



## ServoPac TT Application Templates

**Digital drive  
for sinusoidal  
synchronous  
AC motors**

**WARNING**

This is a general manual describing a series of servo drives having output capability suitable for driving AC brushless sinusoidal servo motors.

Please see also:

- o **ServoPac TT Installation Guide** for the hardware installation of the drive (mounting, wiring, ...)
- o **ServoPac TT STO** for the Safe Torque Off function
- o **ServoPac TT User Guide** for the operation of the drive (commissioning, configuration, ...)
- o **Gem Drive Studio software Quick Start manual** for the drive parameterization.

**Instructions for storage, use after storage, commissioning as well as all technical details require the MANDATORY reading of the manual before getting the drives operational.**

**Maintenance procedures should be attempted only by highly skilled technicians having good knowledge of electronics and servo systems with variable speed (EN 60204-1 standard) and using proper test equipment.**

The conformity with the standards and the "CE" approval is only valid if the items are installed according to the recommendations of the drive manuals. Connections are the user's responsibility if recommendations and drawings requirements are not met.



Any contact with electrical parts, even after power down, may involve physical damage. Wait for at least 5 minutes after power down before handling the drives (a residual voltage of several hundreds of volts may remain during a few minutes).

**ESD INFORMATION (ElectroStatic Discharge)**

TRANSTECHNIK drives are conceived to be best protected against electrostatic discharges. However, some components are particularly sensitive and may be damaged if the drives are not properly stored and handled.

**STORAGE**

- The drives must be stored in their original package.
- When taken out of their package, they must be stored positioned on one of their flat metal surfaces and on a dissipating or electrostatically neutral support.
- Avoid any contact between the drive connectors and material with electrostatic potential (plastic film, polyester, carpet...).

**HANDLING**

- If no protection equipment is available (dissipating shoes or bracelets), the drives must be handled via their metal housing.
- Never get in contact with the connectors

**ELIMINATION**

In order to comply with the 2002/96/EC directive of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE), all TRANSTECHNIK devices have got a sticker symbolizing a crossed-out wheel dustbin as shown in Appendix IV of the 2002/96/EC Directive.

This symbol indicates that TRANSTECHNIK devices must be eliminated by selective disposal and not with standard waste.

TRANSTECHNIK does not assume any responsibility for any physical or material damage due to improper handling or wrong descriptions of the ordered items.

Any intervention on the items, which is not specified in the manual, will immediately cancel the warranty.

TRANSTECHNIK reserves the right to change any information contained in this manual without notice.

# Contents

PAGE

<b>CONTENTS.....</b>	<b>3</b>
<b>CHAPTER 1 - GENERAL .....</b>	<b>4</b>
1.1 - INTRODUCTION.....	4
<b>CHAPTER 2 - BASIC ANALOG SPEED DRIVE TEMPLATE .....</b>	<b>5</b>
2.1 - "BASIC ANALOG SPEED DRIVE" DESCRIPTION.....	5
2.2 - "BASIC ANALOG SPEED DRIVE" CONNECTION DIAGRAM .....	6
2.3 - "BASIC ANALOG SPEED DRIVE" CONFIGURATION .....	6
2.4 - "BASIC ANALOG SPEED DRIVE" COMMISSIONING .....	7
<b>CHAPTER 3 – ADVANCED ANALOG SPEED DRIVE TEMPLATE.....</b>	<b>8</b>
3.1 - "ADVANCED ANALOG SPEED DRIVE" DESCRIPTION .....	8
3.2 - "ADVANCED ANALOG SPEED DRIVE" CONNECTION DIAGRAM .....	10
3.3 - "ADVANCED ANALOG SPEED DRIVE" CONFIGURATION.....	10
3.4 - "ADVANCED ANALOG SPEED DRIVE" COMMISSIONING .....	11
<b>CHAPTER 4 – BASIC POSITIONER TEMPLATE.....</b>	<b>12</b>
4.1 - "BASIC STAND-ALONE POSITIONER" DESCRIPTION.....	12
4.2 - "BASIC STAND-ALONE POSITIONER" CONNECTION DIAGRAM .....	13
4.3 - "BASIC STAND-ALONE POSITIONER" CONFIGURATION .....	13
4.4 - "BASIC STAND-ALONE POSITIONER" COMMISSIONING .....	13
<b>CHAPTER 5 – ADVANCED POSITIONER TEMPLATE.....</b>	<b>15</b>
5.1 - "ADVANCED STAND-ALONE POSITIONER" DESCRIPTION .....	15
5.2 - "ADVANCED STAND-ALONE POSITIONER" CONNECTION DIAGRAM .....	17
5.3 - "ADVANCED STAND-ALONE POSITIONER" CONFIGURATION.....	17
5.4 - "ADVANCED STAND-ALONE POSITIONER" COMMISSIONING .....	17
<b>CHAPTER 6 – BASIC STEPPER EMULATION TEMPLATE.....</b>	<b>19</b>
6.1 - "BASIC STEPPER EMULATION" DESCRIPTION.....	19
6.2 - "BASIC STEPPER EMULATION" CONNECTION DIAGRAM .....	20
6.3 - "BASIC STEPPER EMULATION" CONFIGURATION .....	20
6.4 - "BASIC STEPPER EMULATION" COMMISSIONING .....	20
<b>CHAPTER 7 – ADVANCED STEPPER EMULATION TEMPLATE .....</b>	<b>22</b>
7.1 - "ADVANCED STEPPER EMULATION" DESCRIPTION.....	22
7.2 - "ADVANCED STEPPER EMULATION" CONNECTION DIAGRAM .....	23
7.3 - "ADVANCED STEPPER EMULATION" CONFIGURATION.....	23
7.4 - "ADVANCED STEPPER EMULATION" COMMISSIONING .....	23

# Chapter 1 - General

## 1.1 - INTRODUCTION

**ServoPac TT** all-digital drives with sinusoidal PWM control are servo drives that provide the control of brushless AC motors with a position sensor.

The standard control interface can be:

- CANopen,
- EtherCAT®<sup>1</sup>,
- analog,
- stepper motor emulation,
- logic I/Os.

But the **ServoPac TT** range also offers more sophisticated functions such as:

- DS402 including position capture,
- Master/slave and electronic gearing,
- Positioner with motion sequencing.

All versions are delivered as standard with the integrated protection function **Safe Torque Off: STO SIL 2**.

With its very small dimensions, the **ServoPac TT** drive is available in various designs:

- stand-alone or multi-axis version,
- standard forced air or push-through cooling version.

