
Application Note

C005 Pos Fbk Alignment for PMAC motors

HA502487C005_002

AC30P/D V2.13 onwards

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Requirements

Intended Users

This Application Note 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 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.

Hazards

Refer to the Safety Information given at the front of the Product Manual supplied with every Parker SSD Drives product.

C005 POS FBK ALIGNMENT FOR PMAC MOTORS

Abstract

This Application Note gives information and how to use the Pos Fbk Alignment feature to align position from motor feedback to the PMAC motor back EMF. This is required to run the PMAC motor in Vector Control mode.

Pre-Requirement

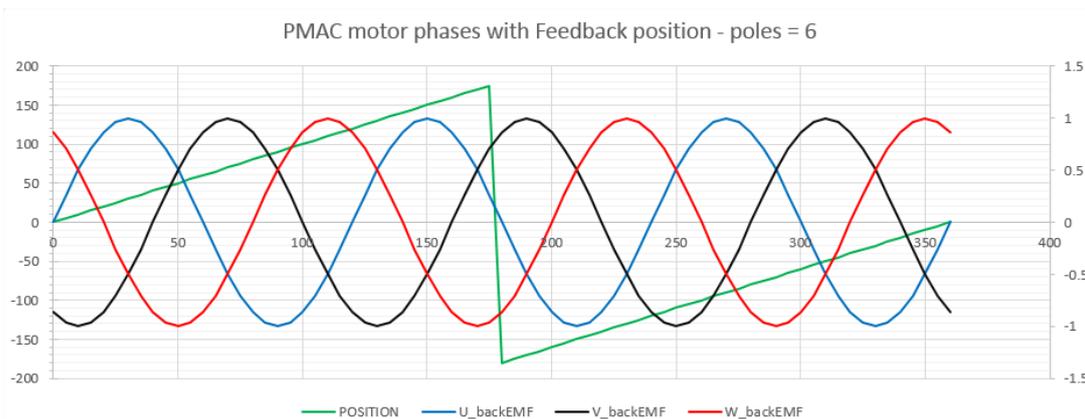
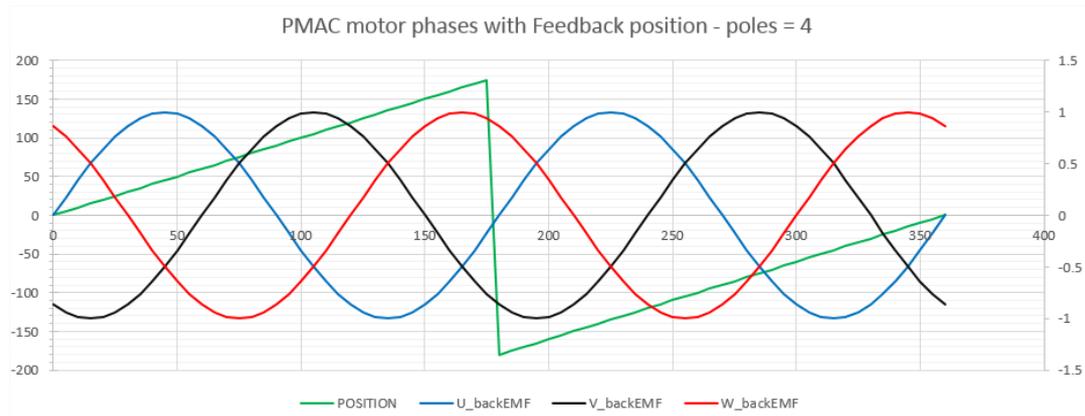
The pre-requisites are :

- a AC30 drive
- a feedback attached to the motor with the associated feedback option fitted into the drive.

Parameters described below are part of PMAC Motor Data and Pos Fbk Alignment.

Introduction

By definition, the motor Vector Control is based on the assumption that the back EMF is crossing the 0V line in a positive direction when the electrical position is also crossing the 0° line in a positive way. Another requirement is to insure a positive 'encoder/resolver' rotation with a positive electrical motor rotation (U, V, W).



The Pos Fbk Alignment feature is used to automatically calculate any offset between the Zero encoder absolute position and the motor back EMF, as well as selecting the correct wiring of the motor (U, V, W sequence) with the encoder position.

The feature needs to be run at least once with a PMAC motor associated to an absolute encoder type.

The feature needs to be run after each power cycle with a PMAC motor associated to a relative encoder type (pulse encoder for example). In that case, the absolute position information is lost by the power cycle and the alignment is required after power ON.

The feature is run on a motor free to rotate, no load attached to the motor shaft.

Regardless of the Alignment Method selected, the motor should move during the sequence.

Pos Fbk Alignment operation

2 Methods can be selected to align feedback and motor.

Alignment Method = MANUAL

The motor is moved to an electrical position corresponding to the motor phase selected by **Alignment On Motor** parameter.

This electrical position depends on the PMAC Wiring type selected and on the real motor phase wiring.

