ABB machinery drives

Supplement
CAM control program for ACSM1 drives

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Related manuals

Drive hardware manuals and guides	Code (English)	
ACSM1-04 (0.75 to 45 kW) drive modules hardware manual	*3AFE68797543*	*1)*
ACSM1-04 (55 to 110 kW) drive modules hardware manual	*3AFE68912130*	*2)*
ACSM1-04Lx (55 to 132 kW) liquid-cooled drive modules hardware manual	*3AUA0000022083*	*1)*
ACSM1-04 drive modules system engineering manual	*3AFE68978297*	*2)*
ACSM1 control panel user's guide	*3AUA0000020131*	*2)*

Drive firmware manuals and guides		
ACSM1 Motion Control Program firmware manual	*3AFE68848270*	*1)*

Drive PC tool manuals		
DriveStudio user manual	*3AFE68749026*	*1)*
Solution program composer user manual	*3AFE68836590*	*1)*
DriveCam user guide	*3AUA0000024806*	*1)*

Option manuals and guides		
FIO-01 digital I/O extension user's manual	*3AFE68784921*	*4)*
FIO-11 analog I/O extension user's manual	*3AFE68784930*	*4)*
FEN-01 TTL encoder interface user's manual	*3AFE68784603*	*4)*
FEN-11 absolute encoder interface user's manual	*3AFE68784841*	*4)*
FEN-21 resolver interface user's manual	*3AFE68784859*	*4)*

1) Delivered as a printed copy with the drive or optional equipment.

2) Delivered as a printed copy with the drive if the order includes printed manuals.

3) Delivered as a printed copy with the control program.

4) Delivered as a printed copy with the control program if the order includes printed manuals.

All manuals are available in PDF format on the Internet. See section *Document library on the Internet* on the inside of the back cover.

CAM control program for ACSM1 drives

Supplement

3AUA0000036661 Rev A
EN
EFFECTIVE: 2011-02-01

Table of contents

Introduction to this supplement

This document is a supplement to *ACSM1 Motion Control Program Firmware Manual* (3AFE68848270 [English]). The supplement covers actual signals, parameters, the technology function block, and fault and alarm messages related to the CAM control program. For other information, refer to the *Firmware Manual*.

What this chapter contains

The chapter includes a description of the contents of the supplement. In addition, it contains information about the compatibility, safety and intended audience.

Compatibility

The supplement is compatible with the CAM control program for ACSM1 drives (UTCA1100 and UACA1100 and later).

Safety instructions

Follow all safety instructions delivered with the drive.

- Read the **complete safety instructions** before you install, commission, or use the drive. The complete safety instructions are given at the beginning of the drive *Hardware Manual* (see the list of related manuals on the inside cover, page 2).
- Read the **CAM control program specific warnings and notes** before changing the default settings of the parameters and functions. For each parameter, the warnings and notes are given in chapter *Actual signals and parameters*.
- Read the **firmware function block specific warnings and notes** before changing the default settings of the function. For each firmware function block, the warnings and notes are given in the drive *Firmware Manual* in the section describing the related user-adjustable parameters.

Intended audience

The reader of the supplement is expected to:

- know the standard electrical wiring practices, electronic components and electrical schematic symbols
- have a firm understanding of CAM principles.

Contents

The supplement consists of the following chapters:

- *Introduction to this supplement* describes the contents of this manual.
- *Application overview* gives a brief overview of the CAM application.
- *Start-up gives* instructions for commissioning the CAM application.
- *Default control connections* shows the default control connections of the JCU Control Unit.
- *Actual signals and parameters* describes the actual signals and parameters of the CAM application.
- *CAM technology function block* describes the technology function block and lists the associated input and output parameters and signals.
- *Fault tracing* lists the CAM-specific fault messages with the possible causes and remedies.
- *Control block diagrams* presents the application program page containing the CAM control program technology block.

