Tritex II
CANopen Startup

Overview

The purpose of this application note is to get a Tritex with CANopen system operational “on the bench”, without a load connected to the motor. Some additional comments are added at the end to assist with tuning a loaded motor. The application note goes on to explain a basic system layout recommended for Tritex. At the end there is a section entitled “Where to go from here” which provides links to information on more advanced topics.

Features

The Exlar Expert drive software is a GUI developed to interoperate with the Tritex 485 interface by way of USB interface. All of the functions (Motion profiles) of the drive and user parameters are available through this interface. It may also be used to configure drive user and CANopen interface parameters.

The Exlar Expert drive software is required for tuning and configuring digital I/O.

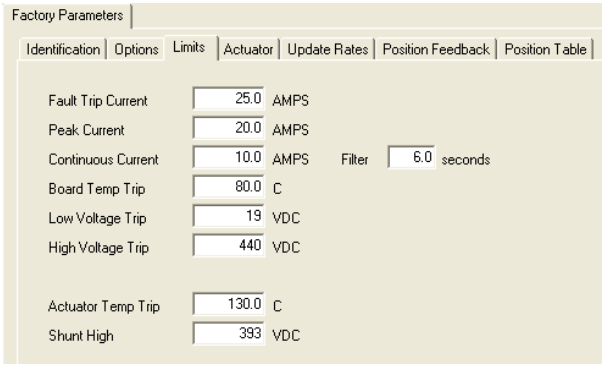
This method establishes communication and uploads all of the parameters from the drive to the PC, and the drive stays online

1. System Setup

System menu allows configuration and viewing of system parameters. Parameters are divided into two segments Factory and user parameters.

1.1.Factory Parameters

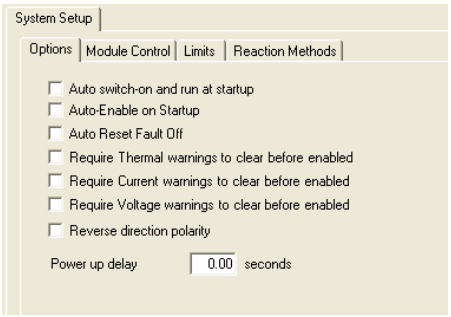
Factory parameters are stored as a block in non-volatile memory. The block contains a CRC (Cyclic Redundancy Checksum) word to guarantee data integrity. At power-up, the factory parameter block is validated and copied to its runtime location in RAM where all parameters are available for both reading and writing through their individual MODBUS identifiers. Factory parameter include, maximum limits and system options.



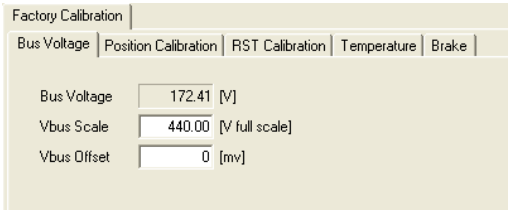
1.2.System Setup

System menu allows one time configuration of:

Power up options	Delay power-up, state machine sequence etc.
Module Control	Which interface (CANopen, Modbus or Digital I/O) has control
User limits	High current warnings and in position window
Reaction methods	Quick Stop 606Ah, Fault reaction 605Eh etc.

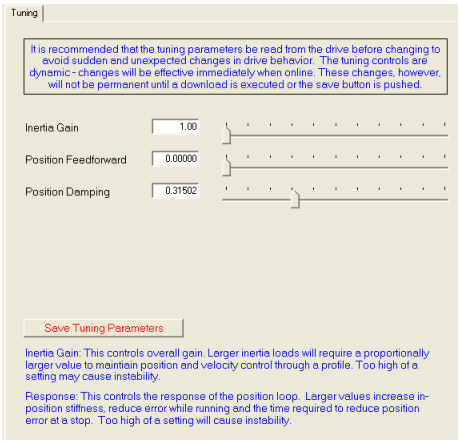


1.3.Factory Calibration



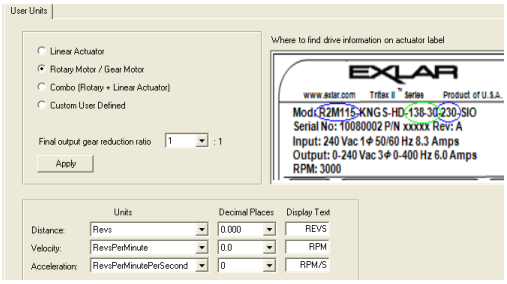
1.4.Tuning

This page allows user to adjust the tuning of the motor base on their application.



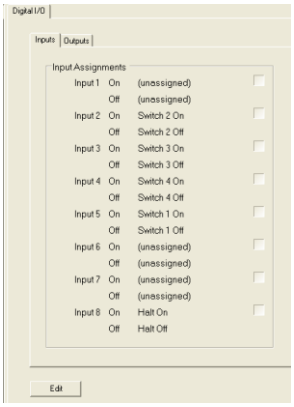
1.5.User units

The user unit page, allows user to change the units displayed, in the Tritex drive software. It does not change data written and stored in the drive.



2. Digital I/O

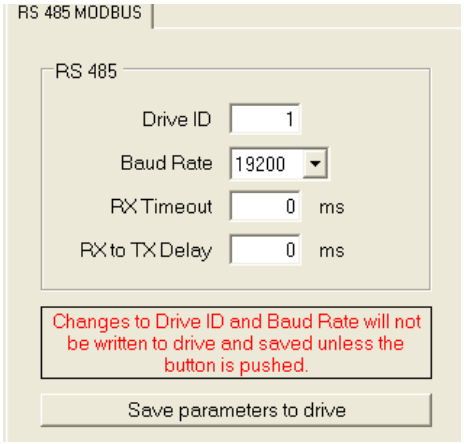
The Digital I/O screen is used to assign the input and output functions and LED outputs to the hardware I/O lines; eight discrete inputs and four discrete outputs. Refer to Expert software for additional information on configuring Digital I/O.



3. Networks

3.1.RS485 Modbus

The Tritex uses an RS485 hardware connection with a Modbus RTU protocol. The RS485 Modbus page allows the user to set the Tritex communication parameters to best connect with their communication. Therefore, an adapter will be required to interface from the RS232 or USB port on the PC to the RS485 port on the actuator (see Installation section for details on the RS485 port).



