

Subset of the

Technical Specification
PLCopen - Technical Committee

Function blocks for motion control
Part 1

Version 1.0

Appendix A :

Compliance Procedure and Compliance List

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Appendix A. Compliance Procedure and Compliance List

Listed in this Appendix are the requirements for the compliance statement from the supplier of the Motion Control Function Blocks. The compliance statement consists of two main groups: supported datatypes (see Appendix A 2 Supported Datatypes) and supported Function Blocks, in combination with the applicable inputs and outputs (see Appendix A 3 Overview of the Function Blocks and its paragraphs). The supplier has to fill out the tables for the used datatypes and Function Blocks, according to their product, committing their support to the specification.

By submitting these tables to PLCopen, and after approval by PLCopen, the list will be published on the PLCopen website, www.plcopen.org, as well as a shortform overview, as specified in Appendix A 2 Supported Datatypes and Appendix A 3 Overview of the Function Blocks here below.

In addition to this approval, the supplier gets access and usage rights of the PLCopen Motion Control logo, as described in chapter Appendix A 4 The PLCopen Motion Control Logo and Its Usage.

Datatypes

The data type REAL listed in the Function Blocks and parameters (e.g. for velocity, acceleration, distance, etc.) may be exchanged to SINT, INT, DINT or LREAL without to be seen as incompliant to this standard, as long as they are consistent for the whole set of Function Blocks and parameters.

Implementation allows to extend data types as long as the basic data type is kept. For example: WORD may be changed to DWORD, but not to REAL.

Function Blocks and Inputs and Outputs

An implementation which claims compliance with this PLCopen specification shall offer a set of Function Blocks for motion control, meaning one or more, with at least the **basic** input and output variables, marked as “**B**” in the tables. These inputs and outputs have to be supported to be compliant.

For higher-level systems and future extensions any subset of the **extended** input and output variables, marked as “**E**” in the tables can be implemented.

Vendor specific additions are marked with “**V**”, and can be listed as such in the supplier documentation.

| | |
|--|---|
| - Basic input/output variables are mandatory | Marked in the tables with the letter “ B ” |
| - Extended input /output variables are optional | Marked in the tables with the letter “ E ” |
| - Vendor Specific additions | Marked in the vendor’s compliance documentation with “ V ” |

Appendix A 1. Statement of Supplier

| | |
|------------------|--|
| Supplier name | Beckhoff |
| Supplier address | Eiserstrasse 5 |
| City | Verl |
| Country | Germany |
| Telephone | +49 5246-963-0 |
| Fax | +49 5246-963-198 |
| Email address | info@Beckhoff.com |
| Product Name | PLC Library 'PLC Motion Control Toolbox' |
| Product version | 2.1.16 |
| Release date | 01.11.2004 |

I herewith state that the following tables as filled out and submitted do match our product as well as the accompanying user manual, as stated above.

Name of representation (person):

W. Osterfeld

Date of signature (dd/mm/yyyy):

01.11.2004

Signature:

Appendix A 2. Supported Datatypes

| Defined datatypes with MC library: | Supported | If not supported, which datatype used |
|------------------------------------|-----------|---------------------------------------|
| BOOL | Y | |
| INT | Y | |
| WORD | N | UDINT |
| REAL | N | LREAL |
| ENUM | Y | |

Table 1: Supported datatypes

Within the specification the following derived datatypes are defined. Which structure is used in this system:

| Derived datatypes: | Where used | Sup. Y/N | Which structure |
|----------------------------|------------------------|----------|--|
| Axis_Ref | Nearly all FBs | Y | <pre> TYPE Axis_Ref_BkPlcMc STRUCT sAxisName: STRING; pStAxParams: POINTER TO ST_TcHydAxParam; pStAxRtData: POINTER TO ST_TcHydAxRtData; pStAxJob: POINTER TO ST_TcHydAxJob; pStAxEncInput: POINTER TO ST_TcPlcMcEncoderIn; pStAxEncOutput: POINTER TO ST_TcPlcMcEncoderOut; pStAxDriveInput: POINTER TO ST_TcPlcMcDriveIn; pStAxDriveOutput: POINTER TO ST_TcPlcMcDriveOut; pStAxAx2000In: POINTER TO ST_TcPlcMcAx2000In; pStAxAx2000Out: POINTER TO ST_TcPlcMcAx2000Out; nActiveRequest: UDINT; bParamsEnable: BOOL; nState: E_TcMCFbState; nInitState: INT; nInitError: DINT; nInterfaceType: UINT; nRtDataType: UINT; nParamType: UINT; nEncInType: UINT; nEncOutType: UINT; nDriveInType: UINT; nDriveOutType: UINT; nAx2000InType: UINT; nAx2000OutType: UINT; END_STRUCT END_TYPE </pre> |
| MC_Direction (extended) | MC_MoveVelocity | Y | <pre> TYPE MC_Direction_BkPlcMc: (MC_Positive_Direction_BkPlcMc := 1, MC_Shortest_Way_BkPlcMc, MC_Negative_Direction_BkPlcMc, MC_Current_Direction_BkPlcMc); END_TYPE </pre> |
| MC_TP_REF | MC_PositionProfile | N | |
| MC_TV_REF | MC_VelocityProfile | N | |
| MC_TA_REF | MC_AccelerationProfile | N | |