Product and service inquiries

Address any inquiries about the product to your local ABB representative, quoting the type code and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to www.abb.com/drives and selecting *Drives – Sales, Support and Service network*.

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For information on ABB product training, navigate to www.abb.com/drives and select *Drives – Training courses*.

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Application overview

What this chapter contains

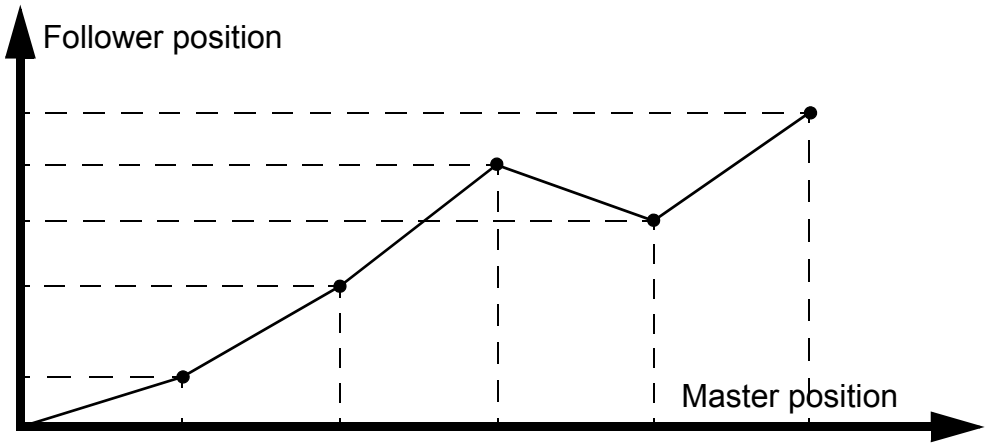
The chapter includes a brief overview of the CAM application and related terms.

CAM overview

The CAM application usually establishes a non-linear relationship between the master drive and follower drive where the CAM input corresponds to the master drive position and the CAM output corresponds to the follower drive position. The CAM application can also perform other functions like cyclic load compensation with torque feedforward control.

The relationship between master and follower position is given by a discrete user-programmable set of data points that is called CAM disk. Follower positions between the data points are determined through linear interpolation.

In the CAM technology block, CAM input is represented by the IN signal, and CAM output is represented by the OUT value. The technology block can be added in a synchron reference chain (for mechanical axis synchronization) or torque reference chain (cyclic load compensation), and the CAM control logic can be modified with additional function blocks and parameters.



CAM disk files

Use DriveCam or CAMtool to create and download CAM disk data.

DriveCam is a graphical user interface based tool. See DriveCam user guide (3AUA0000024806) for more information on DriveCam.

CAMtool is a command line tool that supports .csv import and export. CAMtool has integrated user instructions.

Note: The CAM technology block does not evaluate the downloaded data. Make sure that you download the correct CAM disk file for the application.

CAM features

CAM control

CAM enable

You can enable the CAM profile with CAM enable (ENA). If the CAM is not enabled, output data is unmodified input data. The command location is selected by parameter *80.01* CAM ENABLE.

CAM start

CAM output data calculation starts at the rising edge of CAM start (Start). The calculation ends when the maximum value of CAM input data is reached after descending edge of CAM start (the continuous mode) or after the maximum value of CAM input data is reached once (the single shot mode). The command location is selected by parameter *80.02* CAM START.

CAM preset

CAM preset sets the OUT value of the CAM technology function block. In the relative mode (see *Operation modes* on page *11*), the firmware presets the synchron reference chain to POS ACT during the start. Therefore, to avoid jerks and undesired error values in the controller, CAM preset may be needed in such applications.

