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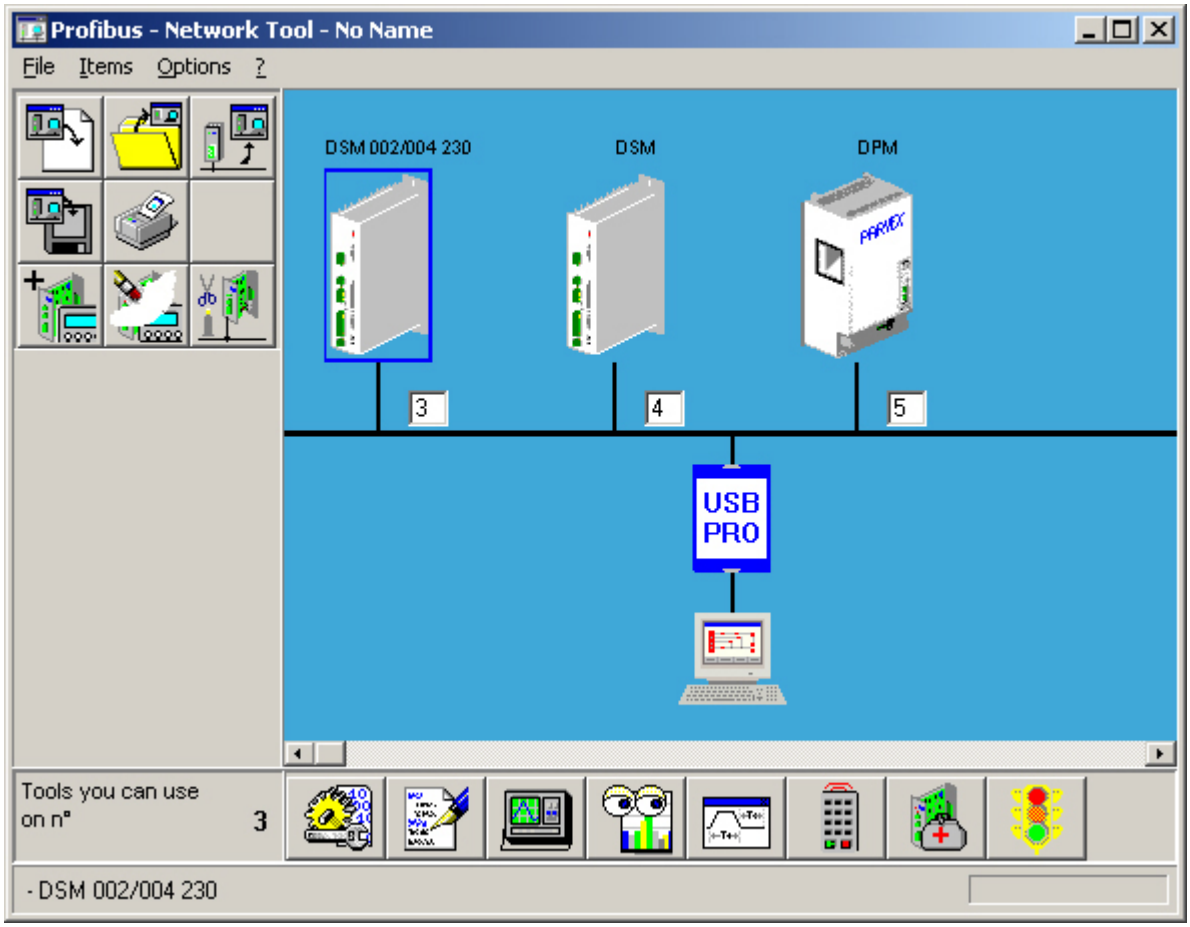
DIGIVEX Motion

PROFIBUS

User and commissioning manual

PVD 3554 GB – 01/2004



PRODUCT RANGE

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- **BRUSHLESS SERVOMOTORS**, LOW INERTIA, WITH RESOLVER
  Very high torque/inertia ratio (high dynamic performance machinery):
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  - ⇒ 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 :
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  - ⇒ or small diameter motors : HD, LD — 9 to 100 N.m

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  - ⇒ MULTIPLE-AXIS DMD
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  - ⇒ SINGLE-AXIS DSM
  - ⇒ POWER SINGLE-AXIS DPM
  - ⇒ MULTIPLE-AXIS DMM
- ADJUSTMENT AND PROGRAMMING SOFTWARE PARVEX MOTION EXPLORER

Contents

Characteristic and dimensions subject to change without notice.

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Available DIGIVEX MOTION instructions

♦ DIGIVEX Single Motion (DSM) User Manual	(DSM)	PVD3515
♦ DIGIVEX Power Motion (DPM) User Manual	(DPM)	PVD3522
♦ DIGIVEX Multi Motion (DMM) User Manual	(DMM)	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" software application		PVD3531
♦ "Rotary blade cutting" software application		PVD3532

1. PROFIBUS-DP GENERAL DEFINITIONS

1.1 Definition

PROFIBUS (PROcess FIeld BUS) is an international open field bus standard. It is defined by international standards EN 50170 and/or IEC 61158, and has a wide range of applications in manufacturing and industrial process automation.

PROFIBUS-DP is a PROFIBUS communication profile. It is optimized for high-speed, time-critical data transmission at field level using low-cost connectors.

PROFIBUS is a multi-master system which allows the joint operation of several automation, engineering or visualization systems with their on-site centralized devices on one bus. PROFIBUS differentiates between master and slave devices:

- Masters control data traffic on the bus and are also called “active” subscribers. A master can send information without having received an external request when it has bus access authorization (token).
  There are two categories of master:

- Master Class 1:
  This concerns central automation stations (e.g. PLC), which exchange cyclic messages with the slaves.

- Master Class 2:
  This includes equipment such as consoles for programming, and parameter setting, or for operator control and monitoring which are used for configuring, starting up (e.g. Parvex Motion Explorer on PC) or monitoring whilst the plant is operating.

- Slaves are field devices such as, for example, DIGIVEX Motion drives, independent inputs/outputs and solenoid valves. They have no bus access authorization; that is to say, they are only empowered to acknowledge received messages or, to return messages to masters on request. Slaves are also called “passive” subscribers.

1.2 Transmission via RS-485

A two-wire shielded cable, with a twisted pair of copper conductors is used as it meets high transmission speed, and simple low-cost installation criteria.

Transmission speed can be freely selected between 9.6 kBauds and 12 MBauds. This same speed is defined for all devices connected to the bus when the system starts up.

A line bus structure is used to connect up all the devices. It is possible to interconnect up to 32 subscribers (masters or slaves) in one segment.

The bus is terminated at the beginning and the end of each segment by an active terminal. Voltage must always be applied to both bus terminals for the bus to work correctly. The terminals are usually switchable in the bus connectors.

Repeaters (cable amplifiers) can be used to link the different bus segments when there are more than 32 subscribers, or to extend the network.

1.3 Bus access and data exchange procedure

The PROFIBUS bus operates in accordance with the principle of token passing. Active stations or masters receive transmit authorization in a logical ring for a defined time window. These masters can, then, communicate in this time window with other masters or manage communication with associated slaves in accordance with a low priority master / slave procedure.
The PROFIBUS-DP uses, first and foremost, the master–slave procedure for exchanging data, predominantly cyclically, with drives such as the DIGIVEX Motion.

Access to the drives is always carried out in accordance with the master-slave procedure; the drives automatically being the slaves. Each slave can be identified through its unique MAC-address on the bus. Data exchange is predominantly carried out cyclically with drives such as DIGIVEX Motion.

1.4 Standards, guidelines and profiles

The standards and guidelines shown below can be obtained from PNO, the PROFIBUS user organization; www.profibus.com.

- PROFIBUS
  "Technical Overview" September 1999
  Order no. 4.001 (German)
- PROFIBUS Specification (FMS, DP, PA)
  All standard definitions relating to the PROFIBUS specification in accordance with EN 50170 vol. 2.0 (version 1.0)
  Order no. 0.042 (English)
- PROFIBUS-DP Extensions
  contains, amongst other things, the acyclic communication functions using PROFIBUS-DP
  "Extensions to EN 50170"
  EN 50 170 vol. 2 (version 2.0)
  Order no. 2.082 (English)
- PROFIBUS Technical Guideline
  "Installation guidelines for PROFIBUS-DP/FMS" September 1998
  Order reference 2.111 (German)
- PROFIBUS guideline
  "Connections for PROFIBUS" February 2000. Version 1.0
  Order no. 2.141 (German)
- PROFIBUS guideline
  "Optical transmission system for PROFIBUS" July 1999 (draft). Version 2.0
  Order no. 2.021 (German)

- PROFIdrive Profile version 2.0:
  "Profile for variable speed drives" September 1997
  PNO - PROFIBUS Profile –
  Order no. 3.071 (German) / 3.072 (English)

- PROFIdrive profile version 3.0:
  "PROFIdrive Profile Drive Technology" September 2000 (draft)
  PNO – PROFIBUS profile – Order no. 3.172 (English)

2. COMMUNICATING WITH DIGIVEX Motion

Technical specifications

Connection to the PROFIBUS bus is carried out using a 9-pin Sub-D plug in compliance with the PROFIBUS standard. All RS485 interface connections are protected against short-circuiting and have galvanic insulation.

The PROFIBUS interface supports transmission speeds of between 9.6 kbauds and 12 MBauds.

