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DIGIVEX Motion

Posivex®

MULTI-TURN ABSOLUTE ENCODER

User Manual

PVD 3568 GB – 01/2005

RANGE OF PRODUCTS

1 - "BRUSHLESS" SERVODRIVES

TORQUE OR POWER RANGES

- **BRUSHLESS SERVOMOTORS**, **LOW INERTIA**, **WITH RESOLVER**:
  Very high torque/inertia ratio (high dynamic performance machinery):
  ⇒ NX -HX - HXA — 1 to 320 N.m
  ⇒ NX - LX — 0.45 to 64 N.m
  High rotor inertia for better inertia load matching:
  ⇒ HS - LS — 3.3 to 31 N.m
  Varied geometrical choice:
  ⇒ short motors range: HS - LS — 3.3 to 31 N.m
  ⇒ or small diameter motors: HD, LD — 9 to 100 N.m
  Voltages to suit different mains supplies:
  ⇒ 230V three-phase for the "L - NX" series
  ⇒ 400V, 460V three-phase for the "H - NX" series
- "**DIGIVEX Drive" DIGITAL SERVOAMPLIFIERS**
  ⇒ SINGLE-AXIS DSD
  ⇒ COMPACT SINGLE-AXIS DµD, DLD
  ⇒ POWER SINGLE-AXIS DPD
  ⇒ MULTIPLE-AXIS (RACK) DMD
- "PARVEX Motion Explorer" ADJUSTMENT SOFTWARE

2 - SPINDLE DRIVES

- **SPINDLE SYNCHRONOUS MOTORS**
  ⇒ "**HV**" COMPACT SERIES
  ⇒ "**HW**" ELECTROSPINDLE frameless, water-cooled motor delivered in kit form — 5 to 110 kW up to 60,000 rpm
- "**DIGIVEX**" **DIGITAL SERVOAMPLIFIERS** with a wide constant power output range

3 - DC SERVODRIVES

- "**AXEM**", "**RS**" **SERIES SERVOMOTORS** — 0.08 to 13 N.m
- "**RTS**" **SERVOAMPLIFIERS**
- "**RTE**" **SERVOAMPLIFIERS** for DC motors + resolver giving position and speed measurement

4 - SPECIAL ADAPTATION SERVODRIVES

- "**EX**" **SERVOMOTORS** for potentially explosive atmospheres
- **"AXL" COMPACT SERIES SERVOREDUCERS** — 5 to 700 N.m

5 - POSITIONING SYSTEMS

- "**CYBER 2000**" **NUMERICAL CONTROLS** 1 to 2 axes
- "**CYBER 4000**" **NUMERICAL CONTROLS** 1 to 4 axes
- **DIGIVEX Motion DRIVE POSITIONER**
  ⇒ SINGLE-AXIS DSM
  ⇒ POWER SINGLE-AXIS DPM
  ⇒ MULTIPLE-AXIS (RACK) DMM
- "PARVEX Motion Explorer" ADJUSTMENT AND PROGRAMMING SOFTWARE

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Characteristics and dimensions may change without prior notification

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1. GENERAL POINTS

1.1 List of published DIGIVEX Motion manuals

♦ DIGIVEX Single Motion (DSM) User Manual	PVD3515
♦ DIGIVEX Power Motion (DPM) User Manual	PVD3522
♦ DIGIVEX Multi Motion (DMM) User Manual	PVD3523
♦ DIGIVEX Motion - CANopen	PVD3518
♦ DIGIVEX Motion - Profibus	PVD3554
♦ PME-DIGIVEX Motion Adjustment Manual	PVD3516
♦ DIGIVEX Motion Directory of Variables	PVD3527
♦ DIGIVEX Motion Programming	PVD3517
♦ DIGIVEX Motion - Cam Function	PVD3538
♦ PME Tool kit User and Commissioning Manual	PVD3528
♦ CANopen - CAN Bus Access via CIM03	PVD3533
♦ CANopen - Remote control using PDO messages	PVD3543
♦ "BLOCK POSITIONING" application software	PVD3519
♦ "Fly Shear Linear Cutting" application software	PVD3531
♦ "Rotary Blade Cutting" application software	PVD3532

1.2 Description of the multi-turn absolute encoder

The Posivex® encoder is an economical and robust absolute encoder for NX servomotors.

The encoder is a combination of a resolver used by the drive to control the motor and an innovative electronic device continuously measuring the absolute position of the motor shaft.

This solution eliminates the long and laborious home settings every time the machine is started up.

The Posivex® encoder option is available when the NX motor is controlled by a DIGIVEX Motion drive.

1.2.1 Operating principle

The DIGIVEX Motion drive is off:
The encoder measures the absolute position of the motor shaft.

The DIGIVEX Motion drive is on:
When the power to the DIGIVEX Motion is turned on, the position memorized by the encoder is transmitted via an RS485 interface to the drive.
The position is, then, defined by the drive whilst the machine is operating using the initial position transmitted at power-on.

