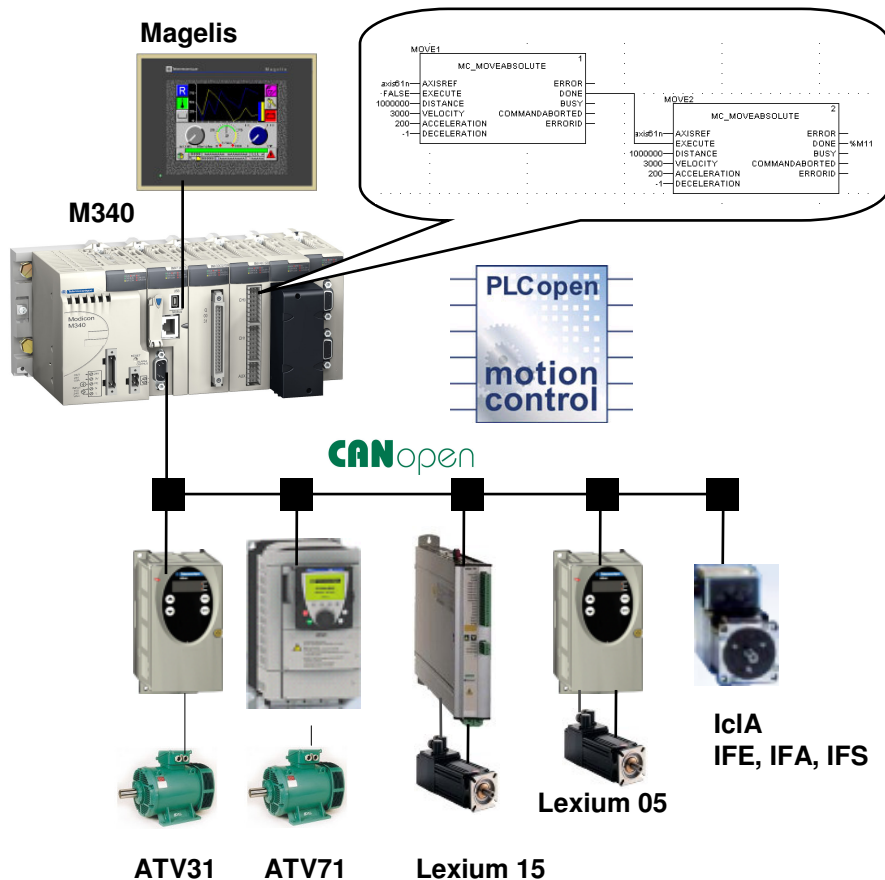


Modicon M340 – CanOpen.

Exemplo de comunicação CanOpen utilizando a biblioteca
PLC Open - MFB (Motion Function Block) com ATV31.

Modicon M340 – UnityPro

• PLC Open – Motion Control:



MFB (Motion Function Blocks) is a library of function blocks integrated in Unity Pro used to set up motion control in the architectures of drives and servo drives on machine buses and CANopen installations:

- Altivar 31: For asynchronous motors from 0.18 to 15 kW
- Altivar 71: For asynchronous motors from 0.37 to 500 kW
- Lexium 05: For servo motors from 0.4 to 6 kW
- Lexium 15LP/MP/HP: For BSH and BDH servo motors from 0.9 to 42.5 kW
- Lexium 17D: For BPH, BPL and SER servo motors from 1.5 to 70 A rms (1)
- IclA IFA/IFE/IFS: For integrated motor drives from 0.05 to 0.25 kW

In compliance with PLCopen specifications, the MFB library allows both easy and flexible motion programming with Unity Pro, as well as axis diagnosis. In maintenance operations, drives can be replaced quickly and safely thanks to drive parameter download blocks.

Setting up drives on the CANopen network is facilitated through Motion Tree Manager organization in the Unity Pro browser, making it easy for users to access the application drives.

The features of the Motion Function Blocks library are particularly suitable for machines with independent axes. In the case of these modular/special machines, MFB function blocks are the perfect solution for controlling single axes. The following are typical applications for this type of architecture:

- Automatic storage/removal
- Handling
- Palletizers/depalletizers
- Conveyors
- Packaging, simple label application
- Grouping/ungrouping
- Adjustment axes in flexible machines, etc.

Modicon M340 – UnityPro

• Funções disponíveis e compatibilidades:



Functions

The table below lists the function blocks of the MFB library and the drives compatible with them. The prefix indicates the block family:

- MC: Function block defined by the Motion Function Blocks PLCopen standard
- TE: Function block specific to Telemecanique products
- Lxm: Function block specific to Lexium servo drives

Type	Function	Function block	Altivar 31	Altivar 71	Lexium 05	Lexium 15 HP/MP/LP	Lexium 17D (1)	IclA IFA/ IFE/IFS
Management and motion	Read an internal parameter	MC_ReadParameter						
	Write an internal parameter	MC_WriteParameter						
	Read the current position	MC_ReadActualPosition						
	Read the instantaneous speed	MC_ReadActualVelocity						
	Acknowledge error messages	MC_Reset						
	Stop all active movement	MC_Stop						
	Axis coming to standstill	MC_Power						
	Movement to absolute position	MC_MoveAbsolute						
	Relative movement	MC_MoveRelative						
	Additional movement	MC_MoveAdditive						
	Homing	MC_Home						
	Movement at given speed	MC_MoveVelocity						
	Read diagnostic data	MC_ReadAxisError						
	Read servo drive status	MC_ReadStatus						
	Torque Control command	MC_TorqueControl						
	Reading of actual torque value command	MC_ReadActualTorque						
	Manual move command	MC_Jog				Except LP		
Save and restore parameters (FDR)	Read all parameters and store in PLC memory	TE_UploadDriveParam						
	Write all parameters from the PLC memory	TE_DownloadDriveParam						
Advanced Lexium functions	Set the reduction ratio	Lxm_GearPos						
	Read a motion task	Lxm_UploadMTask						
	Write a motion task	Lxm_DownloadMTask						
	Start a motion task	Lxm_StartMTask						
System	Communication with the servo drive	TE_CAN_Handler						

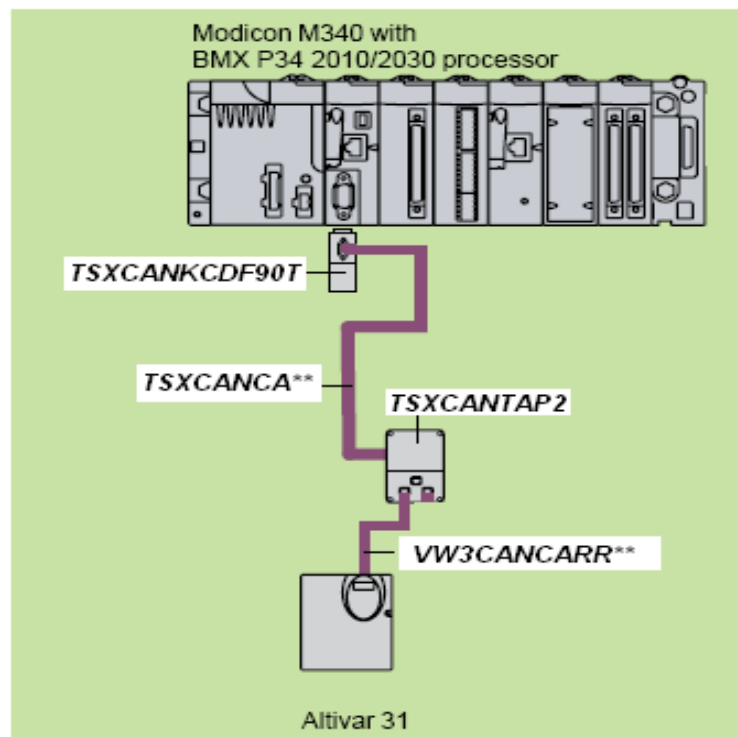
Compatible

(1) Lexium 17D supported by MFB with Modicon Premium platform only.

