M221

M221 and PTO functions

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Introduction

1

Overview

This chapter gives the introduction.

Contents of this chapter

This chapter contains the following topics:

Before You Begin

General

The products specified in this document have been tested under actual service conditions. Of course, your specific application requirements may be different from those assumed for this and any related examples described herein. In that case, you will have to adapt the information provided in this and other related documents to your particular needs. To do so, you will need to consult the specific product documentation of the hardware and/or software components that you may add or substitute for any examples specified in this documentation. Pay particular attention and conform to any safety information, different electrical requirements and normative standards that would apply to your adaptation.

⚠ WARNING

REGULATORY INCOMPATIBILITY

Be sure that all equipment applied and systems designed comply with all applicable local, regional and national regulations and standards

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material. A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved. Failure to observe this information can result in injury or equipment damage.

The use and application of the information contained herein require expertise in the design and programming of automated control systems. Only the user or integrator can be aware of all the conditions and factors present during installation and setup, operation, and maintenance of the machine or process, and can therefore determine the automation and associated equipment and the related safeties and interlocks which can be effectively and properly used. When selecting automation and control equipment, and any other related equipment or software, for a particular application, the user or integrator must also consider any applicable local, regional or national standards and/or regulations.

Some of the major software functions and/or hardware components used in the proposed architectures and examples described in this document cannot be substituted without significantly compromising the performance of your application. Further, any such substitutions or alterations may completely invalidate any proposed architectures, descriptions, examples, instructions, wiring diagrams and/or compatibilities between the various hardware components and software functions specified herein and in related documentation. You must be aware of the consequences of any modifications, additions or substitutions.

A residual risk, as defined by EN/ISO 12100-1, Article 5, will remain if
- it is necessary to modify the recommended logic and if the added or modified components are not properly integrated in the control circuit.
- you do not follow the required standards applicable to the operation of the machine, or if the adjustments to and the maintenance of the machine are not properly made (it is essential to strictly follow the prescribed machine maintenance schedule).
- the devices connected to any safety outputs do not have mechanically-linked contacts.

⚠ CAUTION
EQUIPMENT INCOMPATIBILITY Read and thoroughly understand all device and software documentation before attempting any component substitutions or other changes related to the application examples provided in the document **Failure to follow these instructions can result in injury, or equipment damage.**

Start-Up and Test

Before using electrical control and automation equipment after design and installation, the application and associated functional safety system must be subjected to a start-up test by qualified personnel to verify correct operation of the equipment. It is important that arrangements for such testing be made and that enough time is allowed to perform complete and satisfactory testing.

⚠ CAUTION
EQUIPMENT OPERATION HAZARD •Verify that all installation and set up procedures have been completed. •Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices •Remove tools, meters, and debris from equipment. **Failure to follow these instructions can result in injury, or equipment damage.**

Verify that the completed system, including the functional safety system, is free from all short circuits and grounds, except those grounds installed according to local regulations. If high-potential voltage testing is necessary, follow the recommendations in equipment documentation to help prevent injury or equipment damage.

Operations and Adjustments

General

Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly installed and operated.
In some applications, such as packaging machinery, additional operator protection such as point-of-operation guarding must be provided. This is necessary if the hands and other parts of the body are free to enter the pinch points or other hazardous areas where serious injury can occur. Software products alone cannot protect an operator from injury. For this reason, the software cannot be substituted for or take the place of point-of-operation protection.

⚠ WARNING
UNGUARDED MACHINERY CAN CAUSE SERIOUS INJURY •Do not use this software and related automation equipment on equipment which does not have point-of -operation protection. •Do not reach into machinery during operation. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Ensure that appropriate safeties and mechanical/electrical interlocks related to point-of-operation protection have been installed and are operational before placing the equipment into service. All interlocks and safeties related to point-of-operation protection must be coordinated with the related automation equipment and software programming.

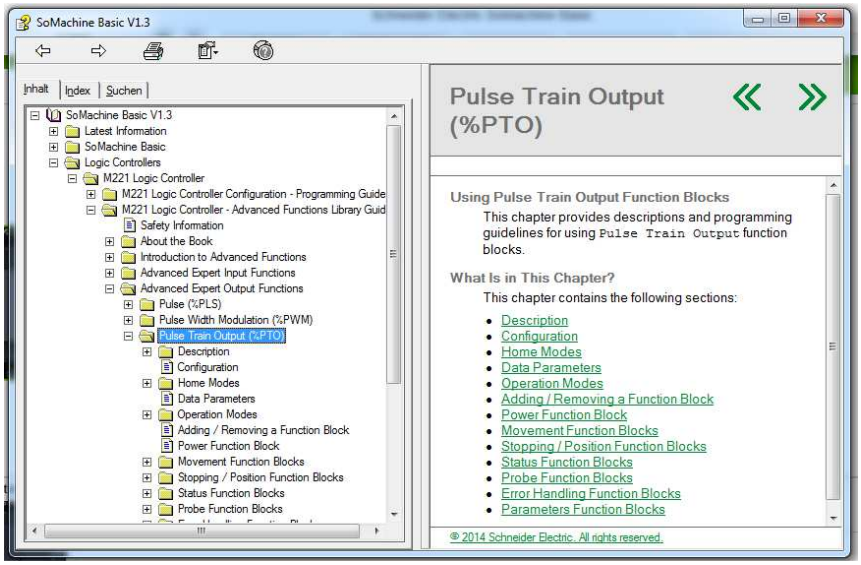
NOTE: Coordination of safeties and mechanical/electrical interlocks for point-ofoperation protection is outside the scope of the examples and implementations suggested herein. It is sometimes possible to adjust the equipment incorrectly and this produce unsatisfactory or unsafe operation. Always use the manufacturer instructions as a guide to functional adjustments. Personnel who have access to these adjustments must be familiar with the equipment manufacturer instructions and the machinery used with the electrical equipment. Only those operational adjustments actually required by the machine operator should be accessible to the operator. Access to other controls should be restricted to help prevent unauthorized changes in operating characteristics.

2

Programming example overview

This programming example shows the basic PTO (Pulse Train Out) implementation of the controller M221. Via the HMI visualization of this program example, the corresponding operating modes and functions can be executed. Other opportunity: force values via animation table.....

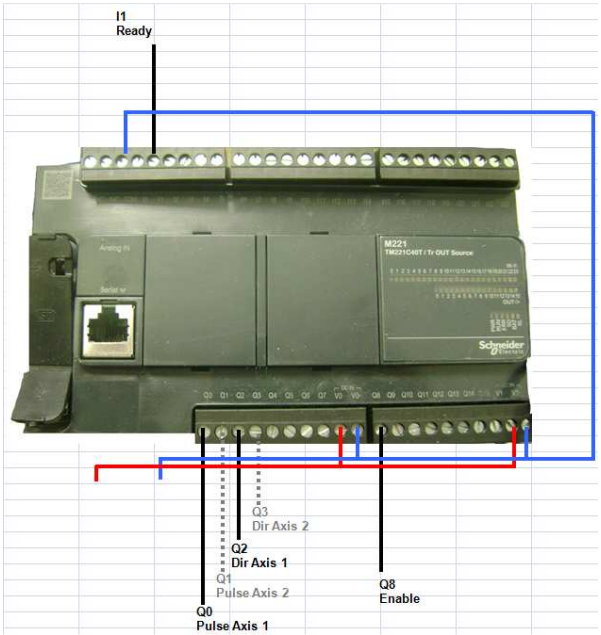
For detail information, please see the SoMachine Basic Online Help or M221 manual.



This document describes the configuration and programming basics of M221 PTO implementation on a test environment. In this programming example, the TM221C40T is used as the test controller.
This M221 test project is no real application, it's only to show the usage of the PTO functionality.

Wiring M221 PTO

There is a wiring guide for several devices in combination with the M221. It is attached with this program example and also available in the TIP database. Please note: The wiring of the controller´s sink and source logic to the connected devices is different.



SoMachine Basic version:

Following SoMachine Basic version was used for this example: SoMachine Basic Version 1.3

Downloads (manuals, etc.):

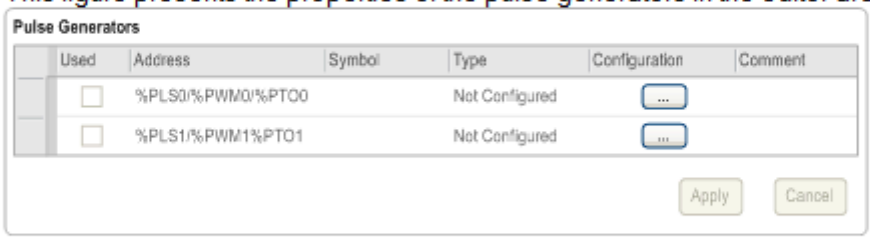
http://shoppingkiosk.schneider-electric.com

Used HMI for comfortable operation of this programming example:

HMISTU655: The corresponding Vijeo Designer project is also added...

