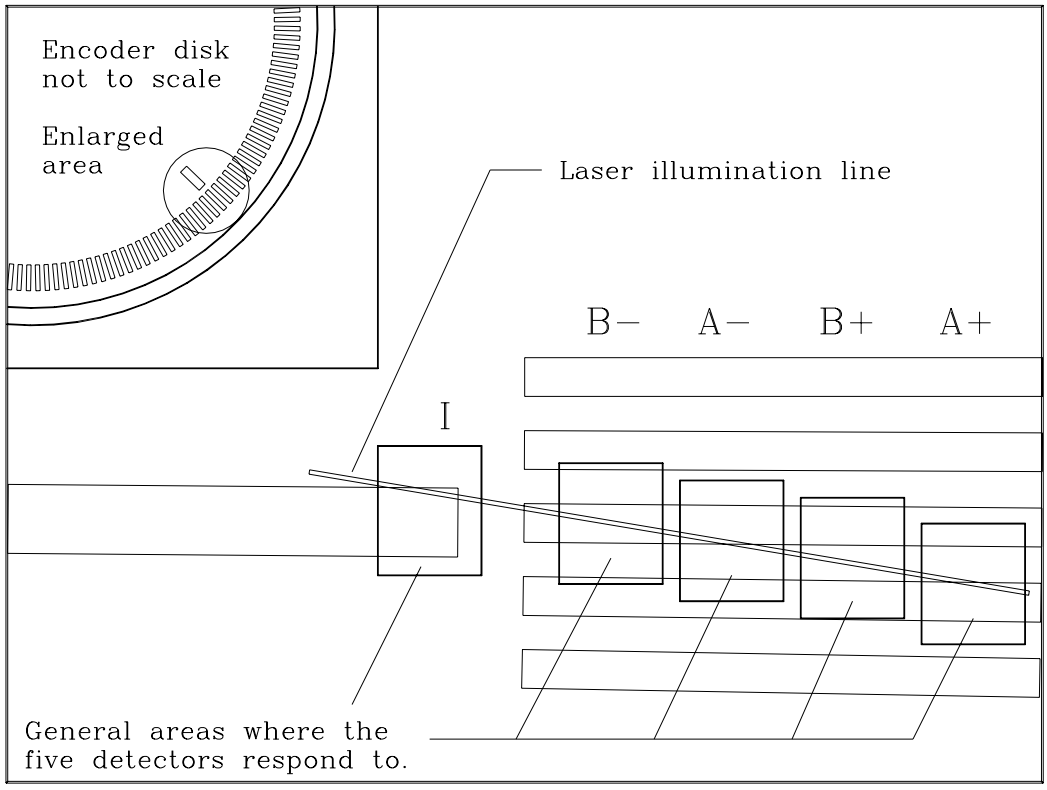


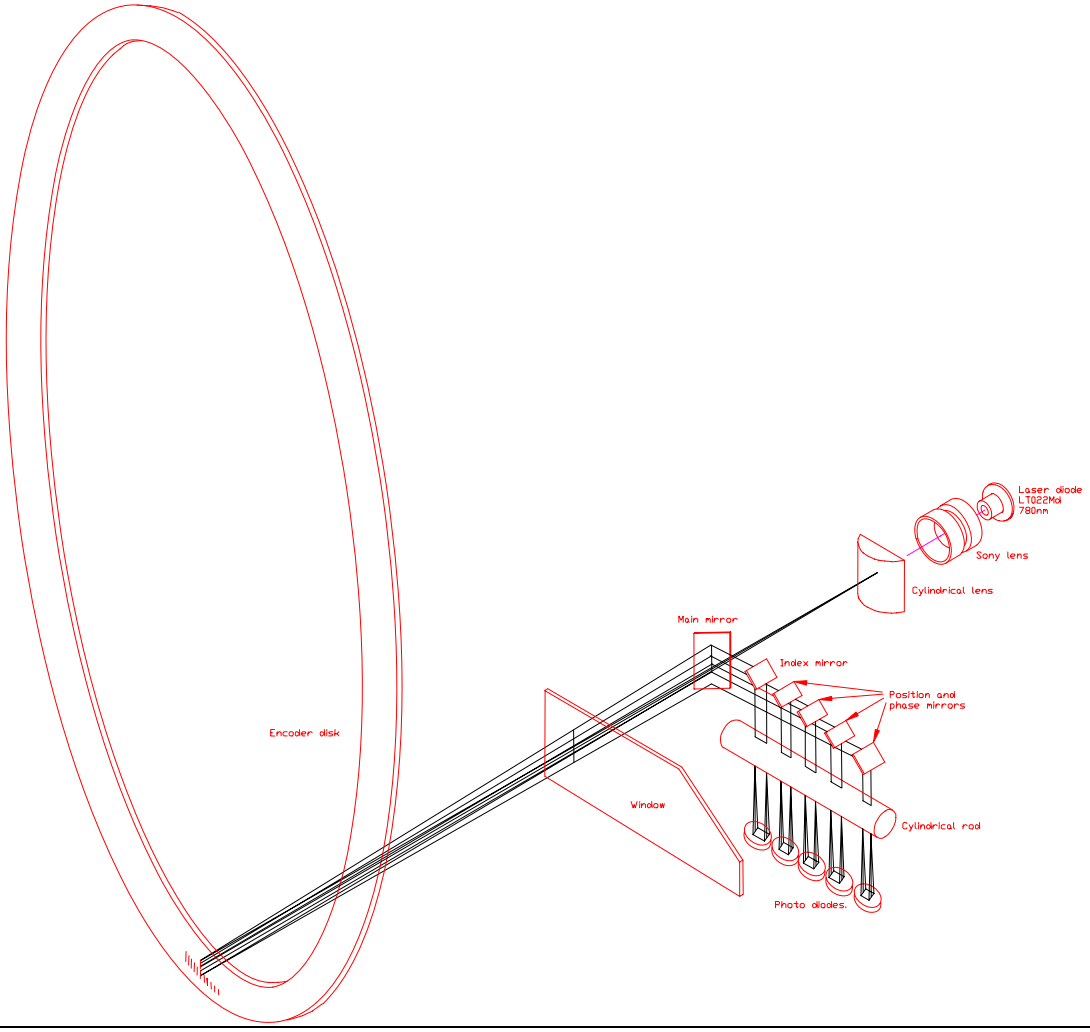
Figure 15 Beam and Sensor Positions on Encoder Disk

Five detectors 'follow' different segments of the illumination line, collecting any reflected light. Reflected light is directed sideways by a flat mirror inside the encoder block, then directed towards a detector by one of five small mirrors. Each small mirror 'links' one of the five segments of the laser line to one of the five detectors. The detectors produce five signals named **A+**,**A-**,**B+**,**B-** and **I**. See figure 15.

The encoder block is mounted so that the illumination line from the laser diode crosses the chrome lines at an angle so that only a segment of a chrome line is lit at any given time. The regions corresponding to detectors **A+** and **A-** would be 1/2 of a line spacing apart. The signal **A-** is subtracted from **A+** and the resultant signal is called **AD**. This difference signal is then fed into a schmitt trigger with TTL compatible output levels to generate **SA**, a 'squared up' version of **AD**. **AD** is HIGH if **A+** is larger than **A-** (**AD** > 0). A potentiometer controls the gain on **A-** hence the point at which **A+** becomes larger than **A-**. It is used to set the duty cycle of the output signal. Two detectors are used so that the **A** signal is independent of the light level and reflectivity of the disk. Since the detectors respond to large areas, the signals are relatively insensitive to small defects on the encoder disk.

The **B+** and **B-** detectors are arranged in the same way as the **A**s. They generate the signals **BD** that then spawn **SB** in the same way **AD** and **SA** are generated from **A+** and **A-**. The regions corresponding to detectors **A+** and **B+** are 1/4 line spacing apart. See figure15 for details.

The fifth detector receives reflection from the index line. The receiver adds a DC offset to the output signal which is then fed into a schmitt trigger with TTL compatible output levels. The DC offset is adjustable through a potentiometer labeled **I BIAS** on the circuit board.



Together, **SA** and **SB** generate a quadrature signal, which changes state 4 times for each chrome line that passes under the laser illumination line. This allows the drum position to be measured to one part in 36000. If **A** leads **B** the drum is moving in the forwards direction. If **A** lags **B** the drum is moving in the reverse direction. The forward direction of the drum is defined as the top of the drum moving away from the carriage.

The signals **TACH A**, **TACH B** and **TACH I** on the MPE / RCE board are inverted versions of the signals **SA**, **SB** and **SI**, respectively.