Arquitetura

- Rede CanOpen:

CANopen bus wiring system



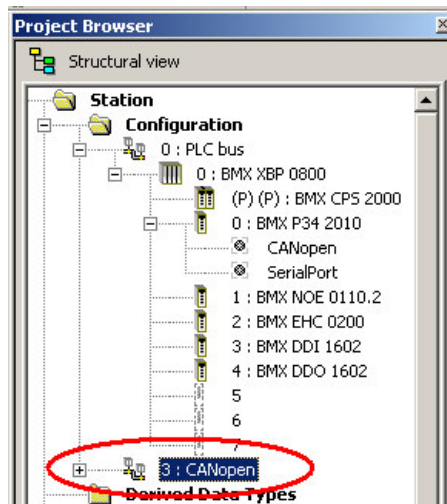
Modicon M340 automation platform

CANopen machine and installation bus
Wiring system

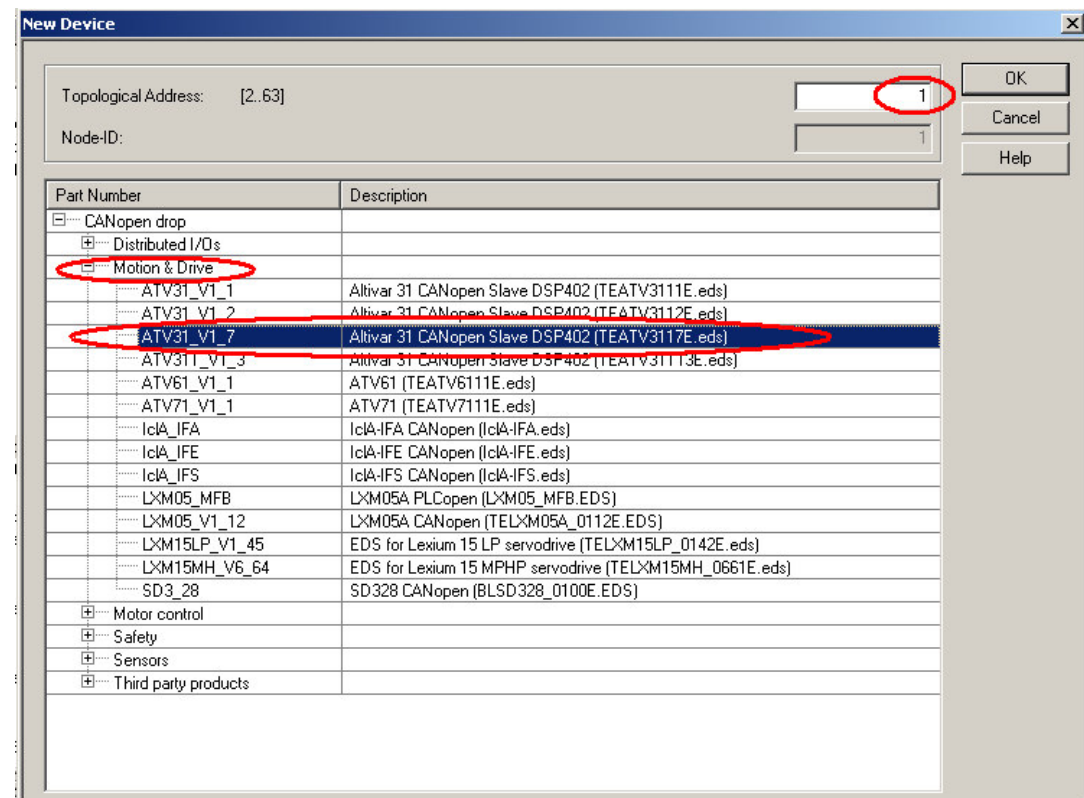
IP 20 connectors	90° angled	TSX CAN KCDF 90T
CANopen female 9-way SUB-D.	Straight (2)	TSX CAN KCDF 180T
Switch for line termination	90° angled with 9-way SUB-D for connecting a PC or diagnostic tool	TSX CAN KCDF 90TP
IP 20 CANopen tap junctions for Altivar and Lexium 05	2 RJ45 ports	VW3 CAN TAP2
CANopen cables (AWG 24)	Standard, CE marking: low smoke. Halogen-free. Flame-retardant (IEC 60332-1)	50 m TSX CAN CA50
		100 m TSX CAN CA100
		300 m TSX CAN CA300
Preformed CANopen cordsets for Altivar and Lexium 05 drives	One RJ45 connector at each end	0.3 m VW3 CAN CARR03
		1 m VW3 CAN CARR1

Modicon M340 – UnityPro

- Configuração de rede:

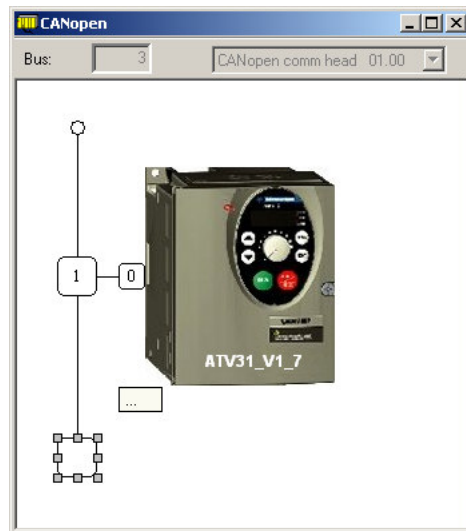


Selecione-se o arquivo ***.eds** de configuração corresponde ao modelo do ATV31.