| | | | |
|----------------------------|-------------------------------|---|---|
| MC_CAM_ID | MC_CamTableSelect MC_CamIn | Y | <pre> TYPE MC_CAM_ID_BkPlcMc: STRUCT stCamRef: MC_CAM_REF_BkPlcMc; bValidated: BOOL; bPeriodic: BOOL; bMasterAbs: BOOL; bSlaveAbs: BOOL; bIsChanged: BOOL; END_STRUCT END_TYPE </pre> |
| MC_CAM_REF (extended) | MC_CamTableSelect | Y | <pre> TYPE MC_CAM_REF_BkPlcMc: STRUCT pTable: POINTER TO LREAL; nFirstIdx: UDINT; nLastIdx: UDINT; END_STRUCT END_TYPE </pre> |
| MC_StartMode (extended) | MC_CamIn | Y | <pre> TYPE MC_StartMode_BkPlcMc: (MC_StartMode_Absolute := 1, MC_StartMode_Relative, MC_StartMode_RampIn); END_TYPE </pre> |

Table 2: Supported derived datatypes

Appendix A 3. Overview of the Function Blocks

| Single Axis Function Blocks | Supported Yes / No | Comments (<= 48 char.) |
|-----------------------------|--------------------|-------------------------------|
| MC_MoveAbsolute | Y | MC_MoveAbsolute_BkPlcMc |
| MC_MoveRelative | Y | MC_MoveRelative_BkPlcMc |
| MC_MoveAdditive | N | |
| MC_MoveSuperimposed | N | |
| MC_MoveVelocity | Y | MC_MoveVelocity_BkPlcMc |
| MC_Home | Y | MC_Home_BkPlcMc |
| MC_Stop | Y | MC_Stop_BkPlcMc |
| MC_Power | Y | MC_Power_BkPlcMc |
| MC_ReadStatus | Y | MC_ReadStatus_BkPlcMc |
| MC_ReadAxisError | Y | MC_ReadAxisError_BkPlcMc |
| MC_Reset | Y | MC_Reset_BkPlcMc |
| MC_ReadParameter | Y | MC_ReadParameter_BkPlcMc |
| MC_ReadBoolParameter | Y | MC_ReadBoolParameter_BkPlcMc |
| MC_WriteParameter | Y | MC_WriteParameter_BkPlcMc |
| MC_WriteBoolParameter | Y | MC_WriteBoolParameter_BkPlcMc |
| MC_ReadActualPosition | Y | MC_ReadActualPosition_BkPlcMc |
| MC_PositionProfile | N | |
| MC_VelocityProfile | N | |
| MC_AccelerationProfile | N | |

| Multi-Axis Function Blocks | Supported Yes / No | Comments (<= 48 char.) |
|----------------------------|--------------------|---------------------------|
| MC_CamTableSelect | Y | MC_CamTableSelect_BkPlcMc |
| MC_CamIn | Y | MC_CamIn_BkPlcMc |
| MC_CamOut | Y | MC_CamOut_BkPlcMc |
| MC_GearIn | Y | MC_GearIn_BkPlcMc |
| MC_GearOut | Y | MC_GearOut_BkPlcMc |
| MC_Phasing | N | |