3.2.CANopen

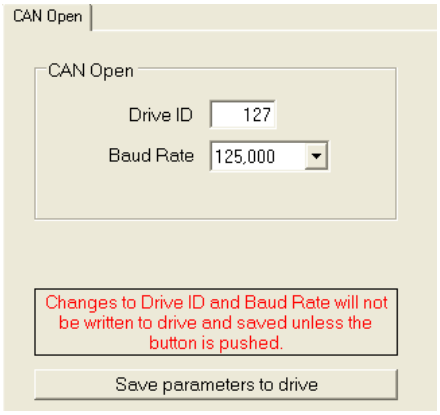
Exlar have implemented a CANopen protocol based on the 'Communication Profile' (CiA DS 301) in the Tritex, which supports both direct access to device parameters and time-critical process data communication. These parameters are accusable through the CANopen interface and Drive software.

Tritex with CANopen incorporates DS402 motor profile with several additional options that enhances the system use in a system. These additions add flexibilities to the overall system performance.

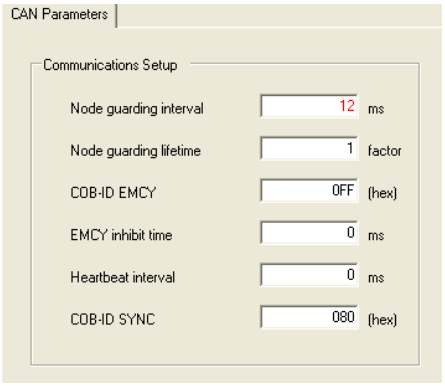
The Tritex support Variable PDO mapping this means the PDOs can only be mapped or re-mapped during Pre-operational state. This can be accomplished through SDO's or using Exlar Drive software. The PDO programming sequence of PDOs is handled using our drive software.

3.2.1.CAN Open

The CAN Open allows a simple method of changing Drive ID and Baud rate. Note, changes do not take effect until new power cycle.



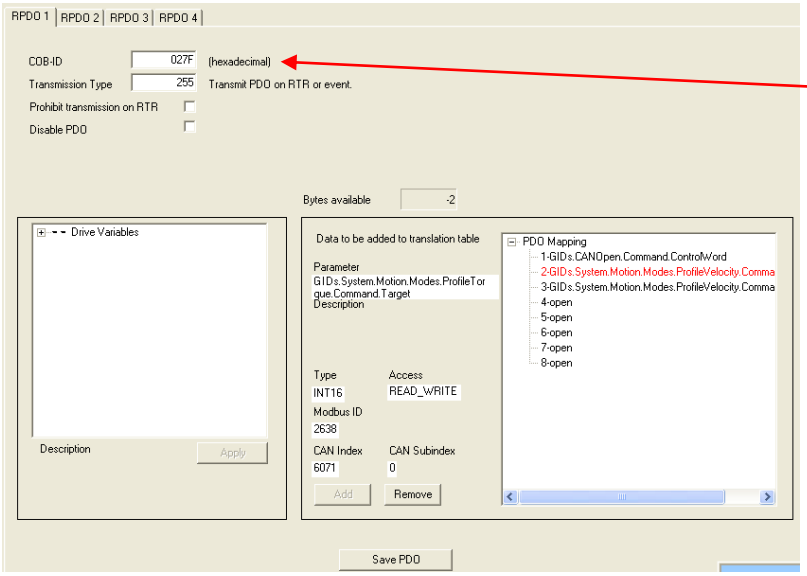
3.2.2.CAN Parameters



3.2.3.PDOs Setup

The object linker (translation tables) offers a significant improvement by supporting fully automated mapping/linking of PDOs in only a few steps. All available objects are sorted according to input and output data.

A unique COB-ID (unique with respect to the entire CANopen network, not just the node) must be assigned to each PDO which will be used over the CAN network. It is recommended using the Predefined Connection Set where ever possible. It is the system designer's responsibility to ensure that all PDOs have a unique COB-ID. It is best to assign the COB-IDs in a logical order, with the most important PDOs assigned to the lowest COB-IDs.



27Fh = 200h + 7Fh

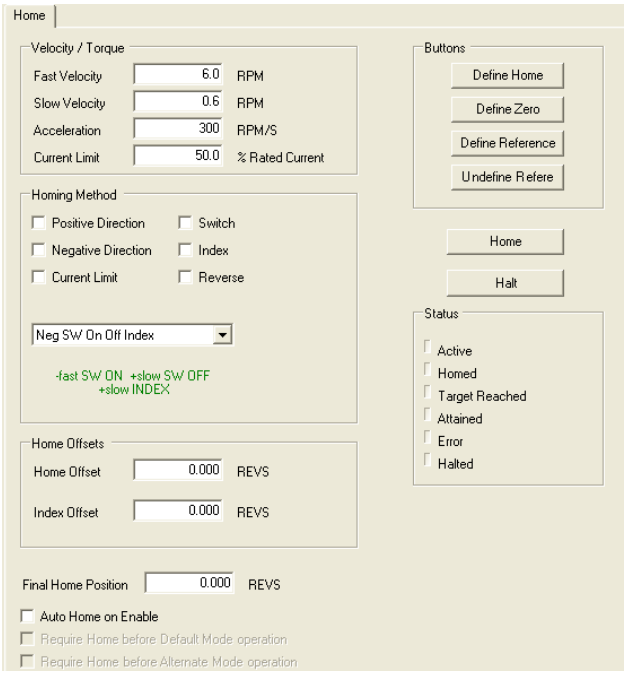
PDOs Predefined Connection Set	
COB-ID(s) hex	**Slave nodes**
180 + NodeID	1. Transmit PDO
200 + NodeID	1. Receive PDO
280 + NodeID	2. Transmit PDO
300 + NodeID	2. Receive PDO
380 + NodeID	3. Transmit PDO
400 + NodeID	3. Receive PDO
480 + NodeID	4. Transmit PDO
500 + NodeID	4. Receive PDO

4. Motion

The device profile for drives and motion control defines the functional behavior of controllers for servo drives, frequency inverters and stepper motors. The specification includes a finite state automaton (FSA). The state of the drive determines which commands are accepted and if high power is applied. States are changed by a *control-word* received from the host-controller can be initiated by internal events. The current state is indicated by the *statusword*.