Since the **A**s and **B**s follow the order **A+**, **B+**, **A-** and **B-** at 1/4 line spacing each, the signals generated share the same characteristics. The following figures show the timing relationships among the signals present on the circuit. Each HI-LO or LO-HI transition made by **SA** and **SB** is counted as a 'tach tick'. Therefore **SA** and **SB** must have 50% duty cycle and must be 1/4 of the period apart.

The index signal (**SI**) indicates drum position 0. When the drum is spinning forward, **SA** is HI and **SB** makes a transition from LO to HI, the MPE/RCE checks if **SI** is LO. If so, it resets the drum position count to zero. It is then imperative that **SB** makes a *single* LO to HI transition in **SI**'s presence. Otherwise the index would be 'missing' or the MPE/RCE might reset drum position twice.

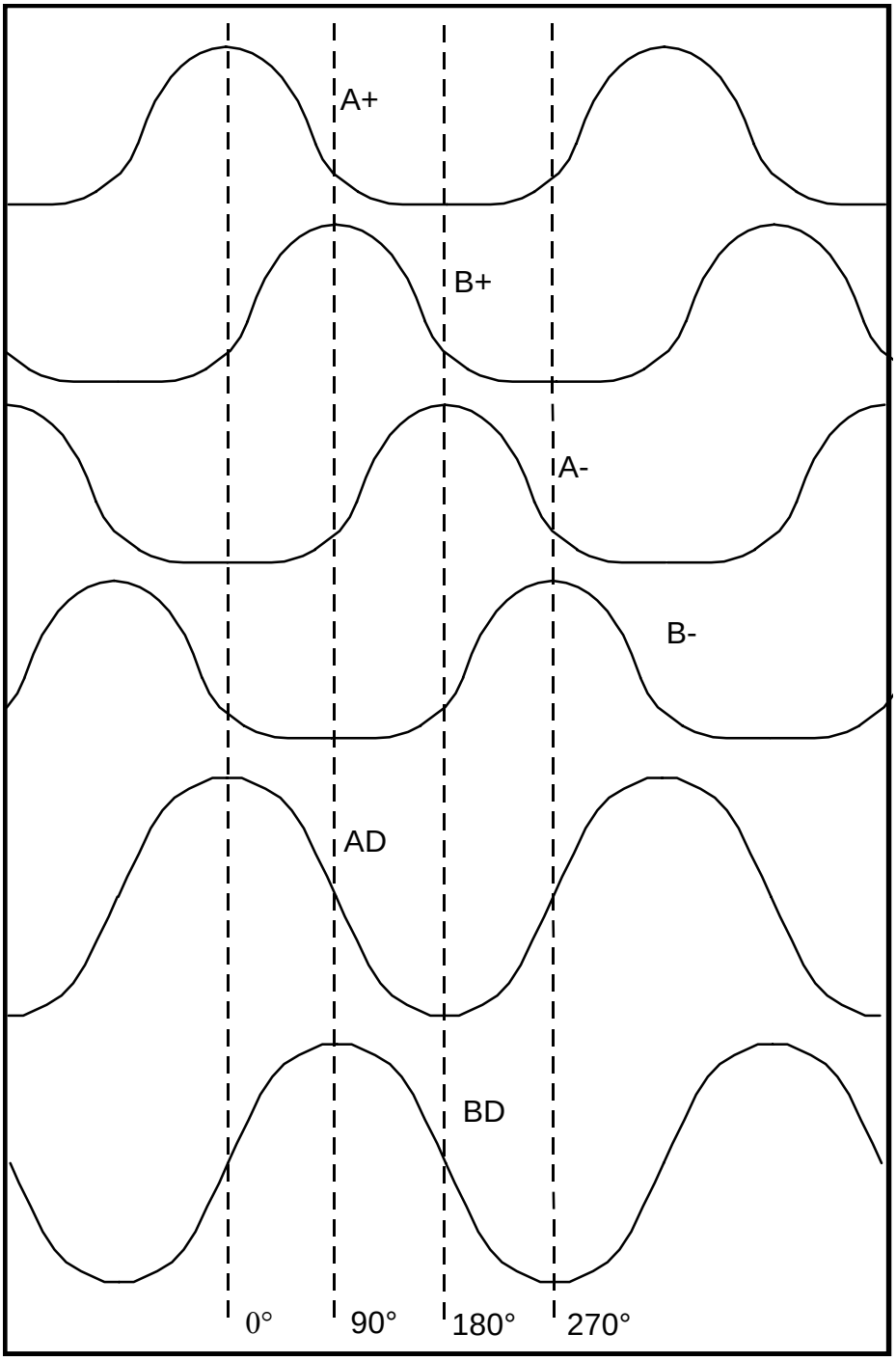


Figure 16 Analog Encoder Signals (drum is moving forward)