Configuration of the general PTO settings

Pulse Generators

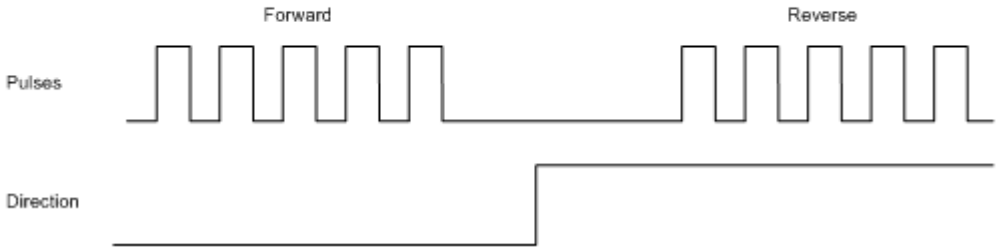
Step	Action
1	Click the **Pulse Generators** node in the hardware tree to display the pulse generator properties. This figure presents the properties of the pulse generators in the editor area: 
2	Edit the properties and click **[...]** to configure the pulse generator output. For detailed information on the pulse generator configuration parameters, refer to the table below.

Pulse / Direction option (used in the programming example)

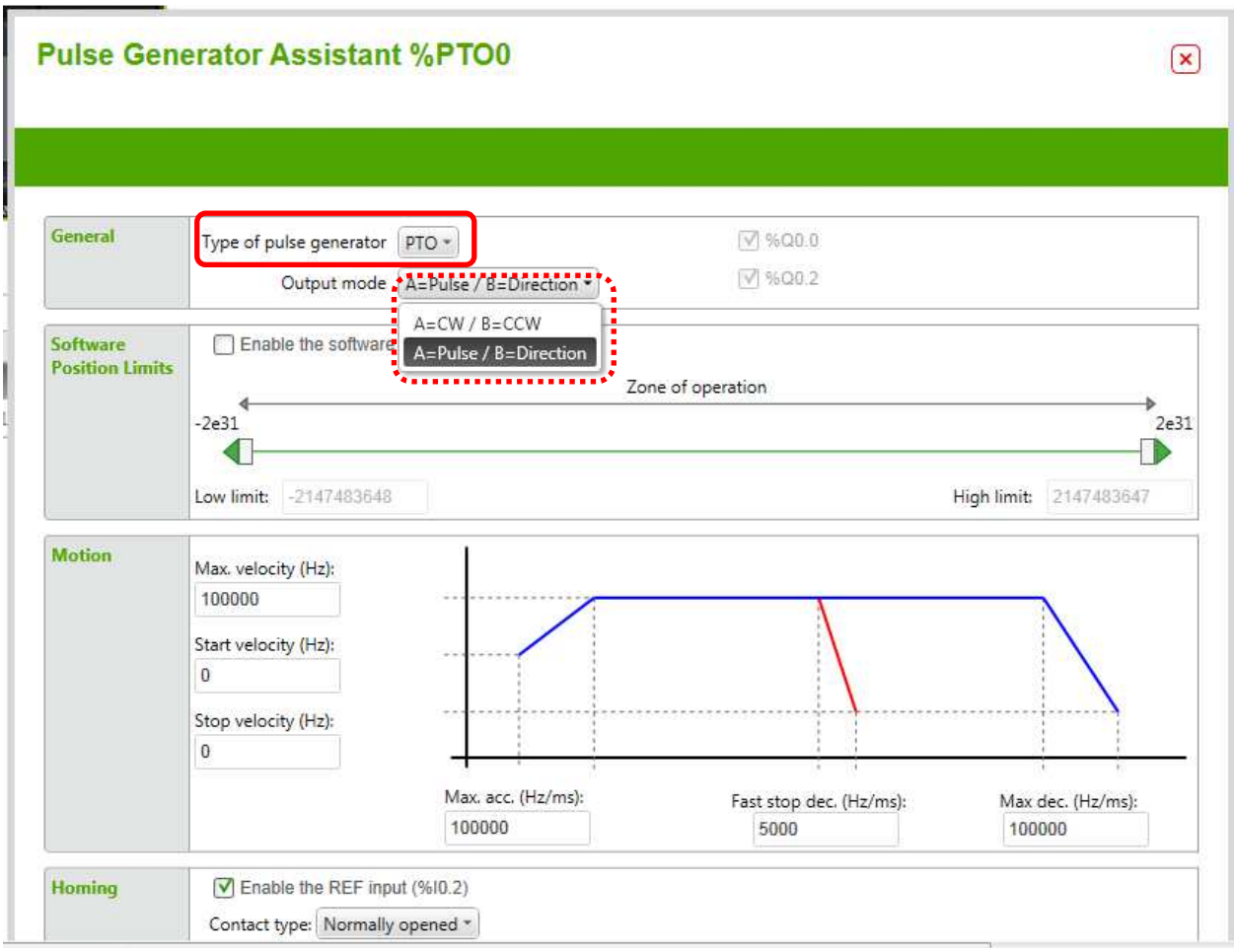
Pulse / Direction Mode

This mode generates two signals on the PTO channels:

- The pulse output provides the motor operating speed (`Pulses`).
- The direction output provides the motor rotation direction (`Direction`).

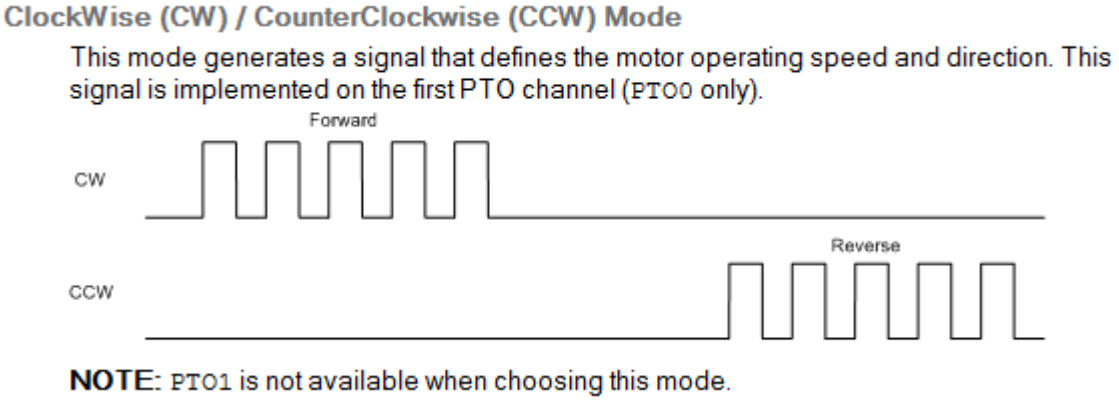


Choose PTO option with output mode Pulse/Direction:



Basic settings: max 2 axis are available -> PTO0 and PTO1

CW - CCW option

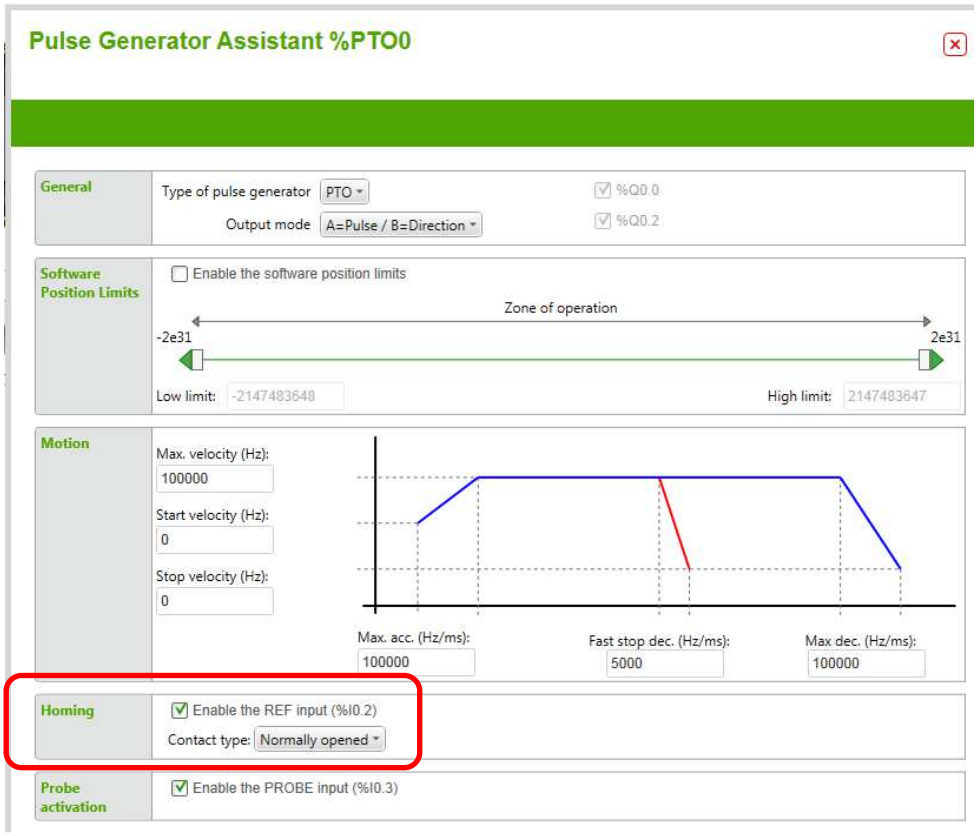


Choose PTO option with output mode CW/CCW:

Basic settings: only 1 axis are available with CW/CCW option -> PTO0 !! No 2nd axis function available.