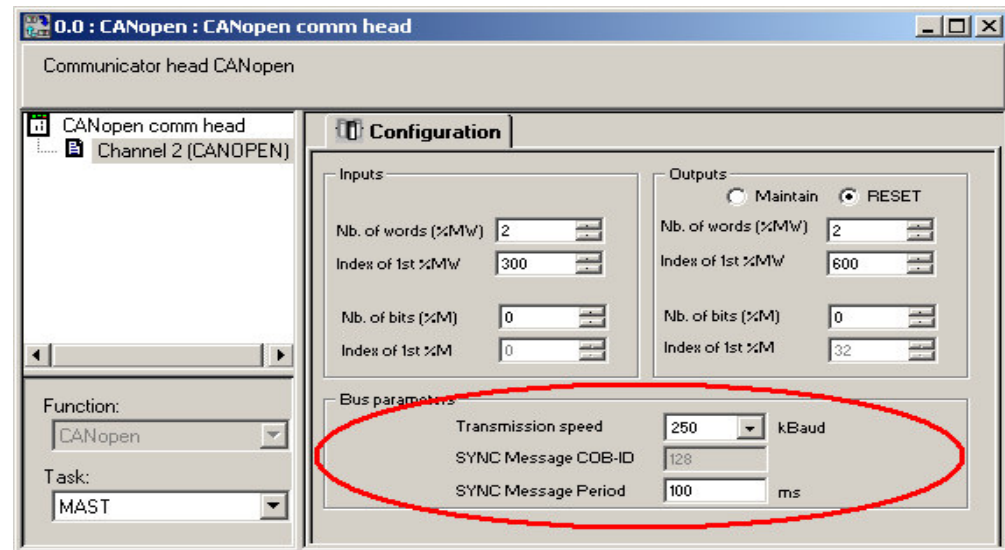
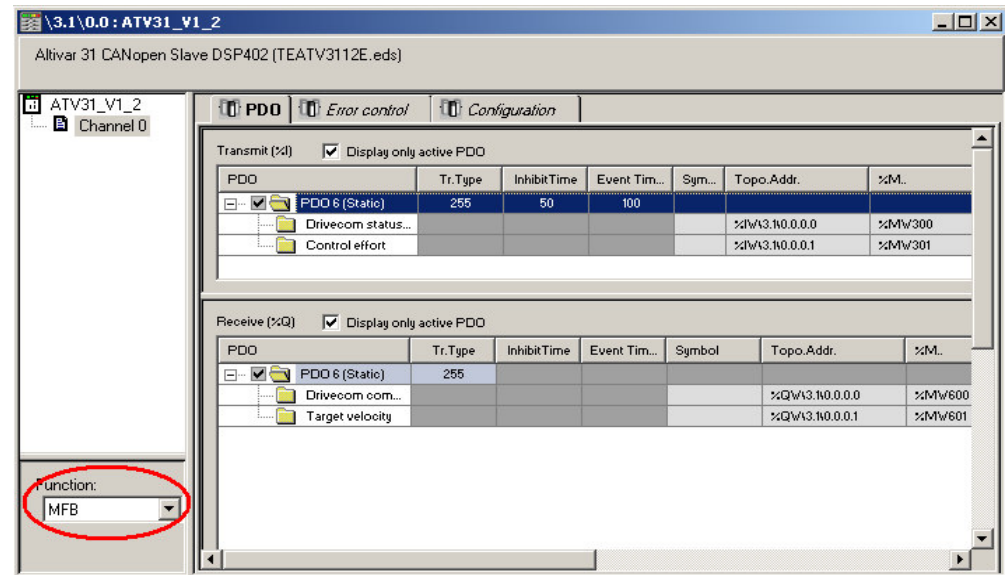


Modicon M340 – UnityPro

- Configuração de rede:



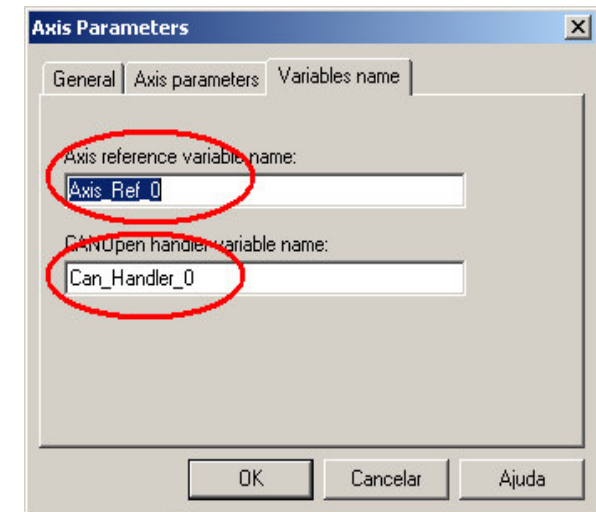
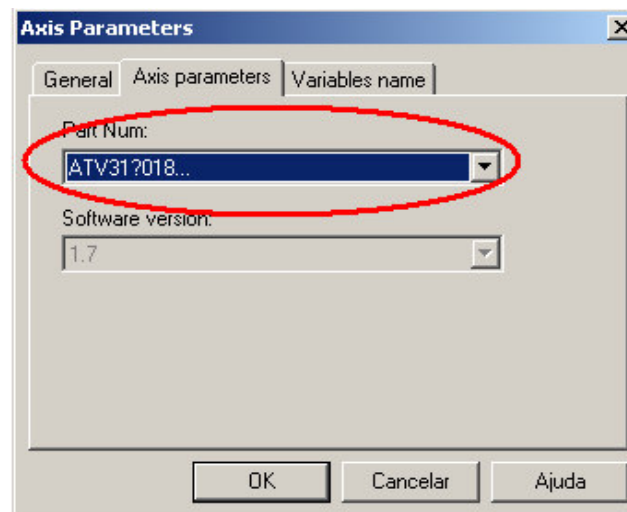
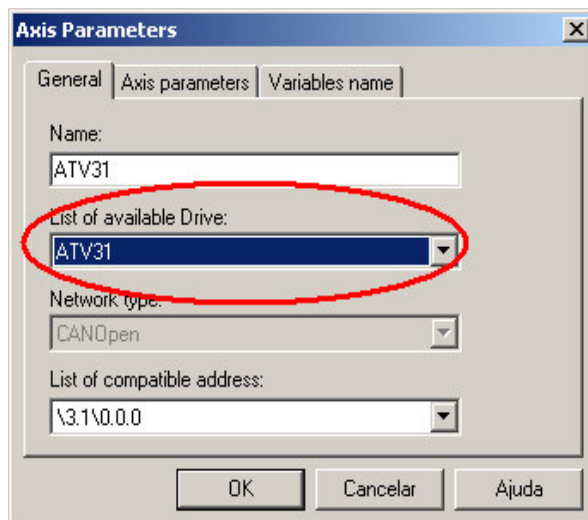
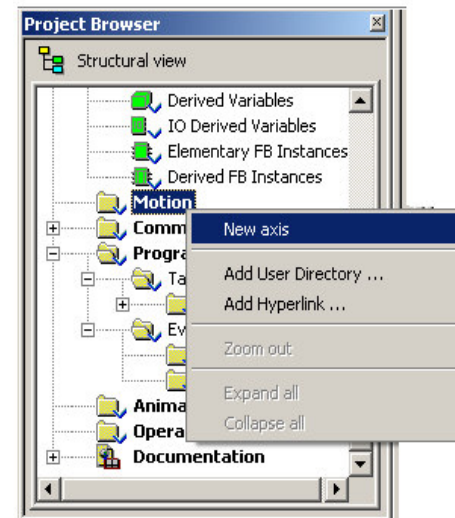
A função MFB permite utilizar a biblioteca PLC Open dedicada para Motion.



