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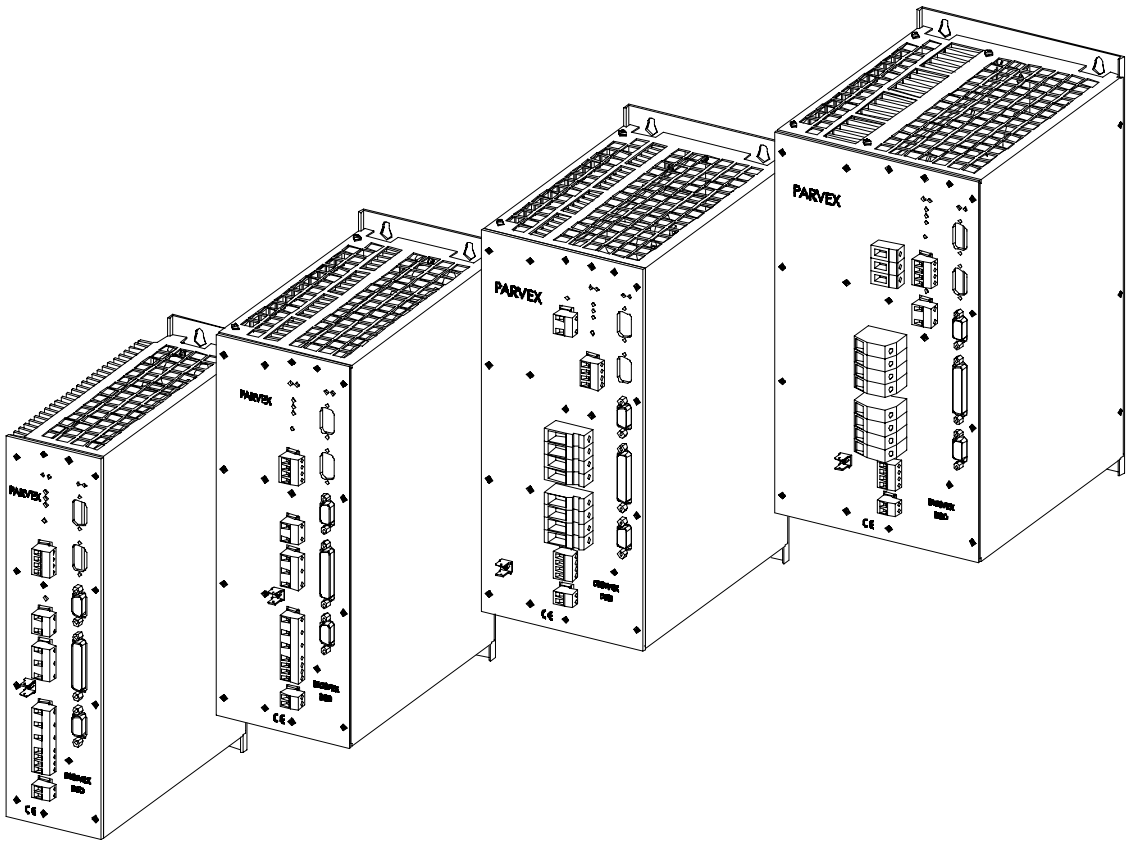
DIGIVEX MOTION

application software

BLOCK POSITIONING

PVD 3519 GB – 11/2003



PRODUCT RANGE

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 «série L - NX»

  ⇒ 400V, 460V three-phase for «série H - NX»
- **"DIGIVEX DRIVE" DIGITAL SERVOAMPLIFIERS**
  - ⇒ SINGLE-AXIS DSD
  - ⇒ COMPACT SINGLE-AXIS DµD, DLD
  - ⇒ POWER SINGLE-AXIS DPD
  - ⇒ MULTIPLE-AXIS DMD
- "PARVEX MOTION EXPLORER" ADJUSTING SOFTWARE

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- **SPINDLE SYNCHRONOUS MOTORS**
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- **"RTS" SERVOAMPLIFIERS**
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- **"EX" SERVOMOTORS** for explosive atmosphere
- "**AXL" COMPACT SERIES SERVOREDUCERS** — 5 to 700 N.m

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- **"CYBER 2000"** NC 1 to 2 axes
- **VARIABLE SPEED DRIVE - POSITIONER**
  - ⇒ SINGLE-AXIS DSM
  - ⇒ POWER SINGLE-AXIS DPM
  - ⇒ MULTIPLE-AXIS DMM
- ADJUSTMENT AND PROGRAMMING SOFTWARE PARVEX MOTION EXPLORER

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Characteristics and dimensions subject to change without notice

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List of published DIGIVEX MOTION manuals

♦ 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. GENERAL POINTS

"Block Positioning" software is a predefined application program for positioner drive control with 24V logic orders from a plc or manual switches. This software is only for DIGIVEX Motion with CAN open communication interface

It can operate in either of two modes:

- Manual and teach mode:
  Motion can be controlled with push-buttons

- Automatic Mode
  The different movements and processing routines are defined in advance and stored in "blocks" numbered 1-63. To initiate block execution, just select the block number by a combination of logic inputs and then validate the selection with the "start" input. Once the block has been executed, the drive switches the "end_of_block" output state, indicating the block has been completed.