4.1.Home

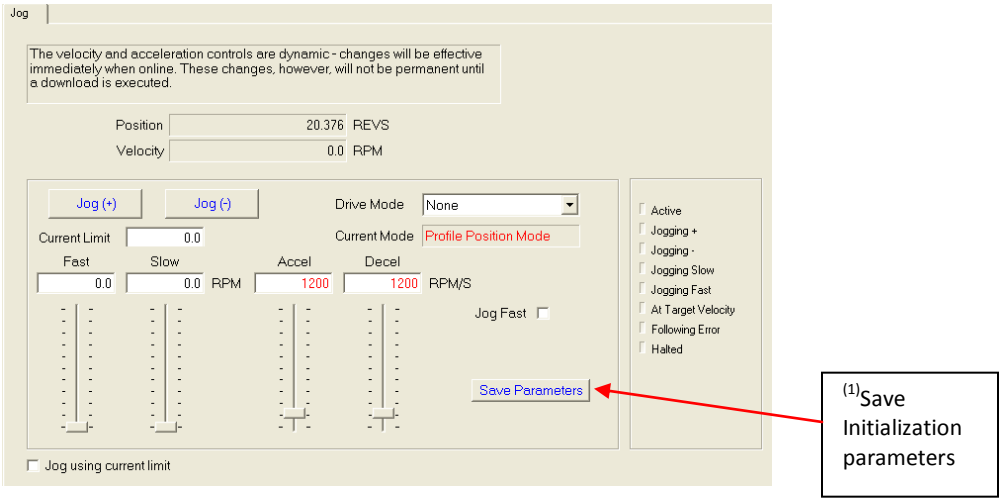
The Home Page configures and commands the Home operation.



4.2.Jog

The Jog Page is used to command jog mode on the Tritex. Once jog mode has been enabled, the jog inputs can be used to produce motion on the actuator. The inputs that will be used as jog inputs are determined by the Jog (+) or Jog (-) command. Once the jog inputs have been enabled, they will remain enabled, until user disable operation.

The motion profile have several option are configurable by the user, Fast, slow velocity and acceleration and deceleration rates.

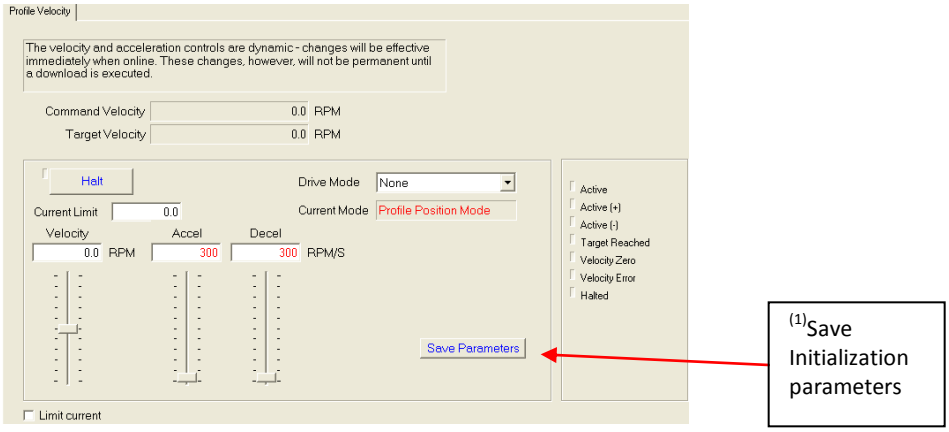


(1) Saves the current displayed as new Initialization value (Fast Slow Velocity, Acceleration, Declaration and Current limit), when entering mode for the first time.

NOTE! Typical motion profile commands and options could be set each time on power up from host or

set using a configuration file and stored to NVM once. Clicking Jog (+) or (-) changes will automatically generated a enter mode request of Jog.

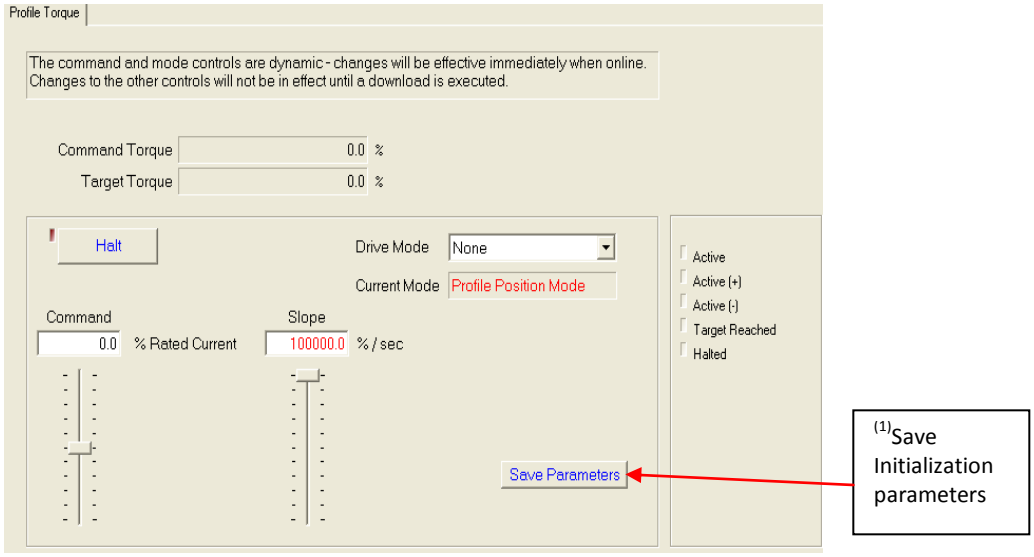
4.3.Profile Velocity



(1) Save current displayed as new Initialization value (Acceleration, Deceleration, Current Limit and Target Velocity), when entering mode for the first time.

