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Manual for standard Function Block FB_DriveVirtual

ESS Motion Control and Automation Group

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0.2	Added output parameters, execution sequence example	26. 06. 2015

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1. INTRODUCTION

The ESS Motion Control and Automation Group (MCAG) works with motion control and Automation of mainly Instruments but also have responsibility for motion control at accelerator and Target. The MCAG evaluates motion control hardware and one interesting supplier is Beckhoff Automation GmbH. Some standard function blocks have been developed in order to standardise interfaces and reduce coding efforts for the individual projects. One of the standard function blocks is called FB_DriveVirtual. FB_DriveVirtual handles most common motion tasks.

2. FB_DRIVEVIRTUAL

The function block FB_DriveVirtual handles the following motion tasks:

- Jogging
- Absolut positioning
- Relative positioning
- Modulo positioning
- Constant speed
- Homing
- Soft limit switches
- Hard limit switches
- Homing switch

The Epics interface to the motor record relies on use of one FB_DriveVirtual for each motion axis.

2.1. Declaration of variables

For each axis certain variables needs to be declared, see Table 1 and Figure 1.

Table 1: Declared variables for one axis

Index	Variable	Type	Description
1	sVersion	String	Version number (for the users version control)
2	M1	FB_DriveVirtual	Motion standard function block
3	M1Link	FB_NCAxis	Connection point in PLC of motion axis (Linked to NC)
4	bLimitFwd	Bool	Forward hard limit switch (linked to I/O)
5	bLimitBwd	Bool	Backward hard limit switch (linked to I/O)
6	bHomeSensor	Bool	Homing sensor (linked to I/O)

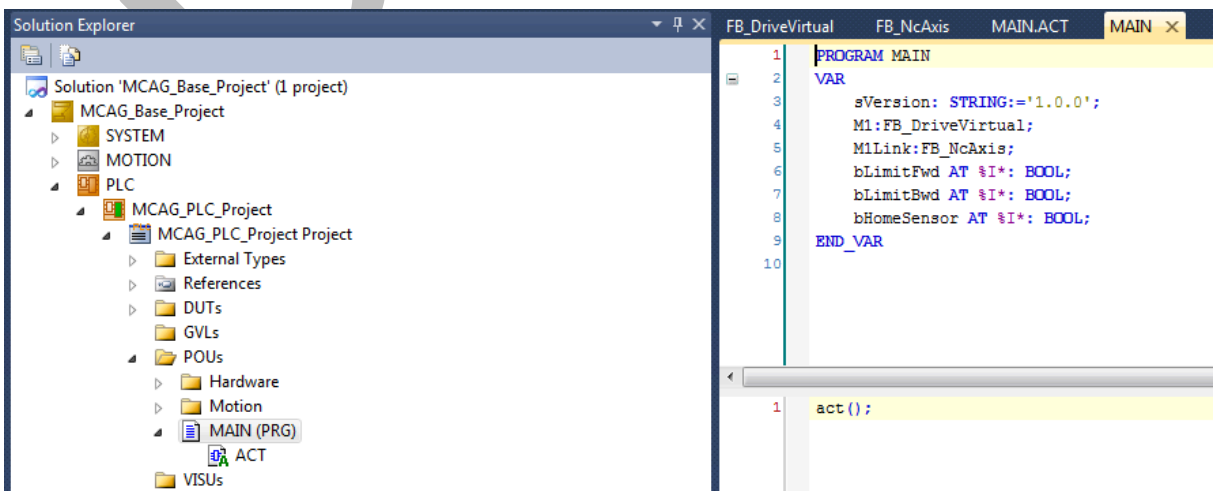

Figure 1: Declared variables for one axis

2.2. Execution

The call for the two FB:s are normally made in an Action that is called from the Main POU, see Figure 2.