  The blocks perform the following functions:
  - absolute or relative motion
  - tab positioning controlled by an interrupt input
  - message display on the µVision terminal
  - value entry via the µVision terminal
  - ancillary functions:
    - ♦ motor braking control
    - ♦ origin setting

2. COMMISSIONING STAGES

2.1 Wiring the mains supply, motor and resolver

Wiring information is given in the relevant DIGIVEX MOTION User Manual (DSM, DPM or DMM).

2.2 Wiring the drive logic inputs and outputs

Wiring information is given in the relevant DIGIVEX MOTION User Manual (DSM, DPM or DMM). See Section 3.1 of this Manual for how to assign functions to inputs and outputs.

2.3 Connecting a PC with the CRS232 or CIM03 module

A PC is required for specifying the drive parameters and programming the drive. The PC is to be connected to the drive via either a CRS232 module or a CIM03 module. These modules convert the PC's RS232 link into a CAN link so connecting the PC to the CAN network. For further information see the DIGIVEX MOTION - µVision - CRS232 - CAN –DAD05 (PVD 3518 Manual).

2.4 Energising the auxiliary power supply

The control section of the drive is energised and a connection with the PC can be established. The motor is not powered up.

2.5 Loading the drive parameters and settings

Follow the instructions in the PME - DIGIVEX MOTION (PVD 3516) Setting and Adjustment Manual which explains the various parameter setting options (choice of operating mode, motor, etc.) and servo-control adjustment.

The following options must be validated for this application program to work:

- enable program execution (Operating Mode environment, Options tab):
  - ☒ Enable program execution upon energizing
  - ☒ Wait for power-up before crossing PROG0 #START address
- enable torque (Operating Mode environment, Options tab):
  ☒ Enable torque upon energizing
- Enable motion (Operating Mode environment, Options tab):
  ☒ Enable motion upon energizing
- drive mode = position control (Operating Mode environment, Options tab):
  ☒ Position control
- Input In14 must not be assigned (Input / Output environment, Logic Input tab):
  in14 not assigned
- Output out0 must be assigned to the "home_made" system variable (Input / Output environment, Logic Output tab):
- Output out2 must be assigned to the "fault" system variable (Input / Output environment, Logic Output tab):

If the drive has hard limit switches:

- validate these contacts (Operating Mode environment, Origin Setting tab):
  ☒ Hard limits active
- assign inputs In11 and In12 to these contacts (Input / Output environment, Logic Input tab):
  - in11 hardp_input
  - in12 hardm_input

If an origin switch is used:

- validate the origin switch (Operating Mode environment, Origin Setting tab):
  ☒ Origin switch acknowledged
- assign input In13 to the origin switch (Input / Output environment, Logic Input tab): in13 switch0_input

2.6 Loading the "block positioning" application program and specifying parameters

See the instructions in Section 4 of this Manual. The application program is in the directory "C:\Parvex\Pme\App_Parvex\Samples\Motion_Block\" and is named "block.bdm". To recopy in "C:\Parvex\PME\App_User" The program must be edited with the program editor, the parameters specified with the values and types of motion to be performed and then loaded into the drive. All these operations are carried out with PME software.

2.7 Testing

Manual mode is a simple mode for checking whether the unit is operating correctly. See Section 3 of this Manual on how to activate manual mode.

3. INSTRUCTIONS FOR USE

Once loaded the application program is ready for use. The program requests the block selection inputs be scanned upon energising the auxiliary supply (option selected when specifying the drive parameters, see Section 2.5).

The user has a "manual_sel" input for selecting either manual operation (motion controlled visually) or automatic operation (blocks selected by combining logic inputs, inputs may be controlled by a plc).