1.2.2 Characteristics

- Absolute position on +/-15,000 revolutions
- Position accuracy: +/- 10' max
- Maximum speed: 8,000 rpm
- Absolute position resolution: 14 bits per revolution
- Operating temperature range: -20°C to +110°C
- Lithium battery supply : typical life 10 years for drive turned on half the time
- Same inertia as a resolver
- Compatible with NX2 to NX8 servomotors and DIGIVEX Motion

1.2.3 Key points

- Robust and economical solution
- Encoder used to control the motor
- No need for home settings when the machine is started up
- Continuous encoder state monitoring

2. SETTING THE PARAMETERS

There are three sections to this document:

- Setting the drive parameters.
- Initializing the absolute position.
- Absolute encoder faults.

2.1 Equipment used

Driving with Posivex® encoder requires:

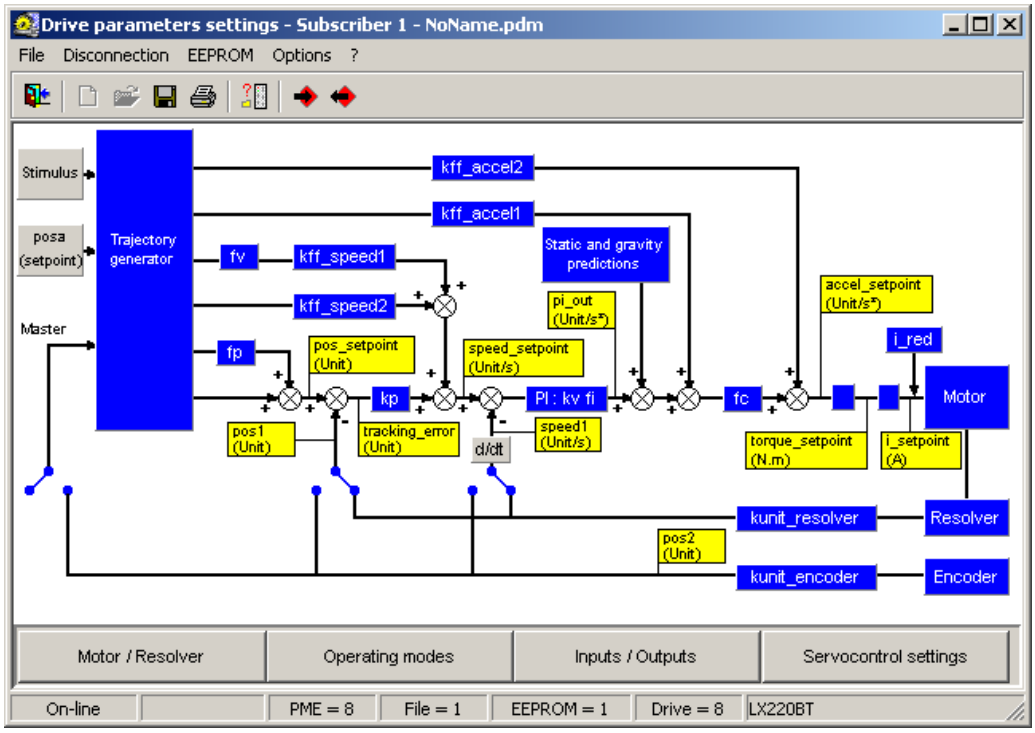
- DIGIVEX Motion drive with a product code ended by DSM------**M** (example: DSM13004C**M**)
- NX2 to NX8 servo motor with Posivex® encoder with a product code: NX----**M**- (example: NX310E**M**P)
- Parvex Motion Explorer (PME) software above or equal to **PME4.08**
- Specific cable for encoder, part number **220198R00--** .

2.2 Setting the drive parameters

All parameters are set using *Parvex Motion Explorer (PME)* software via the *Drive Parameters Settings* window.

2.2.1 Drive parameters settings window

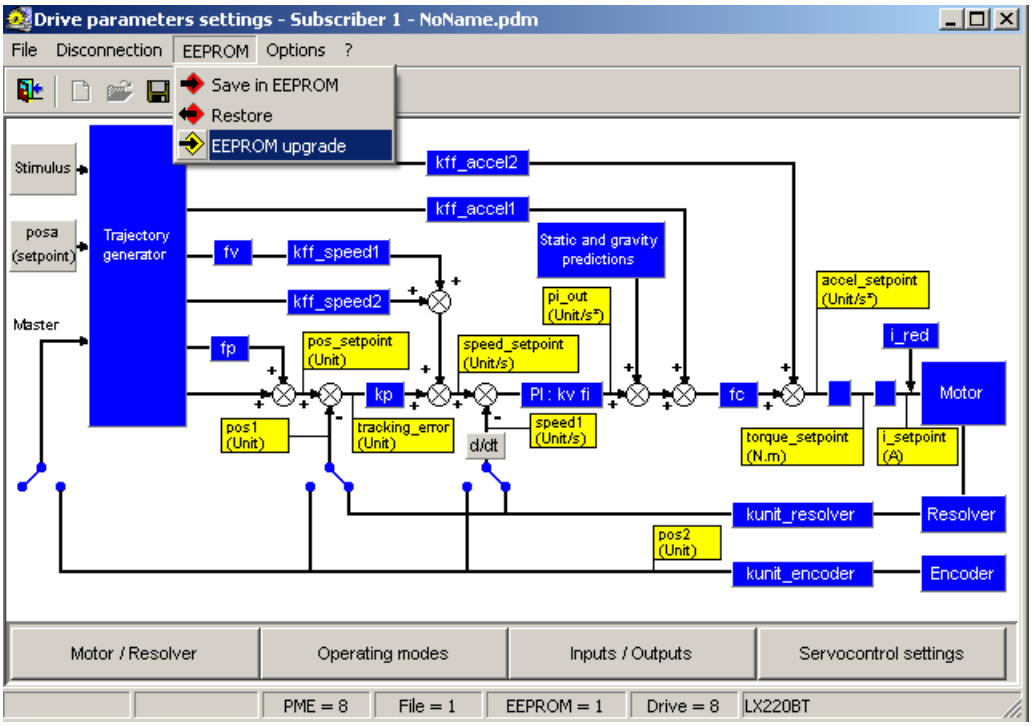
Attention : These settings are performed in factory. Please don't modify them except special case.