Series **ServoPac TT** drives are fully configurable in order to fit various applications. Both drive versions of the **ServoPac TT** range are described below.

The **ServoPac TT-CAN** version with **CANopen** interface can be used in the following application types:

- Axes controlled by CANopen fieldbus according to the DS402 protocol,
- Stand-alone operation as a motion sequencer with control by means of logic I/Os,
- Traditional analog speed amplifier with +/- 10 V command and position output by A, B, Z encoder signal emulation,
- Stepper motor emulation with PULSE and DIR command signals.

The **ServoPac TT-ETH** version with **EtherCAT®** interface can be used in the following application types:

- Axes controlled by EtherCAT® fieldbus according to the DS402 protocol,
- Stand-alone operation as a motion sequencer with control by means of logic I/Os.

The configuration and parameterization software tool *Gem Drive Studio* allows a quick configuration of the **ServoPac TT** drives according to the application requirements.

This manual describes the quick configuration of the **ServoPac TT** servo drive by using the application templates available in the *Gem Drive Studio* software.

When an application template is selected in the Drive Configuration library, the **ServoPac TT** inputs and outputs functionalities as well as the drive operation are set according to the target application. The *Gem Drive Studio* parameterization windows are also adapted to the target application in order to display only the required parameters and functions. The user can go back to the full configuration mode at any time by selecting the Expert mode in the Drive Configuration window.

The application templates described in this document are listed below:

- Basic analog speed drive,
- Basic stand alone positioner,
- Basic stepper motor emulation,
- Advanced analog speed drive,
- Advanced stand-alone positioner,
- Advanced stepper motor emulation.

<sup>1</sup> EtherCAT® is a registered trade mark and a patented technology of Company Beckhoff Automation GmbH, Germany.

## Chapter 2 - Basic analog speed drive template

### 2.1 - "BASIC ANALOG SPEED DRIVE" DESCRIPTION

When the **ServoPac TT** drive is configured with the **Basic Analog Speed Drive** template, the motor speed input command is an analog voltage ( $\pm 10$  V), and the rotor position monitor is available as two channels A and B in quadrature and one marker pulse per revolution (encoder emulation output). The maximum motor speed according to a 10 V input voltage is programmable from 100 rpm to 25'000 rpm. The encoder emulation output resolution is also programmable. All values (binary or decimal) between 64 pulses per revolution and 16384 pulses per revolution (ppr) can be programmed according to the maximum motor speed. This drive configuration is suitable for conventional DNC control.

In the **Basic Analog Speed Drive** configuration, the servo motor can be enabled or disabled by activating or deactivating the Enable input. During the operation of the **ServoPac TT** drive, the motor acceleration and deceleration with regard to the  $\pm 10$  V input voltage variation can be limited by setting the **Accel time** and the **Decel time** parameter value.

The activation of the **Limit switch+** input inhibits any CW motor rotation and the activation of the **Limit switch-** input inhibits any CCW motor rotation.

The activation of the STOP input stops the axis rotation in current limitation or ramping according to the selected operation.

The RESET input allows the cancellation of any stored drive fault when the cause of the fault release has been eliminated

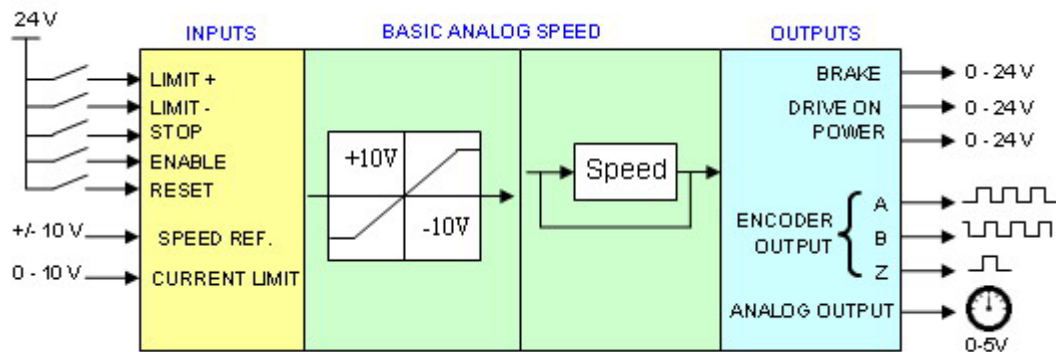
The BRAKE output allows the control of the motor brake when the drive is enabled or disabled.

The DRIVE ON output is activated when the drive is enabled.

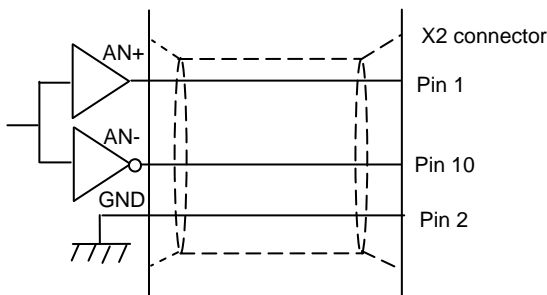
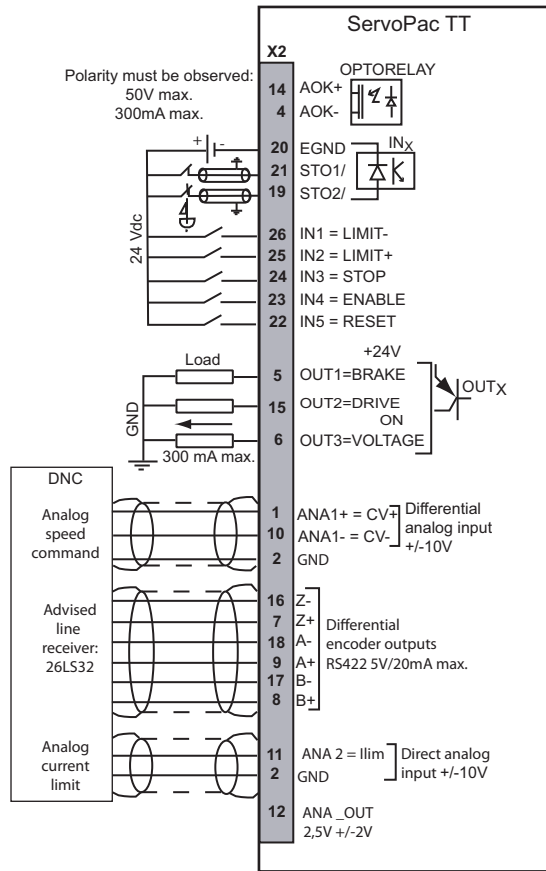
The POWER output is activated when power supply voltage is applied to the drive.