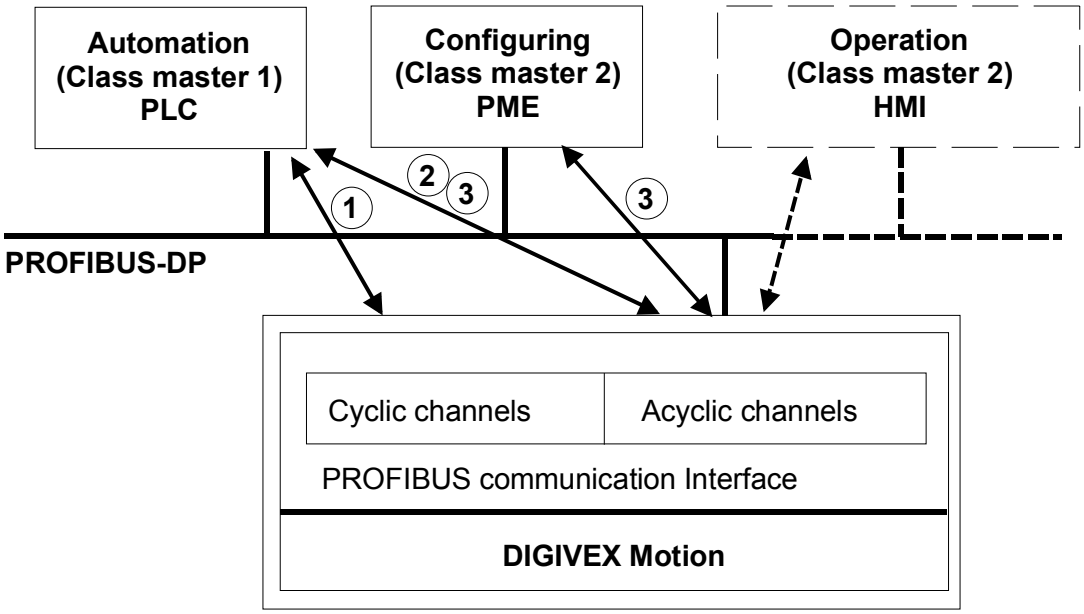
Functionalities

- ① Cyclical process data exchange (PZD-DPV0) in accordance with the PROFIdrive Profile V2.0 and/or V3.0

- Parameter access:

  - ② Cyclical parameter access (PKW-DPV0) in accordance with the PROFIdrive ProfileV2.0
  - ③ Acyclical parameter access (data block 47-DPV1) in accordance with the PROFIdrive Profile V3.0

The diagram shown below gives a preview of the communication functions carried out by DIGIVEX Motion using PROFIBUS-DP:



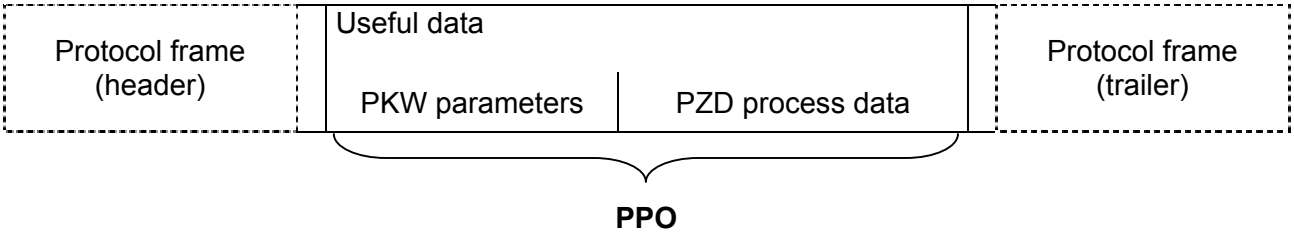
DIGIVEX Motion PROFIBUS-DP data channels

2.1 Cyclical data transmission

DIGIVEX Motion is controlled through the cyclical PROFIBUS-DP channel. Moreover, this same channel can be used for exchanging parameters.
The structure of useful data for the cyclical channel is defined in the PROFIDrive Profile version 2.0, and is called PPO (Parameter Process Data Object). This structure is used by the master to access drive slaves by exchanging cyclical data.

2.1.1 Useful data structure in accordance with PROFIDrive Profiles V2.0 and V3.0

Useful data structure according to the PPO
The useful data structure in cyclical transmission is divided into two sections which can be transmitted in each telegram:



• PZD, process data area, that is to say, control words or status information.
• PKW, parameter area for reading / writing drive parameters.

It is possible, when configuring the master, to define the type of PPO (see below) with which the master is to access the drives when the network is starts up. The type of PPO selected depends on the task assigned to the drive in the automation system.

Process data is automatically transmitted. They are processed as top priority in the shortest time slots in the drives. The drive is controlled by process data; e.g. On / Off, etc.

The parameter area gives the user complete access to all parameters and variables in the drive via the bus. It is possible, for example, to write a target position or to read detailed information concerning diagnosis, fault messages, etc.

DIGIVEX Motion supports two types of PPO from amongst those defined in the PROFIDrive Profile version 2.0:

• PPO1: PKW, parameter area with 4 words and 2 words of PZD, process data.
• PPO3: PKW, without parameter area with - 2 words of PZD, process data.

	PKW				PZD	
	PKE	IND	PWE		STW1 ZSW1	STW2 ZSW2
	1st word	2nd word	3rd word	4th word	1st word	2nd word
PPO1						
PPO3						

PKW: Parameter identifier and value
PKE: Parameter identifier and request type
IND: Index
PWE: Parameter value

PZD: Process data
STW: Control word
ZSW: Status word

The various essential tasks are accounted for by subdividing the useful data into PKW parameter data, and PZD process data.

Parameter setting data area (PKW)
The PKW (parameter identifier value) telegram section is used for monitoring and/or modifying any of the parameters in the drive. The required request / response identifier mechanisms are described in section 2.4 ” PKW mechanism”.

Process data area (PZD)
Process data is used to transmit control words (requests: master → drive) or status words (responses: drive → master).

2.1.2 DIGIVEX Motion response time

The DIGIVEX Motion response time with regard to PZD is 0.8 milliseconds.
This is the time between the “control word arriving in the DP slave” and the “status word being made available to PROFIBUS-DP”.
The DIGIVEX Motion response time for a PKW, parameter modification, goes up to 1.5 milliseconds.

2.2 Acyclical data transmission

Extended PROFIBUS-DP functions (DPV1)
The PROFIBUS-DP extensions DPV1 include the definition of an acyclic data exchange which takes place at the same time as the cyclical data transmissions.
Acyclic data transmission is used for:
• exchanging large quantities (up to 240 bytes) of useful data.
• simultaneous access by other PROFIBUS masters (class 2 master, e.g. PME (Parvex Motion Explorer) start-up tool)
• reducing the bus cycle time by removing the PKW area from cyclical transmission and assigning it to acyclical data transmission.

Implementing the extended PROFIBUS-DP functionality

The different masters and/or the different types of data exchange are represented by channels in DIGIVEX Motion:
• Acyclic data exchange with the same class 1 master (if supported).
Use of DPV1 READ and WRITE functions.
The contents of the transmitted data block correspond to the structure of the acyclic parameter channel as defined in the PROFIdrive Profile version 3.0 (with data block 47).
• Acyclic transmission using the PME, Parvex Motion Explorer, start-up tool (class 2 master)
PME can acyclically access parameter and process data in the drive.
• Acyclic transmission with an HMI (second class 2 master) which can acyclically access parameters in the drive.

2.3 Control and status words

The control and status words correspond to the specifications in PROVIdrive Profile V2.0 and/or V3.0 for the “positioning” mode.

Assigning STW1 control word bits

STW1 control word (bits 0 - 11 as defined in the PROFIDrive Profile, bits 12 - 15 specific to DIGIVEX Motion.

BIT	VALUE	MEANING	COMMENTS
0	1	ON	Sets the drive to “ready to run” status
	0	OFF 1 = ABORT	Stoppage using brakes: movement stops (abort_cmd = 1) in accordance with programmed acceleration (accel_prog) then set to zero torque (torque_cmd = 0) when the axis is shutdown (moving = 0) This function is not active when the drive is in speed drive mode (drive_mode = 1)
1	1	ON	Operating condition
	0	OFF2 = TORQUE CMD	Freewheel stoppage: motor set to zero torque (torque_cmd = 0)
2	1	ON	Operating condition
	0	ARRET3 = EMERGENCY	Fast stoppage (emergency_cmd = 1) fastest possible deceleration (accel_max) then set to zero torque (torque_cmd = 0) when moving = 0
3	1	Torque mode	Automatic drive control lifted (torque_cmd = 1): motor torque set
	0	Zero torque	Automatic control implemented: motor set to zero torque (torque_cmd = 0)
4	1	ON	Operating condition
	0	EMERGENCY STOP	Fastest possible braking (emergency_cmd = 1). No zero torque setting when the axis is shutdown (different from STW1 bit 2)
5	1	MOVE EN	Movement is authorized (move_en = 1)
	0	Movement stoppage	Movement in progress is suspended (move_en = 0). Movement is stopped using programmed deceleration (accel_prog)
6	-	-	Not in use
7	1	Acknowledge fault	Fault is acknowledged with a rising front (reset_cmd = 1)
	0	-	Normal operating condition
8	-	-	Not in use
9	-	-	Not in use
10	1	Control word validation	Drive follows control words from the Master
	0	Invalid control words	Drive ignores control words from the Master
11	1	HOME	Origin setting sequence is running (home_cmd = 1)
	0	-	Origin setting sequence is not running (home_cmd = 0)

12	1	EXEC EN	Authorizes the program in DIGIVEX Motion to run (exec_en = 1)
	0	-	Prohibits the program in DIGIVEX Motion from running (exec_en = 0)
13	1 0	ub0	DIGIVEX Motion ub0 binary variable
14	1 0	ub1	DIGIVEX Motion ub1 binary variable
15	1 0	out0	DIGIVEX Motion out0 logic output

The abort_cmd, torque_cmd, emergency_cmd, move_en, home_cmd, exec_en and moving variables are detailed in user manual PVD 3517 “Programming”.
MOVE EN is only taken into account if in14 input is not assigned to move_en
EXEC EN is only taken into account if in15 input is not assigned to exec_en

The STW2 control word is assigned to the DIGIVEX Motion ui0 low order 16-bit variable.

Assigning ZSW1 control word bits

Status word (bits 0 - 13 as defined in the PROFIDrive Profile, bits 14 - 15 specific to DIGIVEX Motion).