- Global transfer the parameters from a *.pdm file if it has been created.

If this is not the case

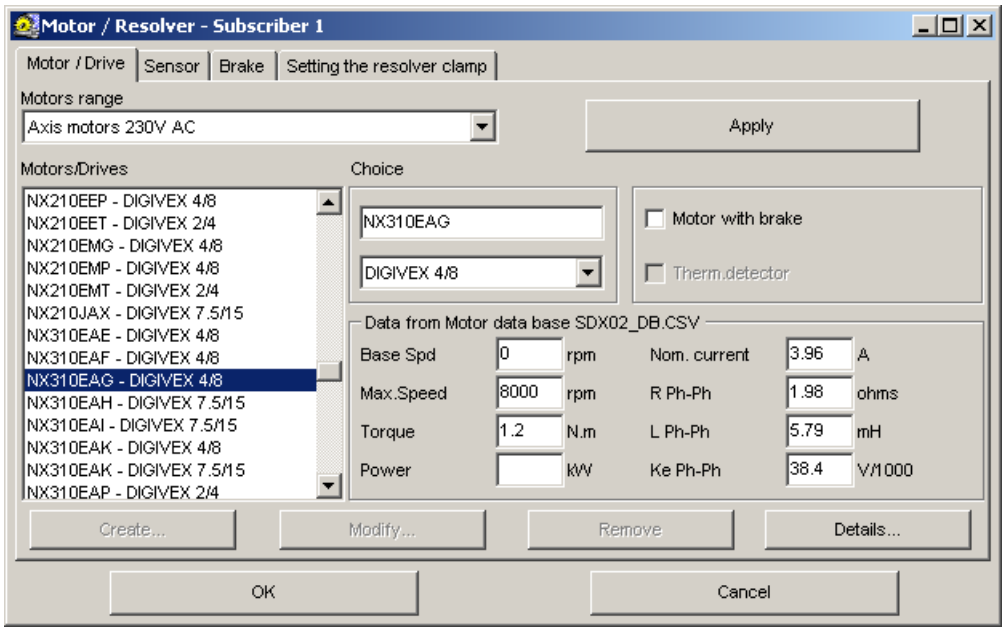
- Upgrade the set of EEPROM parameters so that the absolute encoder option appears in the *Motor/Resolver* window (minimum level of EEPROM parameters required = level 8).



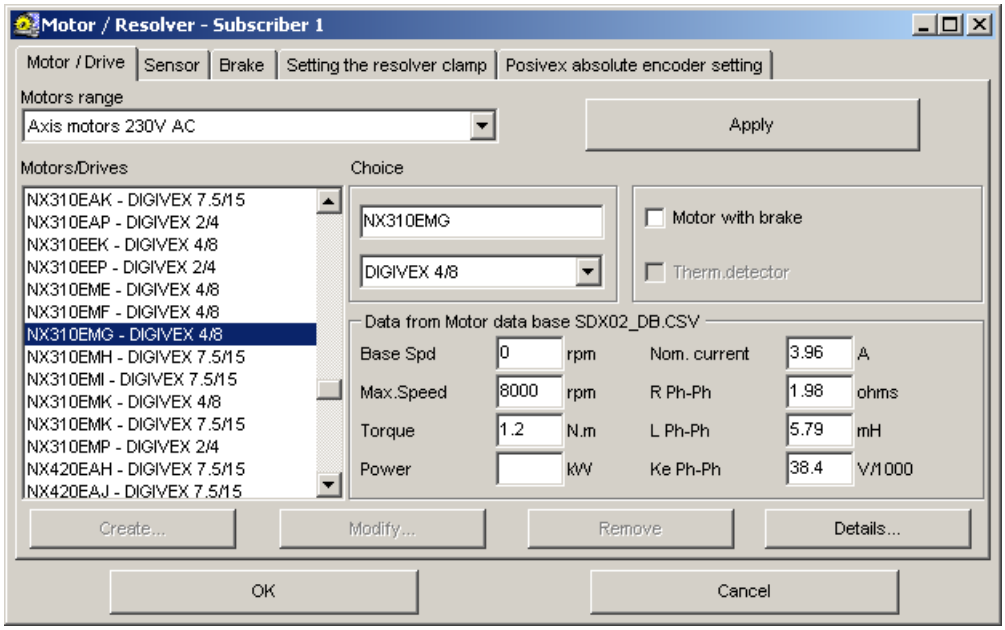
The parameter setting procedure consists of the following 2 stages:

<u>Stage 1</u>: Selecting the motor

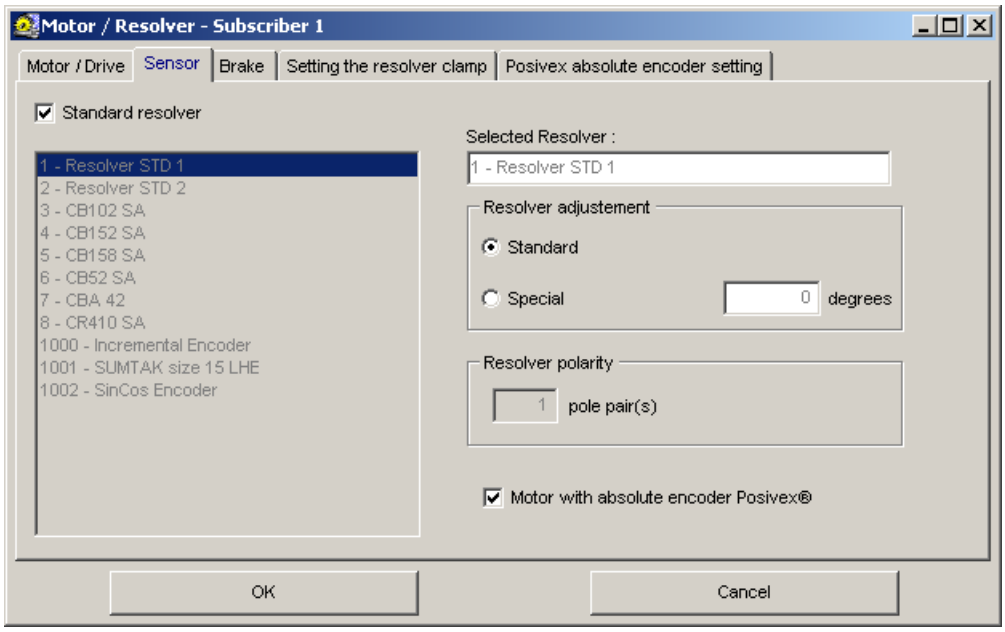
- Clicking on the Motor / Resolver button opens the following window:



- Select the Motor/Drive association from the motor database.
  NB: A motor fitted with an absolute encoder is designated in the motor database by its letter **M** (example NX310E**M**G).
- Apply.
- It will automatically appear in the Motor/Resolver window under the *Posivex Absolute Encoder setting* tab



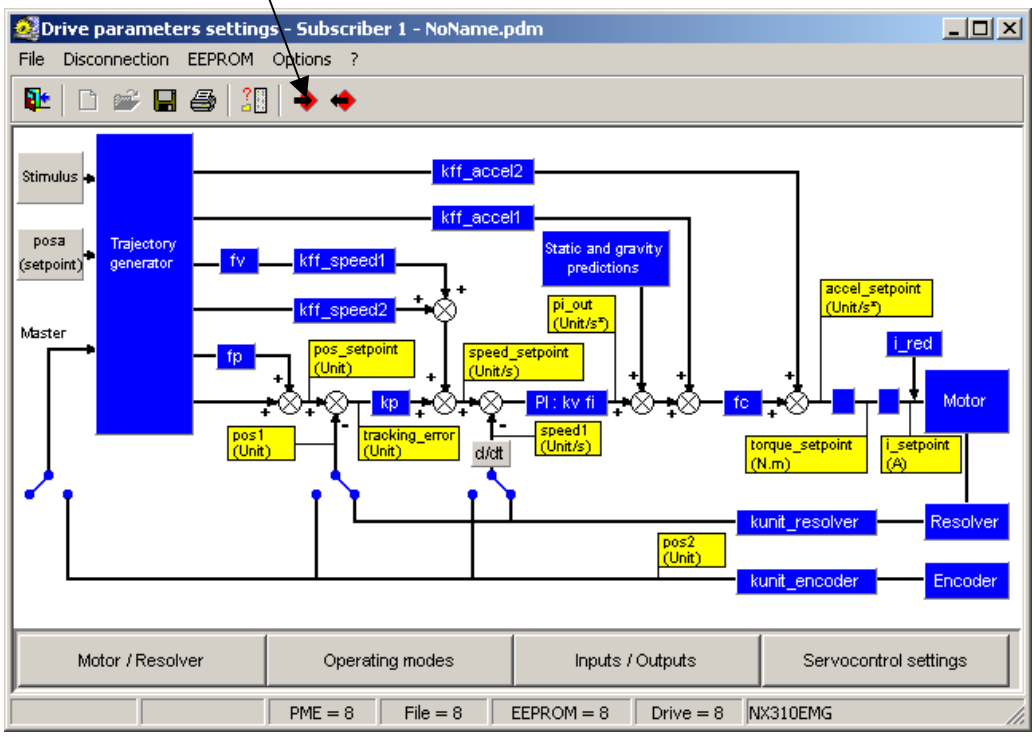
- And the *Motor with absolute encoder Posivex®* option is automatically validated under the *Sensor* tab



<u>Stage 2</u>: Saving the parameters

- Click on the *RAM ---> EEPROM* button to save the drive configuration.