3.1 Logic Inputs-Outputs over Sub-D Connector

3.1.1 Inputs

The logic inputs assignments are defined as follows:

Input	Name	Function	Associated Variable	Type
in0	fly_index	position stop trigger		rising edge
in1	manual_p	manual + direction		state
in2	manual_m	manual - direction		state
in3	manual_sel	manual / automatic selection		state
in4	start	selected block validation		pulse
in5	sel1	block code weight 1		state
in6	sel2	block code weight 2		state
in7	sel3	block code weight 4		state
in8	sel4	block code weight 8		state
in9	sel5	block code weight 16		state
in10	sel6	block code weight 32		state
In11	hardlimit_p	+ electrical limit switch	hardp_input	state
In12	hardlimit_m	- electrical limit switch	hardm_input	state
in13	switch0	origin switch	switch0_input	state
in14	block_enable	block and motion enable		state
in15	teach_in	teach		edge

The "block_enable" input must be set to 1 for motion and block selection to be possible:

- In manual mode, setting this input to 0 inhibits acknowledgement of "manual_p" and "manual_m" inputs and stops current motion (with deceleration ramp). Motion can only be resumed if this input goes back to 1.
- In automatic mode, setting this input to 0 stops current motion (with deceleration ramp) and the current block is considered to have been completed. The "start" input is no longer acknowledged and no new block can be selected.

3.1.2 Definition of levels

Level 1 : Command or logic state corresponding to a potential close to the 24 V supply voltage.
Level 0 : Command or logic state corresponding to an open circuit or potential close to 0V.

3.1.3 Outputs

Logic outputs are assigned in a fixed way:

Output	Name	Function	Associated Variable
out0	home_made	Origin set info	home_made
out1	end_of_block	Block execution completed info	
out2	fault	Drive fault info	fault
out3	-	Unused	
out4	-	Unused	
out5	-	Unused	
out6	-	Unused	
out7	-	Unused	

A "home_made" output tells the user whether the origin has been set. This output is set to 1 when the origin has been successfully set. It is set to 0 on energising the appliance and at the start of the origin setting cycle.

The "end_of_block" output, when at 1, indicates that no block and no motion is currently being executed.

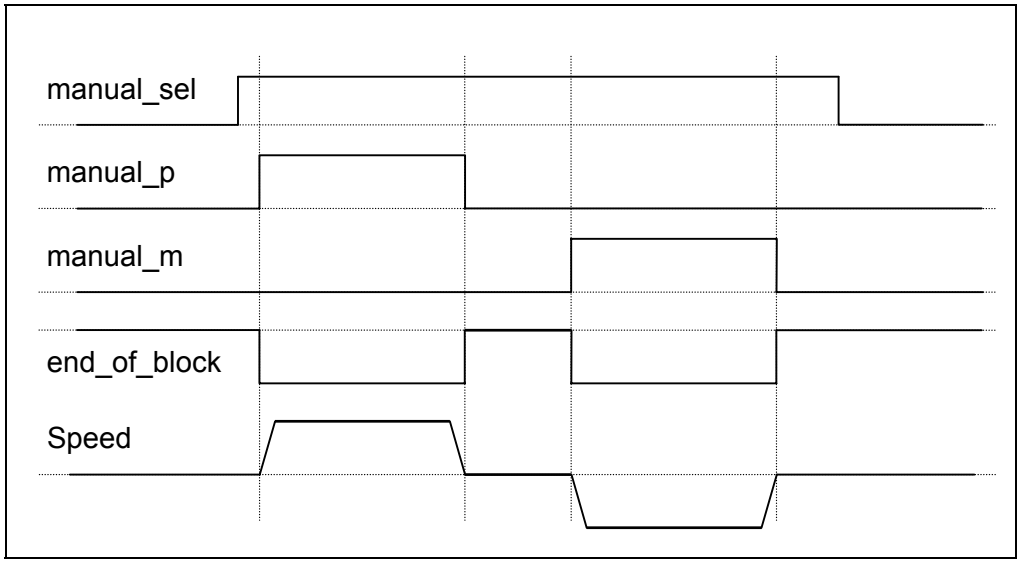
The "fault" output switches to 1 to indicate a fault with the drive (see the list of faults in the relevant DIGIVEX MOTION Drive Manual (DSM, DPM or DMM)).

3.2 Manual and teach mode operation

Manual operation is selected if the "manual_sel" input is at 1:

- Maintaining state 1 on the "manual_p" input moves the axis in the positive direction.
- Maintaining state 1 on the "manual_m" input moves the axis in the negative direction.
- Maintaining state 1 or 0 on both "manual_m" and "manual_p" inputs stops motion (deceleration ramp).
- The "end_of_block" output is set to 0 when a manual displacement is underway and is set to 1 otherwise.
- Motion stops when the system reaches an electrical or software limit switch (stoppage with deceleration ramp). Only manual operation away from the limit switch is then authorized.
- Setting the "block_enable" input to 0 inhibits acknowledgement of "manual_p" and "manual_m" inputs and halts current motion (with deceleration ramp). The "end_of_block" output is set to 1 when all movement has come to a halt. The "manual_p" and "manual_m" inputs are then only acknowledged if this input is set to 1 again.