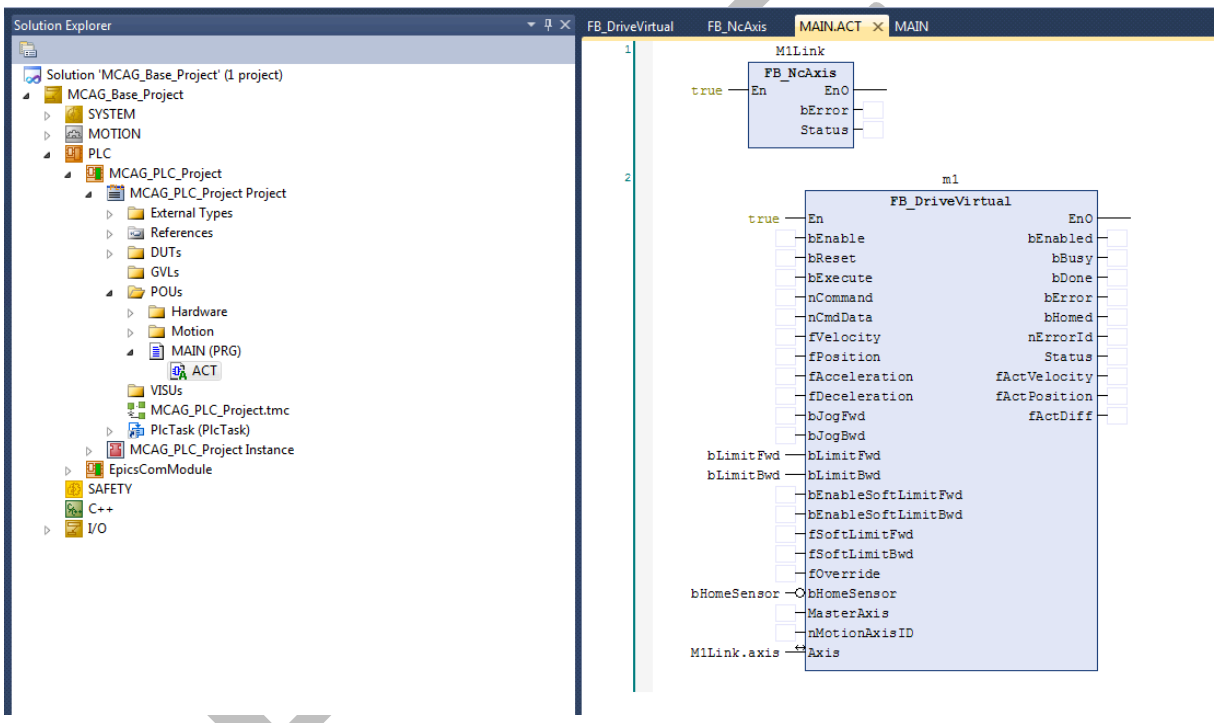

Figure 2: Call of function blocks

The variables that link to hardware need to be added as input parameters to FB_DriveVirtual, like shown in Figure 2.

2.3. Input Parameters

Table 2: FB_DriveVirtual input parameters

Index	Variable	Type	Description
1	En	BOOL	Variable needed for coding standard
2	bEnable	BOOL	Enables amplifier
3	bExecute	BOOL	Executes a command
4	nCommand	UINT	Defining the functionality of the block (see Table 3)
5	nCmdData	UINT	Parameters needed for a certain functionality (see Table 3)
6	fVelocity	LREAL	Speed setpoint
7	fPosition	LREAL	Position setpoint
8	fAcceleration	LREAL	Maximum acceleration
9	fDeceleration	LREAL	Maximum deceleration
10	bJogFwd	BOOL	Jog forward input (from software or hardware)
11	bJogBwd	BOOL	Jog backward input (from software or hardware)
12	bEnableSoftLimitFwd	BOOL	Enable forward soft limit
13	bEnableSoftLimitBwd	BOOL	Enable backward soft limit
14	fSoftLimitFwd	LREAL	Forward soft limit
15	fSoftLimitBwd	BOOL	Backward soft limit
16	fOverride	LREAL	Time scale factor for axis [%]
17	bHomeSensor	BOOL	Homing sensor input
18	MasterAxis	AXIS_REF	Link to Master Motion axis (synchronized movement)
19	Axis	AXIS_REF	Link to Motion axis in FB_NCAxis

Table 3: nCommand and corresponding available options for nCmdData

nCommand	nCmdData	Description
0 = Jog	0	Jog with slow speed (default)
	1	Jog with fast speed
	2	Jog with parameter speed
	3	Jog stepping
	4	Modulo stepping
1= Move Velocity	NAN	NAN
2 = Move Relative	NAN	NAN
3 = Move Absolute	NAN	NAN
4 = MoveModulo	0	Not allowed (default)
	1	Positive direction
	2	Shortest way
	3	Negative direction
	4	Current direction
10 = Homing	0	Default homing (default)
	4	Direct homing
	7	Set reference flag
	8	Reset reference flag
20 = SuperImpose	NAN	Not implemented
30 = Gearing	0	GearRatio Numerator/Denominator is 1:1
	1	1 = GearRatio is fVelocity

2.4. Output parameters

Index	Variable	Type	Description
1	EnO	BOOL	Variable needed for coding standard
2	bEnabled	BOOL	Amplifier enabled
3	bBusy	BOOL	Motion command executing
4	bDone	BOOL	Motion command executed
5	bError	BOOL	Error bit
6	bHomed	BOOL	Axis homed
7	nErrorId	UDINT	Error ID
8	Status	AxisStatus	Axis status
9	fActVelocity	LREAL	Actual velocity
10	fActPosition	LREAL	Actual position
11	fActDiff	LREAL	Actual position error (or velocity error)

3. MOTION COMMAND EXECUTION SEQUENCE

1. Set bEnable
2. Wait for bEnabled to go high
3. Set nCommand
4. Set nCmdData if needed
5. Set position setpoint if needed
6. Set velocity setpoint if needed
7. Set bExecute to start motion

Example: Absolute positioning

Conditions:

- M1 instance of FB_DriveVirtual in Main.
- Velocity setpoint=100
- Position setpoint=1000

Execution sequence:

1. Set “Main.M1.bEnable” to 1
2. Wait for “Main.M1.bEnabled” to go high
3. Set “Main.M1.nCommand” to 3
4. nCmdData not needed for this motion type
5. Set “Main.M1.fPosition” to 1000
6. Set “Main.M1.fVelocity” to 100
7. Set “Main.M1.bExecute” to 1

LIST OF ABBREVIATIONS

Abbreviation	Definition
MCAG	Motion Control and Automation Group
EPICS	Experimental Physics and Industrial Control System