RAM → EEPROM

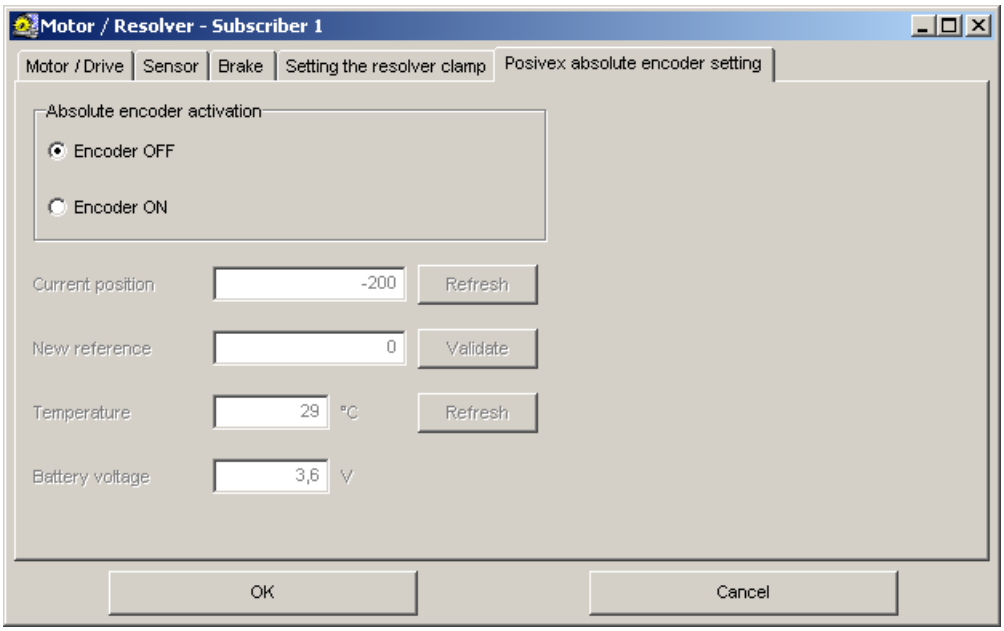


- Save the parameters in a *.pdm parameter file in order to set the parameters for the other drives more quickly in the future.

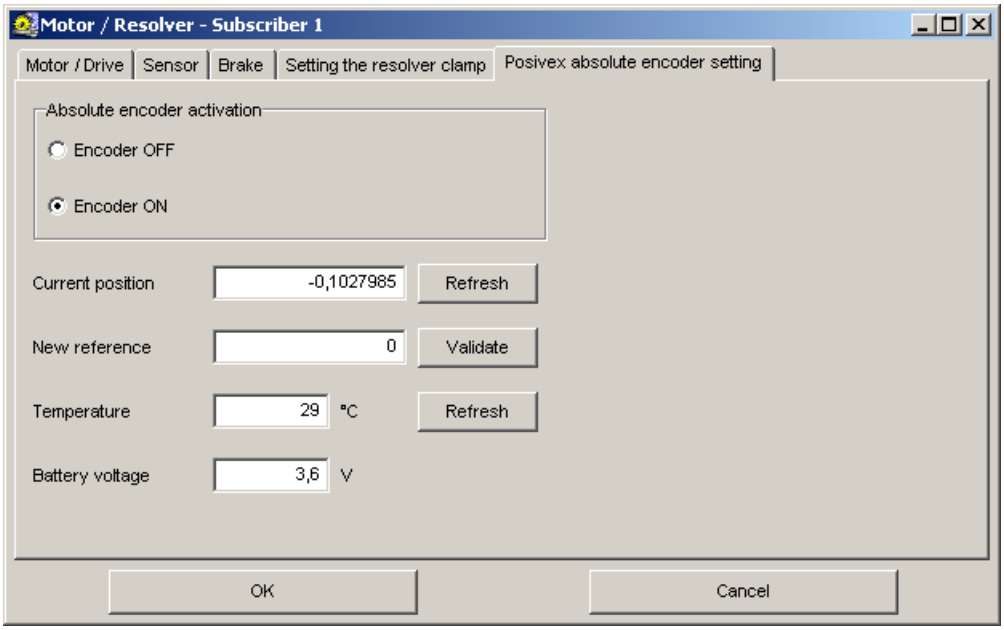
- **Shutdown and restart the drive to operate in absolute encoder mode.**

2.2.2 Absolute encoder settings window

- This window is used to initialize the absolute encoder and to check that the temperature and the battery voltage for the absolute encoder are correct.