BIT	VALUE	MEANING	COMMENTS
0	1	DRIVE OK	Power supply present and no serious faults (fatal_error = 0): drive_ok = 1 Torque may or may not be present
	0	-	No power supply or presence of a serious fault (fatal_error = 1): drive_ok = 0
1	1	READY (Ready to run)	Drive turned on (drive_ok = 1) and no faults present (fault = 0). The drive can start with the command “Enable operation” (STW1 bit 3)
	0	Not ready to run	Causes: no ON command, fault present, OFF2 or OFF3 command
2	1	Operation enabled	Torque set (torque_on = 1)
	0	Operation disabled	Motor set to zero torque (torque_on = 0)
3	1	A serious fault is present	Serious fault (fatal_error = 1): drive fault relay opens and zero torque is set
	0	-	No serious fault present (fatal_error = 0)
4	1	-	
	0	OFF2 command applied	See STW1 bit 1
5	1	-	
	0	OFF3 command applied	See STW1 bit 2
6	-	-	

7	1	A warning is present	A minor fault is present: status does not change for the drive fault relay and the torque
	0	-	
8	1	Setpoint-measured position deviation ok	Deviation between setpoint position and measured position values is within tolerance limits (tracking_error < trackerror_max)
	0	Setpoint-measured position deviation fault	Deviation between setpoint position and measured position values has exceeded the limits set by trackerror_max (tracking_error ≥ trackerror_max)
9	1	Valid control word	The control word is enforced
	0	Invalid control word	The control word is ignored
10	1	Target position reached	in_position = 1
	0	Target position not reached	in_position = 0
11	1	HOME MADE	Origin setting sequence carried out (home_made = 1)
	0		Origin setting sequence not carried out (home_made = 0)
12	-	-	Not in use
13	1	Movement in progress	moving = 1 This bit is always set to 1 in "speed" and "master-slave" synchronization mode
	0	No movement in progress	moving = 0
14	1	Program running	exec_on = 1
	0	No program running	exec_on = 0
15	1 0	ub10	DIGIVEX Motion ub10 variable

The ZSW2 control word is assigned to the DIGIVEX Motion ui10 low order 16-bit variable.

2.4 List of standard PROFIDrive parameters

The standard parameters defined by PROFIDrive V3.0 and supported by DIGIVEX Motion are listed below, except 967):

NB: These parameters are only accessible in read mode.

Index	Designation	Comments
918 (0x396)	Param_PB_918 PROFIBUS address	Selected address returned with the “address” code wheel.
922 (0x39A)	Param_PB_922 Standard telegram	Positioning interface (default value = 0)
930 (0x3A2)	Param_PB_930 Operating mode	Positioning mode (default value = 2)
964 (0x3C4)	Param_PB_964 Equipment identification	Subindex: 0: manufacturer’s code (0x0792) 1: type = DIGIVEX Motion 2: version 3: date / year 4: date-day/month
965 (0x3C5)	Param_PB_965 Profile number	PROFIDrive V3.0 (default value = 0x03)
967 (0x3C7)	Param_PB_967 STW1 control word	See description section 2.3
968 (0x3C8)	Param_PB_968 ZSW1 status word	See description section 2.3
980 (0x3D4)	Param_PB_980 List of the defined parameter numbers	Each subindex of this parameter indicates a number of a parameter supported by DIGIVEX Motion (in ascending order).

2.5 PKW Profidrive V2.0 mechanism for processing parameters

Parameter area (PKW)

The PKW mechanism is used to manipulate and observe (write / read) parameters as follows:
Condition:
PPO type 1 for DIGIVEX Motion in accordance with PROVIdrive Profile V2.0
The parameter area always contains 4 words.

	Parameter identifier (PKE)					1st word
Bit no.	15	12	11	10	0	
	AK		0	PNU		

	Parameter identifier (IND)					2nd word
Bit no.:	15	8	7	5	4	0
	SSIND		0		PNUE	

Parameter value (PWE)	
High order word (PWE1)	3rd word
Low order word (PWE2)	4th word

AK: Request and/or response identifier
PNU: Parameter number

Parameter identifier (PKE), 1st word

The parameter identifier (PKE) is always a 16-bit value.
Bits 0 - 10 (PNU) contain the low order parameter number required.
Bit 11 is reserved.
Bits 12 - 15 (AK) contain the request and/or response identifier.
The meaning of the request identifier is shown in the 1st table below.
The meaning of the request identifier for response telegrams (drive → master), is shown in the 2nd table below. Only certain response identifiers are possible according to the request identifier.
An error code is put in parameter 2 value (PWE2) as shown in the 3rd table below when the value of the response identifier is 7 (request cannot be processed).

Request identifier table (master - > drive)

REQUEST IDENTIFIER	MEANING	RESPONSE IDENTIFIER	
		Positive	Negative
0	No request	0	-
1	Parameter value request	1 / 2	7
2	Parameter value modification (word)	1	7
3	Parameter value modification (double word)	2	7

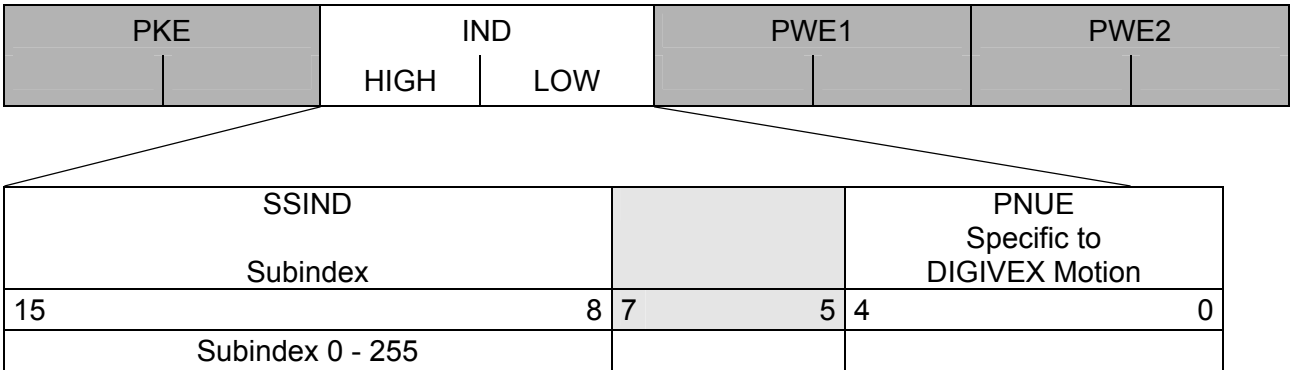
Response identifier table (drive -> master)

RESPONSE IDENTIFIER	MEANING
0	No response
1	Parameter value transmission (word)
2	Parameter value transmission (double word)
7	Request cannot be processed (with error number)

Error codes returned with the response "request cannot be processed"

No.	MEANING	
0	Wrong parameter number (PNU + PNUE)	Parameter does not exist
1	Parameter value cannot be modified	This is a parameter which is only accessible in read mode
2	Overrunning of upper or lower limits	-
3	Wrong subindex	-
11	Parameter unavailable	Modification request when access is not available

Parameter identifier (IND) 2nd word



The subindex is an 8-bit value which, in the case of cyclical data exchange, is transmitted by the PPO in the high order byte (HIGH, bits 8 - 15) of the parameter index (IND). Low order byte (LOW, bits 0 - 7) is not defined in the PROVIdrive Profile V2.0. The low order byte of the parameter index for DIGIVEX Motion is used to define the high order bits of the parameter number.

The number of index of the DIGIVEX Motion parameter (as defined in user PVD 3527 “Directory of Variables”) is defined using16-bits and made up as follows:

15			INDEX			0
4	PNUE	0	10	PNU		0

CONVERSION TABLE index range / PKW parameter header

The following values are given in hexadecimal format.
The digit of the AK section of the PKW is replaced by the letter “k” in this table.
The 2 digits of the SSIND section of the PKW are replaced by the letters “si” in this table.

16-bit parameter index	Parameter header in the PKW (PKE+IND) 32-bits
0x**0000**	0xk**000**si**00**
…	…
0x**03C4**	0xk**3C4**si**00**
…	…
0x**07FF**	0xk**7FF**si**00**
0x**2800**	0xk**000**si**05**
…	…
0x**2DC7**	0xk**5C7**si**05**
…	…
0x**2FFF**	0xk**7FF**si**05**

Parameter value (PWE) 3rd and 4th word

The parameter value (PWE) is automatically transmitted as a double mot (32-bits). A PPO telegram can only transmit a single value.
A 32-bit parameter value is made up of PWE1 (high order word, 3rd word) and PWE2 (low order word, 4th word).
A 16-bit parameter value is transmitted in PWE2 (low order word, 4th word). In this case, PWE1 (high order word, 3rd word) must be given the value 0.

Rules for processing requests / responses

- A request or a response can only ever refer to one parameter.
- The master must continue to repeat a request until a corresponding response is received.
- The master identifies the response to a previously sent request by:
  - analyzing the response identifier
  - analyzing the parameter number PNU
  - analyzing, if necessary, the parameter index IND
  - analyzing, if necessary the parameter value PWE.

• The complete request must be sent in one telegram; telegrams cannot be split. The same applies to the responses.
• As regards response telegrams containing parameter values, the drive will always reply giving the actual value in the event that the response telegrams are repeated.
• If there is not a requirement for information from the PKW interface operating cyclically (only PZD data is relevant), then a “no request” request must be sent (AK=0).

Example:

Below is the request and the response for a request to modify parameter number 0x2900, subindex 0, with the value 40.00 (this parameter has a 32-bit, 40.00 floating format and is written: 0x4220 0000

	AK	PNU	SSIND	PNUE	PWE1	PWE2
Request	3	0x100	0	5	0x4220	0
Response	2	0x100	0	5	0x4220	0

i.e.

	PKE	IND	PWE1	PWE2
Request	0x3100	0x0005	0x4220	0x0000
Response	0x2100	0x0005	0x4220	0x0000

The PPOConverter.exe software tool to be found in the C:\Program Files\Parvex\Profibus file can be used to carry out the conversion between a parameter index number and the corresponding values for the PKW section of the PPO. Moreover, this tool can be used to carry out the conversion between a floating value and the PWE fields of the PPO, and display the uncoded contents of STW1 control words and ZSW1 status words.

NB:

The SFC15 function contained in the SIEMENS S7 automate program is used to access the write mode for outgoing PPO. Likewise, the SFC14 function is used to access the read mode for incoming PPO.

2.6 DPV1-Profidrive V3.0 mechanism for processing parameters

This mechanism is supported by the range S7-400 which has the latest firmware as well as the PME, Parvex Motion Explorer, tool through the PROFIBUS PC interfaces. It has the advantage of reducing the cycle time since the PKW cyclical exchange is no longer required to occasionally access the parameters. This mechanism is also used to access large scale parameters (for example DIGIVEX Motion firmware upgrade by PME).