The Ilim analog input (0 to 10 V) allows the limitation of the motor peak current proportionally to the applied input voltage (no limitation for 0 V).

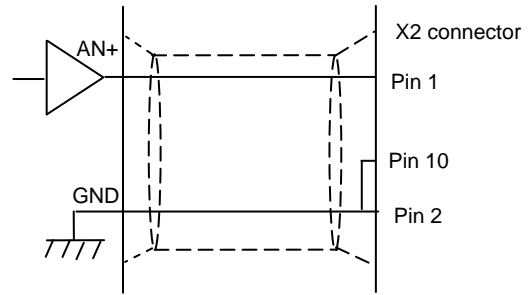
The block diagram of the "basic analog speed drive" configuration is presented below.



## 2.2 - "BASIC ANALOG SPEED DRIVE" CONNECTION DIAGRAM



ANA1 input connection with a differential analog signal source



ANA1 input connection with a unipolar analog signal source

## 2.3 - "BASIC ANALOG SPEED DRIVE" CONFIGURATION

Start the *Gem Drive Studio* software (see **ServoPac TT User guide**).

Start the communication with the **ServoPac TT** servo drive (see **ServoPac TT User guide**)

Select "Basic Analog Speed Drive" in the *Drive Configuration* window.

## 2.4 - "BASIC ANALOG SPEED DRIVE" COMMISSIONING

Setup the motor parameters in the *Motor Configuration* window (see **ServoPac TT User guide**).

Setup the user position scaling, in the *Position sensors* window, in order to get the axis position and speed displayed in the application unit according to the mechanical load (not mandatory for a speed drive).

Setup the analog command scaling (max. motor speed for 10 V) and the accel / decel ramp in the *Analog Speed Ref* window.

Setup the encoder output parameters (resolution) in the *Encoder Output* window.

Setup the Stop operation parameters, the Brake control parameters and the Analog output signal if required.

Setup the servo loop gains by using the Auto-tuning procedure (see **ServoPac TT User guide**).

Enable the drive and check the motor stability at standstill and in rotation by using the *Manual Jog* operation.

Select *Auto* in the *Device control* window and set the CV analog input at 0 V.

Enable the drive and start the offset compensation procedure in the *Analog Speed Ref* window if the motor is moving.

Check for the motor current limitation by the Ilim input voltage.

Before switching off the drive, store the parameters to the flash memory in the *Parameters Files* window.

## Chapter 3 – Advanced analog speed drive template

### 3.1 - "ADVANCED ANALOG SPEED DRIVE" DESCRIPTION

When the **ServoPac TT** drive is configured with the **Advanced Analog Speed Drive** template, the motor speed input command is an analog voltage ( $\pm 10$  V), and the rotor position monitor is available as two channels A and B in quadrature and one marker pulse per revolution (encoder emulation output). The maximum motor speed according to a 10 V input voltage is programmable from 100 rpm to 25'000 rpm. The encoder emulation output resolution is also programmable. All values (binary or decimal) between 64 pulses per revolution and 16384 pulses per revolution (ppr) can be programmed according to the maximum motor speed. This drive configuration is suitable for conventional DNC control.

In the **Advanced Analog Speed Drive** configuration, the servo motor can be enabled or disabled by activating or deactivating the Enable input. During the operation of the **ServoPac TT** drive, the motor acceleration and deceleration with regard to the  $\pm 10$  V input voltage variation can be limited by setting the **Accel time** and the **Decel time** parameter value.

IN1, IN2, IN3 and IN5 logic inputs can be freely connected to any of the following drive input functions: Limit switches, STOP, RESET or PHASING.

The activation of the "**Limit switch+**" input inhibits any CW motor rotation and the activation of the "**Limit switch-**" input inhibits any CCW motor rotation.

The activation of the STOP input stops the axis rotation in current limitation or ramping according to the selected operation.

The RESET input allows the cancellation of any stored drive fault when the cause of the fault release has been eliminated.

The activation of the PHASING input is starting the motor phasing procedure required at drive power up when the motor is equipped with an incremental encoder without Hall Effect sensors.

OUT1, OUT2 and OUT3 logic outputs can be freely connected to any of the following drive output functions: BRAKE, DRIVE ON, POWER, PHASING NOT OK, FAULT or WARNING.

The BRAKE output allows the control of the motor brake when the drive is enabled or disabled.

The DRIVE ON output is activated when the drive is enabled.

The POWER output is activated when the power supply voltage is applied to the drive.

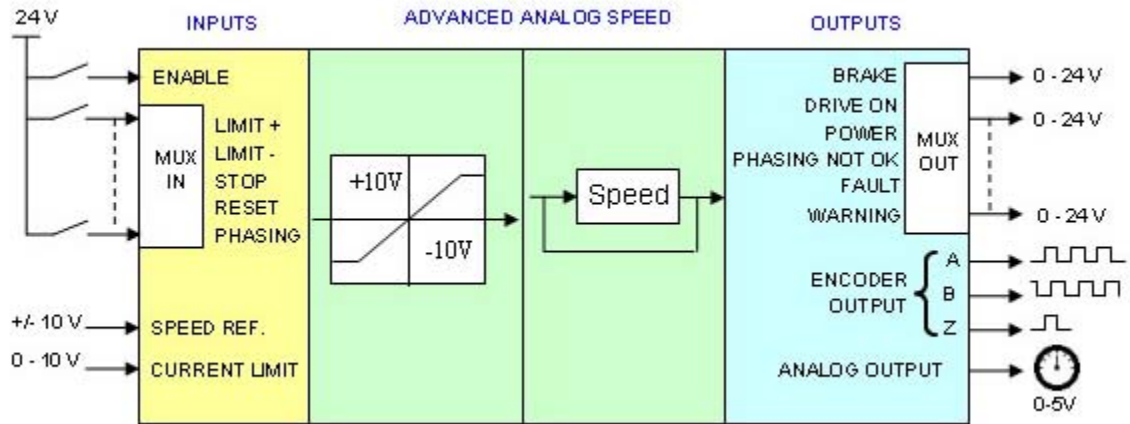
The PHASING NOT OK output is activated when the motor phasing procedure is required.

The FAULT output is activated when a drive fault is released.