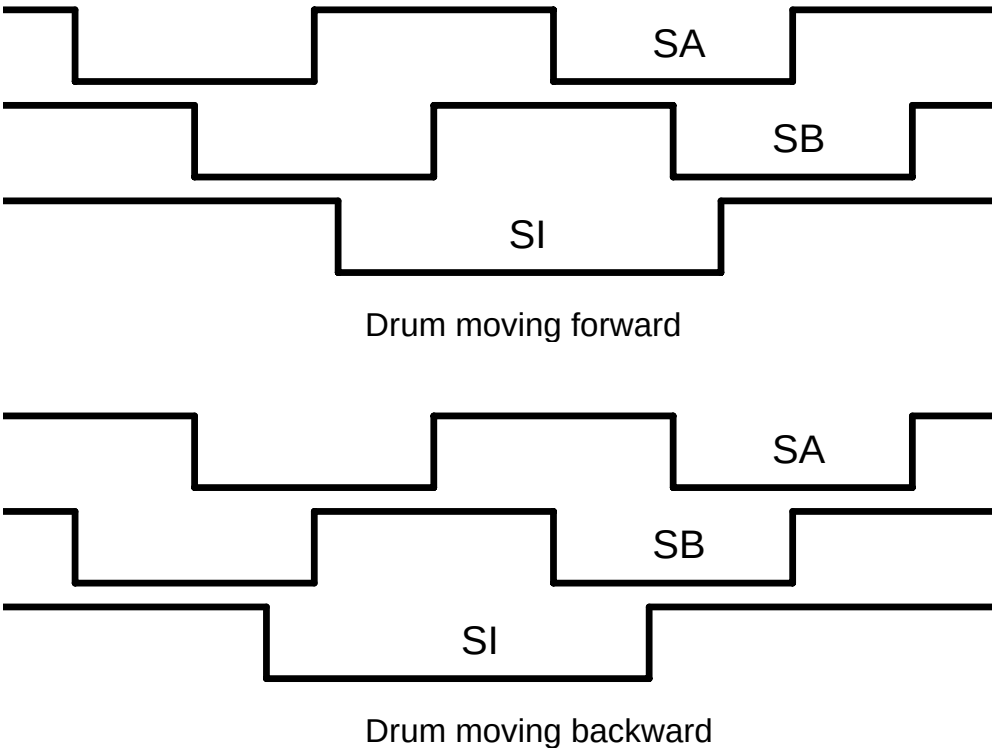


Figure 17 - SA, SB and SI as functions of time.

5. Troubleshooting

5.1. Using the Fluke 99

5.1.1 Set up for A+ and A-

a) Connect the red probe to INPUT A and the grey probe to INPUT B and power up the scope.

b) Connect the INPUT A probe to test point **A+** and the INPUT B probe to test point **A-**.

c) If the Fluke is in METER mode ("METER" highlighted) then press F1 "SCOPE" to get "SCOPE" highlighted.

d) If the cursors are on, you can turn them off as follows:

Press "SUB MENU".

Press F5 "CURSOR READINGS" to deselect .

e) To set up probe A, press INPUT A.

1. Highlight "DISPLAY INPUT A" using F2.
2. Use F3 to highlight "DC".
3. Inspect the probes looking for a divide ratio of 1:1 or 10:1.

   Press F5 "PROBE A MENU".

   Use the blue Up and Down arrow keys to select "PROBE on INPUT A".

   Press F5 "SELECT ITEM".

   Use the arrow keys to select the same ratio found on the probes.

   Press F5 "SELECT ITEM".

   Press F1 "CLOSE".

   DO NOT select the Calibrate probe menu item.
4. .Press F1 "More Input A".

   Use the blue Up and Down arrow keys to select "Glitch detect". Press F5 to turn it Off.

   Select "Combine A&B" and then select Off.

   Press F1 "close".
5. Use the MOVE ↕ key to move the ground reference bar for A into the center of the screen.
6. Use the RANGE key to set the vertical scale (displayed at the top of the screen) to 200mV/div. (Press the "mv" side of the key to decrease the value displayed and the "v" side to increase it.)

f) To set up probe B, press INPUT B.

