| APPLICATION NOTE | AN-Lift-0011v103EN |
|---|---|
| **Automatic Pole-Tuning when using Incremental Encoder with PMSM** | |

| | |
|---|---|
| **Inverter type** | FRENIC Lift |
| **Software version** | From 1300, 1301 |
| **Required options** | Not required |
| **Related documentation** | RM FRENIC Lift,Explanation for New function (0808), BS003594-04LM1S_Explanation for New function _1300,1301 BS003594-04LM1S |
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| **Revised** | Jordi Català |
| **Approved** | David Bedford |
| **Use** | Public, Web |
| **Date** | 18/03/2009 |
| **Version** | 1.0.3 |
| **Languages** | English |

## Introduction.

When FRENIC-Lift is used with Synchronous machines with incremental encoder a pole tuning must be done every power-up. The inverter by itself doesn't perform this action automatically and therefore an external device must give the command to execute the pole tuning after every power up. The lift controller can do this or some schematic can be prepared in order to perform this action before the first travel after power up.

From ROM version 1300 (and 1301) it is possible to use the PTD (Pole-Tuning Done) signal in order to perform the automatic Pole-Tuning, without the Lift Controller's intervention by following some indications described in this paper.

The PTD Signal behaviour is shown in the Figure 1. Basically, this signal is OFF if the pole-tuning has not been performed from the last power-up. Once this action is done, the signal turns ON if the pole tuning is performed without error, until the inverter power supply is removed or some specific trips appear. For further details, please refer to figure 1.

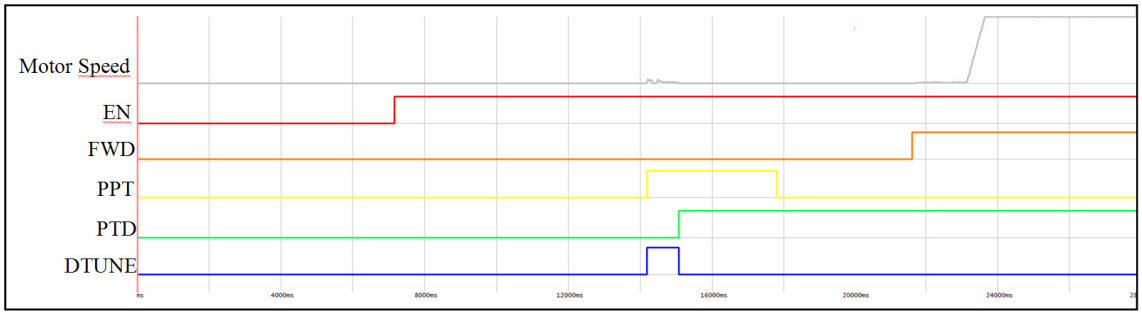



Figure 1: PTD Signal Behaviour

## Application implementation.

In order to perform a completely automatic Pole-Tuning, there are two conditions that must be accomplished:

- The inverter must perform the Pole-Tuning automatically at every Power-Up, once the ENABLE signal is activated, in order to know the offset between the poles' position and the position read from the encoder.
- The inverter has to ignore a RUN Command until the Pole-Tuning has been performed after a Power-Up.

To accomplish these conditions, is necessary to have the signal PTD in active-high logic and in active-low logic, due to the following reasons:

- The active-low logic signal of PTD function will be used, by means of a digital input set as PPT function, to give the command to the inverter to execute the Pole-Tuning.
- The active-high logic signal of PTD function will be used as common for the relays that control inverter's digital inputs like FWD, REV, SS1, etc. In this way, we ensure that the inverter does not receive the RUN command until the Pole-Tuning has been correctly finished. Otherwise, if the inverter receives the RUN command during the Pole-Tuning, an alarm trip will occur.

As we need the two signals, in the solution proposed in this document the 30ABC relay output is used. For details, please refer to the "Connection Setup" section.

The final inverter's behaviour is shown in Figure 2. In this picture, it is possible to see how the inverter behaves after a power-up.