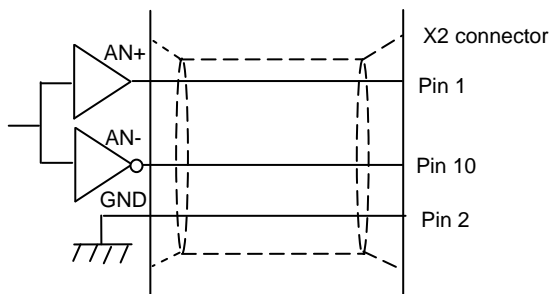
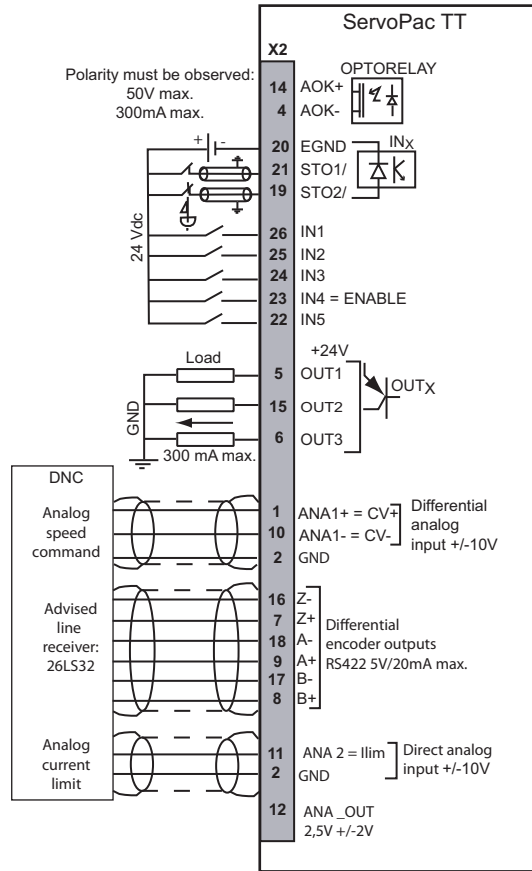
The WARNING output is activated when a drive warning is released. The Ilim analog input (0 to 10 V) allows the limitation of the motor peak current proportionally to the applied input voltage (no limitation for 0 V).



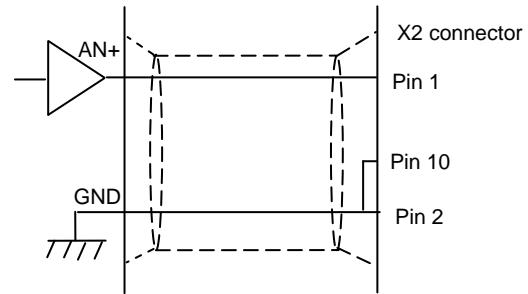
The block diagram of the “Advanced analog speed drive” configuration is presented below.



### 3.2 - "ADVANCED ANALOG SPEED DRIVE" CONNECTION DIAGRAM



ANA1 input connection with a differential analog signal source



ANA1 input connection with a unipolar analog signal source

### 3.3 - "ADVANCED ANALOG SPEED DRIVE" CONFIGURATION

Start the *Gem Drive Studio* software (see **ServoPac TT User guide**).

Start the communication with the **ServoPac TT** servo drive (see **ServoPac TT User guide**)

Select "Advanced Analog Speed Drive" in the *Drive Configuration* window.

### 3.4 - "ADVANCED ANALOG SPEED DRIVE" COMMISSIONING

Setup the motor parameters in the *Motor Configuration* window (see **ServoPac TT User guide**).

Setup the user position scaling, in the *Position sensors* window, in order to get the axis position and speed displayed in the application unit according to the mechanical load (not mandatory for a speed drive).

Setup the analog command scaling (max. motor speed for 10 V) and the accel / decel ramp in the *Analog Speed Ref* window.

Setup the encoder output parameters (resolution) in the *Encoder Output* window.

Setup the Stop operation parameters, the Brake control parameters and the Analog output signal, if required.

Connect the freely configurable logic I/Os according to the required I/O functions.

Setup the servo loop gains by using the Auto-tuning procedure (see **ServoPac TT User guide**).

Enable the drive and check the motor stability at standstill and when rotating by using the *Manual Jog* operation.

Select *Auto* in the *Device control* window and set the CV analog input at 0 V.

Enable the drive and start the offset compensation procedure in the *Analog Speed Ref* window if the motor is moving.

Check for the motor current limitation by the Ilim input voltage.

Before switching off the drive, store the parameters to the flash memory in the *Parameter Files* window.

## Chapter 4 – Basic positioner template

### 4.1 - "BASIC STAND-ALONE POSITIONER" DESCRIPTION

When the **ServoPac TT** drive is configured with the **Basic Stand Alone Positioner** template, up to 32 control sequences including axis homing, absolute or relative displacement, speed profile running, and torque regulation can be programmed and combined in order to solve various applications. The sequence chaining capability allows the definition of macro-sequences for complex applications: several control sequences can be linked together in order to be automatically executed one after the other. The control sequences are pre-programmed. So, the application programming simply consists in initializing the sequence parameters with the desired values. This drive configuration is suitable for stand-alone single axis control applications.

In the **Basic Stand-Alone Positioner** configuration, the servo drive can be enabled or disabled by the activation or the deactivation of the Enable input.

When the Start input is activated, sequence 0 is started, then, the other sequences linked with sequence 0 are automatically executed according to the user programming.

When the Stop input is activated, the program execution is immediately stopped and the motor is kept enabled at standstill.

The Index input is used for the homing sequence and for the user position reset function.

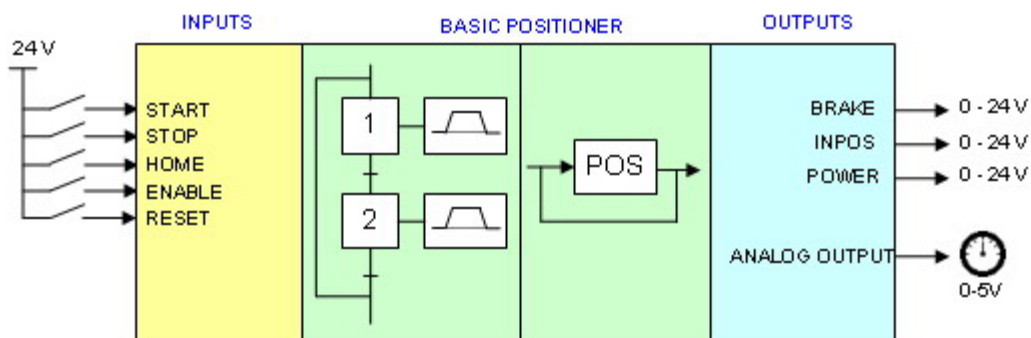
The RESET input allows the cancellation of any stored drive fault when the cause of the fault release has been eliminated.