LOGIC CHART



TEACH

Teach mode is activated by setting input In15 to 1. It is valid in manual mode only. This functionality allows 64 absolute positions to be stored for subsequent re-use in motion blocks in automatic mode (blocks 14 - 62).

A rising edge on input In15 "teach_in" stores the absolute position of the axis. So the position can be precisely read and stored it is recommended that the axis be at rest at the moment input In15 is activated.

The axis position is stored in a user variable ud, depending on the block number selected (inputs sel1 - sel6) when input In15 is set to 1:

- ud0 for block 0
- ud1 for block 1
- .....
- ud63 for block 63

The ud variable may then be assigned to the uf7 variables of motion blocks 14-62 (see Section 4.6 of these instructions):

```
%PROG14
; ***  motion block 14  (absolute or relative movement)  ***
;
ub0 = 1                  ; 1 = absolute    0 = relative
uf6 = 100                ; speed to be used (in Units/s)
uf7 = ud14               ; distance (in Units)
RETURN
%ENDPROG
```

3.3 Automatic Operation

Automatic operation is selected if the "manual_sel" input is at 0:

- The user must select a block (numbered 0-63) with the "sel1" to "sel6" inputs (see table below).
- The user must then validate the selection by a rising edge on the "start" input (it is acceptable for the code and start to rise at the same time). The "end_of_block" output then switches to 0 (indicating the block is being executed and the start signal can fall again). It is best to test the "end_of_block" output state before asking for a new block. This output must be at 1 when a new block is to be selected. If the "start" input switches to 1 (rising edge) when a block is being executed, the block request is ignored.
- When execution of the block is completed, the "end_of_block" output switches back to 1 (indicating execution of the block is complete, and the device waits for a new block to be selected).
- When the system reaches an electrical or software limit switch, block execution is halted and cannot be resumed and current motion stops (with deceleration ramp, the stop position becomes the current position). Only movement away from the limit switch is then authorized.
- A 0 state on the "block_enable" input inhibits acknowledgement of the "start" input (no block can then be selected).
- During execution of the block with motion (blocks 3 and 14-63), if the "block_enable" input switches to 0 then block execution is halted permanently (motion stop with deceleration ramp, and the stop position becomes the current position). The "end_of_block" output is reset to 1 when all motion has stopped completely.

The user can access the following functions by selecting the appropriate code:

Block no.	sel 6	sel 5	sel 4	sel 3	sel 2	sel 1	Function
0	0	0	0	0	0	0	No effect - block unused
1	0	0	0	0	0	1	Open brake
2	0	0	0	0	1	0	Close brake
3	0	0	0	0	1	1	Origin setting
4	0	0	0	1	0	0	Display operator message
…	…	…	…	…	…	…	Display operator message
9	0	0	1	0	0	1	Display operator message
10	0	0	1	0	1	0	Conversational (variable uf0)
11	0	0	1	0	1	1	Conversational (variable uf1)
12	0	0	1	1	0	0	Conversational (variable uf2)
13	0	0	1	1	0	1	Conversational (variable uf3)
14	0	0	1	1	1	0	Absolute or relative motion
...	...	...	...	...	...	...	Absolute or relative motion
62	1	1	1	1	1	0	Absolute or relative motion
63	1	1	1	1	1	1	Position stop triggered by fly_index input

N.B. Once the "end_of_block" disappears (state 0) it is best to zero reset the "start" input. Before motion ends, the block number may also be changed to prepare the next block as it will only be validated by a rising edge on the "start" input.

4. INITIALISING BLOCKS

To set the application parameters, the user must complete the following internal variables:

Block Type	Internal Variables Used
General initialisation (program 9999)	• initialise variables uf0 - uf3 • µVision terminal address • page number for display • acceleration value • speed of displacement in manual mode
Operator message display	• message script
Conversational	• question script
Displacement	• type of displacement (absolute or relative) • speed of displacement • position to be reached or relative displacement value
Position stop	• speed of displacement • stop distance (the sign indicates the direction of motion)