1. Highlight "Display Input B" using F2.
2. Use F3 to highlight "DC".
3. Inspect the probes, looking for a divide ratio 1:1 or 10:1.

   Press F5 "Probe B Menu".

Use the blue Up and Down arrow keys to select “Probe on INPUT B”.

Press F5 “Select Item”.

Use the arrow keys to select the same ratio found on the probes.

Press F5 “select item”.

Press F1 “close”.

DO NOT select the Calibrate probe menu item.

4. .Press F1 “More Input B”.

   Select “Combine A&B” and select Off.

   Press F1 “close”.

5. Use the MOVE ↕ key to move the ground reference bar for B in the center of the screen.
6. Use the RANGE key to set the vertical scale (displayed at the top of the screen) to 200mV/div. (Press the “mv” side of the key to decrease the value displayed and the “v” side to increase it.)

g) Press TRIGGER

1. Press F1 “More Trigger”.
2. Use the blue Up and Down arrow keys to select “Trigger source”.

   Press F5 “Select item.”

   Use the arrow keys to select “Input A”, and F5 to “select item”.
3. Use the arrow keys to select “Trigger Slope”.

   Press F5 to select item and change to “+Slope”.
4. Use the arrow keys to select “Trigger Level” and

   change to “Autolevel”.
5. Use the arrow keys to select “Trace Repeat” and

   change to “Recurrent”.
6. Use the arrow keys to select “Trace Start” and

   change to “Free Run”.
7. Press F1 “close”.
8. Press F3 “time delay”.

   Use the arrow keys to set delay to “–3 div”.

   Press F1 to “close”.

h) Use the TIME key to set the time base (displayed at the top of the screen) to 20µS/div. (Pressing one side of the key increases the time and the other side of the key decreases it.)

5.1.2 Set up for **SA** and **SB**

a) Connect probe A to testpoint **SA** and probe B to testpoint **SB**.

b) If the cursors are on, you can turn them off as follows:

Press “SUB MENU”.

Press F5 “Cursor Readings” to deselect.

c) Press INPUT A.

1. Highlight “Display Input A” using F2.
2. Use F3 to highlight “DC”.
3. Inspect the probes looking for a divide ratio 1:1 or 10:1.

   Press F5 “Probe A Menu”.

   Use blue Up & Down arrow keys to select “Probe on INPUT A” .

   Press F5 “Select Item”.

   Use arrow keys to select the same ratio found on the probes.

   Press F5 “select item”.

   Press F1 “close”.

   DO NOT select the Calibrate probe menu item.
4. .Press F1 “More Input A”.

   Use the blue Up and Down arrow keys to select “Glitch detect”. Press F5 to turn it Off.

   Select “Combine A&B” and select Off.

   Press F1 “close”.
5. Use the MOVE ↕ key to move the ground reference bar for A in the center of the screen
6. Use the RANGE key to set the vertical scale (displayed at the top of the screen) to 2V/div. (Press the “mv” side of the key to decrease the value displayed and the “v” side to increase it.)

d) Press INPUT B.

1. Highlight “Display Input B” using F2.
2. Use F3 to highlight “DC”.
3. Inspect the probes looking for divide a ratio 1:1 or 10:1.

   Press F5 “Probe B Menu”.

   Use the blue Up and Down arrow keys to select “Probe on INPUT B”.

   Press F5 “Select Item”.

   Use the arrow keys to select the same ratio found on the probes.

   Press F5 “select item”.

   Press F1 “close”.

   DO NOT select the Calibrate probe menu item.

4. .Press F1 “More Input B”.

   Select “Combine A&B” and select Off.

   Press F1 “close”.

5. Use the MOVE ↕ key to move the ground reference bar for B to one division from the bottom of the screen.

6. Use the RANGE key to set the vertical scale (displayed at the top of the screen) to 2V/div. (Press the “mv” side of the key to decrease the value displayed and the “v” side to increase it.)

e) Press TRIGGER.

1. Press F1 “More Trigger”.

2. Use the blue Up and Down arrow keys to select “Trigger source”.

   Press F5 “Select item”.

   Use the arrow keys to select “Input A”, and F5 to “select item”.

3. Use arrow keys to select “Trigger Slope”.

   Press F5 to select item and change to “+Slope”.