This mechanism can be broken down into 4 phases:

1) <u>Parameter request (from the Master)</u>

This 1st phase is carried out as the result of a DB47 data block write request integrating either a read request, or a write parameter request:

DPV1 Write Header

Fct_num = Wr (octet 0)	Slot_num	Index = DB47	Length (bytes)
0x5F	0x00	0x2F	0x0A(Rd), > 0x0C(Wr)

Parameter Request Header

Request ref	Request ID	Axis	No. of parameters
Selected by the master	0x01 (Rd), 0x02 (Wr)	0x00	0x01

Parameter address

Attribute	No. of elements	Param. Num. (**16-bit**)	Subindex (**16-bit**)
0x10	0x00	0xXXXX	0xXXXX

Parameter value (for a write request only)

Format	No. of values	Value
cf. table page 2	0x01	Variable size

2) <u>Request acknowledgment (from the Slave)</u>

DPV1 Write Acknowledgement

Fct_num = Wr (octet 0)	Slot_num	Index = DB47	Length (bytes)
0x5F	0x00	0x2F	0x0A(Rd), > 0x0C(Wr)

3) <u>Response request (from the Master)</u>

DPV1 Read Header

Fct_num = Rd (octet 0)	Slot_num	Index = DB47	Length (bytes)
0x5E	0x00	0x2F	0xF0 (max. size)

4) <u>Response acknowledgement (from the Slave)</u>

1st case: the response is negative
DPV1 Read Acknowledgement

Fct_num = Rd (0 byte)	Slot_num	Index = DB47	Length (bytes)
0x5E	0x00	0x2F	0x0A

Parameter Response Header

Request ref	Request ID	Axis	No. of parameters
Request repeated	0x81 (Rd), 0x82 (Wr)	0x00	0x01

Parameter value

Format	No. of values	Value
0x44	0x01	Error code (16-bit)

NB: If the acknowledgment of the response is not ready, only the first 4 bytes are returned.

2nd case: the response is positive
DPV1 Read Acknowledgment

Fct_num = Rd (0 byte)	Slot_num	Index = DB47	Length (bytes)
0x5E	0x00	0x2F	> 0x06(Rd), 0x04(Wr)

Parameter Response Header

Request ref	Request ID	Axis	No. of parameters
Request repeated	0x01 (Rd), 0x02 (Wr)	0x00	0x01

Parameter value (for a read only request)

Format	No. of values	Value
cf. table page 2	0x01	Variable size

<u>Data code (8-bit) format table (taken from PROFIDrive V3.0):</u>

Data type	**Code "Format"**
Integer16	0x03
Integer32	0x04
Unsigned16	0x06
Unsigned32	0x07
Floating32	0x08
VisibleString (ascii–16 bytes)	0x09
OctetString (16 bytes)	0x0A
Bit Sequence (32 bits)	0x23
Error (16 bits)	0x44
OctetString (128 bytes)	0xFE
Floating64	0xFF

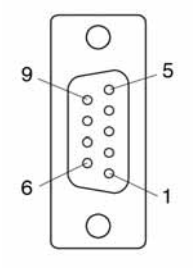
3. CONNECTING

3.1 Connecting the bus cable (RS485)

3.1.1 Pin configuration of the Sub-D connector

DIGIVEX Motion PROFIBUS comprises a 9-pin Sub-D female connector (X1) for connecting it to the PROFIBUS system. All RS485 interface connections are protected against short-circuiting and have galvanic insulation.

Pin configuration of the Sub-D female connector



PIN	DESIGNATION	MEANING
1	-	Not assigned
2	-	Not assigned
3	TxD	Emission data (B)
4	RTS	Control signal
5	DGND	PROFIBUS data reference potential (C)
6	VP	Power supply voltage (+5V)
7	-	Not assigned
8	RxD	Receiving data (A)
9	-	Not assigned

3.1.2 Cables

RS485 technology is the most frequently used transmission mode for PROFIBUS-DP. Thus a two-wire shielded cable, with a twisted pair of copper conductors is used.
It is possible to connect up to a maximum of 124 devices with one PROFIBUS line. Up to 32 devices can be interconnected in a linear topology within one bus segment. Repeaters (cable amplifiers) can be used to link the different bus segments if the number of subscribers exceeds 32.
The maximum cable lengths are dependant on the baud rate (transmission speed).
The maximum cable lengths given in the table below can only by guaranteed with PROFIBUS bus cables CB08320.

REFERENCE	DESIGNATION
CB08320	PROFIBUS cable by the metre

Permissible cable length for one segment

Transmission speed	Max. cable length for one segment
9.6 – 187.5 kbauds	1000 m
500 kbauds	400 m
1.5 Mbauds	200 m
3 - 12 Mbauds	100 m

Repeaters can be installed to increase the length of a segment.

Cable installation rules
It is prohibited for the bus cable to be:
- twisted
- stretched
- or compressed

during installation. Moreover, the conditions linked to electromagnetic compatibility must also be observed during installation.

PROFIBus cable requirements for DIGIVEX Multi Motion (DMM

REFERENCE DMM	REQUIRED LENGTH
DMM06002P DMM06004P DMM06008P	0,17 mm between axes
DMM06016P	0,22 mm between axes
DMM06032P	0,30 mm between axes

3.1.3 Bus connector

Use a bus connector such as one of those described in the table below to connect up the PROFIBUS cable to the communication module.

Recommended PROFIBUS connectors

REFERENCE	AC62001	AC62002	AC62003
Max. transmission speed	12 Mbauds		
Terminal resistor	On/Off switch		
Cable output	45°	180° (coaxial)	45°
Interfaces PROFIBUS subscribers PROFIBUS bus cable	9-pin Sub-D female connector 4 junction terminals for wires up to 1.5 mm²		
PROFIBUS cable diameter	8 ± 0.5mm		

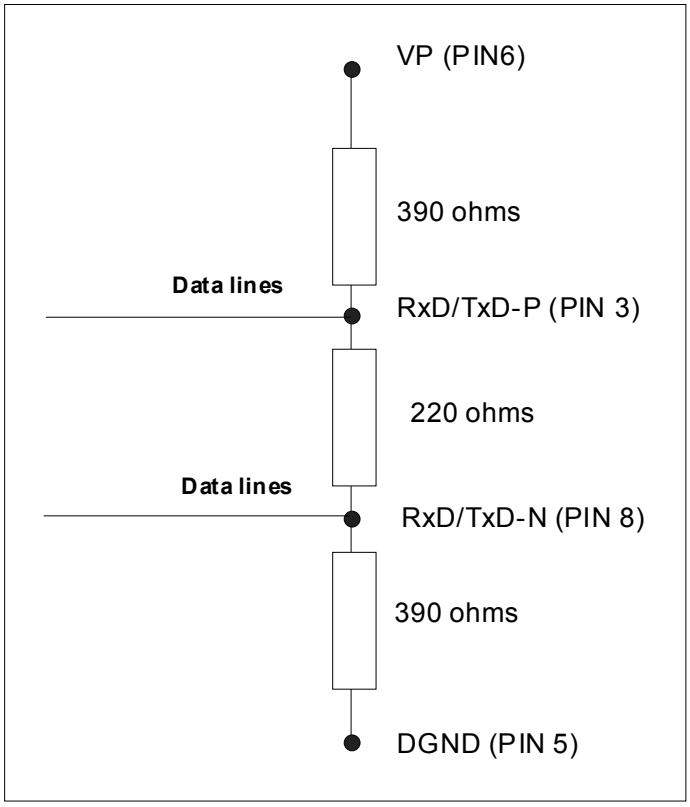
Please refer to the manual delivered with the connector for connector cable assembly instructions and wire baring lengths.

Each bus segment must have a resistor network i.e. a bus terminal at both ends.
The terminal can be switched on and off if the recommended connectors have been used for the connections.

Terminal resistor switched ON	**ON**	Terminal resistor switched OFF	**OFF**

Position of the switch for activating and deactivating the terminal resistor

Users must ensure that a resistor terminal network is installed on the first and last subscriber as specified in the diagram below if these bus connectors are not used.

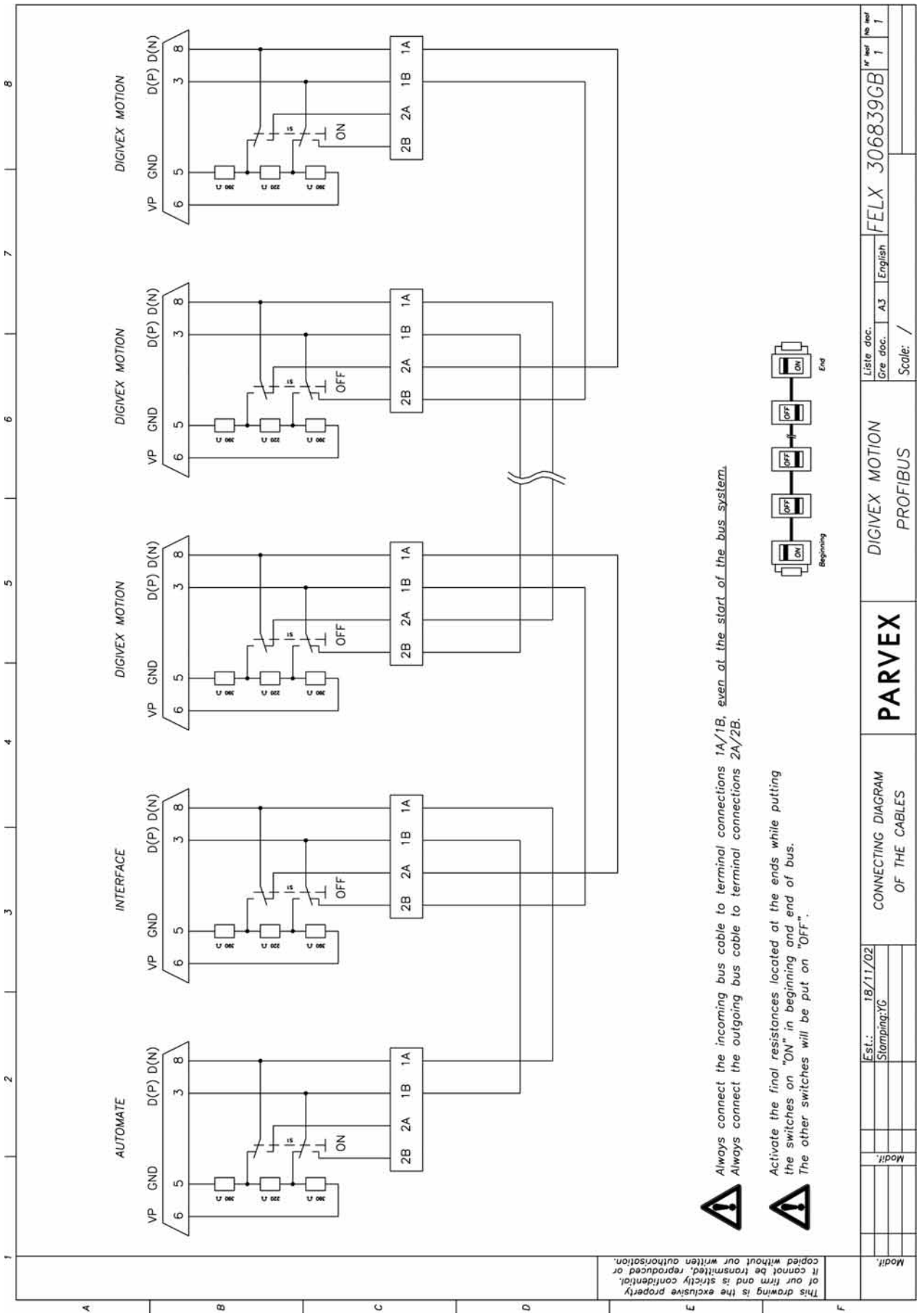


Resistor terminal network

A bus segment must always be terminated at both ends by a terminal resistor. This condition is not fulfilled, for example, if the last slave with bus connector is switched off. The resistor is inoperative if the bus connector voltage is supplied by the station.
Please make sure that all stations comprising an active terminal resistor are supplied with power at all times.