4.1 Common Values (PROG99)

The header of the "motion_block.bdm" program is the general variable initialisation program. The parameters of this program 99 must be specified using the application values. The numerical values must be replaced by the desired values. However, the program must not be modified by deleting lines or changing the names of variables.

```
%PROG99
; ***  default values for user variables ***
;
uf0 = 0          ; default value of uf0 (keyboard value of block 10)
uf1 = 0          ; default value of uf1 (keyboard value of block 11)
uf2 = 0          ; default value of uf2 (keyboard value of block 12)
uf3 = 0          ; default value of uf3 (keyboard value of block 13)
;
ui0 = 32         ; keyboard address
ui1 = 1          ; page number for display
;
uf4=100          ; acceleration value in  Units/s²
uf5=100          ; speed for manual mode in Units/s
;
RETURN
%ENDPROG
```

4.2 Brake Controls - Blocks 1 & 2

There is no parameter specification for the brake control blocks. There is therefore no %PROG1 or %PROG2.

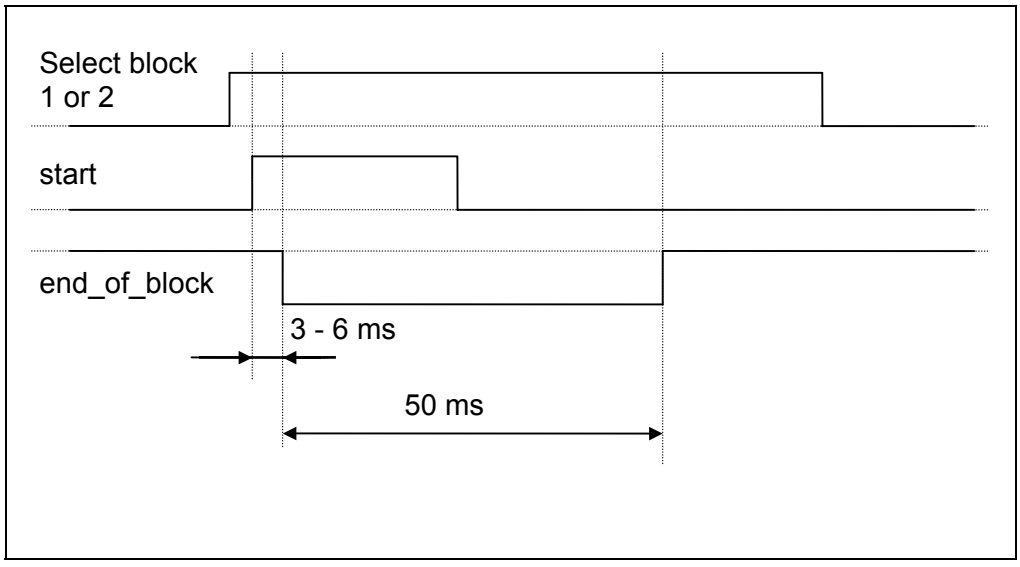
If the brake is declared as being controlled by the program, and the system is in automatic mode ("manual_sel" input at 0), then:

Block 1 controls brake opening.
Block 2 control brake closure.

N.B. For both blocks, the "end_of_block" output is maintained at 0 for 50 ms (so any external plc has time to acknowledge it).

If the brake is declared open in the parameters when powered up, these two instructions are unused.

LOGIC CHART :



4.3 Origin Setting - Block 3

There is no parameter specification for block 3 which controls origin setting. There is therefore no %PROG3. The origin setting options are defined in the drive parameters (PME DIGIVEX MOTION Setting and Adjustment Manual).

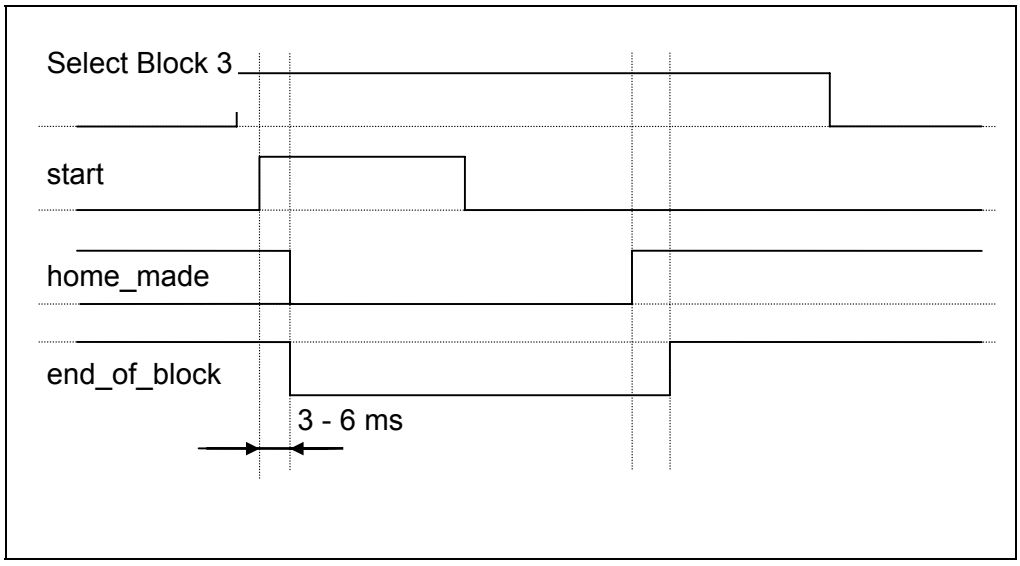
To request origin setting, block 3 must be selected (automatic mode, therefore "manual_sel" = 0). When origin setting is requested, "end_of_block" switches to 0. At the end of origin setting, "end_of_block" switches back to 1 as does the "home_made" out0 output indicating the origin has been set. The "home_made" output switches to 1 as soon as the origin is encountered while the "end_of_block" output only switches back to 1 when the axis is stopped again. The switching time delay between these two outputs is related to the braking time.