NOTE! Typical motion profile commands and options could be set each time on power up from host or set using a configuration file and stored to NVM once

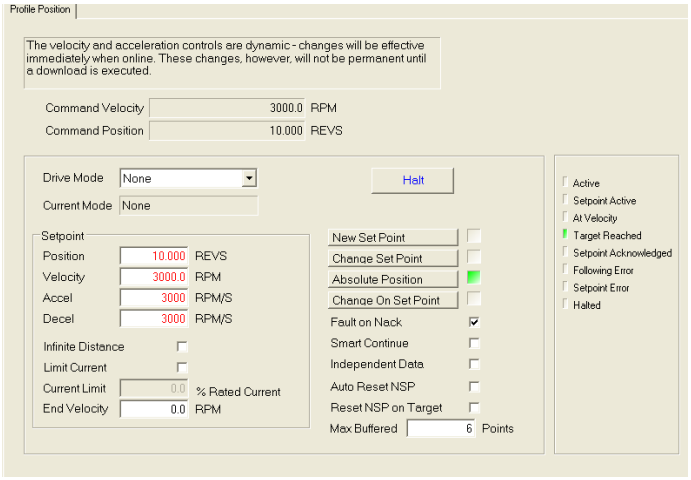
4.4.Profile Torque



(1) Save current displayed as new Initialization value (Target Torque and Slope), when entering mode for the first time.

NOTE! Typical motion profile commands and options could be set each time on power up from host or set using a configuration file and stored to NVM once

4.5.Profile Position



NOTE! Typical motion profile commands and options could be set each time on power up from host or set using a configuration file and stored to NVM once

Options

FAULT ON NACK
A rising edge of NEW_SETPOINT IMMEDIATE and SETPOINT_ACK active will normally generate a 'warning' and raise the SETPOINT_NACK event. If the PP_OPTION_FAULT_ON_NACK is selected, a fault will be generated instead.

SMART CONTINUE
When a new SETPOINT is to be buffered (not immediately executed) and the PP_CONTROL_CONTINUOUS flag is set the default action is to modify the END_VELOCITY of the previous (or active) set-point to its velocity so that it doesn't stop and targets the new SETPOINT's velocity and distance when it completes. The PP_OPTION_SMART_CONTINUE overrides this behavior to set the previous (or active) SETPOINT's END_VELOCITY to the lesser of the previous (or active) SETPOINT velocity and the new. SETPOINT velocity.

INDEPENDENT DATA
Doesn't copy profile type, acceleration, and deceleration values from global profile data when loading a SETPOINT. The global are copied into the SETPOINT setup structure only at startup.

RESET NSP
Internally resets CONTROL.NEW_SETPOINT as soon as the drive is able to accept another SETPOINT.

RESET NSP_ON TARGET
Internally resets CONTROL.NEW_SETPOINT when STATUS.TARGET_REACHED becomes active.

MAXIMUM BUFFERS
Maximum number of set-point buffers, maximum allows valve is 8; set-point buffer array is load only during mode creation

5. Diagnostic

The overall system status is displayed on the diagnostic page; user can monitor faults, warnings, position and temperatures. Also contain record of satirical information of history of the drive.

5.1.Status Log

The Status log page displays the log of Faults and Warning of the drive.

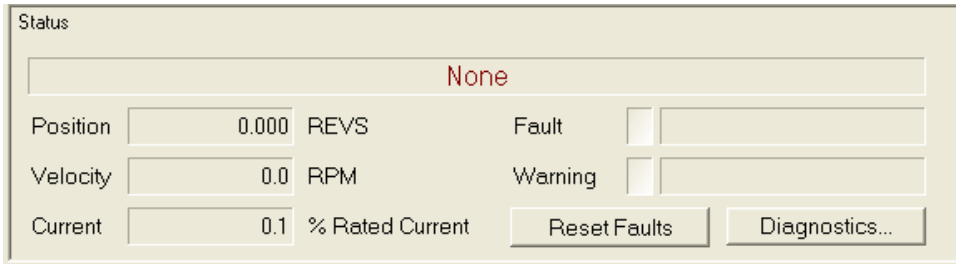
5.2.Diagnostics

The Diagnostic page displays the current Status and history of Faults of the drive.

6. Monitor / Control

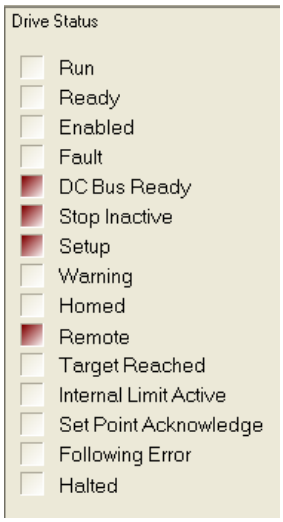
6.1.Status

The Status wedge shows an overview the drive status.



6.2.Drive Status

The Drive Status wedge indictors show the statusword (6041.0h) states; while the controlword (6040.0h) can be commanded from the Drive Control wedge.



The statusword provide the status of the PDS FSA.

Drive Status										
Statusword										
15 -10	9	8	7	6	5	4	3	2	1	0
x … x	**Remote**	**Homed**	**x**	**Setup**	**Stop Active**	**DC Bus Ready**	**Fault**	**Enabled**	**Ready**	**Run**

Figure 1 - Statusword

Bits	Drive control bits		Description
	Exlar	*DS402*	
0	**Run**	*Ready to run*	Drive is in normal runtime operation mode and is ready to accept the power command
1	**Ready**	*Switch on*	
2	**Enabled**	*Operational enabled*	The drive is enabled and ready to command motion.
3	**Fault**	Fault active	Fault has occurred in the system and fault reaction has completed
4	**DC Bus Ready**	*Voltage enable*	Tritex voltage is greater than low voltage limits.
5	**Stop Active**	*Quick stop actived*	Indicates the PDS is reacting to deactivate request. The final state is determined by Quick Stop option register. 0= Quick Stop Active 1= Inactive,
6	**Setup**	Switch on disabled	Drive is in SETUP mode and not ready for operation. Some commands are available only in SETUP mode. The SETUP bit is a 'convenience' event bit and is always the inverse of the RUN bit
8	**Homed**	*Manufacture defined*	Drive is homed
9	**Remote**	*Remote*	0 = indicate that the controlword is not processed 1 = indicate that the controlword is processed

Figure 2 - Drive status bits

Mode of Operation	Mode specific bits		
	13	12	10
	oms	oms	tr
Profile position (pp)	Following error	Set-point acknowledge	Final target reached
Profile velocity (pv)	x	x	Target velocity reached
Profile torque (pt)	x	x	Target torque reached
Homing (hm)	See Homing Mode		
Profile jog (pj)	See Jog Mode		