Modicon M340 – UnityPro

- Configuração do eixo:

Cria-se um novo eixo associado ao modelo de drive utilizado na configuração da rede CanOpen, neste caso ATV31 configurando o calibre do drive.



Modicon M340 – UnityPro

- IODDT para comunicação CanOpen:

The first screenshot shows the Project Browser with the 'IO Derived Variables' folder highlighted. The second screenshot shows the Data Editor table with the 'T_COM_CO_BMX' variable highlighted. The third screenshot shows the Data Editor table with the 'Can_Handler_0' variable highlighted.

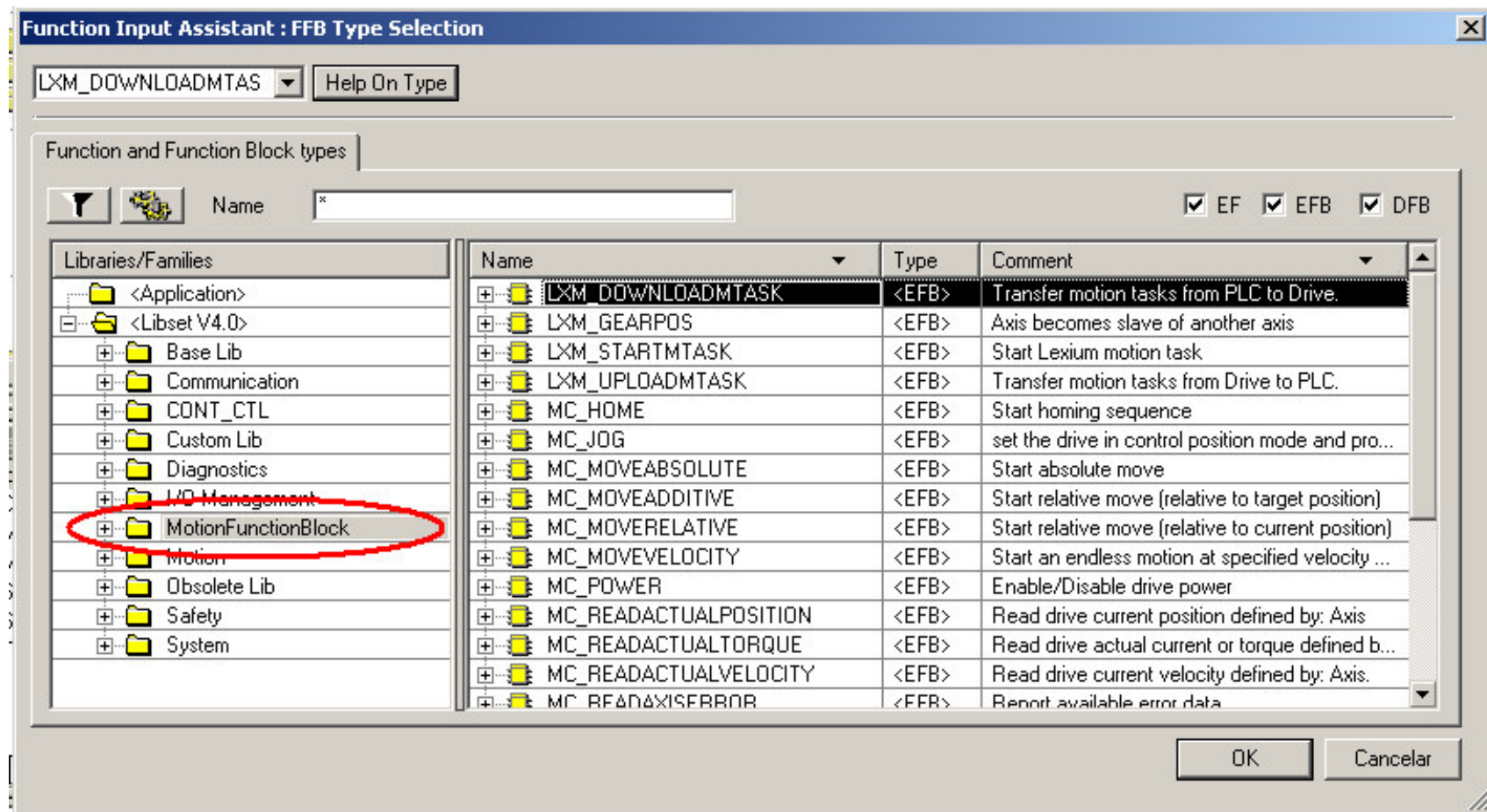
Name	Type	Address
CANOPEN	T_COM_CO_BMX	%CH0.0.2
CH_ERROR	BOOL	%I0.0.2.ERR
COMM_STS	INT	%IW0.0.2.0
CAN_STS	INT	%IW0.0.2.1
EVT_STS	INT	%IW0.0.2.2
SLAVE_ASSIGNED_1_16	INT	%IW0.0.2.3
SLAVE_ASSIGNED_17_32	INT	%IW0.0.2.4
SLAVE_ASSIGNED_33_48	INT	%IW0.0.2.5
SLAVE_ASSIGNED_49_63	INT	%IW0.0.2.6
SLAVE_CONF_1_16	INT	%IW0.0.2.11
SLAVE_CONF_17_32	INT	%IW0.0.2.12
SLAVE_CONF_33_48	INT	%IW0.0.2.13
SLAVE_CONF_49_63	INT	%IW0.0.2.14
SLAVE_FLT_1_16	INT	%IW0.0.2.19
SLAVE_FLT_17_32	INT	%IW0.0.2.20
SLAVE_FLT_33_48	INT	%IW0.0.2.21
SLAVE_FLT_49_63	INT	%IW0.0.2.22
SLAVE_EMCY_1_16	INT	%IW0.0.2.27
SLAVE_EMCY_17_32	INT	%IW0.0.2.28
SLAVE_EMCY_33_48	INT	%IW0.0.2.29
SLAVE_EMCY_49_63	INT	%IW0.0.2.30

Name	no.	Type	Value
Can_Handler_0		CAN_HANDLER	
<inputs>			
<outputs>			
<inputs/outputs>			
<public>			

A função de hardware T_COM_CO_BMX monitora os parâmetros de funcionamento da rede CanOpen (erros de comunicação, escravos ativos, etc). O bloco CAN_HANDLER gerencia a interação entre a rede e o eixo.