Table 3: Short overview of the Function Blocks

Appendix A 6.1 MoveAbsolute

| If Supported | MC_MoveAbsolute_BkPlcM | Sup. Y/N | Comments |
|--------------|------------------------|----------|----------|
| VAR_IN_OUT | | | |
| B | Axis | Y | |
| VAR_INPUT | | | |
| B | Execute | Y | |
| B | Position | Y | |
| E | Velocity | Y | |
| E | Acceleration | Y | |
| E | Deceleration | Y | |
| E | Jerk | N | |
| E | Direction | N | |
| VAR_OUTPUT | | | |
| V | Busy | Y | |
| B | Done | Y | |
| E | CommandAborted | Y | |
| B | Error | Y | |
| E | ErrorID | Y | |

Appendix A 6.2 MoveRelative

| If Supported | MC_MoveRelative_BkPlcM | Sup. Y/N | Comments |
|--------------|------------------------|----------|----------|
| VAR_IN_OUT | | | |
| B | Axis | Y | |
| VAR_INPUT | | | |
| B | Execute | Y | |
| B | Distance | Y | |
| E | Velocity | Y | |
| E | Acceleration | Y | |
| E | Deceleration | Y | |
| E | Jerk | N | |
| VAR_OUTPUT | | | |
| V | Busy | Y | |
| B | Done | Y | |
| E | CommandAborted | Y | |
| B | Error | Y | |
| E | ErrorID | Y | |

Appendix A 6.5 MoveVelocity

| If Supported | MC_MoveVelocity_BkPlcM | Sup. Y/N | Comments |
|--------------|------------------------|----------|----------|
| VAR_IN_OUT | | | |
| B | Axis | Y | |
| VAR_INPUT | | | |
| B | Execute | Y | |
| E | Velocity | Y | |
| E | Acceleration | Y | |
| E | Deceleration | Y | |
| E | Jerk | N | |
| E | Direction | Y | |
| VAR_OUTPUT | | | |
| V | Busy | Y | |
| B | InVelocity | Y | |
| E | CommandAborted | Y | |
| B | Error | Y | |
| E | ErrorID | Y | |

Appendix A 6.6 Home

| If Supported | MC_Home_BkPlcM | Sup. Y/N | Comments |
|--------------|----------------|----------|----------|
| VAR_IN_OUT | | | |
| B | Axis | Y | |
| VAR_INPUT | | | |
| B | Execute | Y | |
| B | Position | Y | |
| VAR_OUTPUT | | | |
| B | Done | Y | |
| E | CommandAborted | Y | |
| B | Error | Y | |
| E | ErrorID | Y | |

Appendix A 6.7 Stop

| If Supported | MC_Stop_BkPlcM | Sup. Y/N | Comments |
|--------------|----------------|----------|----------|
| VAR_IN_OUT | | | |
| B | Axis | Y | |
| VAR_INPUT | | | |
| B | Execute | Y | |
| E | Deceleration | N | |
| E | Jerk | N | |
| VAR_OUTPUT | | | |
| V | Busy | Y | |
| B | Done | Y | |
| B | Error | Y | |
| E | ErrorID | Y | |

Appendix A 6.8 Power

| If Supported | MC_Power_BkPlcM | Sup. Y/N | Comments |
|--------------|-----------------|----------|----------|
| VAR_IN_OUT | | | |
| B | Axis | Y | |
| VAR_INPUT | | | |
| B | Enable | Y | |
| E | Enable_Positive | Y | |
| E | Enable_Negative | Y | |
| VAR_OUTPUT | | | |
| V | Busy | Y | |
| B | Status | Y | |
| B | Error | Y | |
| E | ErrorID | Y | |

Appendix A 6.9 ReadStatus

| If Supported | MC_ReadStatus_BkPlcM | Sup. Y/N | Comments |
|--------------|----------------------|----------|----------|
| VAR_IN_OUT | | | |
| B | Axis | Y | |
| VAR_INPUT | | | |
| B | Enable | Y | |
| VAR_OUTPUT | | | |
| V | Busy | Y | |
| B | Done | Y | |
| B | Error | Y | |
| E | ErrorID | Y | |
| B | Errorstop | Y | |
| B | Stopping | Y | |
| B | StandStill | Y | |
| B | DiscreteMotion | Y | |
| B | ContinuousMotion | Y | |
| E | SynchronizedMotion | Y | |
| E | Homing | Y | |
| E | ConstantVelocity | Y | |
| E | Accelerating | Y | |
| E | Decelerating | Y | |