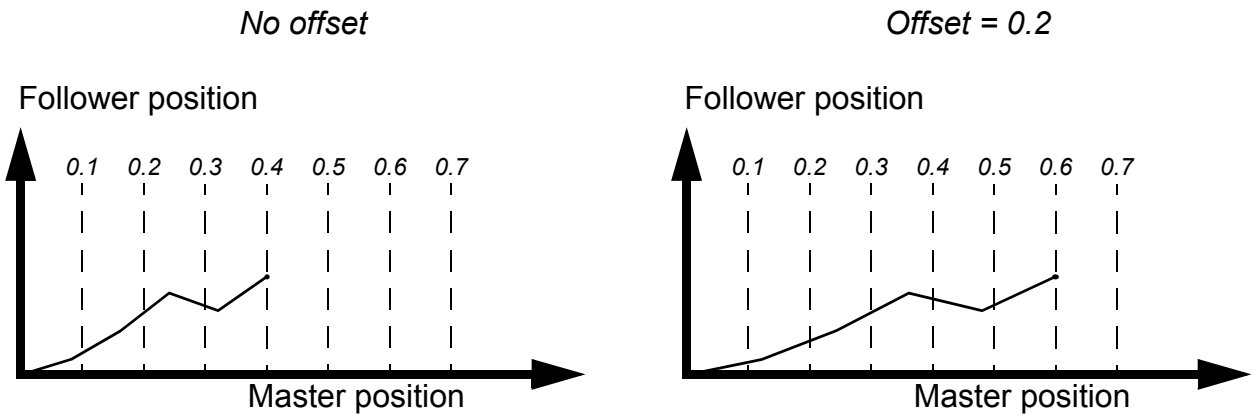
See parameters *5.06*, *80.04*, *80.05*, *80.06* and *80.07*.

CAM selector

You can change the CAM data table in use with parameter *80.03* CAM SELECTOR (Sel).

Online scaling adjustment

With offset to maximum input value (MaxOffs1…4), you can change the scaling between input and output. In the example below, an offset of 0.2 is used.



You can determine the maximum position offset values with parameters *80.08*…*80.11*.

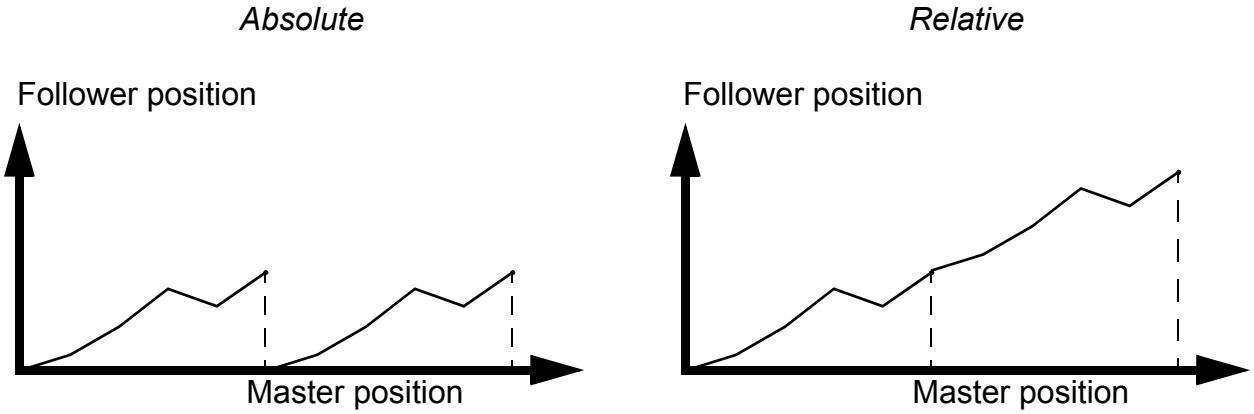
Operation modes

Operation modes determine the behavior of the CAM technology block after the end position of a CAM is reached. Like position data, operation modes are programmed in DriveCam or CAMtool, and are part of the CAM disk file.

Relative and absolute mode

In the relative mode, the follower position is relative to the end position of the previous CAM. In other words, the CAM output value is added to the previous end position to determine the follower position.

In the absolute mode, the follower position is reset each time a CAM is started.