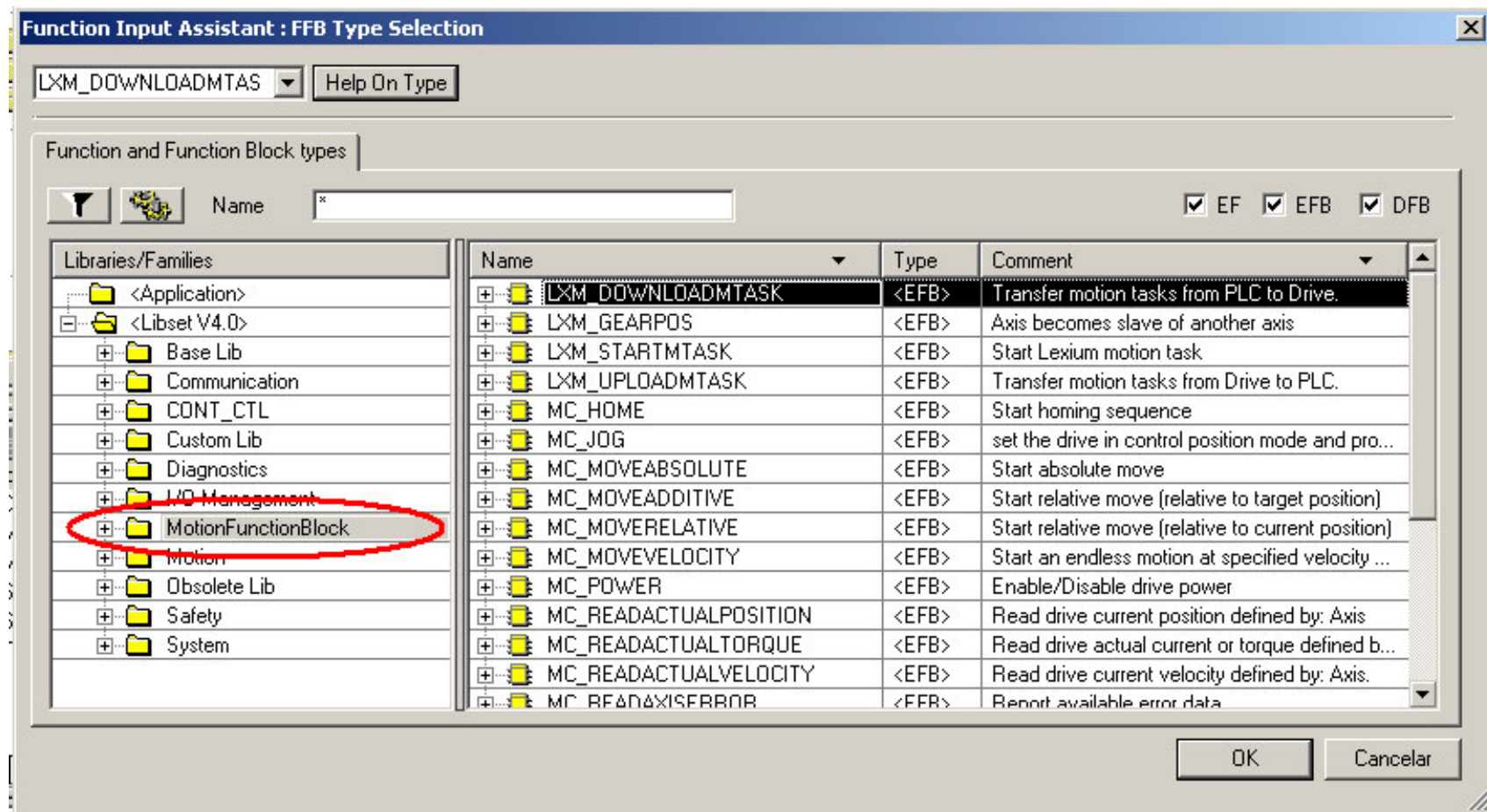
Modicon M340 – UnityPro

- Seleção da biblioteca MFB (Motion Function Block):



Modicon M340 – UnityPro

- Seleção da biblioteca MFB (Motion Function Block):



Modicon M340 – UnityPro

● MFB – CAN_HANDLER:

Description of the Input Parameters

The following table describes the input parameter that is in addition to the [basic parameters](#):

Parameter	Type	Comment
NetworkOperational	BOOL	Correct operation of the CANopen bus' equation result.

Note: Assignment of this parameter is left to the discretion of the developer. It depends on the CANopen bus management philosophy.

It is recommended to use an object (or an equation) taken from the IODDT of the TSX CPP110 card (type T_COM_CPP110) for Premium and of the Modicon M340 CANopen port (type T_COM_CO_BMX). For example, it is possible to assign the SLAVE_ACTIV_X bit taken from the IODDT T_COM_CPP110 (where X is the device's CANopen address).

Description of the Output Parameters

The following table describes the output parameter that is in addition to the [basic parameters](#):

Parameter	Type	Comment
AxisReady	BOOL	The software configuration is consistent with the current hardware configuration and the CANopen bus is OK.

● MFB – MC_POWER:

Description of the Output Parameters

The following table describes the output parameter that is in addition to the [basic parameters](#):

Parameter	Type	Comment
Status	BOOL	If Status is set to TRUE, the status is Standstill . If Status is set to FALSE, the status is Disabled .

Modicon M340 – UnityPro

● MFB – MC_RESET:

Description of the Standard Input Parameters

The following table describes the input parameters:

Parameter	Type	Comment
Axis	AXIS_REF	Axis Ref type object, which defines the device
Enable	BOOL	When Enable is TRUE, the parameters are taken into account and the function is executed. As soon as Enable is FALSE, the output parameters, Error, Done and CommandAborted, are immediately set to FALSE.
Execute	BOOL	On an Execute rising edge, the parameters are taken into account and the function is executed. When Execute is TRUE, the output parameters, Error, Done, CommandAborted and Busy are controlled by the block. When Execute is FALSE, the Busy output parameter is TRUE until the end of the block execution. As soon as one of the Error, Done, Or CommandAborted output parameters changes to TRUE, they all become FALSE.

Description of the Standard Output Parameters

The following table describes the output parameters:

Parameter	Type	Comment
Error	BOOL	Error is TRUE when an execution error is detected by the function block.
Done	BOOL	Done is TRUE when the execution of the function is completed.
Valid	BOOL	Valid is TRUE when the others are enabled.
Busy	BOOL	Busy is TRUE to indicate that the execution of the function block is in progress. Busy is set to TRUE when Execute switches to TRUE (on a rising edge), and is set to FALSE when one of the following status values, Done, Error, or CommandAborted switches to TRUE.
ErrorId	INT	Error identifier.
CommandAborted	BOOL	CommandAborted is TRUE when the execution of the block is cancelled. This cancellation is due to the execution of another command.