The BRAKE output allows the control of the motor brake when the drive is enabled or disabled.

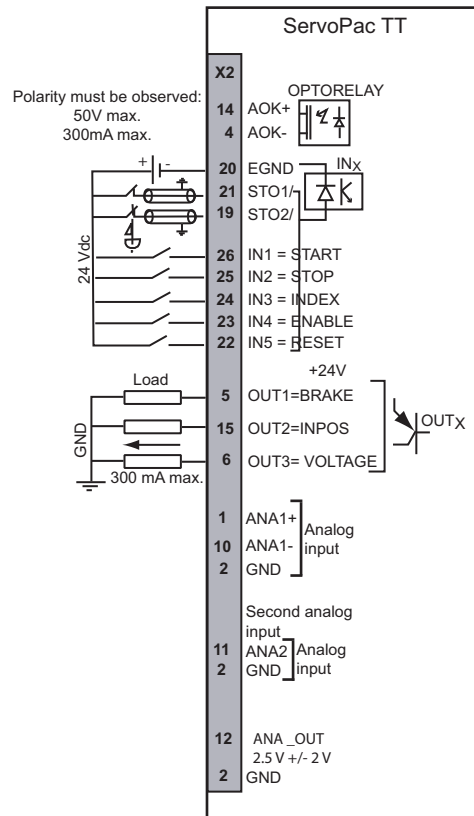
The INPOS output is activated when the target position has been reached.

The POWER output is activated when the power supply voltage is applied to the drive.

The block diagram of the “basic stand alone positioner” configuration is presented below.



## 4.2 - "BASIC STAND-ALONE POSITIONER" CONNECTION DIAGRAM



## 4.3 - "BASIC STAND-ALONE POSITIONER" CONFIGURATION

Start the *Gem Drive Studio* software (see **ServoPac TT User guide**).

Start the communication with the **ServoPac TT** servo drive (see **ServoPac TT User guide**).

Select "Basic Stand Alone Positioner" in the *Drive Configuration* window.

## 4.4 - "BASIC STAND-ALONE POSITIONER" COMMISSIONING

Setup the motor parameters in the *Motor Configuration* window (see **ServoPac TT User guide**).

Setup the user position scaling, in the *Position sensors* window, in order to get the axis position and speed displayed in the application unit according to the mechanical load (see **ServoPac TT User guide**).

Setup the manual movement parameter values in the *Manual mode* window. Enter first a low value for the *Profile Velocity* parameter.

Setup the Brake control parameters, the Encoder output parameters, and the Analog output signal if required.

Setup the servo loop gains by using the Auto-tuning procedure (see **ServoPac TT User guide**).

Select *Manual Positioning* in the *Device control* window. Enable the drive and check the motor stability at standstill and in movement by using the *Manual Positioning* operation.

Open the *Sequence Editor* window for programming and loading into the drive the application program (see **ServoPac TT User guide**).

Select *Manual Sequence* in the *Device control* window and start manually the program sequences in order to test the application.



Select *Auto* in the *Device control* window and test the program execution by using the Start input (starting of the sequence 0), test then the program stop by using the Stop input (movement stopped and motor kept enabled at standstill).

Before switching off the drive, store the parameters to the flash memory in the *Parameter Files* window.

## Chapter 5 – Advanced positioner template

### 5.1 - "ADVANCED STAND-ALONE POSITIONER" DESCRIPTION

When the **ServoPac TT** drive is configured with the **Advanced Stand-Alone Positioner** template, up to 32 control sequences including axis homing, absolute or relative displacement, speed profile running, and torque regulation can be programmed and combined in order to solve various applications. The sequence chaining capability allows the definition of macro-sequences for complex applications: several control sequences can be linked together in order to be automatically executed one after the other. The control sequences are pre-programmed. So, the application programming simply consists in initializing the sequence parameters with the desired values. This drive configuration is suited for stand-alone single-axis control applications.

In the **Advanced Stand-Alone Positioner** configuration, the servo drive can be enabled or disabled by the activation or the deactivation of the Enable input.

When the Start input is activated, the selected sequence is started, then, the other sequences linked with the starting sequence are automatically executed according to the user programming.

When the Stop input is activated, the program execution is immediately stopped and the motor is kept enabled at standstill.

IN3 and IN5 logic inputs can be freely connected to any of the following drive input functions: HOME index, Limit switches, RESET, PHASING, SEQ SEL or SEQ COND.

The HOME index input is used for the homing sequence and for the user position reset function.

The activation of the "**Limit switch+**" input inhibits any CW motor rotation and the activation of the "**Limit switch-**" input inhibits any CCW motor rotation.

The RESET input allows the cancellation of any stored drive fault when the cause of the fault release has been eliminated.

The activation of the PHASING input is starting the motor phasing procedure required at drive power up when the motor is equipped with an incremental encoder without Hall Effect sensors.

The SEQ SEL inputs allow the selection of the sequence to be started.

The SEQ COND input allows the control of the sequences execution.

OUT1, OUT2 and OUT3 logic outputs can be freely connected to any of the following drive output functions: BRAKE, DRIVE ON, POWER, PHASING NOT OK, FAULT, WARNING, INPOS, SEQ, POS, SPEED, SEQ OUT1 to SEQ OUT4.

The BRAKE output allows the control of the motor brake when the drive is enabled or disabled.

The DRIVE ON output is activated when the drive is enabled.

The POWER output is activated when the power supply voltage is applied to the drive.

The PHASING NOT OK output is activated when the motor phasing procedure is required.

The FAULT output is activated when a drive fault is released.

The WARNING output is activated when a drive warning is released.

The INPOS output is activated when the target position has been reached.

The SEQ output is activated during a sequence execution.

The POS output is activated when the positioning displacement is finished.