Figure 3 - Statusword, Mode specific bits

PDS 402 State	Exlar Internal State	Bits in status word						
		6	5	3	2	1	0	
		setup	Stop active	fault	enable	ready	run	
		(sod)	***(qs)***	***(f)***	***(oe)***	***(so)***	***(rtso)***	*DS 402: Bit definition*
Not Ready to Switch On	**Not Ready**	0	X	0	0	0	0	
Switch On Disabled	**Setup**	1	X	X	0	0	0	
Ready to Switch On	**Run**	0	1	0	0	0	1	
Switch On	**Ready**	0	1	0	0	1	1	
Operational Enabled	**Enabled**	0	1	0	1	1	1	
Quick Stop Active	**Stop Active**	0	0	0	1	1	1	
Fault Reaction Active	**Fault Reaction Active**	0	X	1	1	1	1	
Fault	**Fault**	0	X	1	0	0	0	

Figure 4 – DS402 state machine states

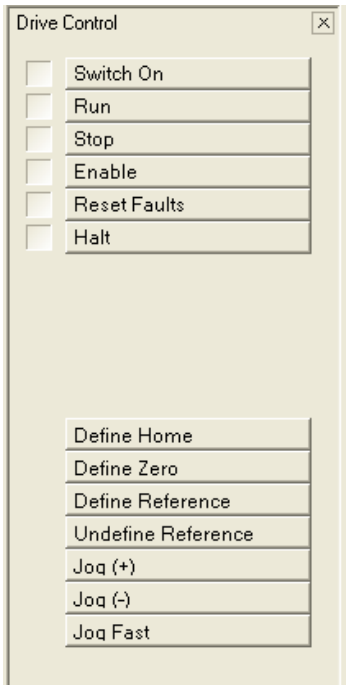
6.3.Drive Control

The Drive control wedge button commands controlword (6040.0h) and LED indicators return controlword state. In the similar fashion, statusword (6040.0h) is showed in the Drive Status wedge.

Basic steps in enable drive for manual control of drive through Exlar Expert Software:

(1) Switch On
(2) Run
(3) Enable

NOTE! Verify appropriate Drive Status is change base on 'Drive Control 'commands.



The controlword has a dual purpose, controlword the state machine of the drive and command the motion mode.

15 12	11	10	9	8	7	6 5 4	3	2	1	0
reserved	Break release	reserved	Mode specific	Halt	Fault reset	Mode specific	Enable	Quick Stop	Run	Switch on

MSB LSB

Figure 5 - Controlword

Drive Control bits
Controlword

15 -7	6	5	4	3	2	1	0
x … x	**Reset fault**	**x**	**x**	**Enable**	**Stop**	**Run**	**Switch on**

Figure 6 - Drive control bits

Bits	Drive Control	*DS402*	Description
0	**Switch on**	Switch on	interlock
1	**Run**	*Enable voltage*	The DS402 FSA 'ready to switch on' state is waiting for the drive to be set to enable high level power. Since the drive doesn't control its own bus power, this state place for controllers that require an extra command interlock before accepting the ENABLE bit. Controllers that don't want the extra interlock may elect to force this control bit set at start-up.
2	**Stop**	*Quick stop*	Command the drive to deactivate, base on Stop option To deactivate stop controlword bit 2 must be equal to 1. Refer to Stop Action (0x605A.0) for more information
3	**Enable**	*Enable operation*	Commands drive into operational enable state.
6	**Reset Faults**	Fault reset	Reset faults on the rising edge.

Figure 7 - Drive control bits

	Operation mode specific bits				
Mode of Operation	9	8	6	5	4
Profile position (pp)	Change on Set point	Halt	Abs/rel	Change set Immediately	New set
Profile velocity (pv)	Reserved	Halt	Reserved	Reserved	Reserved
Profile torque (pt)	Reserved	Halt	Reserved	Reserved	Reserved
Homing (hm)		Halt			
Profile jog (pj)		Halt			

Figure 8 - Controlword, Mode specific bits

7. Motion examples

This section contain sample configuration of the drive.

7.1.Homing

The Tritex drive support many aspects of the homing methods[1] described by DS 402. This includes the use of a switch inputs and/or an encoder index pulse to determine the extent of travel, limit inputs, and a specific acceleration, deceleration, normal speed and slow speed to use while homing. These homing inputs are integrated into the Tritex and are user defined.

To configure the drive Inputs it is recommended using the Tritex Expert software. Below is an example of configuring Home method 19.

Homing method 19 **- POS_SW_ON_OFF**
(Home on positive home switch (inactive)) [d]

[1] Refer to Tritex CANopen manual for supported methods.

7.1.1.Configure Inputs

From the Digital I/O page configure the 'Home Switch' to your wired Input 5. (See Hardware interface manual for information on connecting switch to Tritex.) For this example wire the 'Home Switch' to Input 5.

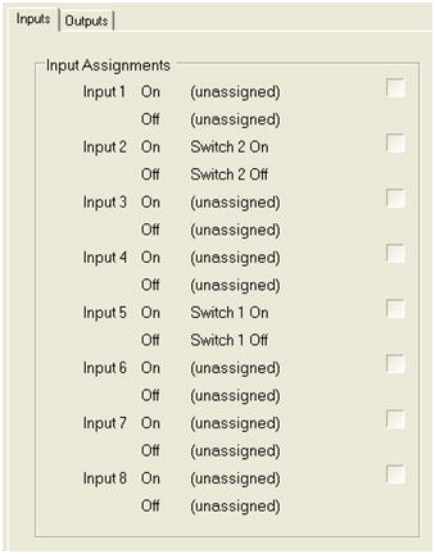


Figure 9 - Example - Home Switches

DS402 Description	Source of Event
Home Switch	Configurable Input Event
Negative Limit Switch	Configurable Input Event
Positive Limit Switch	Configurable Input Event
Index Pulse	Index Pulse

Figure 10 – Exlar Input Switches vs. DS402

7.1.2.Home drive

7.1.2.1.CANopen interface

Homing Mode – demonstrates home method 19 decimal using Service Data Objects (SDOs).

The below example sets typical motion profile commands a system would configure[1], enabling the motor power[2] and executing a homing function using SDOs with Node ID 65 (41h).

[1]Typical configuring I/O should be set using Exlar Drive software and stored to NVM once. Motion user parameters could be set each time on power up or configure and stored to NVM once.

[2]Enabling the motor power only has to be done once on power up.