The bus connector with looped-though bus cable can be disconnected from a drive PROFIBUS-DP interface without interrupting the data transmission on the bus.

3.1.4 Cable connecting diagram


AUTOMATE
INTERFACE
DIGIVEX MOTION
DIGIVEX MOTION
DIGIVEX MOTION
DIGIVEX MOTION
VP GND D(P) D(N)
2B 2A 1B 1A
ON
OFF
Always connect the incoming bus cable to terminal connections 1A/1B, even at the start of the bus system.
Always connect the outgoing bus cable to terminal connections 2A/2B.
Activate the final resistances located at the ends while putting the switches on "ON" in beginning and end of bus.
The other switches will be put on "OFF".
Beginning
End
PARVEX
DIGIVEX MOTION
PROFIBUS
CONNECTING DIAGRAM
OF THE CABLES
FELX 306839GB
Liste doc.
Gre doc.
A3
English
Scale: /
Est.: 18/11/02
Stamping:YC
Modif.
This drawing is the exclusive property of our firm and is strictly confidential. It cannot be transmitted, reproduced or copied without our written authorisation.

3.1.5 Bus cable shielding / EMC precautions

The following precautions should be taken to ensure that the PROFIBUS-DP works correctly, particularly for data transmission using RS485:

Shielding
The shielding for the PROFIBUS bus cable must be connected in the bus connector. Additional shielding is given by a collar placed around the bus cable shielding and connected with a wide contact surface to the protective earth. Be careful not to damage the solid copper core when baring the ends of the conductors. Also make sure that the shielding for each bus cable is not only connected to the protective earth at the entrance to the electric cabinet but also in the drive housing.

RECOMMENDATIONS for installation
The bus cables must be made up of twisted conductors and be shielded. They should be laid separately to the power cables and spaced 20 cm apart.
The braided shielding and any underlying shielding strapping should be connected at both ends with a wide contact surface guaranteeing a good electric connection, that is to say, the bus cable shielding linking two drives should be connected to the housing on each of the drives. The same applies to the shielding on the bus cable between the PROFIBUS-DP master and the drives.
Power supply and bus cables should only cross one another at right angles.

Equipotential bonding
Differences in potential such as different power supplies between the drives and the PROFIBUS-DP master must be avoided.

- Use equipotential bonding conductors:
  - 16 mm^2 Cu for equipotential bonding cables up to 200 m long
  - 25 mm^2 Cu for equipotential bonding cables of over 200 m long
- Equipotential bonding cables must be laid so that the area between the equipotential bonding conductors and the signal cables is as small as possible.
- Equipotential bonding conductors must be connected up to the earth / PE conductor with a wide contact surface.

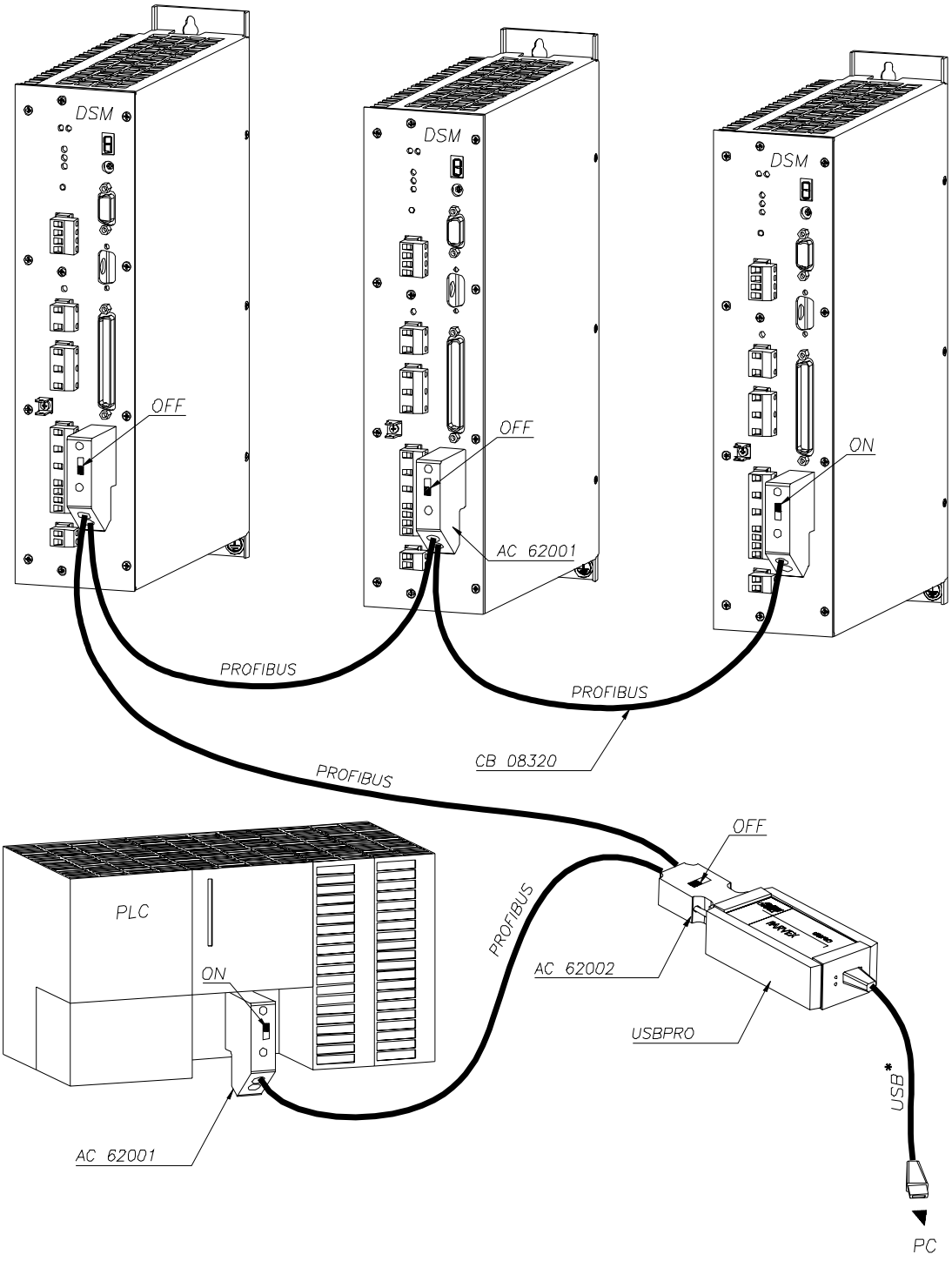
3.2 Connecting for drives setting

3.2.1 Général points

To set a DIGIVEX Motion drive from a PC using PME software, it is necessary to use one of the following interfaces :

REFERENCE	DESIGNATION
USBPRO or USBPROx12	USB-PROFIBUS Interface
PCIPRO	CP5611 PCI-PROFIBUS card
PCMCIAPRO	CP5511 PCMCIA – PROFIBUS card
RS232PRO	RS232 interface can communicate with one drive at a time Caution! It is only possible to use this interface if the drive is not connected to PROFIBUS network. (the drive mustn't be connected to a supervisor or a PLC via PROFIBUS network).