N.B. If origin setting is interrupted by "block_enable" = 0
When the "Block_enable" input switches to zero causes:

- stoppage with ramp
- after stopping, the "end_of_block" signal is reset to 1
- conversely, the "home_made" signal remains at 0
- no action on the brake

To resume origin setting, block 3 must be selected again

LOGIC CHART :



4.4 Transmitting Messages to the µVision Terminal - Blocks 4-9

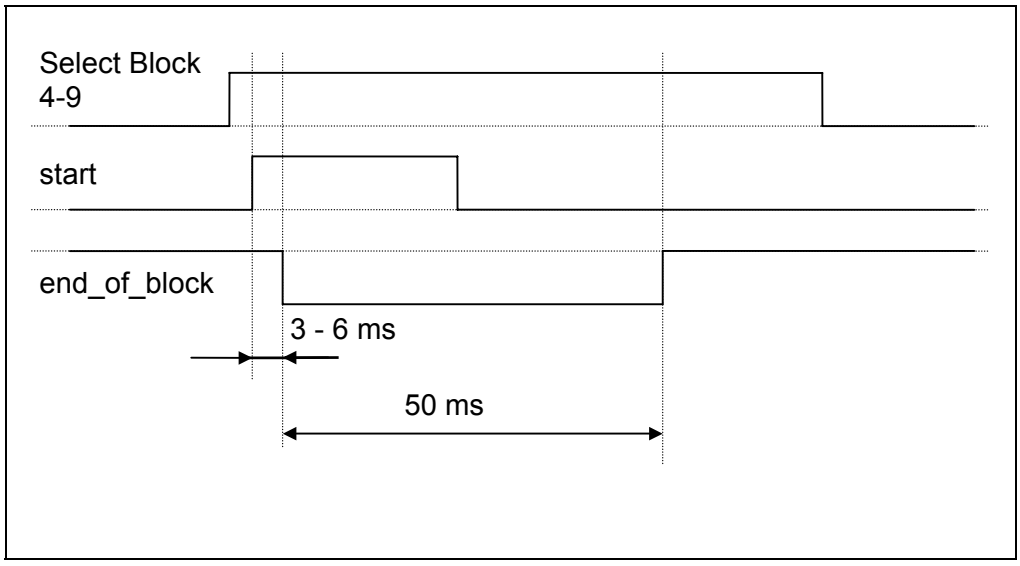
Blocks 4-9 are used to send a message to the µVision terminal. Parameters can be specified for each block defining the messages to be displayed on line 1 and line 2. The message displayed is the script in "Quotation marks".
This script can contain a maximum of 15 characters. The remainder of the program must not be modified.

```
%PROG4
; ***  operator message block4  ***
;
uc0 = "text block4 L1"      ;message to be displayed on line 1
uc1 = "text block4 L2"      ;message to be displayed on line 2
RETURN
%ENDPROG
……..
……..

%PROG9
; ***  operator message block9  ***
;
uc0 = "text block9 L1"      ;message to be displayed on line 1
uc1 = "text block9 L2"      ;message to be displayed on line 2
RETURN
%ENDPROG
```

N.B. For blocks 4-9, the "end_of_block" output is maintained at 0 for 50 ms (so any external plc has time to acknowledge it).