Typical motion profile commands and enabling sequence										
ID	**RTR**	**Data**								**Description**
										DSP402 state machine, 6040.0h
0641	00	2B	40	60	00	06	00	00	00	Send shutdown - transfer to Ready to Switch on
0641	00	2B	40	60	00	07	00	00	00	Switched on
0641	00	2B	40	60	00	0F	00	00	00	Operation Enable
										Typical Motion Parameters
0641	00	23	84	60	00	50	C3	00	00	Set deceleration to 3000 RMP/S, 6084.0h
0641	00	23	83	60	00	50	C3	00	00	Set acceleration to 3000 RMP/S, 6083.0h
										Set to Home Mode
0641	00	2F	60	60	00	06	00	00	00	Set to Profile Home Mode, 6060.0h
										Set Homing Method, Offset and Speeds
0641	00	23	FF	60	00	13	00	00	00	Homing method 19 decimal
0641	00	23	7C	60	00	00	00	00	00	Homing Offset value = 0
0641	00	23	99	60	01	35	82	00	00	Home Speed Fast 2000 RPM
0641	00	23	99	60	02	82	06	00	00	Home Speed Slow 100 RPM
										Start Homing
0641	00	2B	40	60	00	1F	00	00	00	Start Homing and remove active Halt
										Stop Homing after home is acquire
0641	00	2B	40	60	00	0F	00	00	00	Stop Homing (This will Halt Homing and keep Operational Enable)

Figure 11 - Example: Home mode

7.1.2.2.Define Home

To define current position as home using PAC commands, can be accomplish using Tritex Drive software or through CANopen. By using accessing drive internal commands through CANopen interface.

Typical motion profile commands and enabling sequence										
ID	**RTR**	**Data**								**Description**
										DSP402 state machine, 6040.0h
0641	00	2B	40	60	00	06	00	00	00	Send shutdown - transfer to Ready to Switch on
0641	00	2B	40	60	00	07	00	00	00	Switched on
0641	00	2B	40	60	00	0F	00	00	00	Operation Enable
										Set to Home Mode
0641	00	2F	60	60	00	06	00	00	00	Set to Profile Home Mode, 6060.0h
										Define Current Position as Zero
0641	00	23	09	21	00	00	00	20	37	Write Pac [(2)] *System.Post.Commands.DefineHome* (924942336-> 0x37218000)

Figure 12 - Example: Home Absolute Position

[(1)]Halt is enabled automatically, when a Motion mode becomes active.
[(2)] Same function as "Define Home" within 'Expert Tritex' software

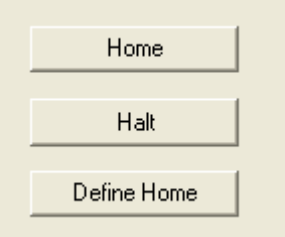


Figure 13 - Drive Software Home Commands

7.2.Position

Profile Position Mode – demonstrates the different move types supported for position control executed via Service Data Objects (SDOs).

Exlar support relative and absolute moves to position. Using either relative or absolute moves, the user can also select (by the control word data) if the target position should be reached before another target position is allowed (finish first) or if the actuator should execute a newly received target position even if still in motion (immediate).

The below example sets typical motion profile commands a system would configure, enabling the motor power[2] and the four different move types[2] supported in Profile Position Mode using SDOs with Node ID 65 (41h).

3000 RMP/S	Acceleration:	3000 ÷ 0.06 = 5000 (0xC350)
2000 RPM	Target Velocity:	2000 ÷ 0.06 = 3333 (0x8235)
10.000 REVs	Distance:	10000 ÷ 0.0001 = 100000 (0x0186A0)

[1]Enabling the motor power only has to be done once on power up. Motion user parameters could be set each time on power up or configure and stored to NVM once.

[2]The Control Word data selects the move type.

Typical motion profile commands and enabling sequence										
ID	**RTR**	**Data**								**Description**
										DSP402 state machine, 6040.0h
0641	00	2B	40	60	00	06	00	00	00	Send shutdown - transfer to Ready to Switch on
0641	00	2B	40	60	00	07	00	00	00	Switched on
0641	00	2B	40	60	00	0F	00	00	00	Operation Enable
										Typical Motion Parameters
0641	00	23	84	60	00	50	C3	00	00	Set deceleration to 3000 RMP/S, 6084.0h
0641	00	23	83	60	00	50	C3	00	00	Set acceleration to 3000 RMP/S, 6083.0h
0641	00	23	81	60	00	35	82	00	00	Set max user velocity to 2000 RPM , 6081.0h
										Set to Profile Position Mode
0641	00	2F	60	60	00	01	00	00	00	Set to Profile Velocity Mode, 6060.0h
										Move Absolute (finish first)
0641	00	23	FF	60	00	A0	86	01	00	Set Target Position to 10.000 REVS
0641	00	2B	40	60	00	1F	00	00	00	Set Control Word bit 4 to 1
0641	00	2B	40	60	00	0F	00	00	00	Set Control Word bit 4 to 0
										Move Absolute (immediate)
0641	00	23	FF	60	00	E0	93	04	00	Set Target Position to 30.000 REVS
0641	00	2B	40	60	00	3F	00	00	00	Set Control Word bit 4 to 1
0641	00	2B	40	60	00	2F	00	00	00	Set Control Word bit 4 to 0
										Move Relative (finish first)
0641	00	23	FF	60	00	50	C3	00	00	Set Target Position to 50.000 REVS
0641	00	2B	40	60	00	5F	00	00	00	Set Control Word bit 4 to 1
0641	00	2B	40	60	00	4F	00	00	00	Set Control Word bit 4 to 0
										Move Relative (immediate)
0641	00	23	FF	60	00	A0	86	01	00	Set Target Position to 10.000 REVS
0641	00	2B	40	60	00	7F	00	00	00	Set Control Word bit 4 to 1
0641	00	2B	40	60	00	6F	00	00	00	Set Control Word bit 4 to 0

Figure 14 - Example: Position

7.3.Velocity

Exlar supports the ability to move in velocity mode. Once in Profile Velocity Mode, any new target velocity will be executed immediately.

The below example sets typical motion profile commands a system would configure[1], enabling the motor power[2] and sending a new target velocity using SDOs with Node ID 65 (41h).