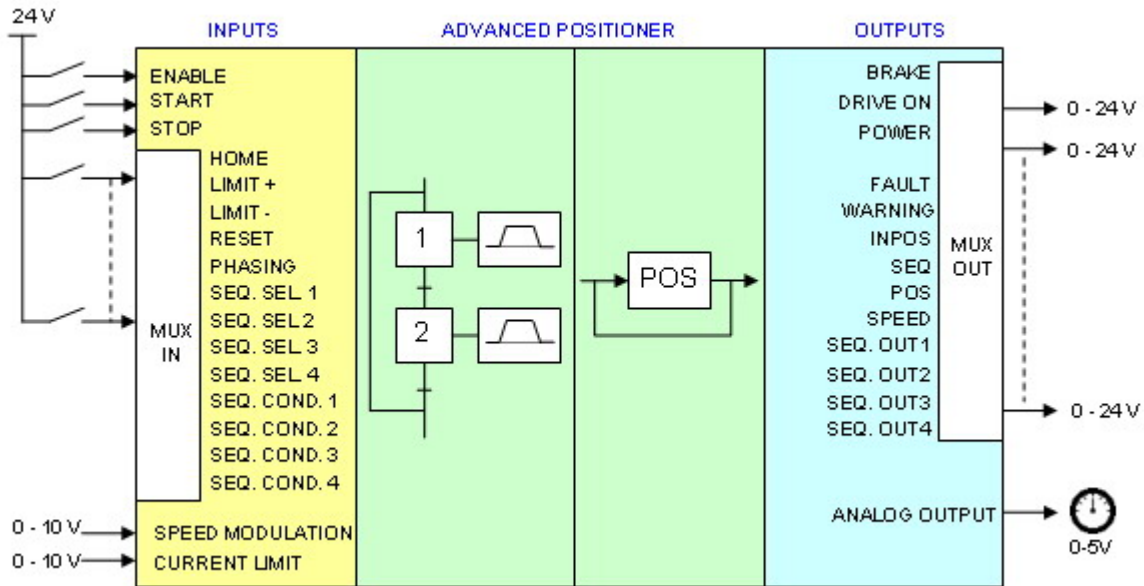
The SPEED output is activated when the sequence positioning speed value is reached.

The SEQ OUT1 to SEQ OUT4 outputs are controlled by the sequences execution.

The SPEED MODULATION analog input (0 to 10V) allows the decrease, on-the-fly, of the sequence speed value proportionally to the applied input voltage.

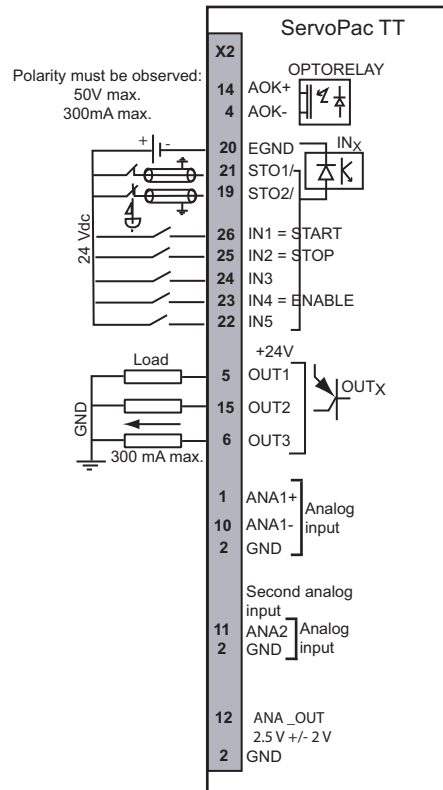
The CURRENT LIMIT analog input (0 to 10V) allows the limitation of the motor peak current proportionally to the applied input voltage.

The block diagram of the “Advanced stand-alone positioner” configuration is presented below.





## 5.2 - "ADVANCED STAND-ALONE POSITIONER" CONNECTION DIAGRAM



## 5.3 - "ADVANCED STAND-ALONE POSITIONER" CONFIGURATION

Start the *Gem Drive Studio* software (see **ServoPac TT User guide**).

Start the communication with the **ServoPac TT** servo drive (see **ServoPac TT User guide**)

Select "Advanced Stand Alone Positioner" in the *Drive Configuration* window.

## 5.4 - "ADVANCED STAND-ALONE POSITIONER" COMMISSIONING

Setup the motor parameters in the *Motor Configuration* window (see **ServoPac TT User guide**)

Setup the user position scaling, in the *Position sensors* window, in order to get the axis position and speed displayed in the application unit according to the mechanical load (see **ServoPac TT User guide**).

Setup the manual movement parameter values in the *Manual mode* window. Enter first a low value for the *Profile Velocity* parameter.

Setup the Brake control parameters, the Encoder output parameters, and the Analog output signal if required.

Connect the freely configurable logic I/Os according to the required I/O functions.

Setup the servo loop gains by using the Auto-tuning procedure (see **ServoPac TT User guide**)

Select *Manual Positioning* in the *Device control* window. Enable the drive and check the motor stability at standstill and in movement by using the *Manual Positioning* operation.

Open the *Sequence Editor* window for programming and uploading the application program in the drive (see **ServoPac TT User guide**).

Select *Manual Sequence* in the *Device control* window and start manually the program sequences in order to test the application.



Select *Auto* in the *Device control* window and test the program execution by using the Start input (start of sequence 0). Then test the program stop by using the Stop input (movement stopped and motor kept enabled at standstill).

Before switching off the drive, store the parameters to the flash memory in the *Parameter Files* window.

## Chapter 6 – Basic stepper emulation template

### 6.1 - "BASIC STEPPER EMULATION" DESCRIPTION

When the **ServoPac TT** drive is configured with the **Basic Stepper Emulation** template, the motor position command is given by the PULSE and DIR logic inputs. The motor is following step by step the pulse train on the PULSE signal (phase and frequency locked), the movement direction is defined by the polarity of the DIR signal. The number of steps per motor revolution is programmable. All values (binary or decimal) between 10 steps per revolution and 100'000 steps per revolution can be programmed according to the PULSE signal maximum frequency and the motor speed limit. The **ServoPac TT** servo drive has got 3 different PULSE and DIR signal channels according to the host controller interface: 24 V optocoupled channel, 5 V to 24 V not optocoupled channel, RS422 receiver channel. The drive can be configured either for counting only the rising edges of the PULSE signal or counting both edges. The motor position monitor is available as two channels A and B in quadrature and one marker pulse per revolution (encoder emulation output). The encoder emulation output resolution is programmable between 64 pulses per revolution and 16384 pulses per revolution (ppr). The **Stepper Emulation** configuration is only possible for a motor equipped with a resolver as position sensor feedback.

In the **Basic Stepper Emulation** configuration, the servo motor can be enabled or disabled by activating or deactivating the Enable input.