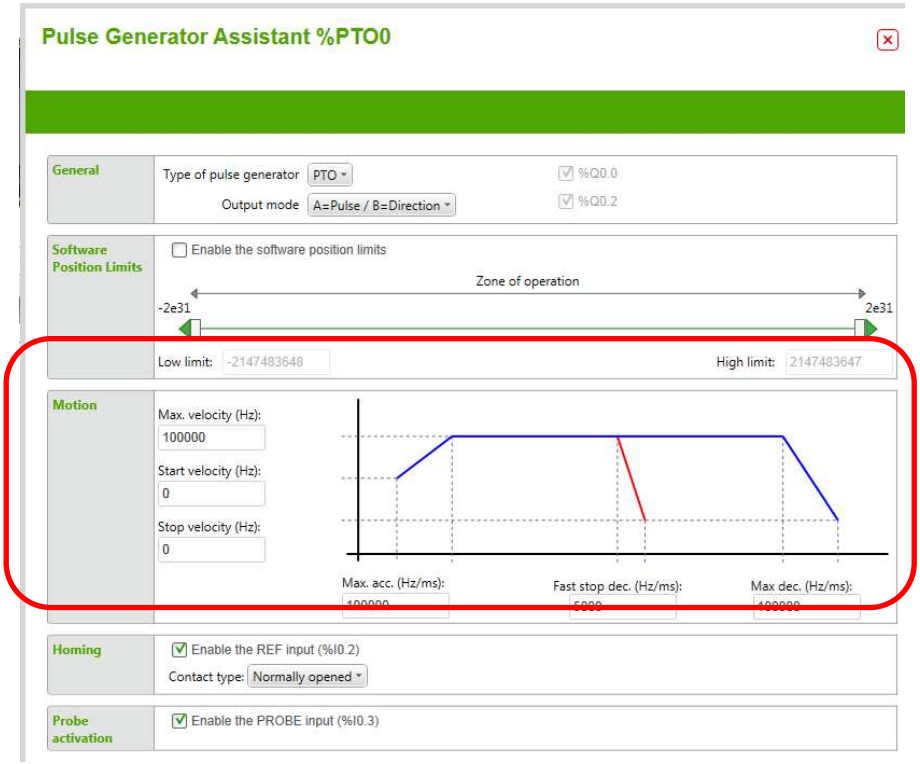
Configuration of the homing function

If homing to reference switch is used:

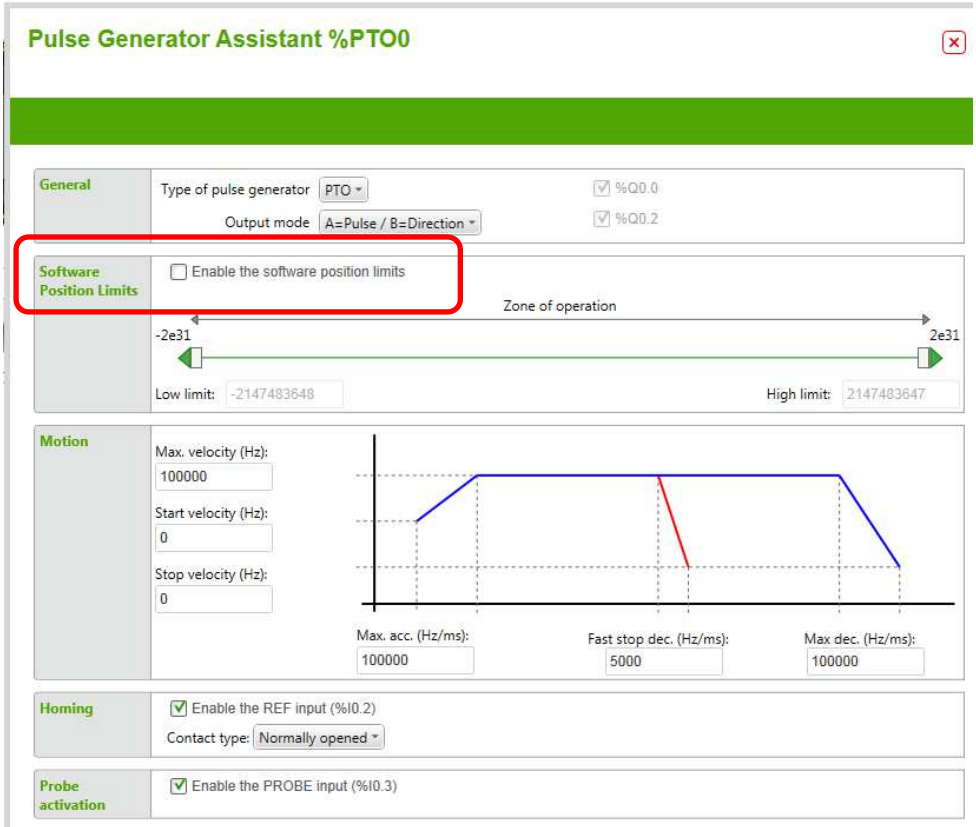


(I0.2 is fix for PTO0 – I0.5 for PTO1 ..... no other option)

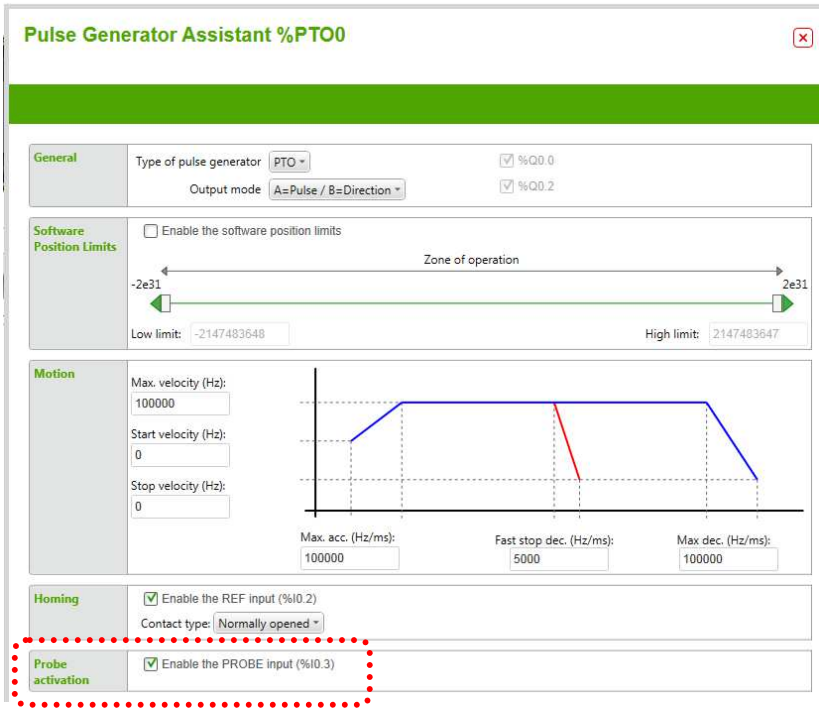
Configuration of the general motion settings



Configuration of the position limits (default: disabled)