3000 RMP/S	Acceleration:	3000 ÷ 0.06 = 5000 (0xC350)
1000 RPM	Target Velocity:	1000 ÷ 0.06 = 16667 (0x411A)

[1]Typical motion profile commands could be set each time on power up from host or set using a configuration file and stored to NVM once.
[2]Enabling the motor power only has to be done once on power up.

Typical motion profile commands and enabling sequence										
ID	**RTR**	**Data**								**Description**
										DSP402 state machine, 6040.0h
0641	00	2B	40	60	00	06	00	00	00	Send shutdown - transfer to Ready to Switch on
0641	00	2B	40	60	00	07	00	00	00	Switched on
0641	00	2B	40	60	00	0F	00	00	00	Operation Enable
										Typical Motion Parameters
0641	00	23	84	60	00	50	C3	00	00	Set deceleration to 3000 RMP/S, 6084.0h
0641	00	23	83	60	00	50	C3	00	00	Set acceleration to 3000 RMP/S, 6083.0h
										Set to Profile Velocity Mode
0641	00	2F	60	60	00	03	00	00	00	Set to Profile Velocity Mode, 6060.0h
										Motion Mode default condition are loaded
										Send new Target Velocity
0641	00	23	FF	60	00	1A	41	00	00	Target Velocity 1000 RPM, 60FF.0h

Figure 15 - Example: Velocity

(3)Halt is enabled automatically, when a Motion mode becomes active.

7.4.Jog

Exlar supports the ability to move in Jog mode. The below example sets typical motion profile commands a system would configure[1], enabling the motor power[2] and sending a new target velocity using SDOs with Node ID 65 (41h).

100 RMP,	Slow Velocity:	100 ÷ 0.06 = 1666 (0x682)
5000 RPM/S,	Acceleration:	5000 ÷ 0.06 = 8333 (0x14585)
5000 RMP/S,	Deceleration:	5000 ÷ 0.06 = 8333 (0x14585)

NOTE! CANopen supports Jog directly with the following functions:
Jog Slow - Positive when active

[1]Typical motion profile commands could be set each time on power up from host or set using a configuration file and stored to NVM once.

[2]Enabling the motor power only has to be done once on power up.

Typical motion profile commands										
ID	**RTR**	**Data**								**Description**
										DSP402 state machine, 6040.0h
0641	00	2B	40	60	00	06	00	00	00	Send shutdown - transfer to Ready to Switch on
0641	00	2B	40	60	00	07	00	00	00	Switched on
0641	00	2B	40	60	00	0F	00	00	00	Operation Enable
										Typical Motion Parameters
0641	00	23	0B	36	00	86	02	00	00	Set Slow Velocity 100 RMP
0641	00	23	0C	36	00	85	45	01	00	Set Acceleration 5000 RPM/S
0641	00	23	0D	36	00	85	45	01	00	Set Deceleration 5000 RPM/S
0641	00	23	60	60	00	FE	00	00	00	Jog Mode (-2)
										Jog Function
0641	00	2B	40	60	00	8F	00	00	00	Halt Jog

Figure 16 - Example Jog

7.5.Torque

If a torque that is relative to current of 2 amps is needed, and object 0x6075 (Motor Rate Current "Continuous Current") is 3200 mA, then:

Target Torque: [6071.0] = 2000 mA x 1000 / 3200 mA = 625 (271h)
Slope: [6087.0] = 180.0 % / sec

This number means 62.5 % of Motor Rate Current

Typical motion profile commands and enabling sequence										
ID	**RTR**	**Data**								**Description**
										DSP402 state machine, 6040.0h
0641	00	2B	40	60	00	06	00	00	00	Send shutdown - transfer to Ready to Switch on
0641	00	2B	40	60	00	07	00	00	00	Switched on
0641	00	2B	40	60	00	0F	00	00	00	Operation Enable
										Typical Motion Parameters
0641	00	2B	87	60	00	50	46	00	00	Set slope 180.0 %/sec, 6087.0h
										Set to Profile Velocity Mode
0641	00	2F	60	60	00	04	00	00	00	Set to Profile Torque Mode, 6060.0h
										Disable Motion Halt
0641	00	2B	40	60	00	0F	00	00	00	Clear Halt[3]
										Send new Target Torque
0641	00	2B	71	60	00	71	02	00	00	Target Torque 62.5 % 6071.0h

Figure 17 - Example Torque

[3]Halt is enabled automatically, when a Motion mode becomes active.

7.6.PDO Mapping

The following is an example of mapping PDO for position Profile:

Device ID = 127 (7Fh)
RPDO -1, COB-ID = 27Fh
(Controlword-6040h, Target Position-607Ah)
TPDO -1, COB-ID = 1FFh
Transmit on Change
(Statusword-6041h)

Typical motion profile commands and enabling sequence										
ID	**RTR**	**Data**								**Description**
										Typical Motion Parameters
067F	00	23	84	60	00	50	C3	00	00	Set deceleration to 3000 RMP/S, 6084.0h
067F	00	23	83	60	00	50	C3	00	00	Set acceleration to 3000 RMP/S, 6083.0h
067F	00	23	81	60	00	35	82	00	00	Set max user velocity to 2000 RPM , 6081.0h
										Configure RPDO-1
067F	00	23	00	14	01	7F	02	00	80	Disable RPDO-1 COB-ID
067F	00	2F	00	16	00	00	00	00	00	Write zero to entries
067F	00	23	00	16	01	10	00	40	60	Configure Map1 with 6040.0 -Controlword
067F	00	23	00	16	02	20	00	7A	60	Configure Map2 with 607A.0 -Target Position
067F	00	2F	00	16	02	FF	00	00	00	Configure Transmission Type
067F	00	2F	00	16	00	02	00	00	00	Write 2 to Entry count
067F	00	23	00	14	01	7F	02	00	00	Enable RPDO-1 COB-ID
										Configure TPDO-1
067F	00	23	00	18	01	FF	01	00	80	Disable TPDO-1 COB-ID
067F	00	2F	00	1A	00	00	00	00	00	Write zero to entries
067F	00	23	00	1A	00	10	00	41	60	Configure Map1 with 6041.0 ,Statusword
067F	00	2F	00	18	02	FF	00	00	00	Configure 1600.5, Transmit on Change
067F	00	2F	00	1A	00	01	00	00	00	Write 1 to Entry count
067F	00	23	00	18	00	FF	01	00	00	Enable TPDO-1 COB-ID
										Mode of Operation - Position
067F	00	2F	40	60	00	06	00	00	00	Write 6 to Mode of Operation
										Enable NMT Operation Mode
000	01	00								Operational Mode
										DSP402 state machine
01FF	70	02								<--- Current Status (Switch on Disabled)
027F	06	00	00	00	00	00				---> (Shutdown -)
01FF	31	02								<--- Drive sends TPDO1- (Ready to Switch on)
027F	07	00	00	00	00	00				---> (Switched on)
01FF	33	02								<--- Drive send TPDO1 – (Switch on)
027F	0F	00	00	00	00	00				---> (Operation Enable)
01FF	23	06								<--- Drive sends TPDO1 – response (Enable)
										Command Position
027F	0F	00	E0	93	04	00				---> Set Target Position to 30.000 REVS
027F	1F	00	E0	93	04	00				---> Set Control Word bit 4 to 1 (New Set Point)
01FF	12	B7								<--- Drive sends TPDO1 – response
027F	0F	00	E0	93	04	00				---> Set Control Word bit 4 to 0
01FF	02	B7								<--- Drive sends TPDO1 – (Set Point ACK)
01FF	06	B7								<--- Drive sends TPDO1 – (In Position)