PMAC Encoder Offset is calculated by looking at real position from the active encoder compared to theoretical position where the motor is.

So, it depends also on the encoder settings (inverted or not).

For standard connections (correct U, V, W motor wiring sequence and position from encoder varying in a positive way looking at the motor front shaft), position offset is extracted and written back into PMAC Encoder Offset.

Correct connection of the encoder means that a clockwise rotation of the motor front shaft equals a positive position variation.

Correct motor wiring means phase U, V, W rotating in a correct sequence for a clock wise rotation of the motor front shaft.

Considering a standard connection, the following table gives possible encoder and **PMAC Wiring** settings and results on speed control :

1809 PMAC Wiring	Active Encoder Invert*	Correct speed control	Positive Speed setpoint **
STANDARD	FALSE	YES	Clockwise direction
STANDARD	TRUE	NO***	
REVERSE	FALSE	NO***	
REVERSE	TRUE	YES	Counter clockwise direction

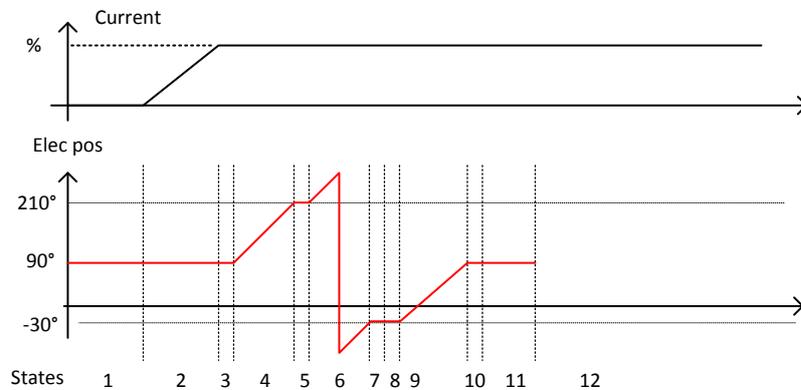
* Active Encoder Invert refers to the active speed feedback invert parameter.

** Looking the front shaft of the motor

*** The motor is uncontrolled. It could overspeed, be stalled, or running at constant speed without any control.

Alignment Method = AUTOMATIC

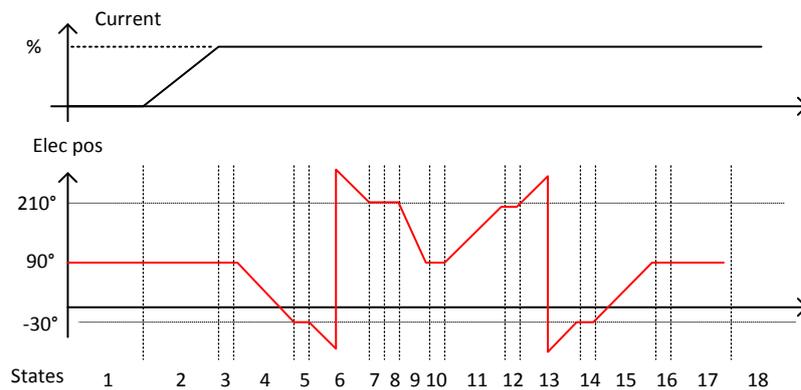
In case of a correct wiring of encoder and/or motor phases, the sequence is as follows :



During the final state (11), the Alignment Offset is automatically calculated and is passed back to **1808 PMAC Encoder Offset**

Also **1809 PMAC Wiring** is set to STANDARD

In the case of a wrong wiring of encoder and/or motor phases, the sequence is as follows :



From State 4 to 9, a wrong direction as been detected, and the direction should be reverted. **Alignment Direction** is set to REVERSE.

During the final state (17), the Alignment Offset is automatically calculated and is passed back to **1808 PMAC Encoder Offset**

Also **1809 PMAC Wiring** is set to REVERSE.

In that case, the direction of motor rotation has been changed during the Pos Alignment sequence. Please verify if the new direction is compatible with your application.

If you want to change it, please change the Invert parameter of the active encoder used to control the motor and run again the Pos alignment sequence.

Setting up **Alignment Method = DIRECTION TEST** allows to verify the direction of positive electrical position by slowly rotating the motor. A correct wiring of the motor phases should turn the motor in a clockwise direction looking at the front shaft of the motor

The motor is slowly rotated with the following sequence U, V, W, U, V, W.....

It allows to verify the rotation direction and detect any wiring inversion on the motor phases.

Active encoder Invert parameter has no effect during this test.

Looking at the position variation from the active encoder may help to know if the active encoder is correctly wired.

Considering a correct connection of the motor phases :

1809 PMAC Wiring	Motor Rotation direction
STANDARD	Clockwise
REVERSE	Counter Clockwise

When running this Method, either set **1257 Seq Stop Method** to DISABLE VOLTAGE or **0505 Zero Speed Threshold** to 1% otherwise you may end up with a motor rotating at slow speed for 60s without any possibility to stop it.