Appendix A 6.10 ReadAxisError

| If Supported | MC_ReadAxisError_BkPlcM | Sup. Y/N | Comments |
|--------------|-------------------------|----------|----------|
| VAR_IN_OUT | | | |
| B | Axis | Y | |
| VAR_INPUT | | | |
| B | Enable | Y | |
| VAR_OUTPUT | | | |
| V | Busy | Y | |
| B | Done | Y | |
| B | Error | Y | |
| B | ErrorID | Y | |

Appendix A 6.11 Reset

| If Supported | MC_Reset_BkPlcM | Sup. Y/N | Comments |
|--------------|-----------------|----------|----------|
| VAR_IN_OUT | | | |
| B | Axis | Y | |
| VAR_INPUT | | | |
| B | Execute | Y | |
| VAR_OUTPUT | | | |
| V | Busy | Y | |
| B | Done | Y | |
| B | Error | Y | |
| B | ErrorID | Y | |

Appendix A 6.12 ReadParameter

| If Supported | MC_ReadParameter_BkPlcM | Sup. Y/N | Comments |
|--------------|-------------------------|----------|----------|
| VAR_IN_OUT | | | |
| B | Axis | Y | |
| VAR_INPUT | | | |
| B | Enable | Y | |
| B | ParameterNumber | Y | |
| VAR_OUTPUT | | | |
| V | Busy | Y | |
| B | Done | Y | |
| B | Error | Y | |
| E | ErrorID | Y | |
| B | Value | Y | |

Appendix A 6.13 ReadBoolParameter

| If Supported | MC_ReadBoolParameter_BkPlcM | Sup. Y/N | Comments |
|--------------|-----------------------------|----------|----------|
| VAR_IN_OUT | | | |
| B | Axis | Y | |
| VAR_INPUT | | | |
| B | Enable | Y | |
| B | ParameterNumber | Y | |
| VAR_OUTPUT | | | |
| V | Busy | Y | |
| B | Done | Y | |
| B | Error | Y | |
| E | ErrorID | Y | |
| B | Value | Y | |

| Name | B/E | R/W | Supp. Y/N | Comments |
|------------------------|-----|-----|-----------|----------|
| CommandedPosition | B | R | Y | |
| SWLimitPos | E | R/W | Y | |
| SWLimitNeg | E | R/W | Y | |
| EnableLimitPos | E | R/W | Y | |
| EnableLimitNeg | E | R/W | Y | |
| EnablePosLagMonitoring | E | R/W | Y | |
| MaxPositionLag | E | R/W | Y | |
| MaxVelocitySystem | E | R | Y | |
| MaxVelocityAppl | B | R/W | Y | |
| ActualVelocity | B | R | Y | |
| CommandedVelocity | B | R | Y | |
| MaxAccelerationSystem | E | R | Y | |
| MaxAccelerationAppl | E | R/W | N | |
| MaxDecelerationSystem | E | R | Y | |
| MaxDecelerationAppl | E | R/W | N | |
| MaxJerk | E | R/W | N | |

Table 4: Parameters for ReadParameter and WriteParameter

Appendix A 6.14 WriteParameter

| If Supported | MC_WriteParameter_BkPlcM | Sup. Y/N | Comments |
|--------------|--------------------------|----------|----------|
| VAR_IN_OUT | | | |
| B | Axis | Y | |
| VAR_INPUT | | | |
| B | Execute | Y | |
| B | ParameterNumber | Y | |
| B | Value | Y | |
| VAR_OUTPUT | | | |
| V | Busy | Y | |
| B | Done | Y | |
| B | Error | Y | |
| E | ErrorID | Y | |

Appendix A 6.15 WriteBoolParameter

| If Supported | MC_WriteBoolParameter_BkPlcM | Sup. Y/N | Comments |
|--------------|------------------------------|----------|----------|
| VAR_IN_OUT | | | |
| B | Axis | Y | |
| VAR_INPUT | | | |
| B | Execute | Y | |
| B | ParameterNumber | Y | |
| B | Value | Y | |
| VAR_OUTPUT | | | |
| V | Busy | Y | |
| B | Done | Y | |
| B | Error | Y | |
| E | ErrorID | Y | |

Appendix A 6.16 ReadActualPosition

| If Supported | MC_ReadActualPosition_BkPlcM | Sup. Y/N | Comments |
|--------------|------------------------------|----------|----------|
| VAR_IN_OUT | | | |
| B | Axis | Y | |
| VAR_INPUT | | | |
| B | Enable | Y | |
| VAR_OUTPUT | | | |
| V | Busy | Y | |
| B | Done | Y | |
| B | Error | Y | |
| E | ErrorID | Y | |
| B | Position | Y | |