- Activate the encoder by selecting *Encoder ON* when the absolute encoder is to be used.



Attention : this operation must be carried out with the torque off and the motor shutdown.

- Home setting is possible via *New Position.* The value to be entered is recorded in the drive Resolver unit (See operating modes window).
- The *Current Position Refresh* button is used to check that the initialisation has been carried out correctly.
- The encoder operating temperature range is –20°C to 110°C. An absolute encoder fault appears (fault 2 flashes) in the event that the temperature is excessive.
- The encoder supply is provided by a long life battery. The voltage of this battery should not drop below 2.4V. An absolute encoder fault will appear (fault 2 flashes) in the event that the battery voltage is less than 2.4V.

NB: The absolute position of the encoder cannot be guaranteed in the event that the battery voltage is less than 2.4V. However, it is still possible to operate in incidental operating mode without absolute position measurement. The drive, therefore, controls the motor using only resolver signals.

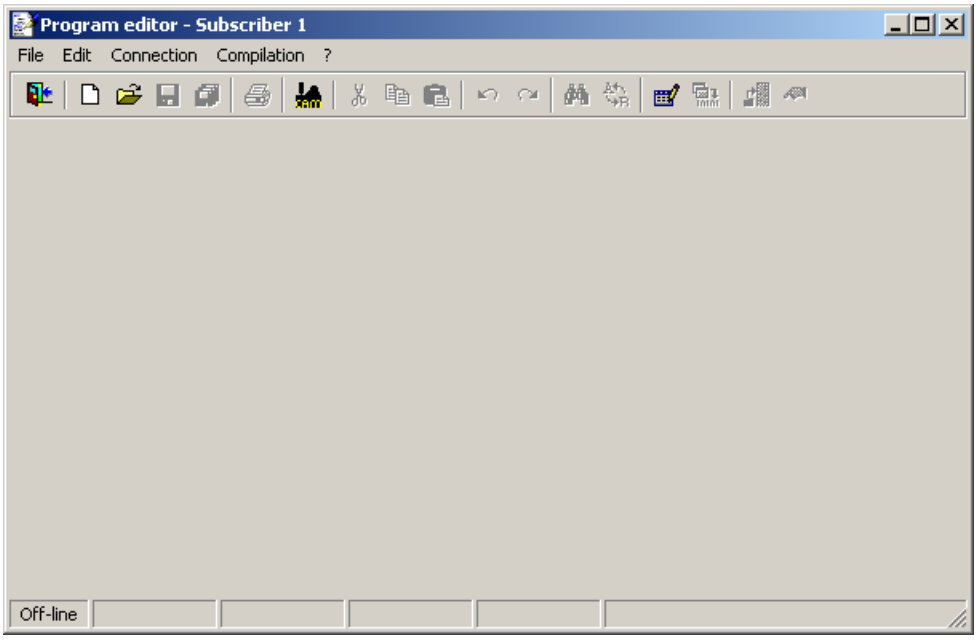
2.3 Initializing the absolute position of the drive

When the power to the drive is turned on, the drive system variable **pos1** (variable giving access to the actual position of the slave axis) must be reinitialized with the position contained in the absolute encoder.
Said initialization is carried out via a user program.

2.3.1 Loading the user program in the drive

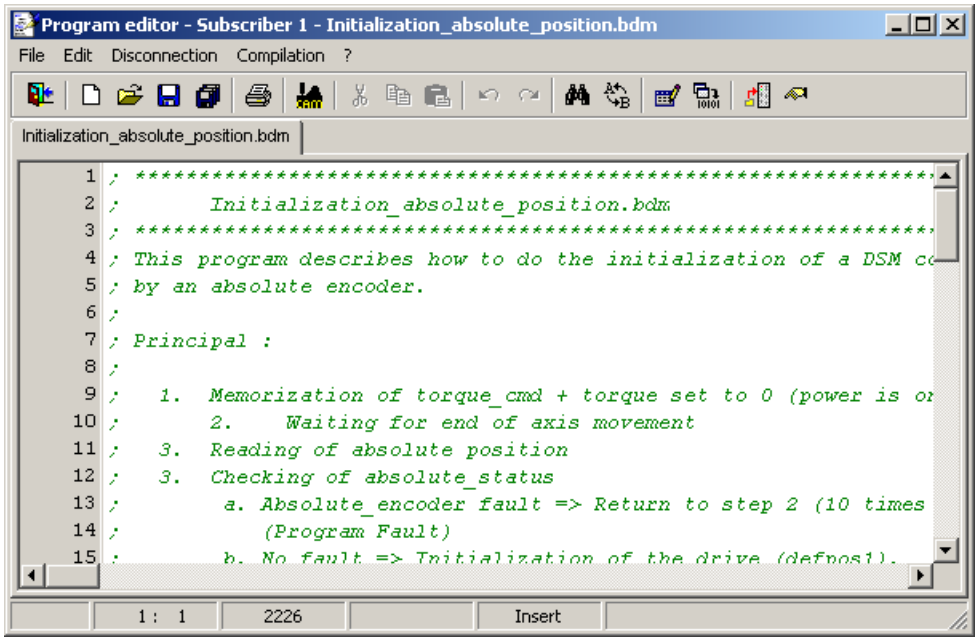
Pos1 can be initialized using the user program I*nitialization_absolute_position.bdm* which is to be found under PARVEX\ PME \App_Parvex\Samples\Misc.
NB: This program is only given as an example and can be modified by the user of the absolute encoder.