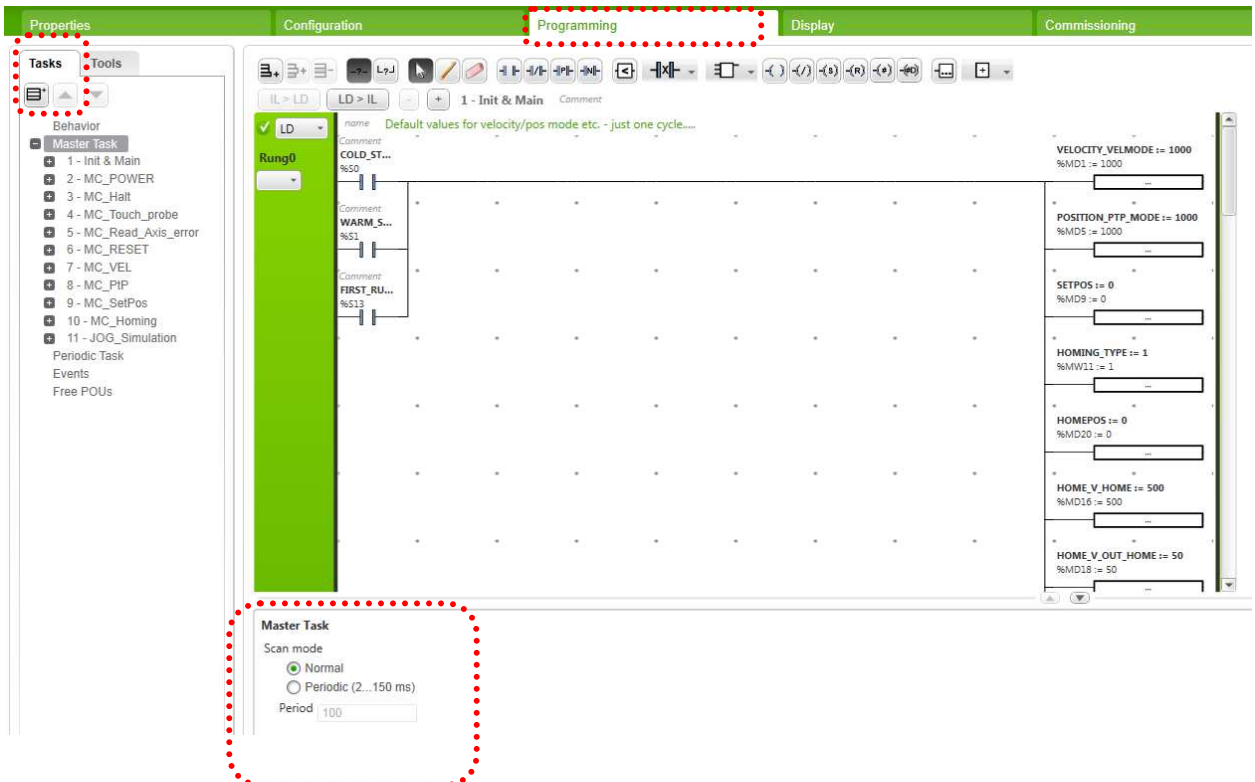


Configuration of the probe input



Task Configuration

The master task represents the main task of the application program. It is obligatory and is created by default. The master task is made up of sections and subroutines represented within Program Organizational Units (POUs). Each POU of the master task can be programmed in any of the supported programming languages: ladder (LD) or instruction list (IL).



Using the programming example

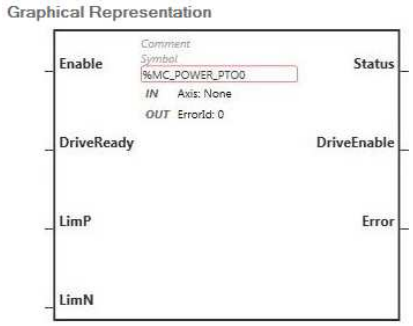
The programming example can be operated via usage of animation tables or usage of an HMI. The corresponding Vijeo Designer project is also added to this programming example.

Implemented functions:

Drive enable, drive reset, read axis status, read error, read parameter, position mode (absolute and relative movement), speed mode, homing mode, simulation of JOG mode, stop, halt, probe function.

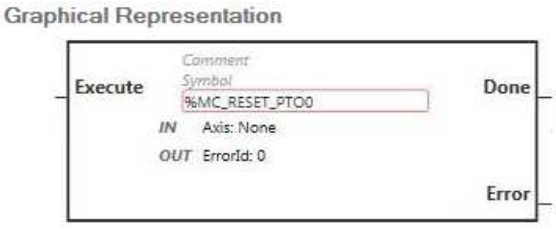
Power function blocks:

Drive Enable (MC_Power_PTO)

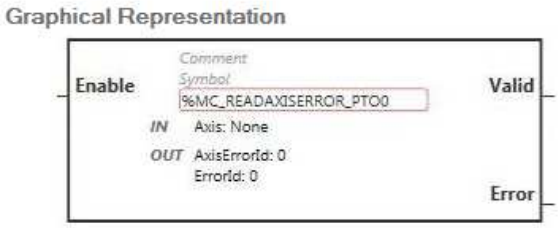


Error handling function blocks:

Drive Reset (MC_Reset_PTO)



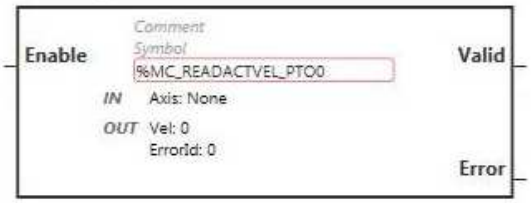
Read Error (MC_ReadAxisError_PTO)



Status function blocks:

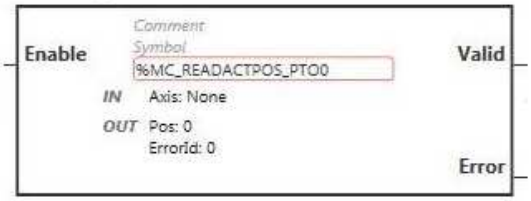
Read velocity (MC_ReadActVel_PTO)

Graphical Representation



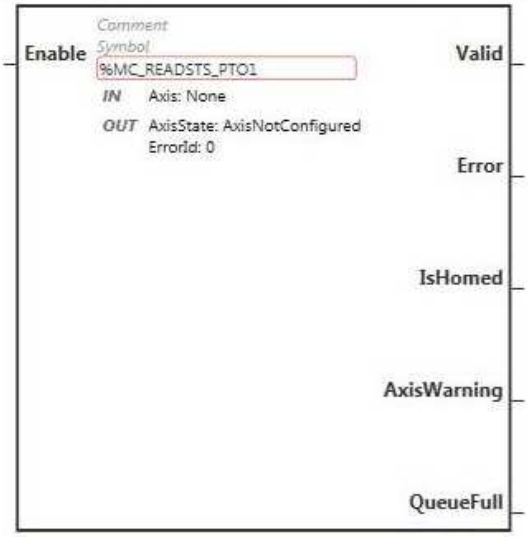
Read position (MC_ReadActPos_PTO)

Graphical Representation



Read status (MC_ReadSts_PTO)

Graphical Representation



Read motion state (MC_ReadMotionState_PTO)

Graphical Representation

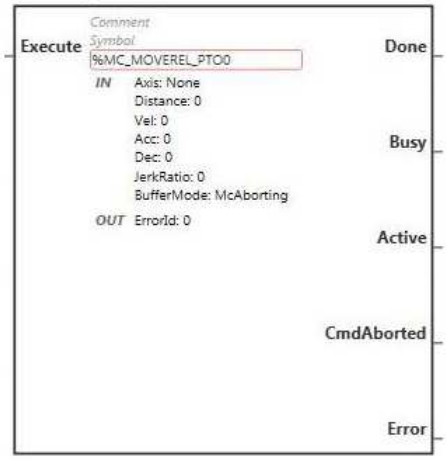
Movement function blocks:

Move velocity (MC_Move_Vel_PTO)

Graphical Representation

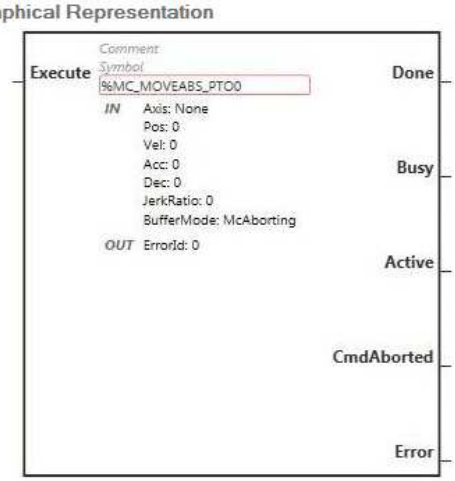
Move relative (MC_Move_Rel_PTO)