Modicon M340 – UnityPro

● MFB – MC_STOP:

Stop on Z Axis

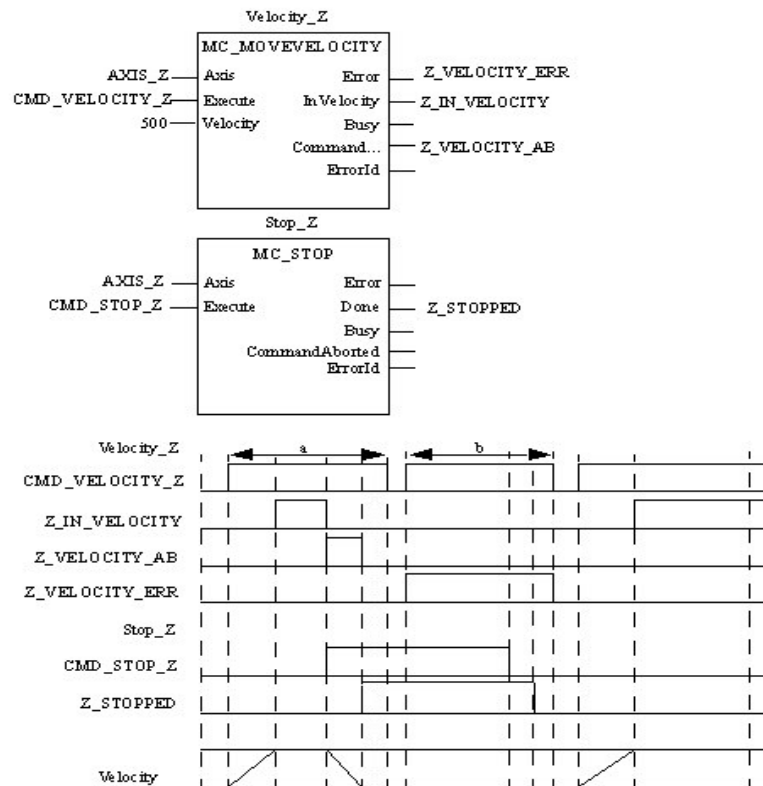
The example below shows how the MC_STOP behaves in combination with MC_MOVEVELOCITY.

The graph below shows the timing chart for the example with:

a) A rotating axis stopped with an MC_Stop MFB

b) The axis rejects the move command when the Execute parameter of the MC_STOP block equals 1. The MC_MOVEVELOCITY MFB raises an error indicating that the MC_STOP command is active.

The graph below shows the timing chart for stopping the axis:



Modicon M340 – UnityPro

- MFB – MC_MOVEVELOCITY:

Function Description

The MC_MOVEVELOCITY function is used to execute an endless move command at a given speed. To use this function, the current axis state must be used to execute an endless move command at a given speed. To use this function, the current axis state must be continuous or StandStill.

Description of the Input Parameters

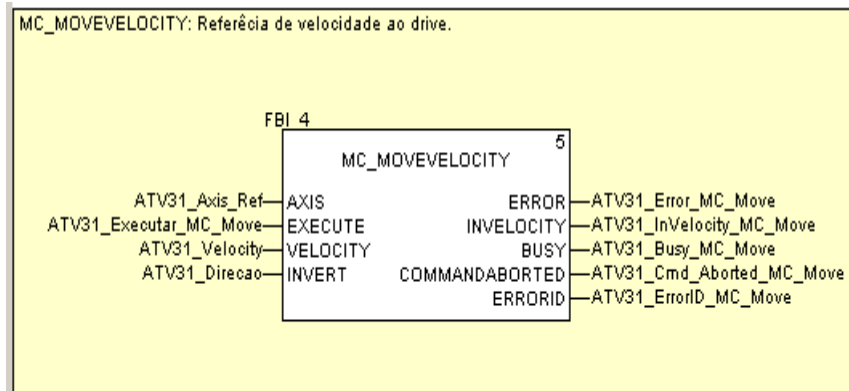
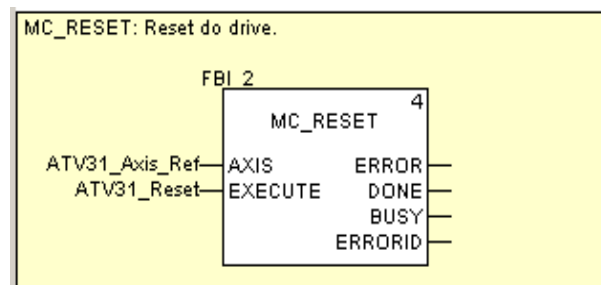
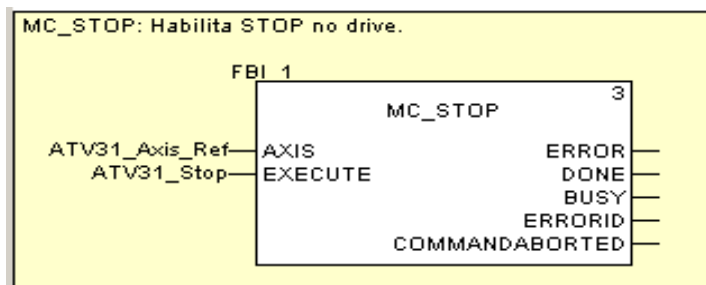
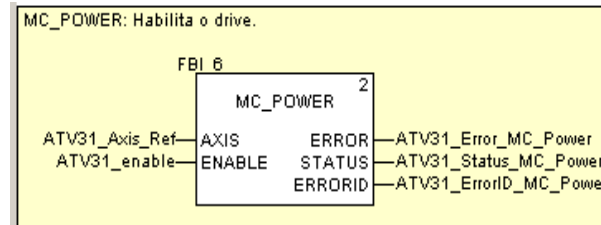
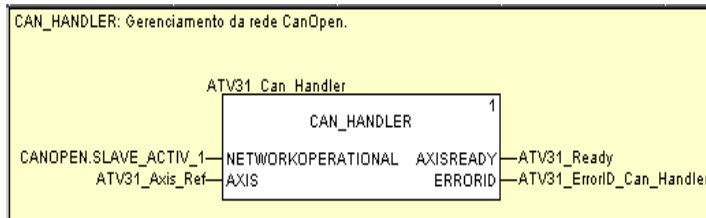
Parameter	Type	Comment
Velocity	DINT	Speed value. For ICLA or ATV31 servodrives, the Velocity parameter is used as INT type.
Invert	Bool	Direction of rotation. If Invert is set to TRUE, the direction is the inverse of the Velocity sign. When Invert is set to FALSE, the direction is that of the Velocity.

Description of the Output Parameters

Parameter	Type	Comment
InVelocity	BOOL	InVelocity is TRUE when the Velocity speed is reached, otherwise it remains set to FALSE.

Modicon M340 – UnityPro

• Programação – Habilitação e movimentação.



Observação:

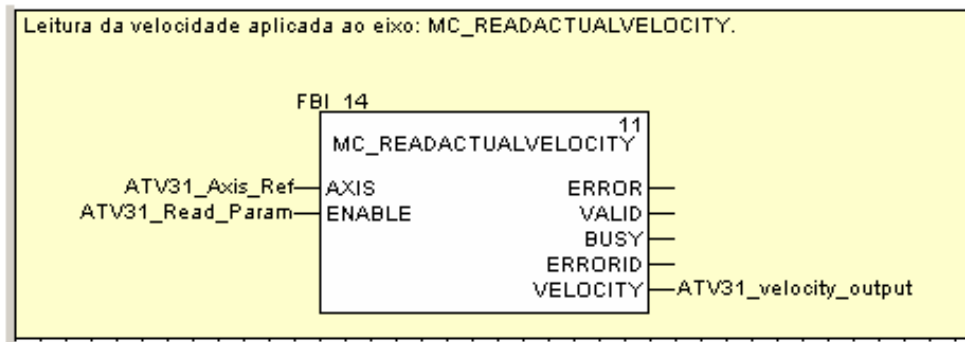
Invert = 0 e Execute 0->1 rotação no sentido do sinal do valor de Velocity
 Invert = 1 e Execute 0->1 rotação no sentido oposto do sinal do valor de Velocity

Modicon M340 – UnityPro

- Programação – Leitura de velocidade e torque.

