

Application note
April 2010

TTA-PRO Positioners

SinCos tracks motor feedback

1) INTRODUCTION

This application note is dedicated to the commissioning of the TTA-PRO amplifier range running a motor equipped with a specific position sensor. The position sensor output signals (SinCos tracks) are analog and differential sine and cosine signals. They are electrically similar to a standard SinCos encoder. The Sin and Cos signal period is generally equal to the motor pole pitch or a multiple. Only the specific information regarding the SinCos tracks feedback sensor setting are described in this document. The complete information for the TTA-PRO amplifier commissioning and parameterization can be found in the appropriate manuals. TTA-PRO applications with SinCos tracks feedback require amplifier version 529.C8 or higher. The parameterization for an application with SinCos tracks motor feedback requires the VDSetup software version 3.67 or an higher release.

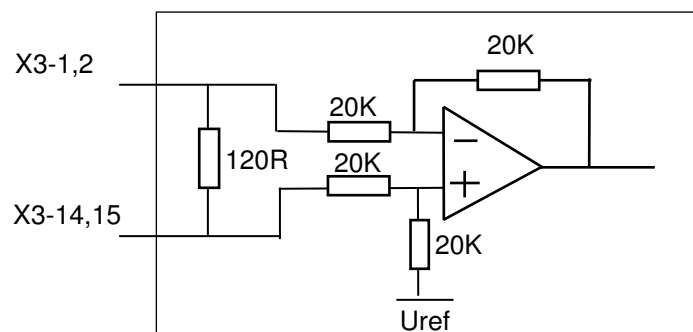
2) X3 CONNECTOR FOR SINCOS TRACKS MOTOR FEEDBACK (Sub D 25 pins female)

The "SinCos tracks motor feedback" configuration is software selectable and stored in the amplifier EEPROM.

The corresponding X3 connector pin functions are described below.

PIN	FUNCTION	REMARKS
14	Sin-	Differential input of the position sensor Sin track
1	Sin+	Differential input of the position sensor Sin track
15	Cos-	Differential input of the position sensor Cos track
2	Cos+	Differential input of the position sensor Cos track
8	+5V	Encoder supply voltage: max 300 mA available
21	GND	Encoder supply GND
9	TC+	Motor thermal sensor input
22	TC-	Motor thermal sensor input
others	reserved	

SIN AND COS CHANNELS SPECIFICATION



3) POSITION SENSOR CABLES

The analog Sin and Cos signals require a pair twisted and shielded cable. The shield must have a "360°" connection via metallic collars at both ends. If the shield is connected by means of a pig tail, it must be connected at one end to the GND pin of the connector on the amplifier side with a connection as short as possible.

Check that the voltage drop in the power supply lines of the position sensor cable is complying with the sensor technical specifications. The voltage drop value for a given cable is calculated as follows:

$$\Delta U[V] = 40 \cdot 10^{-6} \cdot \frac{L_c[m] \cdot I[mA]}{S[mm^2]}$$

With

ΔU:	voltage drop in volts
Lc:	cable length in metres
I:	sensor current in milliamps (see technical specifications)
S:	cross section in squared millimetres

If the voltage drop in the cable is too high, the user has to increase the supply lines cross section or to power the position sensor by an external power supply.

4) OFFSET COMPENSATION ON THE SIN AND COS CHANNELS

For the compensation of the measurement offsets on the TTA servo drive Sin and Cos channels, proceed as described below. This operation is necessary for the TTA servo drive operation with SinCos tracks motor feedback. It must be executed before the servo drive commissioning.

- Switch on the servo drive logic supply (+24V)
- Disconnect the position sensor cable from the X3 connector
- Deactivate the **Enable** input on the command connector
- Connect the serial link RS-232 and start the Windows ASCII terminal
- Send the **OX3** ASCII command to start the offset compensation procedure
- Send the **OX** ASCII command and check that the returned value is 0.
- If the value returned by the **OX** ASCII command is different from 0, the procedure has not been correctly executed. In this case, check that the position sensor cable is really disconnected from the X3 connector. Check also that the **Enable** input is deactivated. Send again the **OX3** ASCII command in order to start the offset compensation procedure and check that the procedure has been correctly executed by reading the **OX** ASCII command value.
- When the procedure has been correctly executed, the Sin and Cos channel offset values are automatically saved in the amplifier internal memory.
- Connect the position sensor cable on the X3 connector.

5) APPLICATION WITH SIN/COS TRACKS MOTOR FEEDBACK

5-1. Amplifier configuration

Proceed as described below for the SinCos tracks motor feedback configuration:

Start the VDSetup software (release 3.67 or higher).

Select "SinCos tracks" feedback in the "Position sensor configuration" window. Click on "OK" to validate the amplifier sensor feedback configuration.

5-2. Amplifier setting and operation

The TTA servo drive operation with SinCos tracks motor feedback is similar to the resolver feedback operation. Refer to the appropriate Installation and User manuals for the servo drive commissioning and parameterization.

Execute the command "Save parameters to EEPROM" before switching off the logic supply (+24V).



When using the VDSetup software with a release lower than 3.67, the servo drive parameters are not correctly loaded and saved in a parameter file (*.PAR) because the "SinCos tracks feedback" configuration is not supported. These operations may involve uncontrolled motor movements that may be dangerous for operator and machine.

5-3. Application limitations

When the TTA servo drive is configured for SinCos tracks motor feedback, Sin/Cos encoder types and Hiperface / Endat encoder types cannot be connected to the servo drive as "second position sensor" for electronic gearing or for loading position feedback applications. Only TTL incremental encoder types can be used for this purpose.

Stepper emulation applications are still available when the TTA servo drive is configured for SinCos tracks motor feedback.