Appendix A 6.20 CamTableSelect

| If Supported | MC_CamTableSelect_BkPlcM | Sup. Y/N | Comments |
|--------------|--------------------------|----------|------------|
| VAR_IN_OUT | | | |
| B | Master | Y | |
| B | Slave | Y | |
| B | CamTable | Y | |
| VAR_INPUT | | | |
| B | Execute | Y | |
| E | Periodic | Y | |
| E | MasterAbsolute | Y | |
| E | SlaveAbsolute | Y | |
| VAR_OUTPUT | | | |
| V | Busy | Y | |
| B | Done | Y | |
| B | Error | Y | |
| E | ErrorID | Y | |
| E | CamTableID | Y | VAR_IN_OUT |

Appendix A 6.21 CamIn

| If Supported | MC_CamIn_BkPlcM | Sup. Y/N | Comments |
|--------------|-----------------|----------|----------|
| VAR_IN_OUT | | | |
| B | Master | Y | |
| B | Slave | Y | |
| VAR_INPUT | | | |
| B | Execute | Y | |
| E | MasterOffset | Y | |
| E | SlaveOffset | Y | |
| E | MasterScaling | Y | |
| E | SlaveScaling | Y | |
| E | StartMode | Y | |
| E | CamTableID | Y | |
| VAR_OUTPUT | | | |
| V | Busy | Y | |
| B | InSync | Y | |
| E | CommandAborted | Y | |
| B | Error | Y | |
| E | ErrorID | Y | |
| E | EndOfProfile | Y | |

Appendix A 6.22 CamOut

| If Supported | MC_CamOut_BkPlcM | Sup. Y/N | Comments |
|--------------|------------------|----------|----------|
| VAR_IN_OUT | | | |
| B | Slave | Y | |
| VAR_INPUT | | | |
| B | Execute | Y | |
| VAR_OUTPUT | | | |
| V | Busy | Y | |
| B | Done | Y | |
| B | Error | Y | |
| E | ErrorID | Y | |

Appendix A 6.23 GearIn

| If Supported | MC_GearIn_BkPlcM | Sup. Y/N | Comments |
|--------------|------------------|----------|----------|
| VAR_IN_OUT | | | |
| B | Master | Y | |
| B | Slave | Y | |
| VAR_INPUT | | | |
| B | Execute | Y | |
| B | RatioNumerator | Y | |
| B | RatioDenominator | Y | |
| E | Acceleration | N | |
| E | Deceleration | N | |
| E | Jerk | N | |
| VAR_OUTPUT | | | |
| V | Busy | Y | |
| B | InGear | Y | |
| E | CommandAborted | Y | |
| B | Error | Y | |
| E | ErrorID | Y | |

Appendix A 6.24 GearOut

| If Supported | MC_GearOut_BkPlcM | Sup. Y/N | Comments |
|--------------|-------------------|----------|----------|
| VAR_IN_OUT | | | |
| B | Slave | Y | |
| VAR_INPUT | | | |
| B | Execute | Y | |
| VAR_OUTPUT | | | |
| V | Busy | Y | |
| B | Done | Y | |
| B | Error | Y | |
| E | ErrorID | Y | |

The PLCopen Motion Control Logo and Its Usage

For quick identification of compliant products, PLCopen has developed a logo for the motion control Function Blocks:



Figure 1: The PLCopen Motion Control Logo

This motion control logo is owned and trademarked by PLCopen.

In order to use this logo free-of-charge, the relevant company has to fulfill all the following requirements:

1. the company has to be a voting member of PLCopen;
2. the company has to comply to the existing specification, as specified by the PLCopen Task Force Motion Control, and as published by PLCopen, and of which this statement is a part;
3. this compliance is done in written form by the company to PLCopen, clearly stating the applicable software package and the supporting elements of all the specified tables, as specified in the document itself;
4. in case of non-fulfillment, which has to be decided by PLCopen, the company will receive a statement on this from PLCopen in written form. The company will have a one month period to either adopt their software package in such a way that it complies, represented by the issuing of a new compliance statement, or remove all reference to the specification, including the use of the logo, from all their specification, be it technical or promotional material;
5. the logo has to be used as is - meaning the full logo. it may be altered in size as long as the original scale and color setting is kept.
6. the logo has to be used in the context of Motion Control.