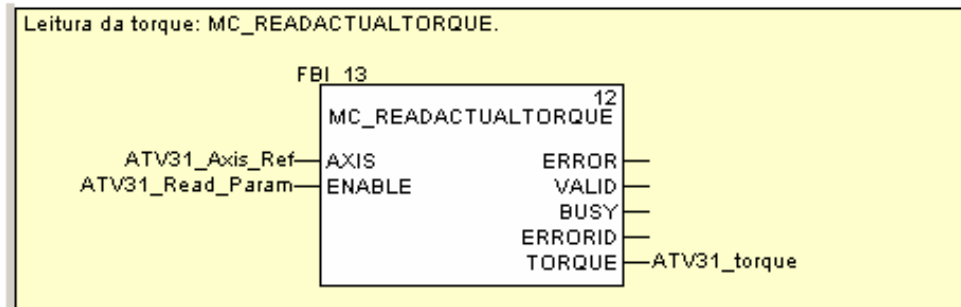
Function Description

The MC_READACTUALVELOCITY function is used to determine the current speed of the axis.



Function Description

The MC_ReadActualTorque function is used to return the current torque.



Modicon M340 – UnityPro

• Programação – Leitura de parâmetros via SDO.

Function Description

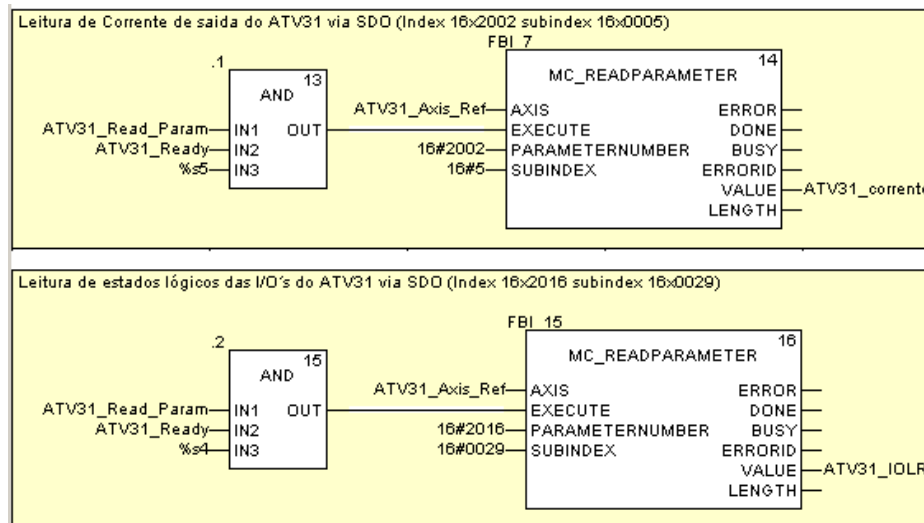
The MC_READPARAMETER function is used to read, via Service Data Object (SDO) messaging, a variable in the servodrive defined by the Axis parameter.

Description of the Input Parameters

Parameter	Type	Comment
ParameterNumber	UINT	CANopen Index number.
SubIndex	UINT	CANopen sub-index number.

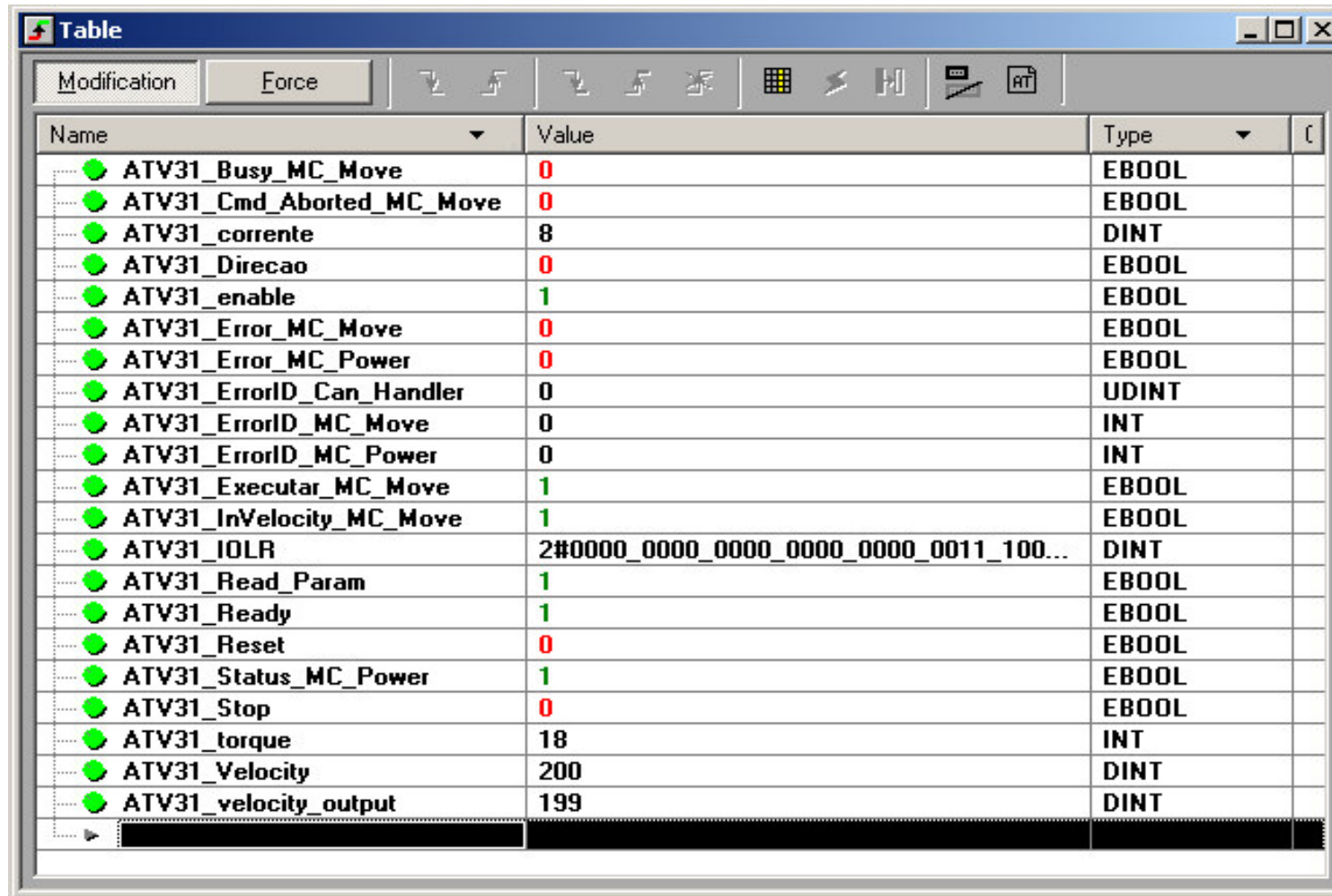
Description of the Output Parameters

Parameter	Type	Comment
Value	DINT	Value read.
Length	UINT	Length in bytes of the value read.