6) SINCOS TRACKS ERROR COMPENSATION

For the compensation of the position sensor errors (offsets and amplitude gap between the Sin and Cos tracks), proceed as described below. This operation allows to reduce the motor speed ripples at high speed and improve the positioning accuracy. It is required when the application performances must be optimized. In this case, the SinCos tracks error compensation operation must be renewed if the motor position sensor is changed for maintenance.

- Start the servo drive commissioning and parameterization according to the appropriate TTA amplifier Installation and User manuals.
- Connect the serial link RS-232 and start the Windows ASCII terminal.
- Deactivate the **Enable** input.
- Send the **MS1** and **AR** ASCII commands.
- Activate the **Enable** input.
- Check that the motor shaft is free and that its displacement in the positive direction over 2 revolutions (or 2 pole pitches for a linear motor), is not dangerous for operator and machine.
- Send the **OC** ASCII command for starting the execution of the sensor compensation procedure. The motor displacement during the procedure execution is about 2 revolutions (or 2 pole pitches for a linear motor). Do not disable the drive before the end of the procedure (TTA front panel leds are flashing during the procedure execution).
- If the **BUSY** fault is continuously displayed after the execution of the compensation procedure, the procedure has failed because of an external cause and the compensation is not valid. Check that the **Enable** input is activated. Check that the limit switches inputs are not activated. Send again the **OC** ASCII command to start the compensation procedure and check that the procedure has been correctly executed.
- The compensation parameters are automatically saved in the amplifier internal memory at the end of the procedure.

7) TTA-PRO PROFIBUS COMMUNICATION

PNU	Parameter	Unit	Min.	Max.	Size	R/W	Saving	Default value
893	Motor feedback selection : - Resolver feedback (0) - Encoder feedback (1)		0	1	Boolean	R/W	E	0
898	SinCos tracks motor feedback selection : - Resolver or encoder feedback (0) - SinCos tracks feedback (1)		0	1	Boolean	R/W	E	0
890	Encoder input type selection		0	15	word	R/W	E	0
894	Sensor feedback programming				-	W		
865	SinCos error compensation				-	W		

Notes R/W Reading / Writing
E These parameters are saved in the EEPROM by instruction 729.

7-1. Motor feedback sensor selection

Motor feedback selection **PNU :** **893**

The motor feedback sensor is used to close the servo motor torque and speed control loops. The servo motor position loop can be closed either by the motor feedback sensor or by the second sensor (see [PNU 885](#)).

Parameter word

Range 0-1

Conversion 0 = Resolver input selection for the motor feedback (if [PNU 898](#) =0)
1 = Encoder input selection for the motor feedback (if [PNU 898](#) =0)

Note The motor feedback selection is only valid after the end of the "Motor Feedback Programming" procedure.

SinCos tracks motor feedback selection **PNU :** **898**

The SinCos tracks motor feedback is used to close the servo motor torque and speed control loops. The servo motor position loop can be closed either by the motor feedback sensor or by the second sensor (see [PNU 885](#)).

Parameter word

Range 0-1

Conversion 0 = Resolver or encoder input selection for the motor feedback according to [PNU 893](#) value
1 = SinCos tracks input selection for the motor feedback

Note The motor feedback selection is only valid after the end of the "Motor Feedback Programming" procedure.

Various encoder types can be used with the TTA servo drive range (TTL, SinCos, incremental, absolute, single-turn, multi-turn). The [PNU 890](#) is set according to the encoder type to be connected on the X3 connector.

Encoder input selection **PNU :** **890**

This parameter allows to select the encoder type to be connected on the X3 connector.

Parameter word

Range 0 to 15

Conversion see table below

Value	Description
0	TTL incremental encoder configuration
1	TTL incremental encoder + 60° HES configuration
2	TTL incremental encoder + 120° HES configuration
3	SIN/COS incremental encoder configuration
4	SIN/COS incremental encoder + 60° HES configuration
5	SIN/COS incremental encoder + 120° HES configuration
6	Absolute single-turn SIN/COS encoder (ERN1085 compliant)
7	Absolute multi-turn / single-turn SIN/COS encoder with ENDAT protocol
8	Absolute multi-turn / single-turn SIN/COS encoder with HIPERFACE protocol
9	Absolute linear SIN/COS encoder with HIPERFACE protocol
15	Pulse and Direction input configuration for stepper motor emulation

Note The encoder input selection is only valid after the end of the "Motor Feedback Programming" procedure.

Motor feedback programming**PNU :** **894**

The motor feedback programming procedure modifies the encoder input selection and the motor feedback selection according to the parameters defined by [PNU 890, 891 893 and 898](#).

Limitation Writing only.

Execution With disabled positioner.

Note The execution of this procedure takes approximately 5 s.

7-2. SinCos tracks error compensation

SinCos error compensation**PNU :** **865**

Parameter None.

Limitation Writing only.

Execution With positioner disabled and **Enable** input activated.

Note This command allows to execute the SinCos tracks error compensation procedure (compensation of the offsets and amplitude difference between the Sin and Cos signals). This operation allows to reduce the motor speed ripples at high speed and improve the positioning accuracy. It is only required when the application performances must be optimized. In this case, the SinCos tracks error compensation operation must be renewed if the motor position sensor is changed for maintenance. The compensation parameters are automatically saved in the amplifier internal memory at the end of the procedure.

Appendix : TTA range hardware indexes for SinCos tracks motor feedback

The following hardware indexes are required in the TTA-PRO amplifier in order to support the SinCos tracks motor feedback functionality.

Drive rating	230/2.25 to 16.5	400/1.8 to 7.2	400/14	400/30 and 45	400/70	400/90
TTA-PRO version	O or greater	L or greater	N or greater	K or greater	A or greater	