Graphical Representation



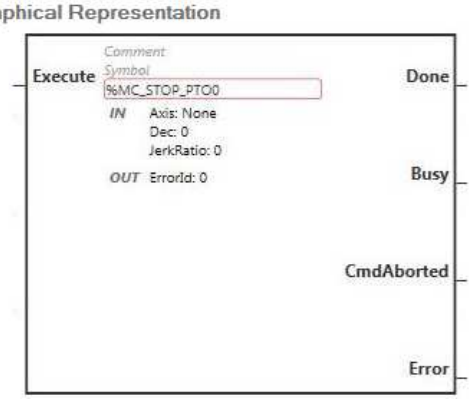
Move absolute (MC_Move_Abs_PTO)

Graphical Representation



Stop (MC_Stop_PTO)

Graphical Representation



Halt (MC_Halt_PTO)

Graphical Representation

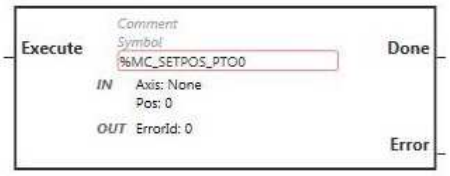
Position function blocks:

Homing (MC_Home_Abs_PTO)

Graphical Representation

SetPos (MC_SetPos_PTO)

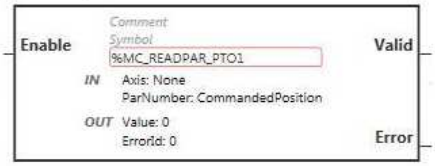
Graphical Representation



Parameter function blocks:

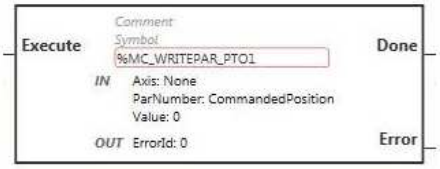
Read parameter (MC_ReadPar_PTO)

Graphical Representation



Write parameter (MC_WritePar_PTO)

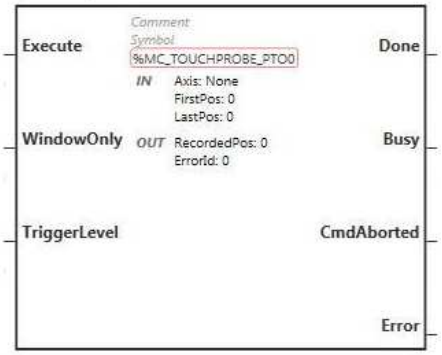
Graphical Representation



Probe function blocks:

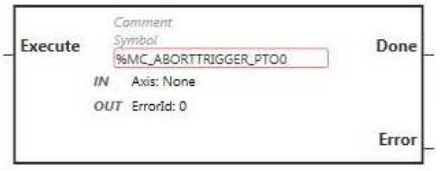
Probe (MC_TouchProbe_PTO)

Graphical Representation

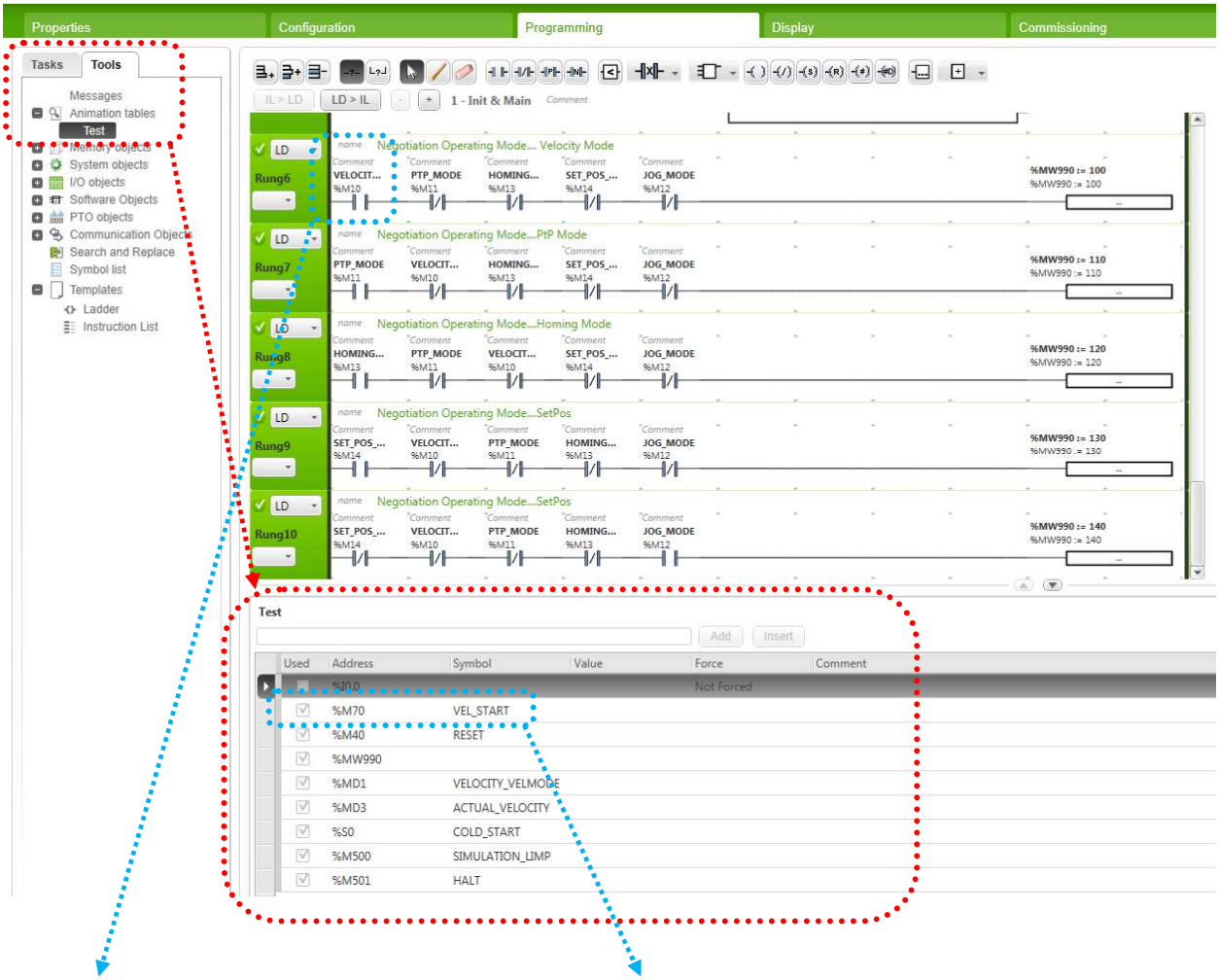


Abort Trigger (MC_AbortTrigger_PTO)

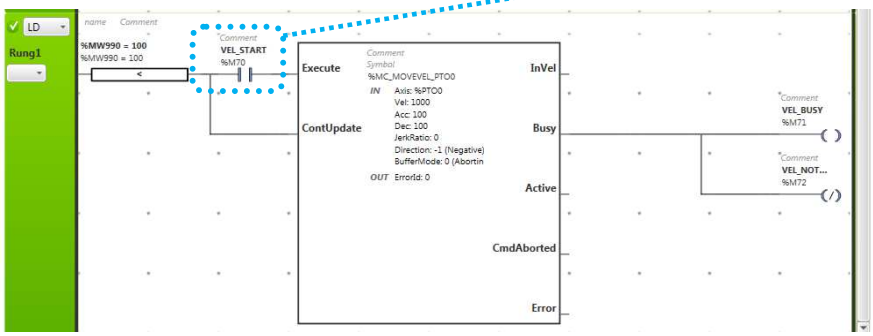
Graphical Representation



Operate the PTO axis via animation table (force values)