Running the sequence

The feature is run on a motor free to rotate, no load attached to the motor shaft.

Regardless of the Alignment Method selected, the motor should move during the sequence.

The sequence is validated by **Alignment Enable** input.

The drive waits for a START/TORQUE ON condition to start the cycle.

The sequence can be stopped by a STOP/TORQUE OFF command anywhere during the cycle.

A successful sequence sets **Alignment Ended = TRUE**.

A STOP/TORQUE OFF command is needed to stop the sequence.

If Alignment Method is set to AUTOMATIC, it is possible that the direction of motor rotation for a positive setpoint could be reversed. The parameter PMAC Wiring can be changed by the sequence if an incompatibility of direction between the encoder and the motor phases wiring is found.

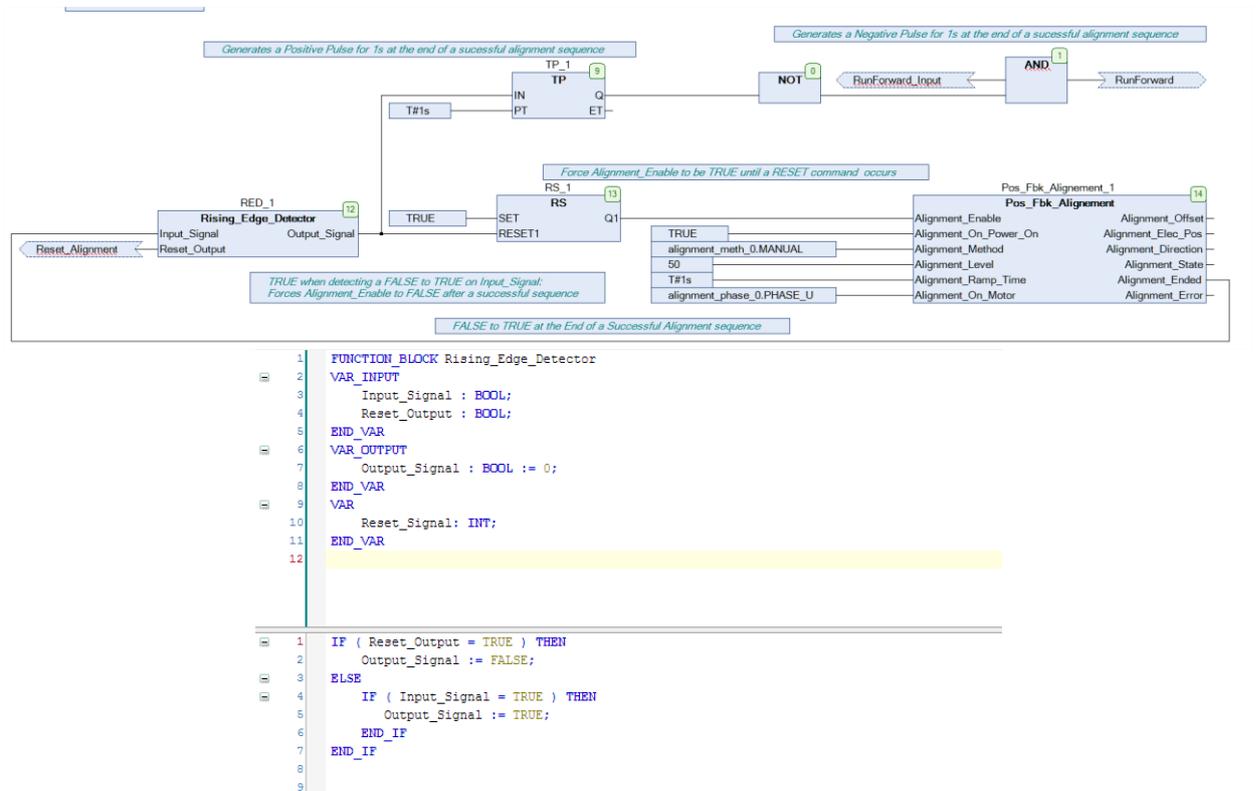
Alignment on Power On

As the feature needs to be run after each power cycle with a PMAC motor associated to a relative encoder type (pulse encoder for example), a parameter 1796 Alignment On Power On could be set up to TRUE.

Set to TRUE, it automatically trips the drive after a power up on a Start command until an Alignment sequence is run and completed successfully.

Application

Below is a simple example on how to force the system to run a Pos Alignment sequence on the first start after power_up :



Alignment On Power On has been set to TRUE

Alignment Method is set to Manual (It could have been set to AUTOMATIC).

Alignment Enable is TRUE from Start-up.

The first start command will run the Pos Alignment sequence.

A running and successfully sequence resets Alignment_Enable to FALSE.

A 1s negative pulse is generated at the end of the sequence (positive at Q output of TP_1). This information can be used to toggle any command to start the system.

The feature is run on a motor free of rotation, no load attached to the motor shaft.

Depending of the Alignment Method selected, the motor is moving during the sequence.

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