3.2.2 Application example with USBPRO interface

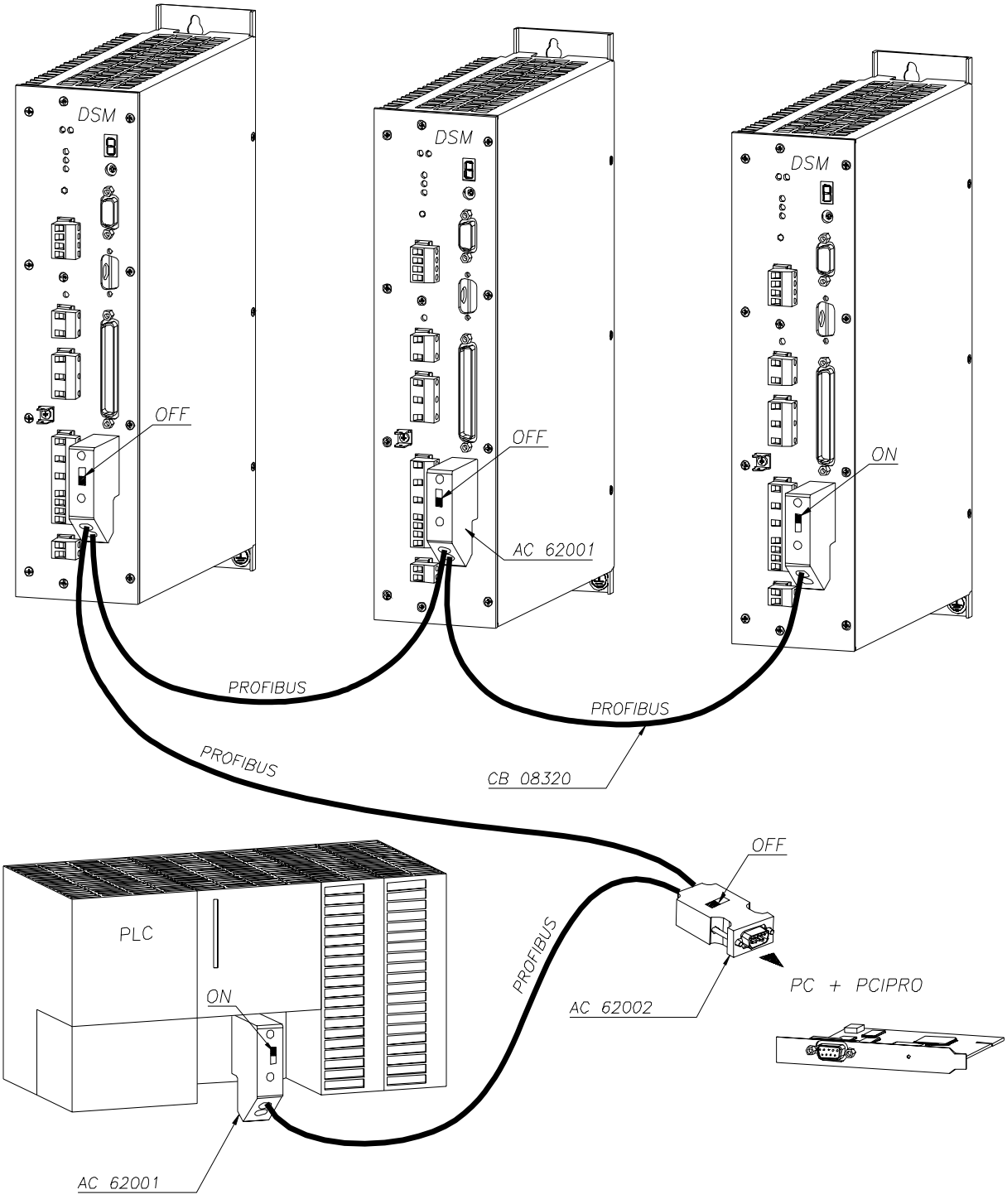


PC/DIGIVEX Motion dialogue is possible with all the drives via PROFIBUS network.

Turn off the PLC or disconnect the connection with the PLC in case of Basic_DM program loading into one of the drives.

* USB cable provided with USBPRO interface.

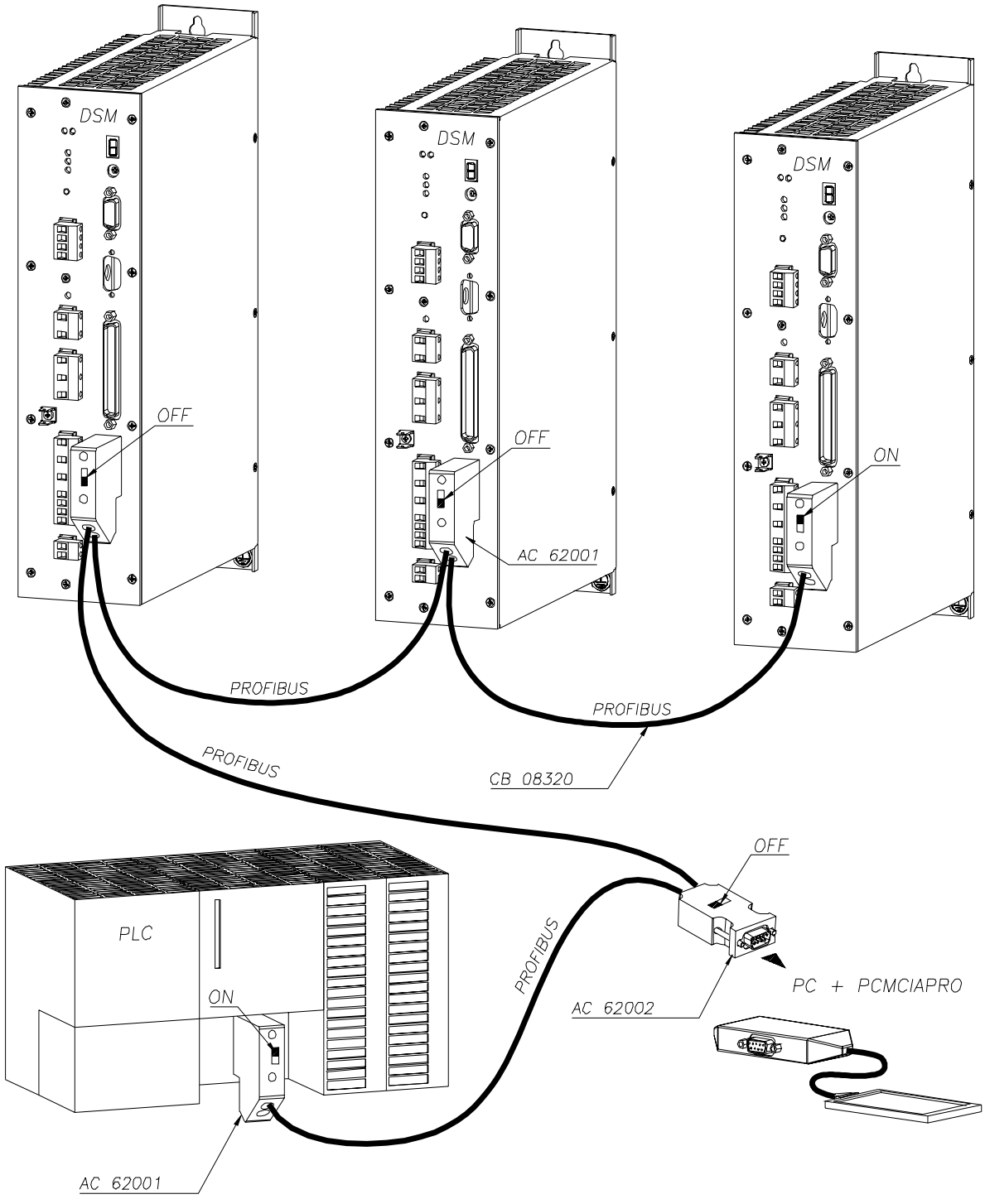
3.2.3 Application example with PCIPRO interface



PC/DIGIVEX Motion dialogue is possible with all the drives via PROFIBUS network.

Turn off the PLC or disconnect the connection with the PLC in case of Basic_DM program loading into one of the drives.

3.2.4 Application example with PCMCIAPRO interface

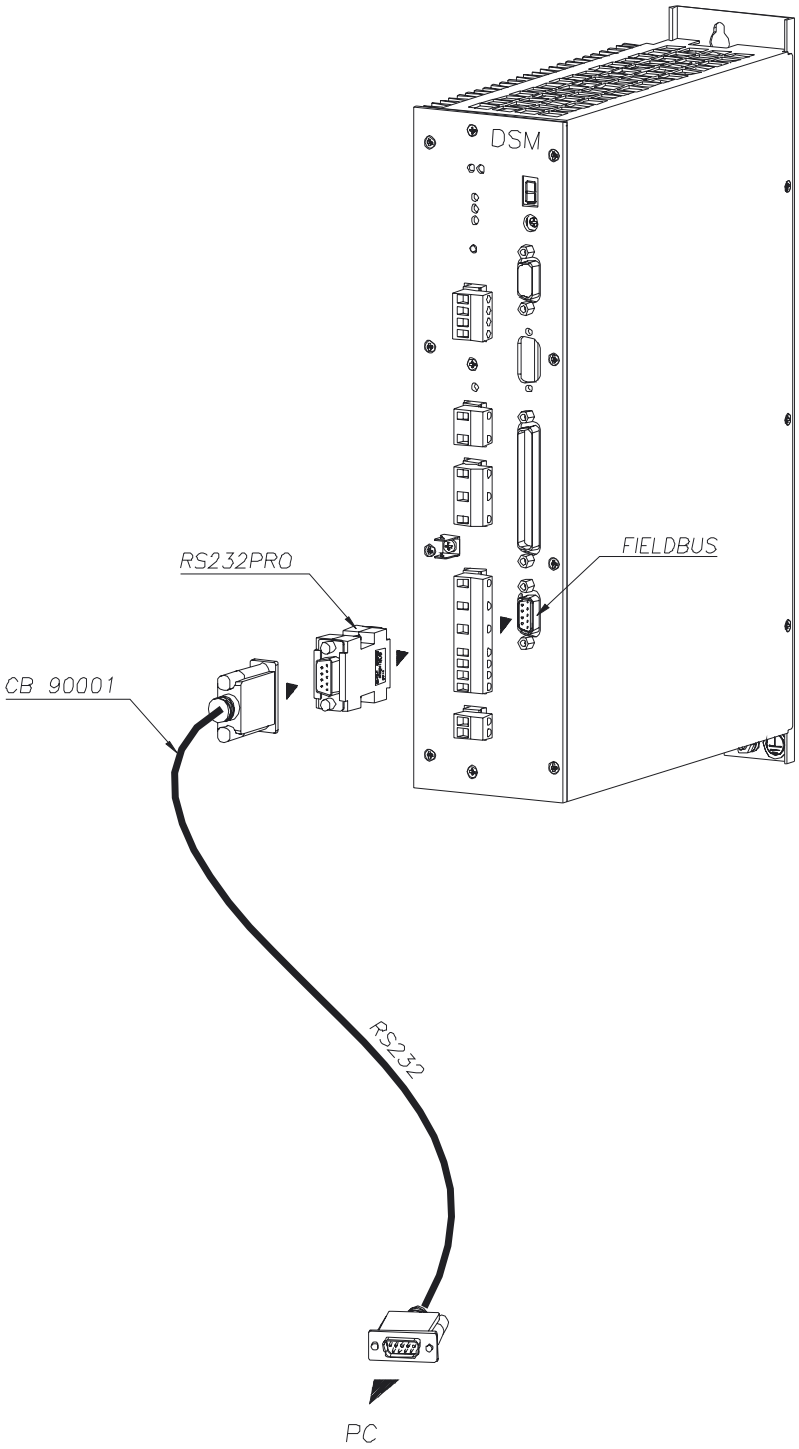


PC/DIGIVEX Motion dialogue is possible with all the drives via Profibus network.

Turn off the PLC or disconnect the connection with the PLC in case of Basic_DM program loading into one of the drives.

3.2.5 Application example with RS232PRO interface

(the drive mustn't be connected to PROFIBUS network)



⚠ PC/DIGIVEX Motion dialogue is only possible with one drive at a time

The drive mustn't be connected to a supervisor or a PLC via PROFIBUS network when RS232PRO is used.