Figure 18 – Example: PDO Mapping Position

8. Access Drive Internal functions

GID or Global Identification is the method used by the Tritex drive to map internal variables. These GID's are then cross reference to installed protocols. For example a GID of 0x3C000000 represents the System warnings and is identify as "SYSTEM.MOTION.EVENTS.FAULTS" cross reference to Modbus ID " 1900 " and CANopen ID "Index 3384, subindex 0".

8.1.GID access

The following demonstrates method to access internal registers using GID.
For example read and write to CANopen ID register:

Node ID 65 (41h)
GID name: CANOPEN.PARAM.ID
GID address: 0x82200000

Reading / writing Drive GID sequence										
ID	**RTR**	**Data**								**Description**
										Reading Drive Parameter
0641	00	23	02	20	01	00	00	20	82	Write GID to System Read, Object 2002.1
0641	00	40	02	20	02	00	00	00	00	Read Data, Object 2002.2
										Write Drive Parameter
0641	00	23	03	20	01	00	00	20	82	Write GID to System Write , Object 2003.1
0641	00	2B	03	20	02	01	00	00	00	Write Data: ID = 1, 2 bytes, Object 2003.2

Figure 19 - Example System Read

8.2. PAC's Access

Programmable Access Commands (PAC's) are functions that perform operations in the system. For example the below PAC function will define current absolute position as home, while home mode is active. Refer to Interface section (UI Modbus, and CANopen) for methods of sending PACs to drive. Note, if interface does not have control rights command will not execute.

The following demonstrates method to access internal registers using PAC (Programmable Access Commands).
Node ID 65 (41h)

Writing PAC sequence										
ID	**RTR**	**Data**								**Description**
										Write PAC
0641	00	23	09	21	00	00	00	20	37	Write Pac *CommandSystem.Post.Commands.DefineZero* (924844032-> 0x3720.0000)

Figure 20 - Example PAC Access

8.3.User Units example

CANopen associates a scale factory to a group of registers, for example scale factory 1 is always assigned to Position measurements. This conversion is transparent to CANopen interface.

Name	Units	Att	Description	GID	Modbus	CO
Scale Factor 1 – Numerator	UINT32	RW	Position	CANOPEN.PARAM.CONVERT.0.MULTIPLIER	7560	2102.1
Scale Factor 1 – Denominator	UINT32	RW		CANOPEN.PARAM.CONVERT.0.DIVISOR	7562	2102.2
Scale Factor 2 – Numerator	UINT32	RW	Velocity	CANOPEN.PARAM.CONVERT.1.MULTIPLIER	7564	2103.1
Scale Factor 2 – Denominator	UINT32	RW		CANOPEN.PARAM.CONVERT.1.DIVISOR	7566	2103.2
Scale Factor 3 – Numerator	UINT32	RW	Acceleration	CANOPEN.PARAM.CONVERT.2.MULTIPLIER	7568	2104.1
Scale Factor 3 – Denominator	UINT32	RW		CANOPEN.PARAM.CONVERT.2.DIVISOR	7570	2104.2

Figure 21 – User Units CANopen

Internal units= (user value) * (Numerator1 / Denominator1) Write operation
User value = (internal units) * (Denominator1 / Numerator1) Read operation

NOTE! Default Numerator and Denominator are 1

The following example demonstrates reading/ writing using 'User Units' for Target Position (607A.h):

Scale Factor 1 – Numerator: 1
Scale Factor 1 – Denominator: 2
Internal units: 0.0001 Rev

Write
Target Position 2000
Internal Units = 2000 * 1/2
Read
Target Position = 1000 * (2 /1)

NOTE! Thirty-two bit conversion is used and rounding error could occur between read and write values.

9. Appendix

9.1. Tips

Highlighting and right clicking display variable ID and help information.

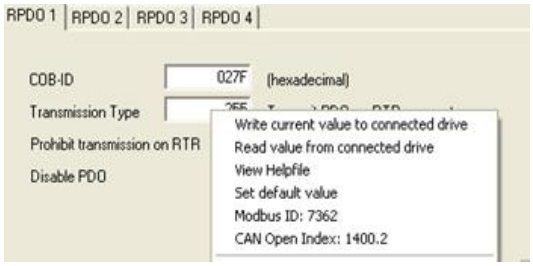


Figure 22 - Expert Software Tips

9.2. Notations

0.001 rated	Percentage of Rated (GID=SYSTEM.BUS.FACTORYPARAM.IRATED) *(CANopen -6075.0, Motor Rated Current)*
mrps/s	Acceleration
mrps	Velocity
0.0001 rev	Distance
ms	milliseconds

Figure 23 - Units

(b)	When read/write from Modbus data length is word, while from CANopen it is a byte.
(M)	CANopen Object is mappable
(d)	CANopen Profile –Motion DS402 specification name

Figure 24 – Superscript

10. Additional information

Expert Software Manual.pdf	Expert Drive software manual
Tritex_CO.eds	CANopen EDS file
Tritex CANopen.pdf	Tritex CANopen user manual
Tritex CANopen Getting Started.pdf	Tritex CANopen Getting started manual

11. Figures