Modicon M340 – UnityPro

- Animation Tables:



Name	Value	Type
ATV31_Busy_MC_Move	0	EBOOL
ATV31_Cmd_Aborted_MC_Move	0	EBOOL
ATV31_corrente	8	DINT
ATV31_Direcao	0	EBOOL
ATV31_enable	1	EBOOL
ATV31_Error_MC_Move	0	EBOOL
ATV31_Error_MC_Power	0	EBOOL
ATV31_ErrorID_Can_Handler	0	UDINT
ATV31_ErrorID_MC_Move	0	INT
ATV31_ErrorID_MC_Power	0	INT
ATV31_Executar_MC_Move	1	EBOOL
ATV31_InVelocity_MC_Move	1	EBOOL
ATV31_IOLR	2#0000_0000_0000_0000_0000_0011_100...	DINT
ATV31_Read_Param	1	EBOOL
ATV31_Ready	1	EBOOL
ATV31_Reset	0	EBOOL
ATV31_Status_MC_Power	1	EBOOL
ATV31_Stop	0	EBOOL
ATV31_torque	18	INT
ATV31_Velocity	200	DINT
ATV31_velocity_output	199	DINT

Altivar 31

- Leitura da corrente do motor via PDO (LCR):

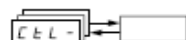
Modbus address	CANopen address	Code	Read/Write	Name/Description/Possible values
3204	2002 / 5	LCr	R	Current in the motor Unit: 0.1 A

- Leitura do valor das entradas digitais ATV31 via SDO (IOLR):

Modbus address	CANopen address	Code	Read/Write	Name/Description/Possible values
5240	2016 / 29	IOLR	R/W	Value of logic I/O (0 = inactive, 1 = active) bits 0 to 7: Not accessible in write mode bit 8: Value of "R1" relay output, accessible in write mode if R1 is not assigned bit 9: Value of "R2" relay output, accessible in write mode if R2 is not assigned bit 10: Value of "LO" logic output, accessible in write mode if LO is not assigned bits 11 to 13: Reserved bit 14: Not accessible in write mode bit 15: Reserved

Altivar 31

• Comando e referência via CanOpen:



Código	Descrição	Faixa de ajuste	Regulagem de fábrica
LAC	Nível de acesso às funções L1: Acesso às funções standard. Este nível permite principalmente a intercambiabilidade com o ATV28. L2: Acesso às funções avançadas no menu FUN-: - +/- Velocidade (potenciômetro motorizado) - Lógica de freio - Comutação da 2ª limitação de corrente - Comutação de motores - Controle de fins de curso - L3: Acesso às funções avançadas e gestão dos modos de comandos mistos. A configuração de LAC a L3 provoca um retorno às regulagens de fábrica dos parâmetros Fr1 (abaixo), Cd1 (página 59) e tCC (página 48). Este último forçado a "2C" no ATV31...A. O retorno de L3 a L2 ou L1 e o retorno de L2 a L1 somente podem ser efetuados por uma "regulagem de fábrica" por FCS (página 61). Para validar a mudança de configuração de LAC, é necessário pressionar continuamente por 2 segundos a tecla "ENT".		L1
Fr1	Configuração de referência 1 Fr11: Entrada analógica AI1 Fr12: Entrada analógica AI2 Fr13: Entrada analógica AI3 Fr1P: Potenciômetro (somente ATV31...A) Se LAC = L2 ou L3, as seguintes configurações adicionais são possíveis: UPdL: (1) + Velocidade/- Velocidade por LI UPdH: (1) + Velocidade/- Velocidade pelas teclas ▲ ▼ do teclado do ATV31 ou ATV31...A ou do terminal remoto. Para utilização, visualizar a frequência rFr (ver página 90) Se LAC = L3, as seguintes configurações adicionais são possíveis: LrC: Referência pelo terminal remoto, parâmetro LFr do menu SET- página 40. MdL: Referência por Modbus Can: Referência por CANopen		AI1 AIP para ATV31...A
CHCF	Modo misto (canais de comando separados dos canais de referência) Acessíveis se LAC = L3 SLP: Não separados SEP: Separados		SIM
Cd1	Configuração do canal de comando 1 Acessíveis se CHCF = SEP e LAC = L3 tEr: Comando da borneira LrC: Comando do teclado (somente ATV31...A) LrT: Comando do terminal remoto MdL: Comando por Modbus Can: Comando por CAN		tEr LOC para ATV31...A

Altivar 31

• Lógica de freio:



Código	Descrição	Faixa de ajuste	Regulagem de fábrica
b L C -	Lógica de freio Função acessível somente se LAC = L2 ou L3 (página 58).		
b L C	Configuração da lógica de freio n O: Não configurada r 2: Relé R2 d O: Saída lógica AOC Se bLC estiver configurada, os parâmetros FLr (página 86) e brA (página 63) serão forçados a nO, e o parâmetro OPL (página 86) será forçado a YES.		nO
b r L	Frequência de abertura do freio	0,0 a 10,0 Hz	Segundo o calibre do inversor
I b r	Nível de corrente do motor para abertura do freio	0 a 1,36 In (1)	Segundo o calibre do inversor
b r t	Tempo de abertura do freio	0 a 5 s	0,5 s
L S P	Velocidade mínima Frequência do motor com referência mínima. Este parâmetro é também modificável no menu SET- (página 41).	0 a HSP (página 41)	0 Hz
b E n	Nível de frequência de fechamento do freio n O: Não ajustado 0 to LSP: Faixa de regulação em Hz Se bLC estiver configurada e que bEn continua igual a nO, o inversor travar-se-á com a falha bLF no primeiro comando de marcha.	nO - 0 a LSP	nO
b E t	Tempo de fechamento do freio	0 a 5 s	0,5s
b I P	Pulso de abertura do freio n O: O conjugado do motor durante a abertura do freio está no sentido de rotação comandado. Y E S: O conjugado do motor durante a abertura do freio está sempre no sentido avanço, qualquer que seja o sentido de rotação comandado.  Verificar que o sentido do conjugado do motor em comando "Avanço" corresponde ao sentido de subida da carga. Se necessário, inverter as duas fases do motor.		nO

(1) In corresponde à corrente nominal do inversor indicada no manual de instalação e na etiqueta de identificação do inversor.



Estes parâmetros somente aparecem se a função foi validada.