4. Use the arrow keys to select “Trigger Level” and

   change to “Manual”. (Press F1 “close” if necessary.)

5. Use the arrow keys to select “Trace Repeat” and

   change to “Recurrent”.

6. Use the arrow keys to select “Trace Start” and

   change to “Wait for Trigger”.

7. Press F1 “close”.

8. Press F3 “time delay”.

   Use the arrow keys to set delay to “–5 div”.

   Press F1 to “close”.

9. Press “Adjust Level”.

   Use the Up and Down arrow keys to change the trigger level to about 2V.

   Or adjust until the “a↑” symbol on the left of the screen is about half way up the wave form.

f) Use the TIME key to set the time base (displayed at the top of the screen) to 10µS/div.

5.1.3 Set up for SI and I.

a) Connect probe A to testpoint **SI** and probe B to testpoint **I**.

b) If the cursors are on, you can turn them off as follows:

   Press “SUB MENU”.

Press F5 “Cursor Readings” to deselect.

c) Press INPUT A.

1. Highlight “Display Input A” using F2.
2. Use F3 to highlight “DC”.
3. Inspect the probes looking for a divide ratio of 1:1 or 10:1.

   Press F5 “Probe A Menu”.

   Use the blue Up and Down arrow keys to select “Probe on INPUT A”.

   Press F5 “Select Item”.

   Use the arrow keys to select the same ratio found on the probes.

   Press F5 “select item”.

   Press F1 “close”.

   DO NOT select the Calibrate probe menu item.
4. Press F1 “More Input A”.

   Use the blue Up and Down arrow keys to select “Glitch detect”. Press F5 to turn it Off.

   Select “Combine A&B” and select Off.

   Press F1 “close”.
5. Use the MOVE ↕ key to move the ground reference bar for A to one division from the bottom of the screen.
6. Use the RANGE key to set the vertical scale (displayed at the top at the screen) to 1V/div.

d) Press INPUT B

1. Highlight “Display Input B” using F2
2. Use F3 to highlight “DC”
3. Inspect probes, look for divide ratio 1:1 or 10:1

   Press F5 “Probe B Menu”

   Use blue Up & Down arrow keys to select “Probe on INPUT B”

   Press F5 “Select Item”.

   Use arrow keys to select the same ratio as is marked on the probes.

   Press F5 “select item”

   Press F1 “close”

   DO NOT select the Calibrate probe menu item..
4. .Press F1 “More Input B”.

   Select “Combine A&B” and select it Off

   Press F1 “close”
5. Use the MOVE ↕ key to move the ground reference bar for B to one division from the bottom of the screen.
6. Use the RANGE key to set the vertical scale (displayed at the top at the screen) to 200mV/div. (Press the “mv” side of the key to decrease the value displayed and the “v” side to increase it.)

e) Press TRIGGER.

1. Press F1 “More Trigger”.
2. Use the blue Up and Down arrow keys to select “Trigger source”.

   Press F5 “Select item”.

   Use the arrow keys to select “Input B”, and F5 to “select item”.
3. Use the arrow keys to select “Trigger Slope”.

   Press F5 to select item and change to “+Slope”.
4. Use the arrow keys to select “Trigger Level” and

   change to “Manual”. (Press F1 “close” if necessary.)
5. Use the arrow keys to select “Trace Repeat” and

   change to “Recurrent”.
6. Use the arrow keys to select “Trace Start” and

   change to “Wait for Trigger”.
7. Press F1 “close”.
8. Press F3 “time delay”.

   Use the arrow keys to set delay to “–3 div”.

   Press F1 to “close”.
9. Press “Adjust Level”.

   Use the Up and Down arrow keys to change the trigger level to about 300mV.

   Or adjust until the “a↑” symbol on the left of the screen is about half way up the wave form.

f) Use the TIME key to set the time base (displayed at the top of the screen) to 10µS/div.

5.1.4 Set up for SI and SB

a) Connect probe A to testpoint **SI** and probe B to testpoint **SB**.

b) If the cursors are on, you can turn them off as follows:

   Press “SUB MENU”.

   Press F5 “Cursor Readings” to deselect.

c) Press INPUT A.

1. Highlight “Display Input A” using F2.
2. Use F3 to highlight “DC”.
3. Inspect the probes looking for a divide ratio 1:1 or 10:1.

   Press F5 “Probe A Menu”.