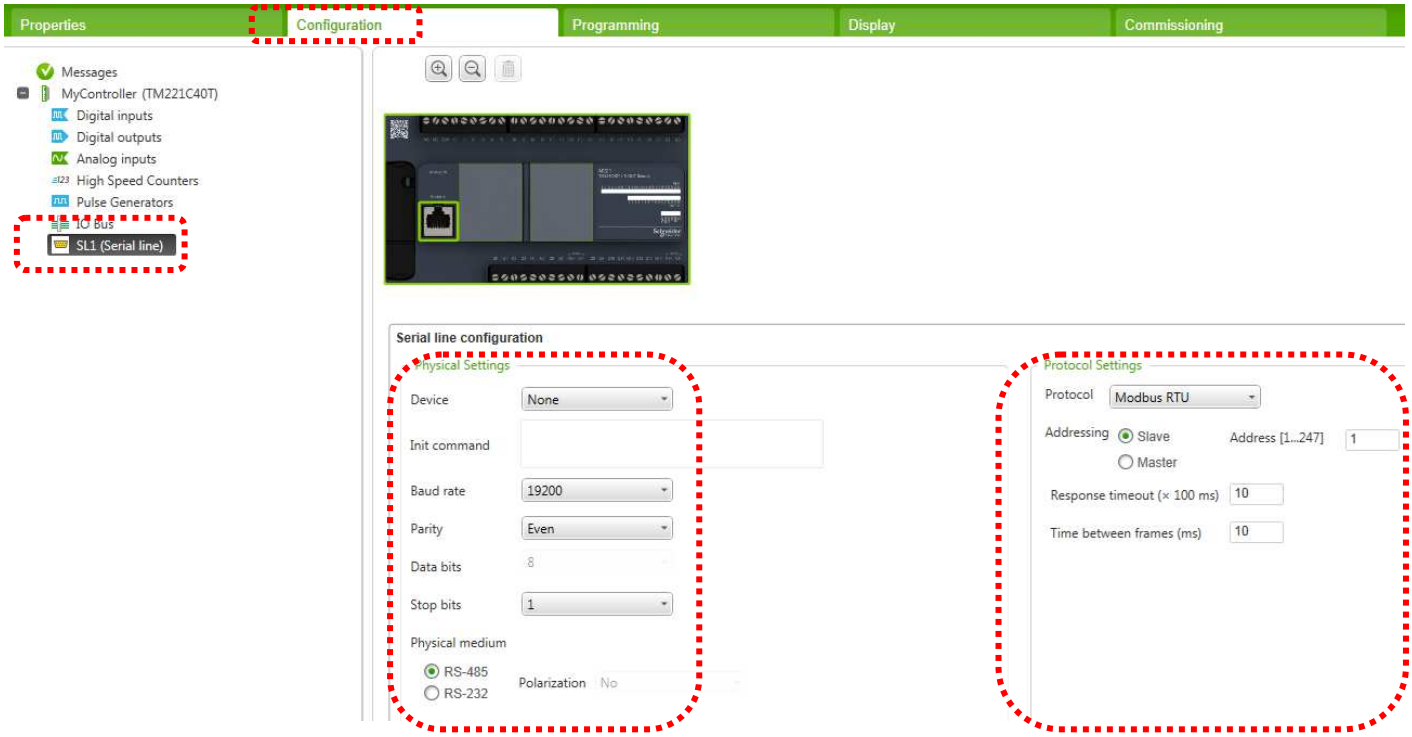
e.g.: %M10 for enable the velocity mode and start with %M70



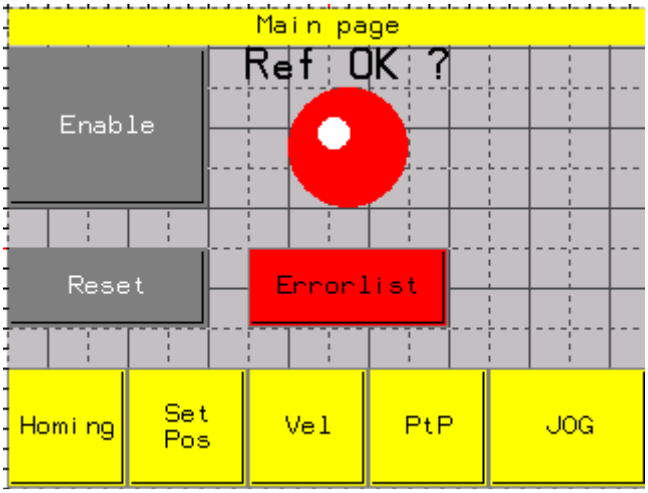
Operate the PTO axis via HMI

Configuration:

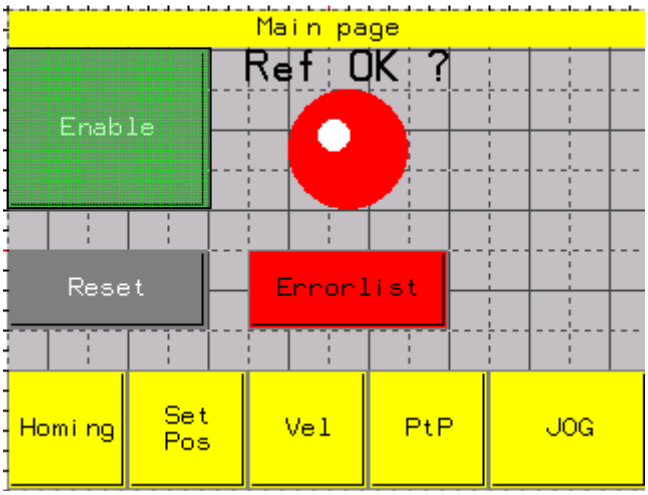
Configuration of the Serial interface (serial communication M221 – HMISTU655)



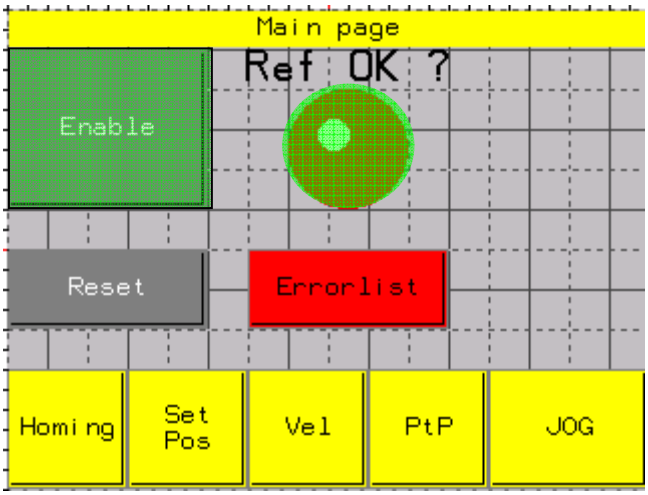
Main menue:



Enable:

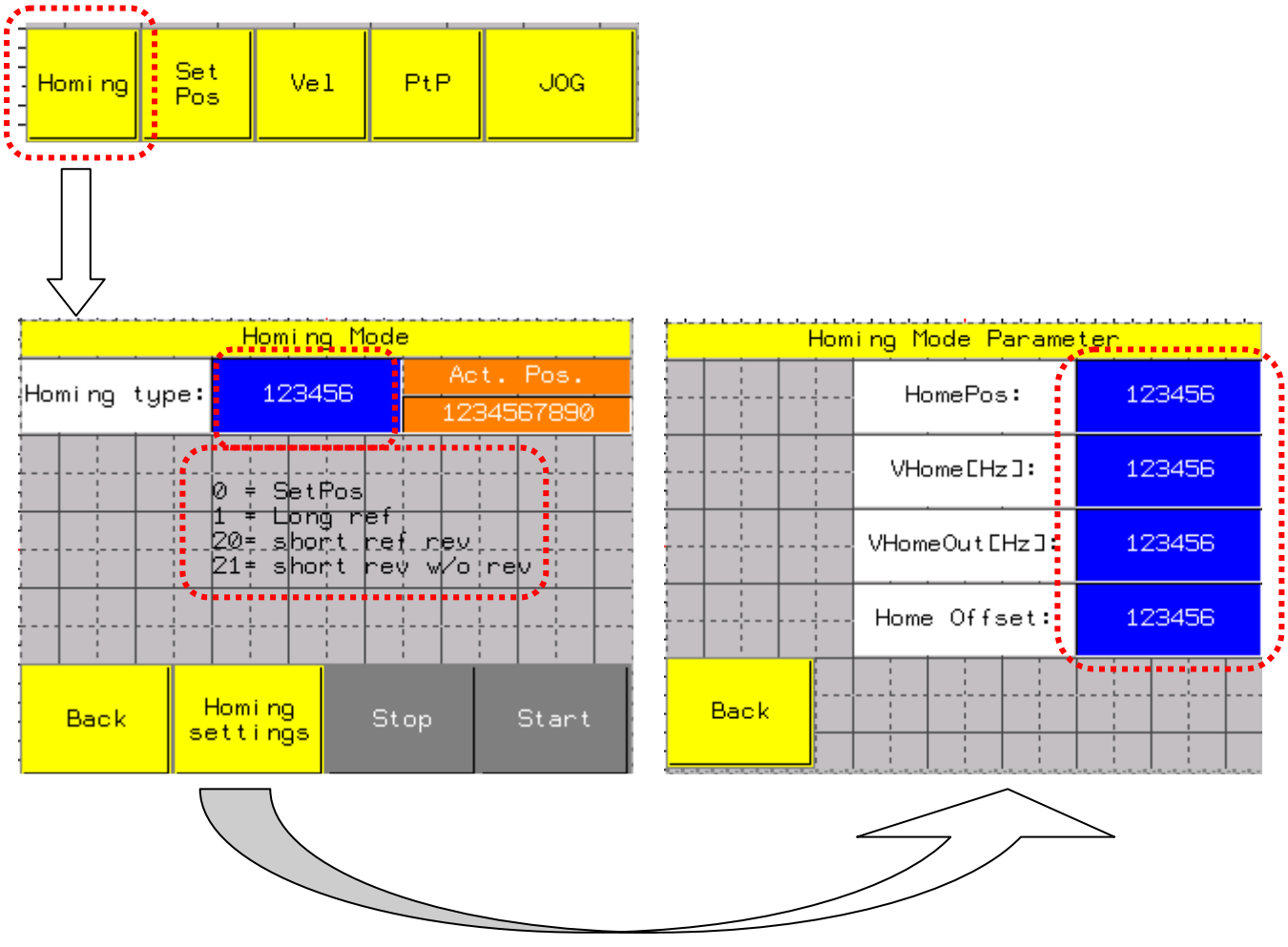


Enabled and referenced:

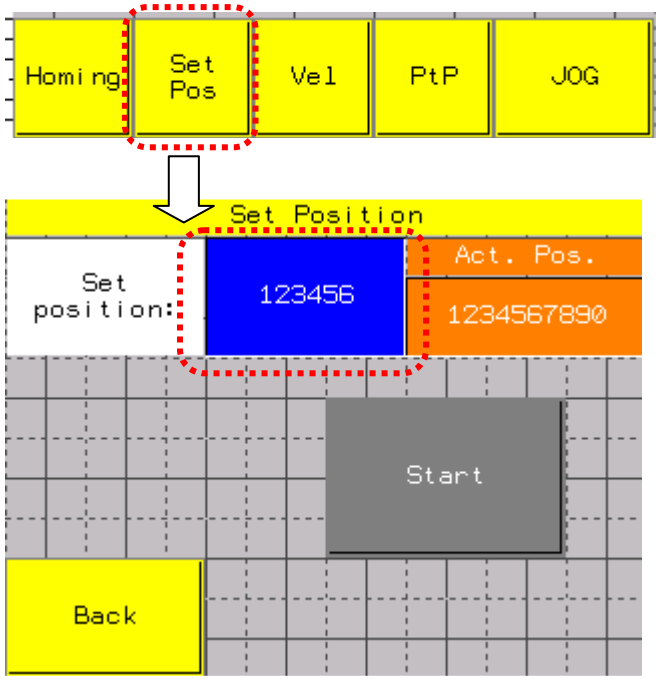


Homing:

The homing mode function can be edited.... homing modes, position value & homing parameters. (Mode 0 = set pos, Mode 1 = long ref to dedicated reference switch I4, 20 = short ref rev, 21 = short ref w/o rev). Dedicated homing input is %I0.2 for PTO0 axis....



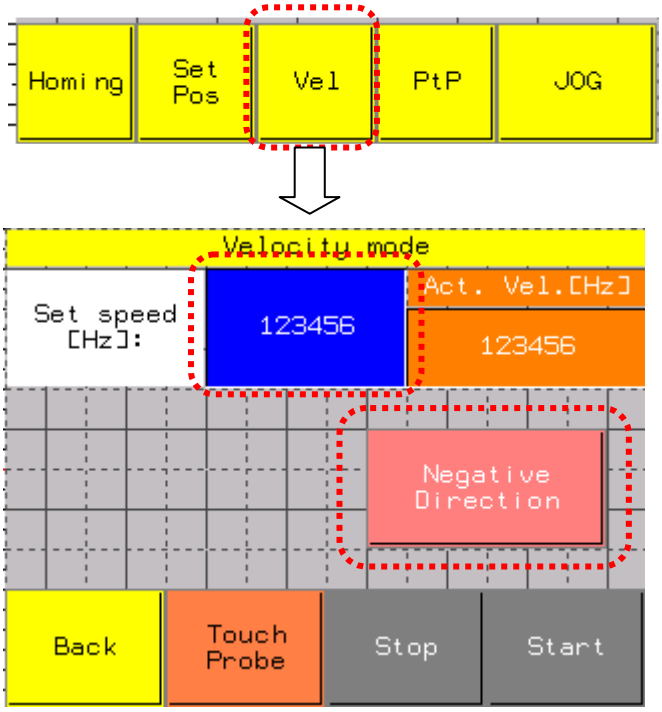
Set pos:



Velocity mode:

The velocity mode function can be edited:

- Edit velocity (in Hz)
- Positive or negative direction



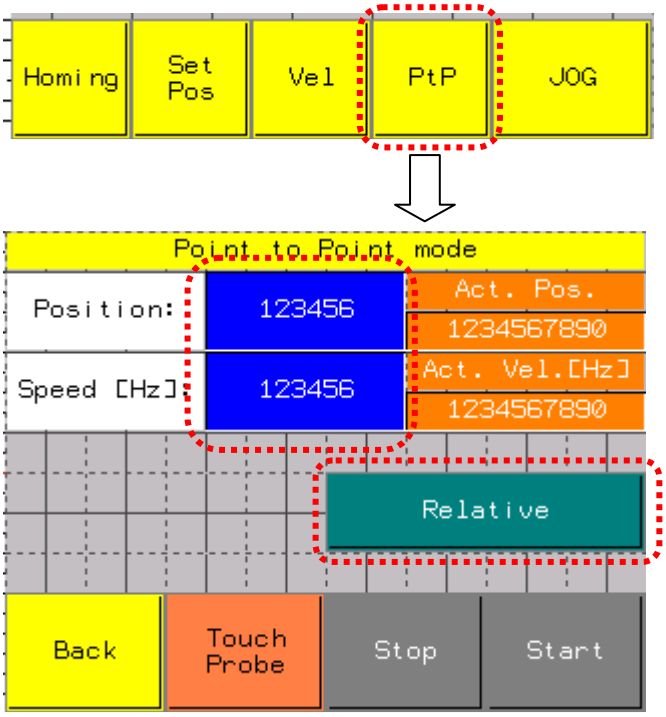
e.g.:
in case of the scaling of the connected drive is set to 1 turn = 1000 increments (or pulses)…

1000Hz = 60 rpm ->([1000 1/sec] / 1000 pulses) * [60 s/min] = 60 rpm
16666Hz = 1000 rpm ->([16666 1/sec] / 1000 pulses) * [60 s/min] = 1000 rpm

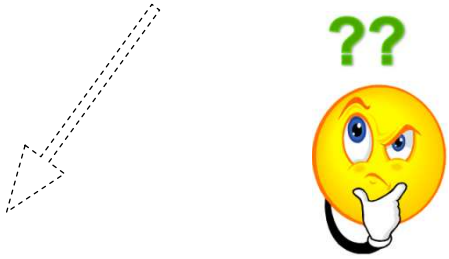
Position mode (ptp movement):

The position mode function can be edited:

- Edit position (in pulses)
- Edit velocity (in Hz)
- Absolute (only available if drive referenced) or relative movement



e.g.: relative movement to position = 10000
In case of the servo drive scaling is set to 1 turn = 1000 pulses -> the motor will turn 10 times (positive direction)….

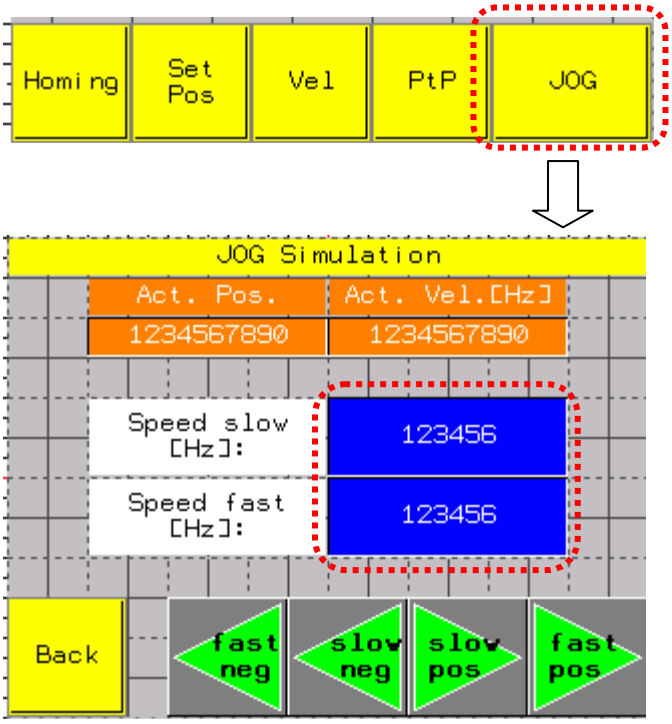


➔ Mandatory for this example: scaling -> 1 turn = 1000 pulses.
E.g.: LXM32 scaling: Motorincrements/scaling value = 131072/1000