LOGIC CHART



4.5 Entering Values via the Terminal - Blocks 10-13

Blocks 10-13 are for:

- Asking a question via the µVision terminal and entering a numerical value
- Testing the numerical value entered by the operator
- Using the value entered as a position or speed in the motion blocks

Block call-up routine:

- When the block is called, the drive sends the message defined in the block (maximum 15 characters, script in " Quotation marks " in the program) to the µVision terminal screen
- The "end_of_block" output switches to 0
- The operator must then key in a numerical value and validate it with the ENTER key
- When the value reaches the drive, the drive records the datum in a variable (variable uf0 for block 10, uf1 for block 11, uf2 for block 12 and uf3 for block 13)
- The drive then tests the variable and checks that it is contained within the interval defined by uf8 (upper limit) and uf9 (lower limit)
- If the test fails, the "ERROR" message is displayed on the µVision terminal for 1 s and then the drive sends the message again and awaits a response
- If the test is successful, the "end_of_block" output switches back to 1

```
%PROG10
; ***  operator message block10  , response stored as uf0 ***
;
uc0 = "text block10 L1"          ;message to be displayed on line 1
uf8 = 0                          ;upper limit of keyboard value
uf9 = 0                          ;lower limit of keyboard value
RETURN
%ENDPROG
……..
……..
%PROG13
; ***  operator message block13  , response stored as uf3 ***
;
uc0 = "text block13 L1"          ;message to be displayed on line 1
uf8 = 0                          ;upper limit of keyboard value
uf9 = 0                          ;mower limit of keyboard value
RETURN
%ENDPROG
```

4.6 Displacement Blocks - Blocks 14-62

Blocks 14 to 62 are positioning blocks. For each block used, the user simply introduces:

- the mode of displacement (absolute or relative),
- the displacement value,
- the displacement speed.

N.B. Values assigned to speed or displacement may be:

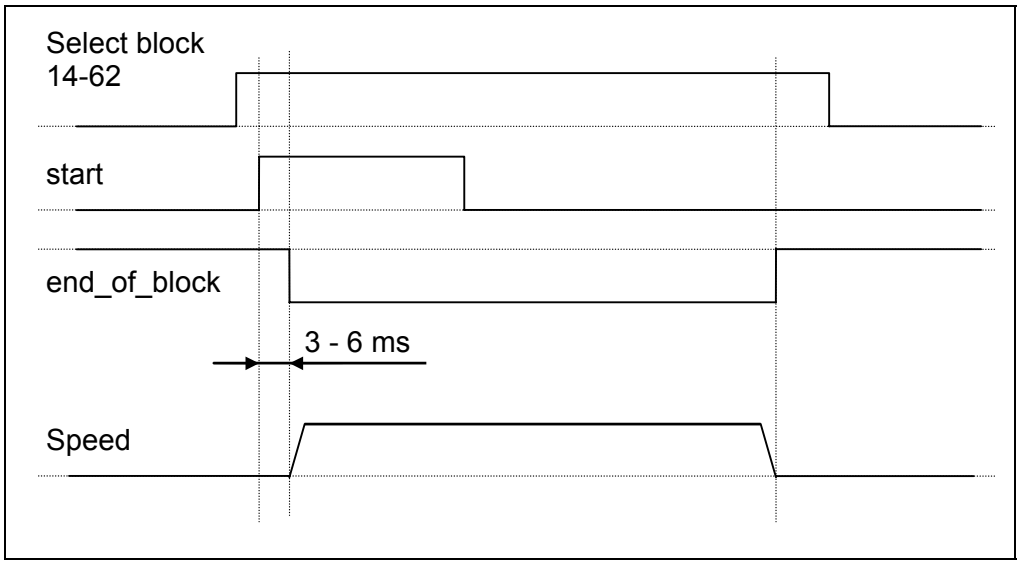
- either numerical values,
- or variables uf0, uf1, uf2 or uf3 entered through blocks 10-13.
- a variable ud0 - ud63 entered in teach mode for an absolute movement

```
%PROG14
; ***  motion block 14 (absolute or relative movement)  ***
;
ub0 = 1               ; 1 = absolute  0 = relative
uf6 = 100             ; speed to be used
uf7 = 12.5            ; distance
RETURN
%ENDPROG

…….
…….

%PROG62
; ***  motion block 62 (absolute or relative movement)  ***
;
ub0 = 0               ; 1 = absolute  0 = relative
uf6 = uf2             ; speed to be used
uf7 = uf3             ; distance
RETURN
%ENDPROG
```

DISPLACEMENT BLOCK LOGIC CHART



INTERRUPTING A DISPLACEMENT BLOCK

If a block is interrupted by the "block_enable" input switching to 0:

- braking occurs (with ramp),
- after stopping, the "end_of_block" signal is set to 1 again,
- there is no action on the brake.

The interrupted block is considered to have been completed.