Single shot and continuous

In the single shot mode, the CAM is run once when started. The follower remains at its end position until you give a new start command.

In the continuous mode, the CAM is run repeatedly as long as CAM enable and CAM start are active.

Auto-increment

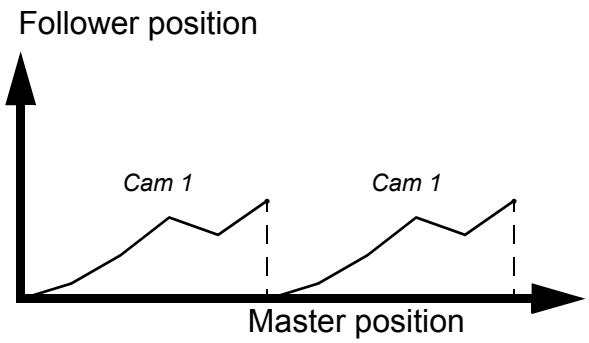
If the auto-increment mode is used with the continuous mode, the CAM control program automatically moves onto the next CAM in the profile when the end position is reached. If the end of the last CAM is reached, the first CAM in the profile is executed.

If the auto-increment mode is used with the single shot mode, the selected CAM is run once, but the selected CAM does not change automatically when the end position is reached. Instead, when CAM start is activated again, the next CAM is selected and run once.

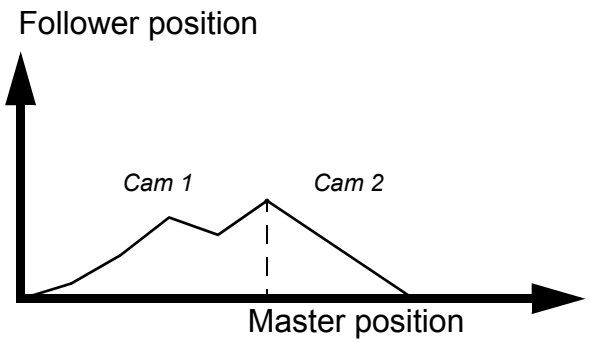
If the reference is negative and the beginning of a CAM is reached, the previous CAM is executed instead, and when the beginning of the first CAM is reached, the last CAM is executed.

If the auto-increment mode is not enabled, the selected CAM does not change after the end position is reached.

Auto-increment: Off



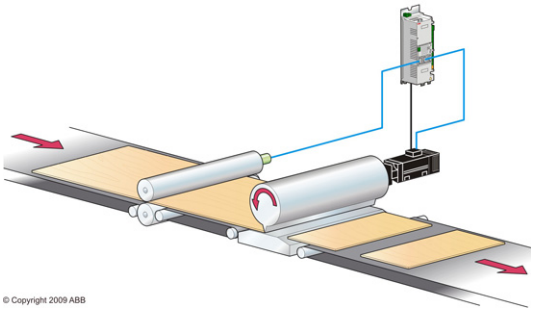
Auto-increment: On



CAM application examples

The following examples present some typical applications where the CAM can be used. Note that the examples only demonstrate the principles of the applications, and contain no information on homing, safety considerations and other issues that depend on the specifics of the application in question.

Rotary axis flying cutter



Rotary cutters are used for cutting continuous feed material into a set length. In the rotary cut application it is usually necessary to synchronize the speed of the follower drive with that of the master drive. The master drive controls feeding the material (eg a conveyor belt) and the follower drive controls the rotary axis on which the cutting blade is mounted. The master speed usually remains constant, but the follower speed varies according to the CAM table.

An encoder and a motion controller monitor the position and speed of the master (conveyor belt). The encoder input determines when a CAM start is given and the rotary axis begins its motion.