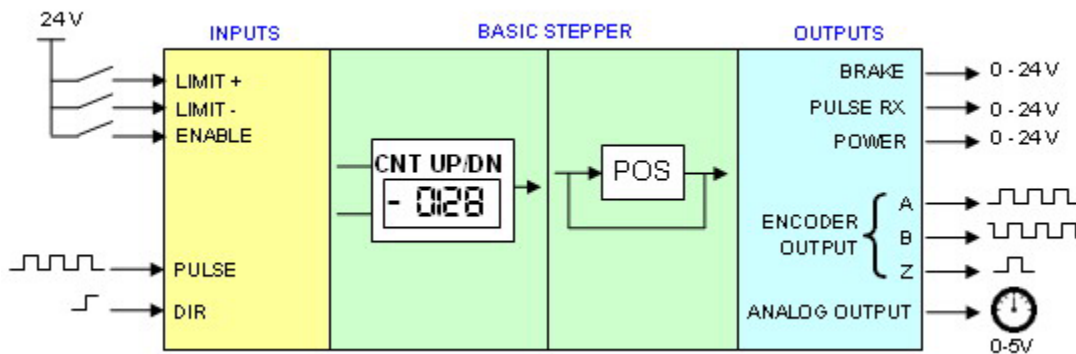
The activation of the **Limit switch+** input inhibits any CW motor rotation and the activation of the **Limit switch-** input inhibits any CCW motor rotation.

The BRAKE output allows the control of the motor brake when the drive is enabled or disabled.

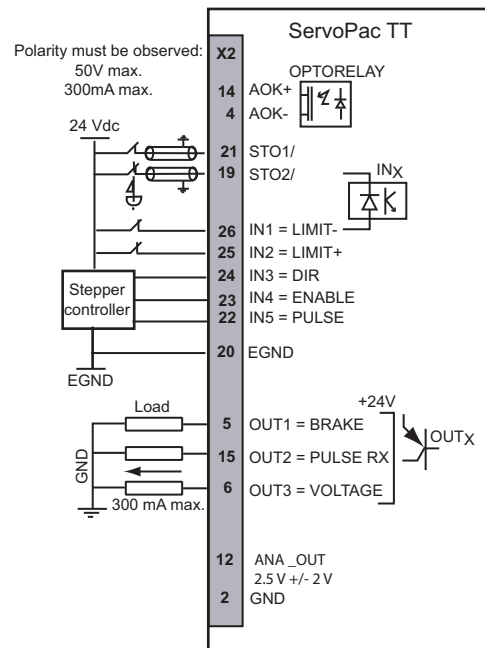
The PULSE RX output is activated when a pulse train is received on the PULSE input.

The POWER output is activated when power supply voltage is applied to the drive.

The block diagram of the “basic stepper emulation” configuration is presented below.



## 6.2 - "BASIC STEPPER EMULATION" CONNECTION DIAGRAM



## 6.3 - "BASIC STEPPER EMULATION" CONFIGURATION

Start the *Gem Drive Studio* software (see **ServoPac TT User guide**).

Start the communication with the **ServoPac TT** servo drive (see **ServoPac TT User guide**)

Select "Basic Stepper Emulation" in the *Drive Configuration* window.

## 6.4 - "BASIC STEPPER EMULATION" COMMISSIONING

Setup the motor parameters in the *Motor Configuration* window (see **ServoPac TT User guide**).

Select the PULSE and DIR channel, in the *Stepper input configuration* window, according to the host controller interface: 5 V to 24 V optocoupled channel, 5 V to 24 V not optocoupled channel, RS422 receiver channel. The pulse signal frequency limit depends on the channel selection (please see **ServoPac TT Installation Guide**, chapter 2: Specifications).

Select the required counting mode in the *Stepper input configuration* window. The selection *Rising and falling edges* is only useful if the generated pulse train has got a ton / toff ratio of 1. In the most general cases, select *Rising edges only*.

Open the *User position scaling* module, in the *Position sensor* window, in order to set the number of steps per motor revolution. *Position unit* = Increment, *Display factor* = 1, *Load displacement* = required number of steps per motor revolution. If both rising and falling edges are counted on the pulse signal, one pulse generates a motor displacement of two steps.

Check that the motor *Maximum speed* parameter value is complying with the maximum frequency value on the pulse train as follows:

$$\text{Max. motor speed (rpm)} = 60 \times \text{Max. pulse frequency (Hz)} / \text{number of steps per motor revolution}$$

(for the counting mode selection = *Rising edges only*)

$$\text{Max. motor speed (rpm)} = 120 \times \text{Max. pulse frequency (Hz)} / \text{number of steps per motor revolution}$$

(for the counting mode selection = *Rising and falling edges*)

The *Maximum Speed* parameter (in the module *Speed limit* of the *Motor configuration* window) is set to the previously calculated value + 10 % to avoid any speed limitation on the servo drive at the max. pulse frequency.

Set the *Pulse RX output detection time* parameter value. This parameter defines the timeout after the last received pulse on the PULSE channel for the signal PULSE RX to be reset.

Setup the servo loop gains by using the Auto-tuning procedure (see **ServoPac TT User guide**). Select *Minimum position overshoot* in the position loop requirement.

Enable the drive and check the motor stability at standstill and in rotation by using the *Manual Move* operation.

Select *Auto* in the *Device control* window and check the motor displacement according to the pulse train generated by the host controller.

Setup the encoder output parameters (resolution) in the *Encoder Output* window if the motor position monitoring is required.

Before switching off the drive, store the parameters to the flash memory in the *Parameters Files* window.

## Chapter 7 – Advanced stepper emulation template

### 7.1 - "ADVANCED STEPPER EMULATION" DESCRIPTION

When the **ServoPac TT** drive is configured with the **Advanced Stepper Emulation** template, the motor position command is given by the PULSE and DIR logic inputs. The motor is following step by step the pulse train on the PULSE signal (phase and frequency locked), the direction of the movement is defined by the DIR signal polarity. The number of steps per motor revolution is programmable. All values (binary or decimal) between 10 steps per revolution and 100'000 steps per revolution can be programmed according to the PULSE signal maximum frequency and the motor speed limit. The **ServoPac TT** servo drive has got 3 different PULSE and DIR signal channels according to the host controller interface: 24 V optocoupled channel, 5 V to 24 V not optocoupled channel, RS422 receiver channel. The drive can be configured either for counting only the rising edges of the PULSE signal or counting both edges. The motor position monitor is available as two channels A and B in quadrature and one marker pulse per revolution (encoder emulation output). The encoder emulation output resolution is programmable between 64 pulses per revolution and 16384 pulses per revolution (ppr). The **Stepper Emulation** configuration is only possible for a motor equipped with a resolver as position sensor feedback.

In the **Advanced Stepper Emulation** configuration, the servo motor can be enabled or disabled by activating or deactivating the Enable input.