JOG mode (simulation – not a basic operating function):

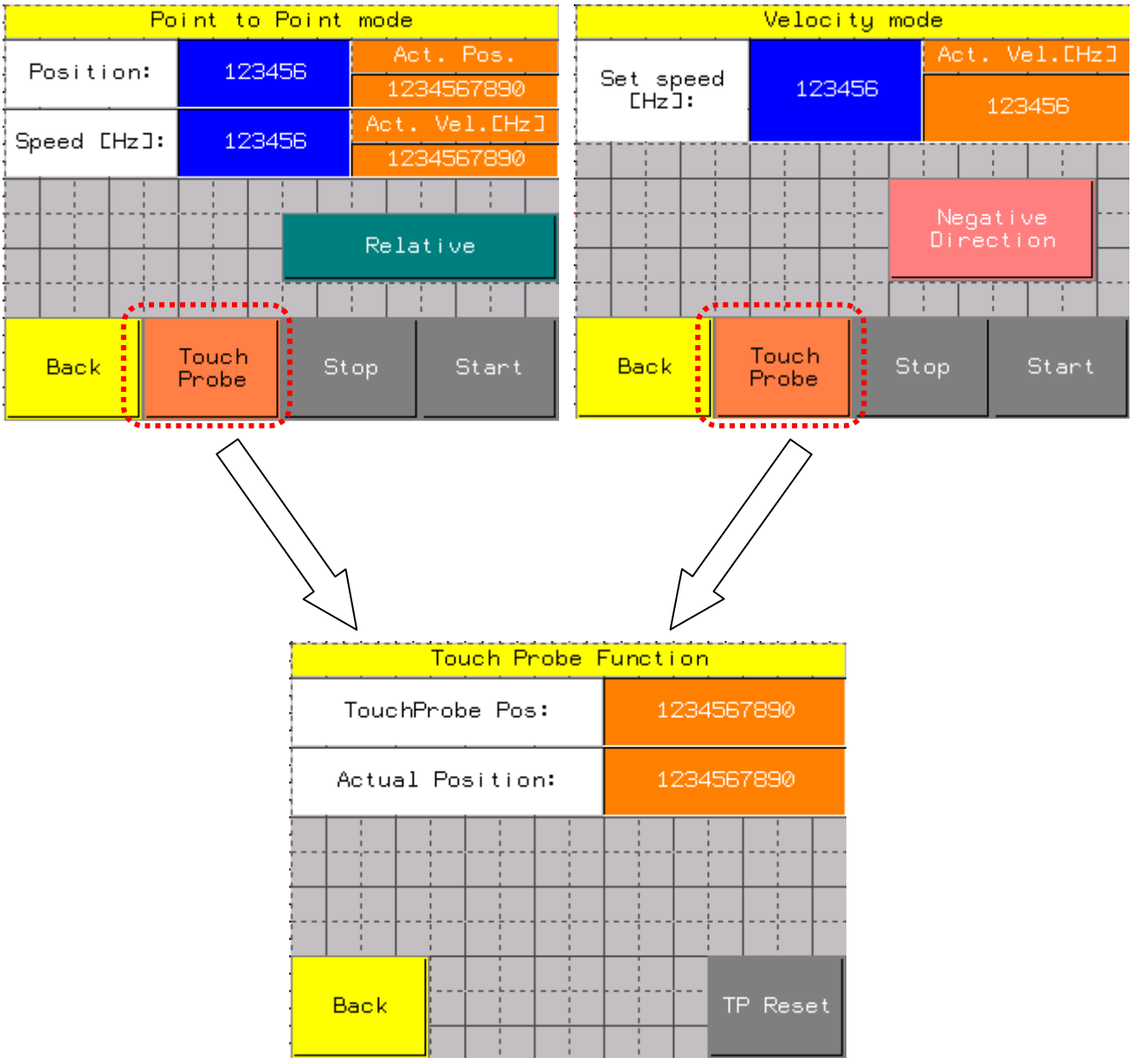
The “JOG mode” (simulation) can be edited:

- Edit slow speed (in Hz)
- Edit fast speed (in Hz)
-



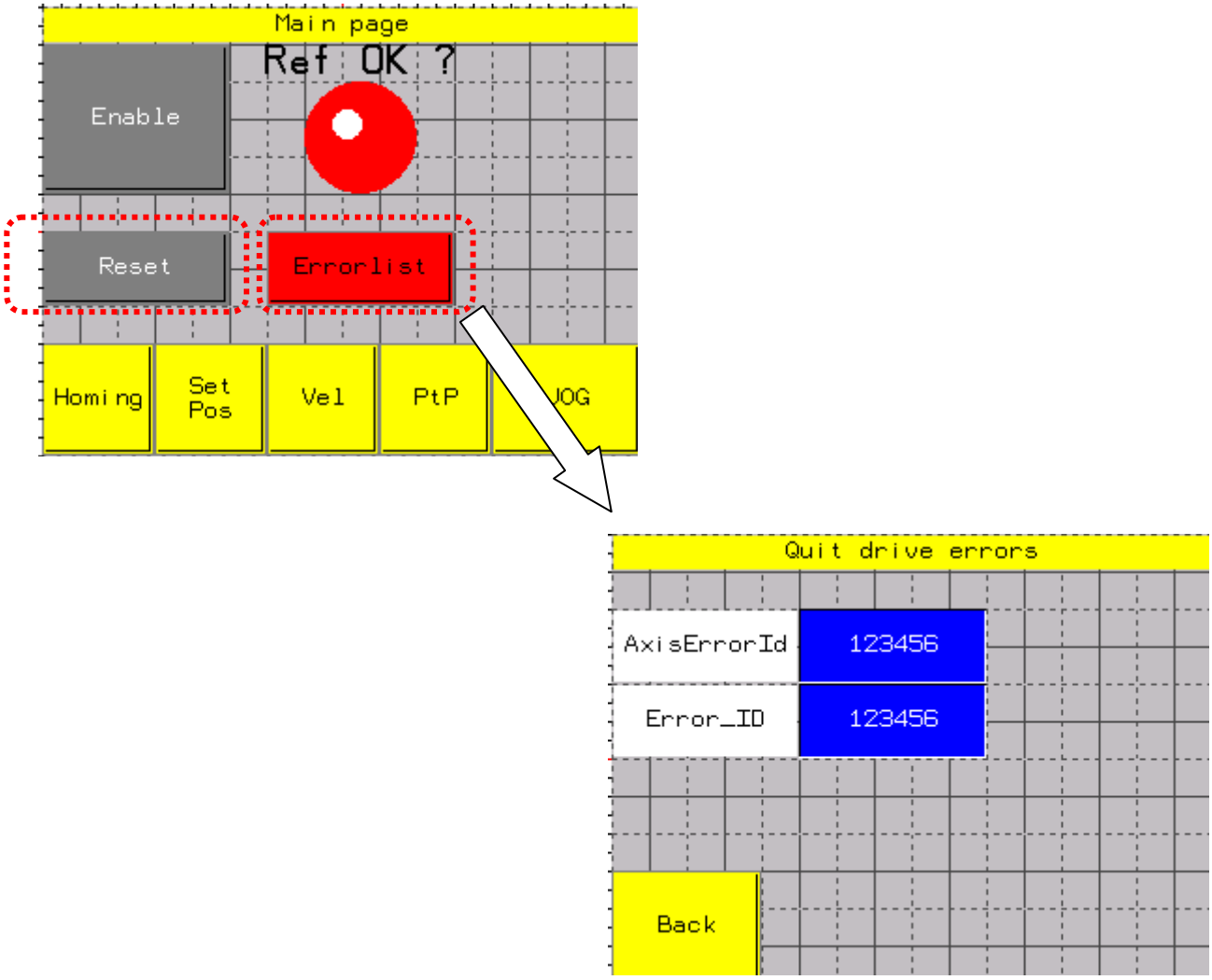
Probe function (available in positioning and velocity mode):

Please notice: the fixed input for PTO0 axis is: %I0.3



Error and reset:

If there is any drive error, the error state can be checked and reset in the main menue:



MC Stop additional detail:

Definition:

This function block commands a controlled motion stop and transfers the axis to the state Stopping. It aborts any ongoing move execution. While the axis is in state Stopping, no other function block can perform any motion on the same axis. This function block is primarily intended for exception situations, or fast stop functionality (for example, machine detected error managed by the user).

MC Halt additional detail:

Definition:

This function block commands a controlled motion stop until the velocity is zero, and transfers the axis to the state Discrete. With the Done output set, the state is transferred to Standstill.