Several possibilities arise:

- If the block was programmed in absolute mode, the "block_enable" signal can be set to 1 again and the block reactivated by the "start" input to complete the trajectory,
- If the block was programmed in relative mode, the interrupted block cannot be completed (If the block were to be reactivated, the system would perform the full relative displacement).

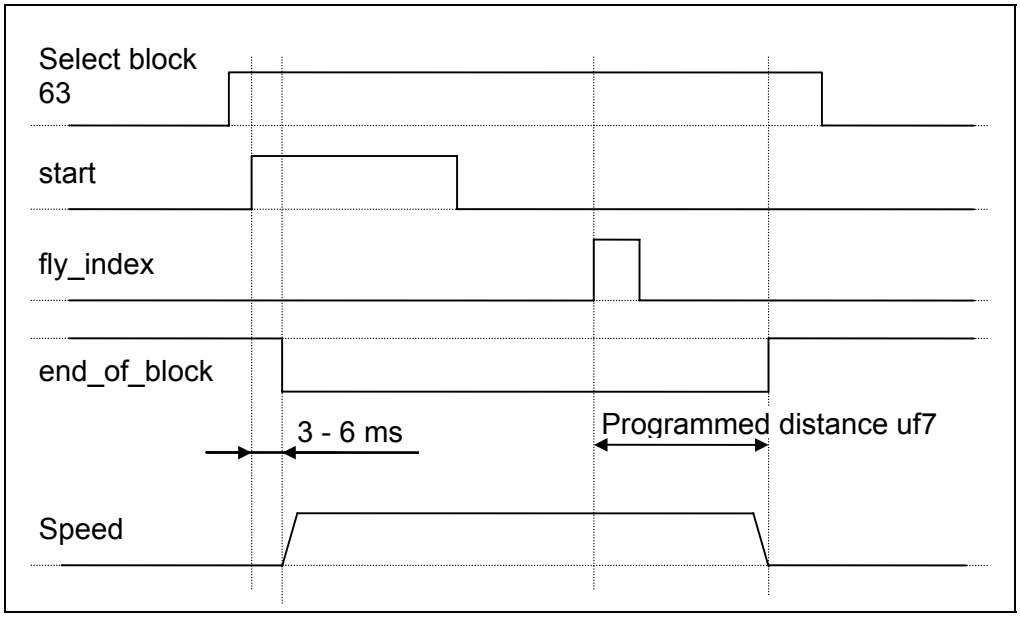
4.7 "Position Stop" Block - Block 63

- Block 63 is a "position stop" type block (stoppage at a programmed distance after sensor action on an interrupt input).
- This block starts motion at the speed declared by uf6. The direction of motion is given by the displacement sign uf7.
- When the "fly_index" input is triggered (a rising edge on this input is acknowledged), motion stops at a distance uf7 after the input signal (stoppage in the direction of motion).

```
%PROG63
; ***  motion block 63 (stop after interrupt)  ***
;
uf6 = 100             ; speed to be used
uf7 = 0               ; distance
RETURN
%ENDPROG
```

Caution: if distance uf7 is too short (shorter than the braking distance required for speed uf6), the motion will overshoot and back up before stopping at distance uf7. If this must be avoided, select uf7 > ½ $(uf6)^2$/(acceleration).

LOGIC CHART (rising edge of in0)



N.B. If "block_enable" switches to 0 during execution of the block, movement stops, the block is discontinued and "end_of_block" switches to 1.

5. BRAKE CONTROL

The 24 V brake is energised or de-energised:

- By the external 24 V "BRAKE SUPPLY" of terminal block B1. This 24 V supply is controlled by the external plc.
- Once the 24 V is established, an internal relay is used to close or open the brake depending on:
  - ♦ the brake control blocks,
  - ♦ the drive operating mode

  (Caution! This relay is not available on DMM drives).

N.B. General brake operation is explained in the PME-DIGIVEX MOTION Setting and Adjustment Manual.

6. FAULT RESETTING

The "fault" output at 1 indicates a drive fault (see the relevant DIGIVEX MOTION Drive Manual (DSM, DPM or DMM)).

In this event:

- The current block is interrupted and motion stopped (the interrupted block is considered to have been completed).
- The fault diagnosis is indicated on the 7-segment drive display.
- For serious faults the "OK" relay is opened.

Resetting the device by switching the RESET input to 1 (on the front panel of the drive, terminal 1-2 of terminal block B5):

- clears electrical or thermal faults (if the causes of the faults have been remedied),
- closes the "OK" relay allowing power to be restored to the drive (if the causes of the faults have been remedied),
- resets the "fault" output to 0.