Use blue Up & Down arrow keys to select “Probe on INPUT A”.

Press F5 “Select Item”.

Use the arrow keys to select the same ratio found on the probes.

Press F5 “select item”.

Press F1 “close”.

DO NOT select the Calibrate probe menu item.

4. .Press F1 “More Input A”.

   Use the blue Up and Down arrow keys to select “Glitch detect”. Press F5 to turn it Off.

   Select “Combine A&B” and select Off.

   Press F1 “close”.

5. Use the MOVE ↕ key to move the ground reference bar for A to the center of the screen.
6. Use the RANGE key to set the vertical scale (displayed at the top of the screen) to 2V/div. (Press the “mv” side of the key to decrease the value displayed and the “v” side to increase it.)

d) Press INPUT B

1. Highlight “Display Input B” using F2.
2. Use F3 to highlight “DC”.
3. Inspect the probes looking for a divide ratio 1:1 or 10:1.

   Press F5 “Probe B Menu”.

   Use the blue Up and Down arrow keys to select “Probe on INPUT B”.

   Press F5 “Select Item”.

   Use the arrow keys to select the same ratio found on the probes.

   Press F5 “select item”.

   Press F1 “close”.

   DO NOT select the Calibrate probe menu item.

4. .Press F1 “More Input B”.

   Select “Combine A&B” and select Off.

   Press F1 “close”.

5. Use the MOVE ↕ key to move the ground reference bar for B to one division from the bottom of the screen.
6. Use the RANGE key to set the vertical scale (displayed at the top of the screen) to 2V/div. (Press the “mv” side of the key to decrease the value displayed and the “v” side to increase it.)

e) Press TRIGGER

1. Press F1 “More Trigger”.
2. Use the blue Up and Down arrow keys to select “Trigger source”.

   Press F5 “Select item.”

   Use the arrow keys to select “Input A”, and F5 to “select item”.

3. Use the arrow keys to select “Trigger Slope”.

   Press F5 to select item and change to “ – Slope”.

4. Use arrow keys to select “Trigger Level” and

   change to “Manual”. (Press F1 “close” if necessary.)

5. Use arrow keys to select “Trace Repeat” and

   change to “Recurrent”.

6. Use arrow keys to select “Trace Start” and

   change to “Wait for Trigger”.

7. Press F1 “close”.

8. Press F3 “time delay”.

   Use the arrow keys to set delay to “–3 div”.

   Press F1 to “close”.

9. Press “Adjust Level”.

   Use the Up and Down arrow keys to change the trigger level to about 2V.

   Or adjust until the “a↑” symbol on the left of the screen is about half way up the wave form.

f) Use the TIME key to set the time base (displayed at the top of the screen) to 10µS/div or 20µS/div depending on preference.

5.2. Signals too small

Check the probe divide ratio is the same as the ratio set up in INPUT X, Probe X Menu.

Some encoders were shipped between Oct 98 and April 99 with the laser power set too low. These may produce A+/A- signals of around 400mV. These may be returned for recalibration. Do not attempt to adjust these in the field, the diode has to be removed and setup with a laser power meter and then the optics have to be completely realigned.

5.3. Scope picture won’t stand still

This is a triggering problem.

a) Make sure that “trace Start is set to “wait for trigger”.

   Press TRIGGER,

   F1 “More Trigger”

   Arrow down to “Trace Start” and change using F5 “select Item”

b) Check that the correct channel is selected under “Tigger Source”

Press TRIGGER

F1 “More Trigger”

Arrow down to “Trigger Source” and change using F5 “Select”.

c) You may need to adjust the trigger level.

Press TRIGGER

F4 “Adjust Level”

Use arrow keys to move the a↑ or a↓ or b↑ or b↓ symbol as applicable, to the bottom of the screen. Then slowly move it up towards the top. You should set the trigger level at about the half way height of the signal.

5.4. SI appears to jump while adjusting IBIAS

a) IBIAS is a fairly sensitive adjustment.

b) You must remember that **SI** and **I** only occur once per revolution, that is once every half second at 120 rpm. Therefore you should move the pot slightly and wait a second for the image to update, before moving it any more.

c) Why don’t we replace the IBIAS pot with a less sensitive option? IBIAS needs the full span of the pot (that is it cannot be replaced by a pot & voltage divider resistors) because one encoder needs it set near the left limit of the pot, and the next needs it set near the right limit of the pot. Using a 10 turn pot means that you no longer have a feel for where in the range the pot is (the procedure says turn it to the one extreme then...). The real reason that we probably won't put in a 10 turn pot is that there are 500 - 700 Creo encoders out there, and they would have to be scrapped, and new products will be using a sealed 5000 line encoder. Yesss!!! way to go!