The IN1 and IN2 logic inputs can be freely connected to any of the following drive input functions: Limit switches, STOP, RESET.

The activation of the **Limit switch+** input inhibits any CW motor rotation and the activation of the **Limit switch-** input inhibits any CCW motor rotation.

The activation of the STOP input stops the axis rotation in current limitation or ramping according to the selected operation.

The RESET input allows the cancellation of any stored drive fault when the cause of the fault release has been eliminated.

OUT1, OUT2 and OUT3 logic outputs can be freely connected to any of the following drive output functions: BRAKE, DRIVE ON, POWER, FAULT, WARNING or PULSE RX.

The BRAKE output allows the control of the motor brake when the drive is enabled or disabled.

The DRIVE ON output is activated when the drive is enabled.

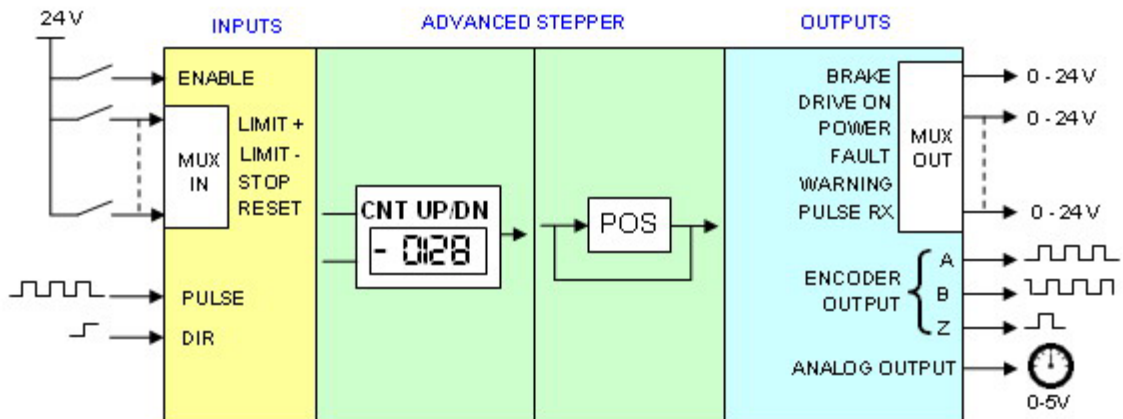
The POWER output is activated when the power supply voltage is applied to the drive.

The FAULT output is activated when a drive fault is released.

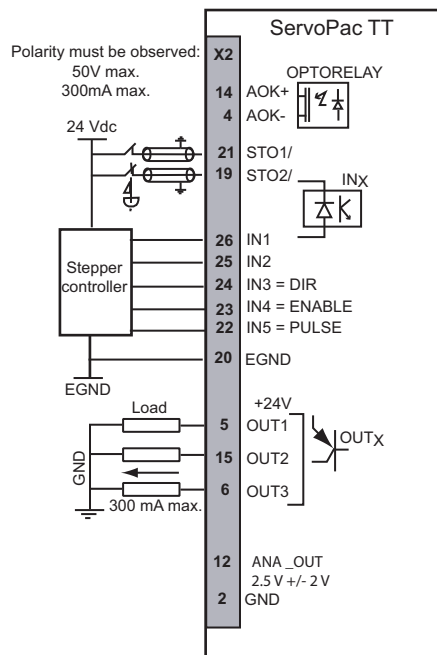
The WARNING output is activated when a drive warning is released.

The PULSE RX output is activated when a pulse train is received on the PULSE input.

The block diagram of the “advanced stepper emulation” configuration is presented below.



### 7.2 - "ADVANCED STEPPER EMULATION" CONNECTION DIAGRAM



### 7.3 - "ADVANCED STEPPER EMULATION" CONFIGURATION

Start the *Gem Drive Studio* software (see **ServoPac TT User guide**).

Start the communication with the **ServoPac TT** servo drive (see **ServoPac TT User guide**)

Select "Advanced Stepper Emulation" in the *Drive Configuration* window.

### 7.4 - "ADVANCED STEPPER EMULATION" COMMISSIONING

Setup the motor parameters in the *Motor Configuration* window (see **ServoPac TT User guide**).

Select the PULSE and DIR channel, in the *Stepper input configuration* window, according to the host controller interface: 5 V to 24 V optocoupled channel, 5V to 24V not optocoupled channel, RS422 receiver channel. The pulse signal frequency limit depends on the channel selection (refer to the **ServoPac TT Installation Guide**, chapter 2: Specifications).

Select the required counting mode in the *Stepper input configuration* window. The selection *Rising and falling edges* is only useful if the generated pulse train has got a ton / toff ratio of 1. In the most general cases, select *Rising edges only*.

Open the *User position scaling* module, in the *Position sensors* window, in order to set the number of steps per motor revolution. *Position unit* = Increment, *Display factor* = 1, *Load displacement* = required number of steps per motor revolution. If both rising and falling edges are counted on the pulse signal, one pulse generates a motor displacement of two steps.

Check that the motor *Maximum speed* parameter value is compatible with the maximum frequency value on the pulse train as follows:

Max. motor speed (rpm) =  $60 \times \text{Max pulses frequency (Hz)} / \text{number of steps per motor revolution}$   
(for the counting mode selection = *Rising edges only*)

Max. motor speed (rpm) =  $120 \times \text{Max pulses frequency (Hz)} / \text{number of steps per motor revolution}$   
(for the counting mode selection = *Rising and falling edges*)

The *Maximum Speed* parameter (in the module *Speed limit* of the *Motor configuration* window) is set to the previously calculated value + 10% to avoid any speed limitation on the servo drive at the max. pulse frequency.

Set the *Pulse RX output detection time* parameter value. This parameter defines the timeout after the last received pulse on the PULSE channel for the signal PULSE RX to be reset.

Setup the servo loop gains by using the Auto-tuning procedure (see **ServoPac TT User guide**). Select *Minimum position overshoot* in the position loop requirement.

Enable the drive and check the motor stability at standstill and during rotation by using the *Manual Move* operation.

Select *Auto* in the *Device control* window and check the motor displacement according to the pulse train generated by the host controller.

Setup the encoder output parameters (resolution) in the *Encoder Output* window if the motor position monitoring is required.

Setup the Stop operation parameters, the Brake control parameters and the Analog output signal, if required.

Connect the freely configurable logic I/Os according to the required I/O functions.

Before switching off the drive, store the parameters to the flash memory in the *Parameter Files* window.