- Start the *Program editor* tool*:*

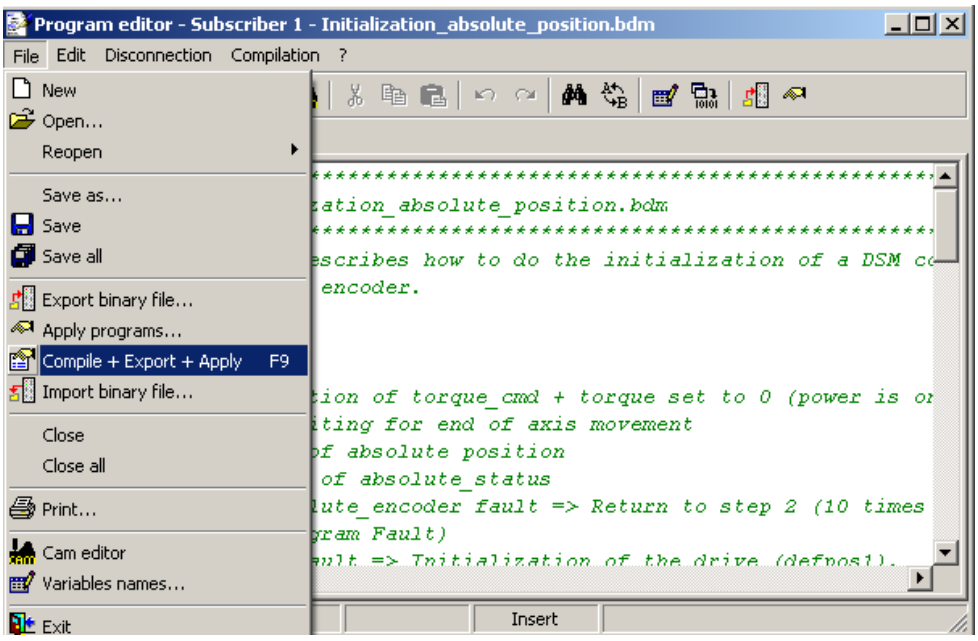


- Click on Connection.

- Load the user program Parvex\PME\App_parvex\Samples\Misc\I*nitialization_ absolute_position.*bdm by clicking on File\Open.



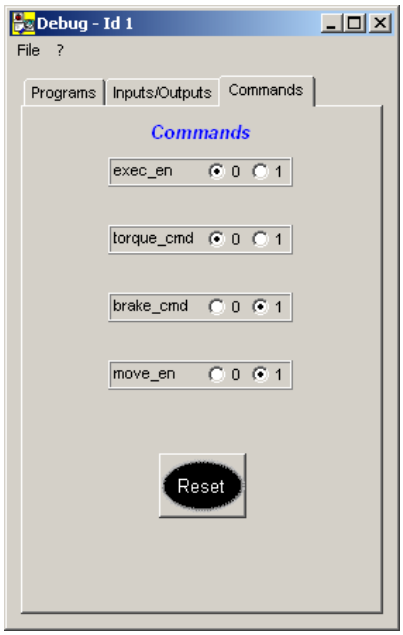
- Compile + Export + Apply:



- Exit the window.

2.3.2 Running the user program

- The program is now in the drive.
- Set the instruction ***exec_en*** to 1 in order to activate this program.



- If the initialization of the drive system variable ***pos1*** (variable giving access to the actual position of the slave axis) with the position contained in the absolute encoder did not take place correctly, the drive starts off in fault P (Program running fault).

Recommendation: So as not to manually activate the user program every time the drive is turned on, save the parameters in EEPROM (see section 2.2.1 Stage 2) having already set the instruction *exec_en* to 1. Thereafter, the drive will start-up with its user program activated every time it is turned on.

2.4 System variables dedicated to the absolute encoder

3 system variables have been created for communicating with the absolute encoder:

- *absolute_command*
- *absolute_data*
- *absolute_status*

- *absolute_command* is used for managing the different types of instruction. The instruction transfers to 0 when it has been transmitted to the absolute encoder.