5.5. Trace does not update at all

a) This is probably also a triggering problem, but check that “Trace Repeat” is “Recurrent”:

Press TRIGGER

F1 “More Trigger”

Arrow down to “Trace Repeat” and change to “Recurrent” using F5 “Select Item”.

b) Check that the correct channel is selected under “Tigger Source”:

Press TRIGGER

F1 “More Trigger”

Arrow down to “Trigger Source” and change using F5 “Select”.

c) You may need to adjust the trigger level:

Press TRIGGER

F4 “Adjust Level”

Use arrow keys to move the a↑ or a↓ or b↑ or b↓ symbol as applicable, to the bottom of the screen. Then slowly move it up towards the top. You should set the trigger level at about the half way height of the signal.

5.6. Tektronix TDS210 screen is slow to update

For users of the Tek TDS210 scope.

There is a setting which will cause the scope to react too slowly to be able to do an encoder mechanical alignment. To set correctly press "ACQUIRE" and select "SAMPLE" for most applications. (The problem is caused by the "Average" setting). Select "PEAK DETECT" if the pulse width you want to see is less than 1/25th of the time/division being used.

5.7. Tektronix TDS210 “Gotcha’s”

Make sure that the following setting are active or you may have problems with the scope image.

1. Press DISPLAY

   Select “TYPE” to “VECTORS”

   Select “PERSIST” to “OFF”

   Select “FORMAT” to “YT”

2. Press “ACQUIRE”

   For most tests select “SAMPLE”

   For the extra index test select “PEAK DETECT”

5.8. Ambient Light “Gotcha”

AND

5.9. Can't set SI Pulse According to Fig 10

This is applicable to Trendsetters and people using a trouble light. If a fairly bright light shines on the photo diodes on the under side of the encoder PCB then the **SI** pulse may appear wider than it should. If you set it to the correct width and remove the light, then it may be too narrow when you do the final check on the I-Tach signal on the MPE.

5.10. Supply Voltage is below 4.8V

This should not happen if the encoder is a 32-4047. If it is a 32-3011, then replace it with a 32-4047.

5.11. What Does “LEADS” Mean ?

Section 2.4.2 (g) tells you to check that SA leads **SB** by 90° +/- 30° This means that every part of the **SA** wave must happen before that same part of the **SB** wave. To check this, pick a feature like the flat top of the wave. Remember that time moves from left to right on the screen, that is, something on the left happened before something on the right. Now look at the flat top of **SA** and the flat top of **SB**. Check that the flat top of **SA** occurs before the flat top of **SB**, that is, the flat top

of **SA** must be on the left (by ¼ of a period) of the flat top edge of **SB**. Of course there will be another flat top of **SA** that comes after the on of **SB** but that is the next cycle.

5.12. How to Measure 15% of **I** for Figure 10

This is described for the Tektronix TDS210.

Press the Cursor button. Select off the menu cursor Type "Voltage".

Use the Vertical position knobs to set the cursor positions.

Set one cursor at the bottom of the **I** wave (the rounded wave) and the other at the top of the **I** wave.

Note down the difference or "Delta" from the screen menu.

Calculate 50% of the difference and 15% and 30% and write them down.

Move the top cursor down till the difference reads the 50% value that you calculated.

Now move the bottom cursor up until the difference reads the 15% number that you calculated. The bottom cursor should still be below the top cursor.

Now adjust the top cursor until the difference reads the 30% value that you calculated.

The point at which the SI pulse crosses the **I** wave must be between the top and the bottom cursors.

5.13. What is Hall Mode

Hall mode is used during the first three revolutions of drum init. The command "**drum spin 120 c**" causes the drum to spin in Hall mode versus the command "**drum spin 120**" which causes the drum to spin in encoder mode. In Hall mode the MPE firmware uses 3 Hall effect sensors inside the motor to determine the drum speed for control purposes while in encoder mode the Creo encoder is used for feedback. The encoder has 9000 lines per drum revolution vs. the Hall sensors only giving 36 pulses per drum revolution (6:1 pulley ratio) therefore encoder mode is much smoother.