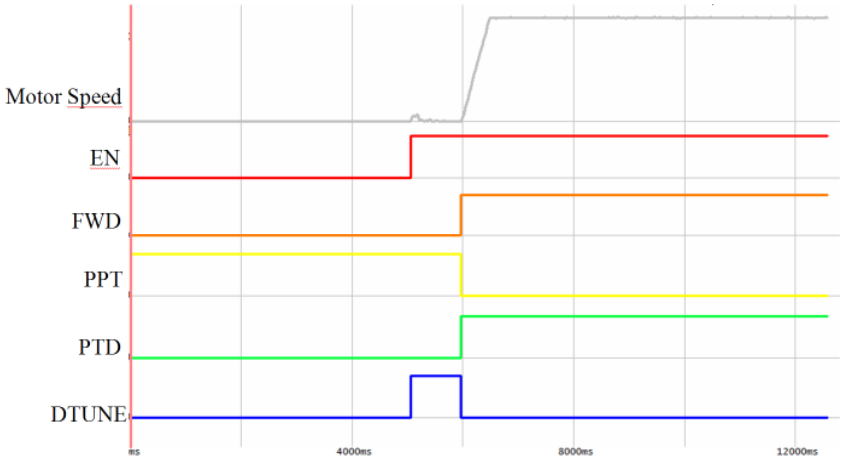


Figure 2: Inverter's Behaviour After a Power-up

## Connection setup diagram.

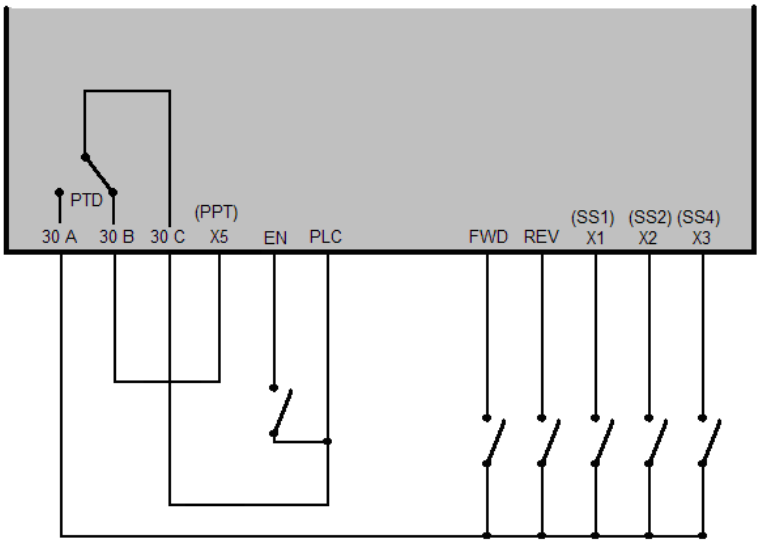



Figure 3: Connection Setup Diagram

As it is shown in Figure 3, the 30A relay output is the common of all the inputs, except the ENABLE and PPT inputs.

Summarizing, when the inverter comes from power-up PTD function is OFF. Therefore, by means of terminal 30B the inverter is giving itself the command to execute the pole tuning (by means of terminal X5). As soon as the lift controller activates the Enable signal of the inverter (with the intention of moving the lift), the inverter performs a Pole tuning. When the Pole tuning is finished the PTD changes from OFF to ON; therefore the relay changes its state and 30A supplies the common to the inverter input commands. Then, as soon as the PTD function is set to ON, and if a RUN command is given from the controller, the inverter starts to move the motor.

The only think that is noticed in this process is just a small delay since the lift controller gives the command to move until the motor starts to move, because pole tuning takes some time to be performed.

## Inverter setup.

The following table describes the function settings that differ from factory defaults.

| Function | Value | Description |
|---|---|---|
| E05 | 69 | Start magnetic pole position offset tuning (PPT) |
| E27 | 115 | Pole tuning done (PTD) |

## Conclusion

From ROM versions 1300 and 1301 and using the PTD function, FRENIC Lift is able to control when it is necessary to do a Pole-Tuning. With the setup explained in this document, it is possible to perform an automatic Pole-Tuning with the FRENIC Lift inverter, in order to ease the jobs of the Lift Controller. This behaviour can be very useful combined with the possibility (that was already available in FRENIC Lift before ROM versions 1300 and 1301) of static Pole-Tuning.

## Document history.

| Version | Changes applied | Date | Written | Checked | Approved |
|---|---|---|---|---|---|
| 0.0.1 | Draft | 27/02/2009 | JM Ibáñez | J. Català | |
| 1.0.1 | Second version | 02/03/2009 | J. Català | | |
| 1.0.2 | Third Version. Some figures added. Small errors checked | 02/03/2009 | JM Ibáñez | J. Català | |
| 1.0.3 | Fourth Version. Small text corrections | 18/03/2009 | JM Ibáñez | J. Català | D. Bedford |