3.3 PROFIBUS address

Starting up the DIGIVEX Motion PROFIBUS simply requires the PROFIBUS address to be set. The PROFIBUS address is set using the “address” code wheel.

NB:

The manoeuvring of the code wheel must be carried out with the drive in shutdown status; power turned off. The address modification will not take effect unit the drive has been restarted. The new restart is activated by cutting the power supply, and then turning it back on again.

The “0”, “1” and “2” addresses are prohibited to the drive. Address “1” and “2” being reserved for the PROFIBUS-DP masters.

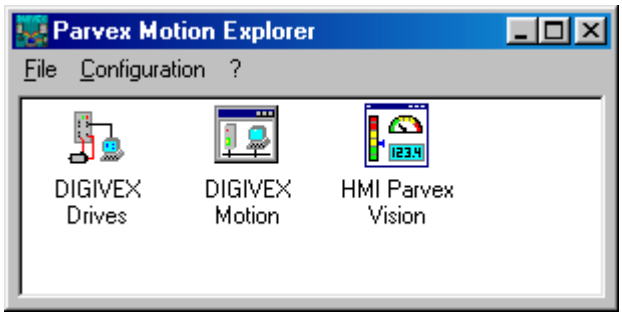
The first available address for the drive is therefore “3”.

4. PROFIBUS-DP MASTER (CLASS 1 & 2) SYSTEM CONNECTION

4.1 Using Parvex Motion Explorer (PME)

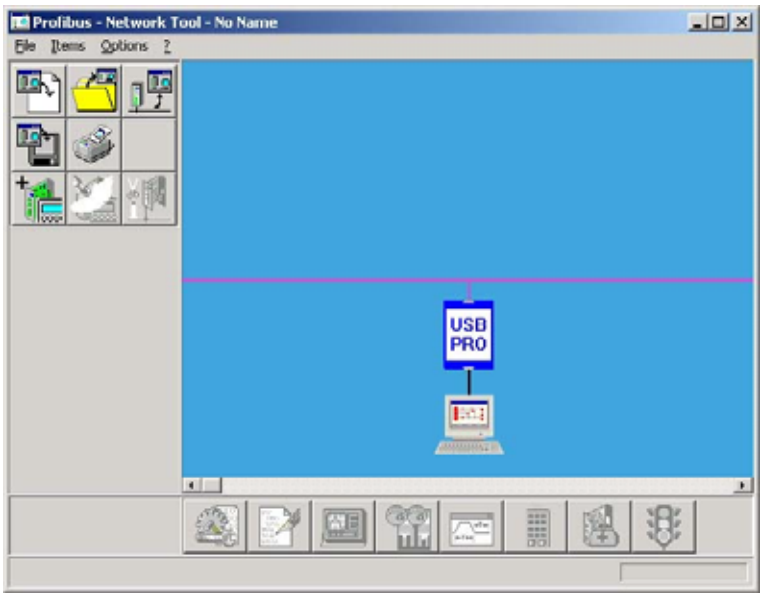
4.1.1 Starting up the application INSTALLATION

Double click on the *PARVEX PME* icon located on the desktop in order to open the *PARVEX Motion Explorer* control panel (or select: *Start*, *Programs*, *Parvex*, *Parvex Motion Explorer*).



DIGIVEX Motion *icon*  This icon is used to start the PME DIGIVEX Motion module dedicated to applications using drive positioners.

Double click on the *DIGIVEX Motion* icon to open the following window:



This environment, called *Profibus - Network Management,* is used to have access to *PME DIGIVEX Motion* functions. A preview of the main functions proposed is given below.

4.1.2 Using PME tools

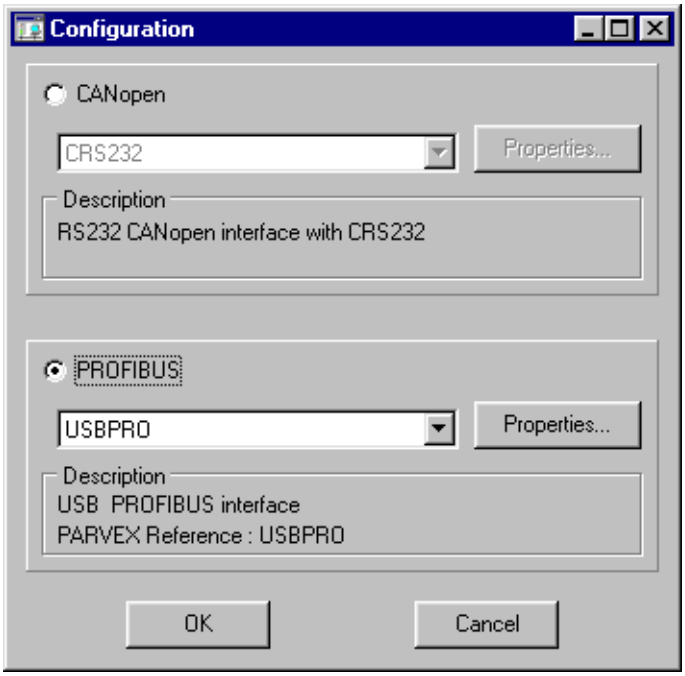
Please refer user manual PVD 3516 “Parvex Motion Explorer Software” for details regarding PME tools.

It is essential that any connected automates be turned off when loading a program with the “Program Editor” tool, and when updating Firmware with the “Incident Diagnosis Assistant” tool.

4.1.2.1.1 PROFIBUS Interface Configuration

The PROFIBUS interface configuration is carried out using the following control sequence:

Options
Configuration



PROFIBUS Interface

Check “Profibus” and indicate which PROFIBUS interface module is used:

- USBPRO module (max rate: 5Mbaud)
- CP5611module
- CP5511module
- RS232PRO module
- USBPROx12 module (max rate: 12Mbaud)

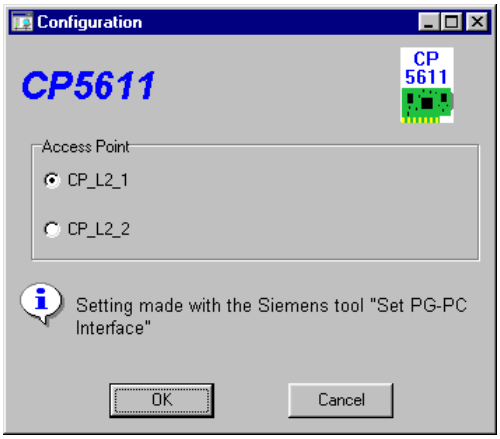
PROFIBUS interfaces are supplied by a third party, please refer to the manufacturer’s installation procedures beforehand.

REFERENCE	DESIGNATION
USBPRO or USBPROx12	USB-PROFIBUS Interface
PCIPRO	PCI-PROFIBUS CP5611 Card
PCMCIAPRO	PCMCIA - PROFIBUS CP5511 Card

Properties

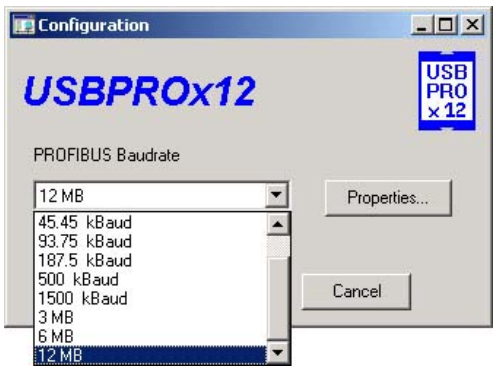
CP5611 & CP5511

The access point must be selected in accordance with the value selected using the SIEMENS “Set PG-PC interface” parameter setting tool



USBPRO and USBPROx12

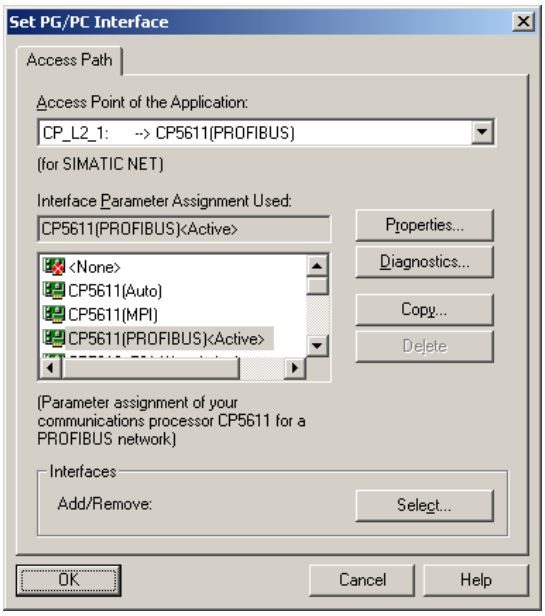
If necessary the transmission speed of porfibus will be changed to be in accordance with the speed imposed by the "Master " :



Click on Properties to select the serial number for the USB/Profibus interface.
This number is detected automatically by clicking on “Search attached device”.

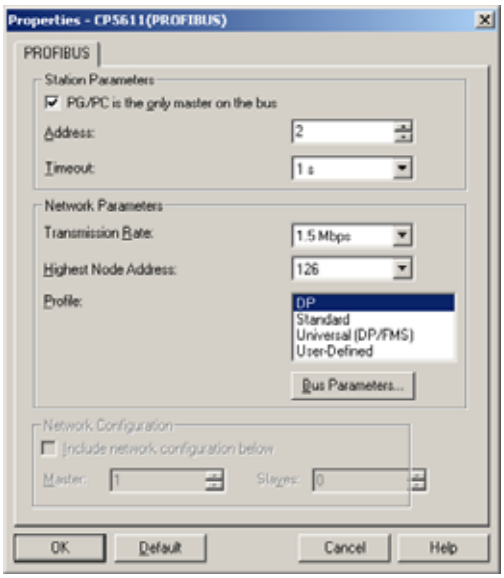
Validate the configuration by clicking on “OK”.

Advice on how to use the SIEMENS "Set PG-PC interface" parameter setting tool is provided with the CP5611 and CP5511 cards:



- Select the CP_L2_1 access point and associate it with the CP5611 (PROFIBUS) or CP5511 (PROFIBUS) set of parameters, as applicable.
- Select the CP_L2_2 access point if input 1 is already assigned.
- Validate by clicking on "OK".