- *absolute_data* is the data register.

	absolute_command	***absolute_data***
READ POSITION	**1**	**(Units*)**
WRITE OFFSET POSITION	**2**	**(Units*)**
MEASURE BATTERY VOLTAGE	**3**	**(V)**
MEASURE CARD TEMPERATURE	**4**	**(°C)**
READ STATUS	**5**	**-**
RESET ENCODER	**6**	**-**
TURN ENCODER ON	**7**	**-**
TURN ENCODER OFF	**8**	**-**

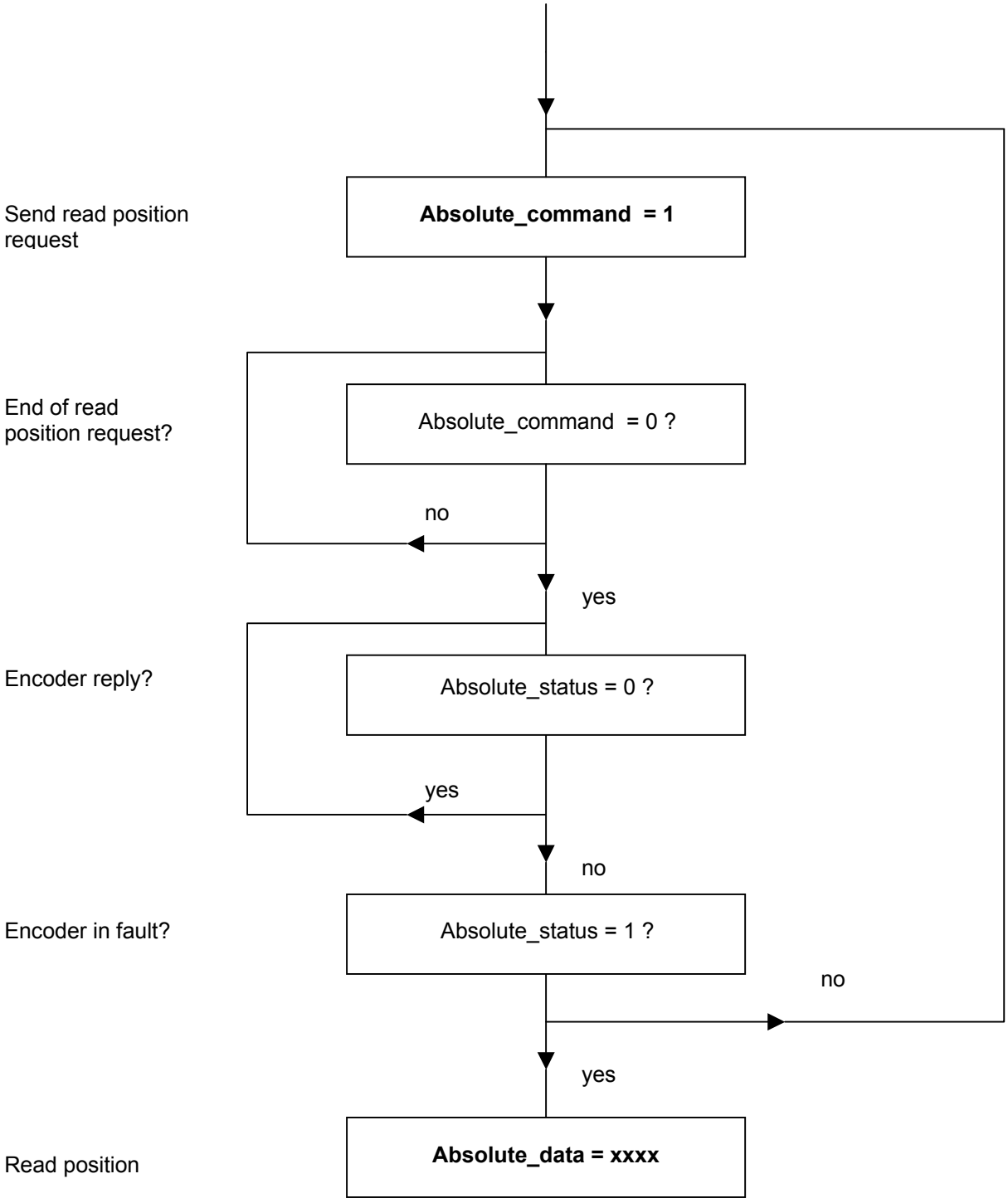
* : Following choice performed from the heading *Drives parameter setting / Operating modes / Configuration* (example : rad, degree, mm…).

- *absolute_status* is used for finding out the state of the absolute encoder.

    - When an *absolute_command* instruction is requested, the *absolute_status* variable is set to 0.

    - When the absolute encoder has replied, the *absolute_status* variable transfers to a value other than 0. The *absolute_status* variable is equal to 1 during normal encoder operating conditions.

Operating mechanism



2.5 Absolute encoder faults

If the drive detects an operating defect with the absolute encoder, **fault 2 flashes**:

There can be several reasons for this:

Fault	Major fault	*Status_number value*
Absolute encoder in off mode	NO	*status_number* = 43
Communication between drive and absolute encoder	YES	*status_number* = 44
Absolute encoder Time_out or Hardware	YES	*status_number* = 45
Battery voltage low	YES	*status_number* = 46
Excessive temperature	YES	*status_number* = 47
Multi-turn absolute encoder counter overflow	YES	*status_number* = 48
Other fault	YES	*status_number* = 49

NB: A major fault opens the OK relay.