Reopen the "Set PG-PC interface" tool, and click on "Properties". In the "Station" details, check "PG-PC is the only master on the bus" (even if this is not the case!), select a free address (ideally 2 as the PLC is at address "1" and the slaves at address "3" and above). In the "Network" details, select the transmission speed in accordance with the hardware configuration defined with STEP7 (see section 4.3), in "Profile" selector "DP".



- Validate by clicking on "OK", then on "OK" in the main window.

4.2 GSD Files

PROFIBUS slaves do not have the same performance characteristics.
The characteristic properties of a slave are grouped together in a database (GSD file) containing the data for the appliance. This file is used by all the master systems for correctly addressing the slave and its individual possibilities.
This file is available in the C:\Program Files\Parvex\Profibus file for the DIGIVEX Motion PROFIBUS (Eudp0792.gsd) range.

4.3 Operating in relation with SIMATIC S7

4.3.1 PROFIBUS-DP interface in SIMATIC S7

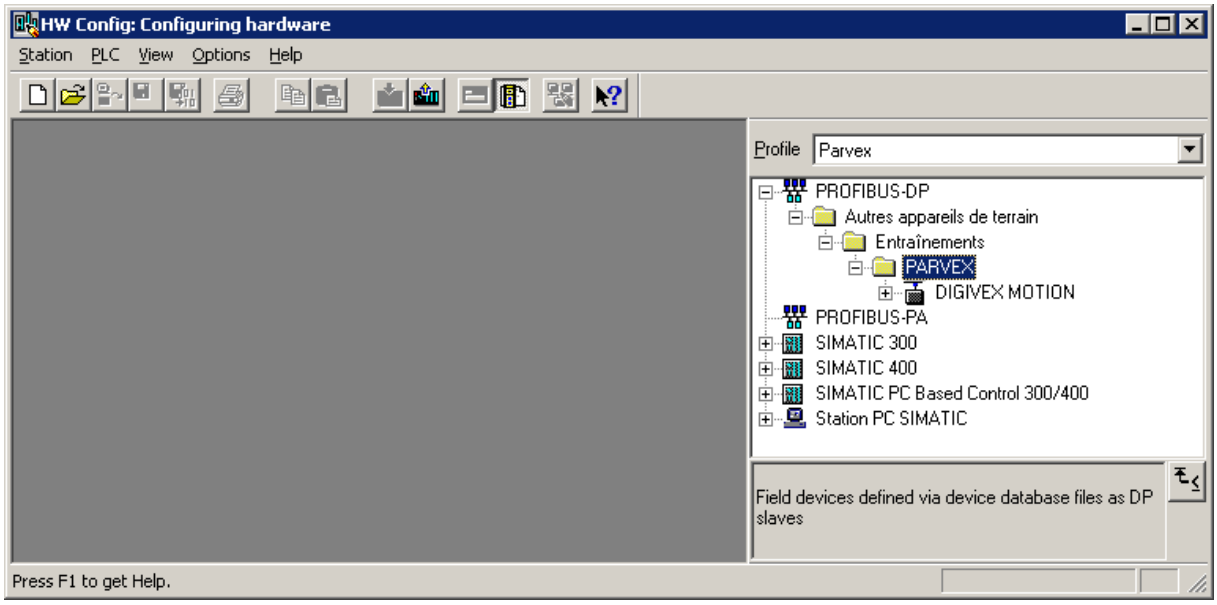
S7 masters can be CPUs with integrated PROFIBUS-DP interface such as for example CPU314C-2DP, CPU315-2DP, CPU413-2DP, CPU414-2DP or CPU416-2DP. For corresponding couplers (CP), please consult us.
The master station as well as the PROFIBUS network system are configured in the hardware manager STEP7.

To create a project using the “SIMATIC Manager” tool (File > New)

4.3.2 Adding DIGIVEX Motion to the module catalogue

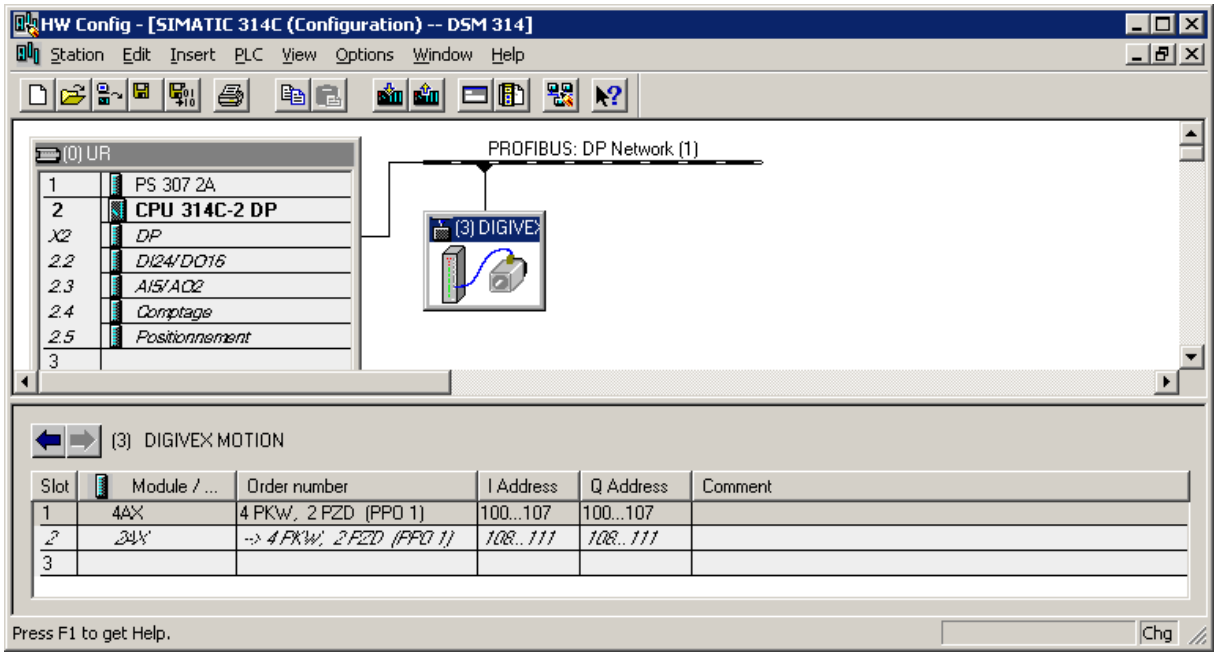
- Start up the hardware configuration tool (SIMATICXXX > Hardware).
- Click on “Tools > Install new GSD”
- Select in C:\Program Files\Parvex\Profibus\Eudp0792.gsd

You should then see the “DIGIVEX Motion” slave catalogue displayed under PROFIBUS-DP > Other field devices > Drives > Parvex, as shown below:



4.3.3 Adding DIGIVEX Motion to the hardware configuration

Continue by adding DIGIVEX Motion to the hardware configuration of your project as shown in STEP7 software help.



Choosing the slots:

Three configurations are possible for the Input/Output slots:

PP01 This standard message is used to access the DIGIVEX Motion parameters following the PKW mechanism (section 2.4) and the 2 process data (2 status words in input or 2 control words in output).

PP03 Only process data is exchanged. This configuration is used when no other DIGIVEX Motion parameter is required by the PLC.

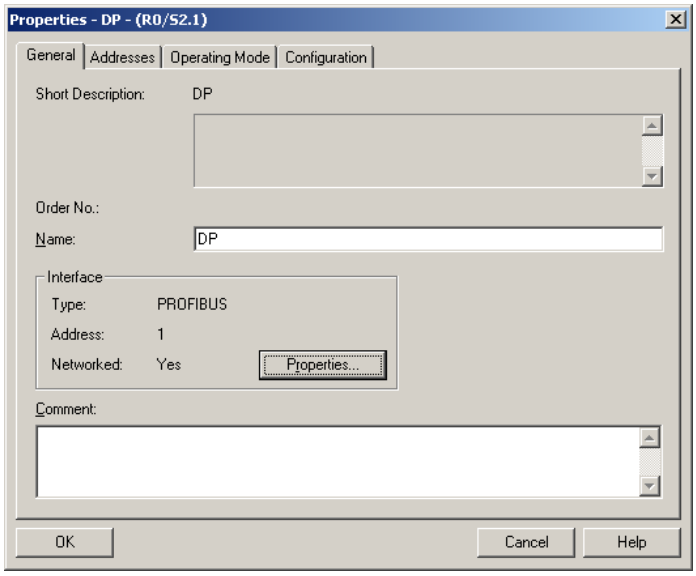
Standard telegram1 As for PP03, only process data is exchanged cyclically. DIGIVEX Motion parameters can however be accessed through the DPV1-Profidrive V3.0 mechanism for the PLC that can support this functionality.

NB:

Addresses for the beginning and end of the Inputs/Outputs in the hardware configuration slots must be adapted to the range supported by the CPU (usually < 256).

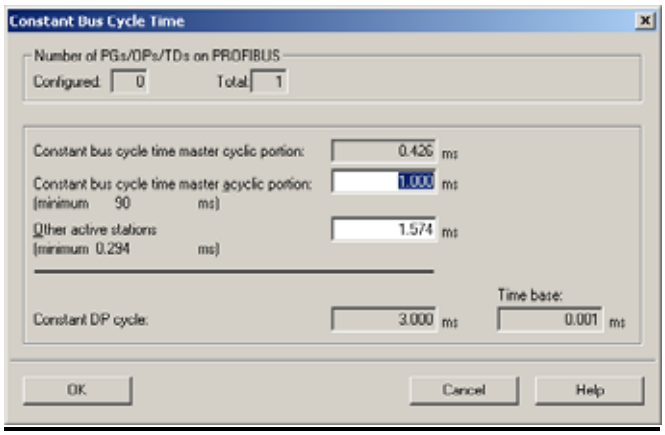
4.3.4 Setting the parameters for the DP master bus

Double click on the “DP” icon associated with the CPU in the hardware configuration window. The following window will open:



- Click on “Properties”.
- Select the sub-network proposed if it is suitable (if not, create a new one with the desired transmission speed).
- Click on ”Properties.
- Select the “Network parameters” tab.
- Click on “Options”.
- Under the “Equidistance” tab, check “Activate the bus cycle”.
- Enter “1” in the “Total” box for the “number of PG”.
- Click on “Details”.

This will then give:



The minimum values are displayed, it is advisable to make the value slightly higher while guaranteeing the shortest possible DP cycle.

NB

A short DP cycle ensures amongst other things better dynamics from PME, Parvex Motion Explorer, tools.