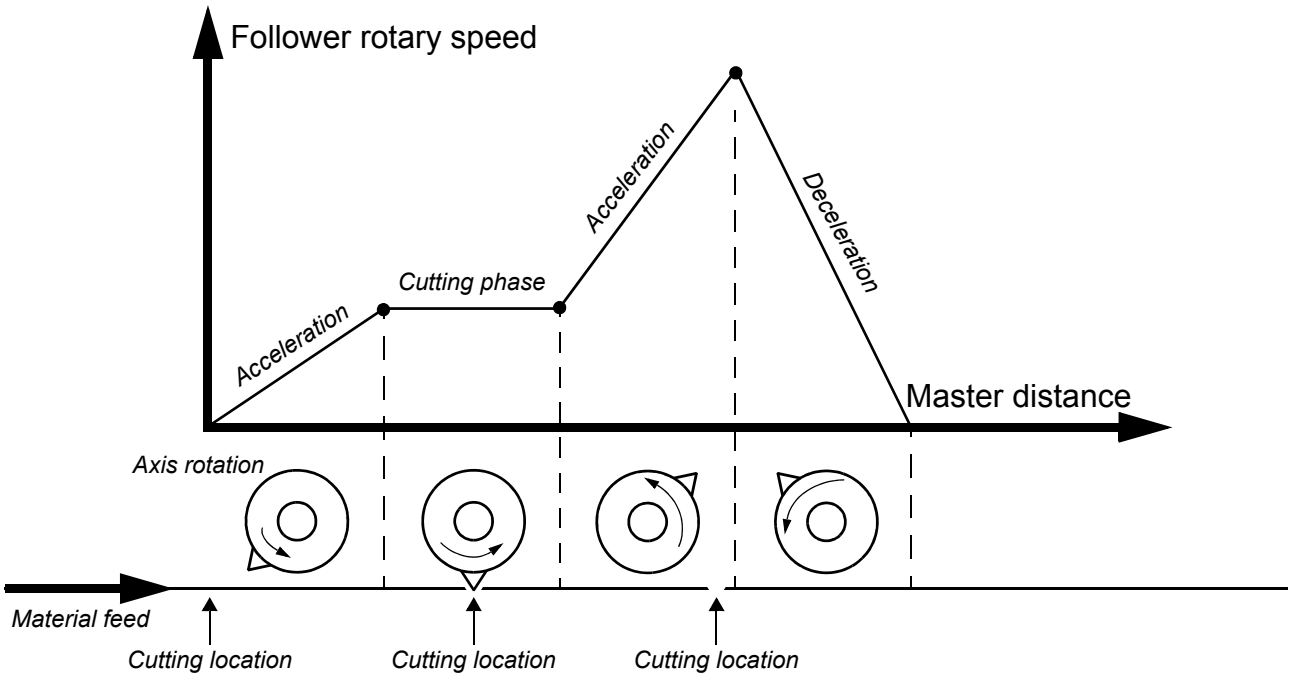
In the following example, the follower has the following phases:

- The rotary axis is in its initial position where the cutting blade is near the feed material.
- Once the CAM start signal is received (eg from a sensor), the follower (rotary axis) accelerates its surface speed to match the linear speed of the master (conveyor belt).
- During the cutting phase, the follower speed remains constant and equal to the master speed.

- After the cutting phase, the follower first accelerates and then decelerates to complete the revolution to its initial position.
- The follower remains in this position until a new CAM start signal is received.

The cutting action and returning the follower to its initial position take place over a defined master distance.

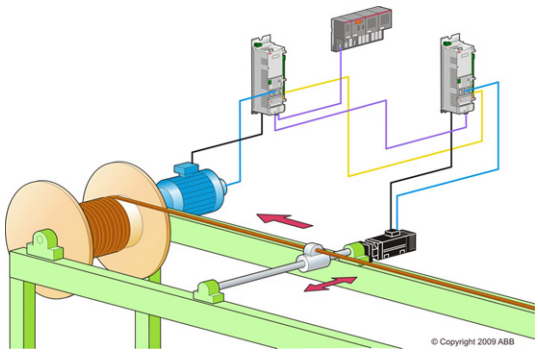
Rotary axis flying cutter



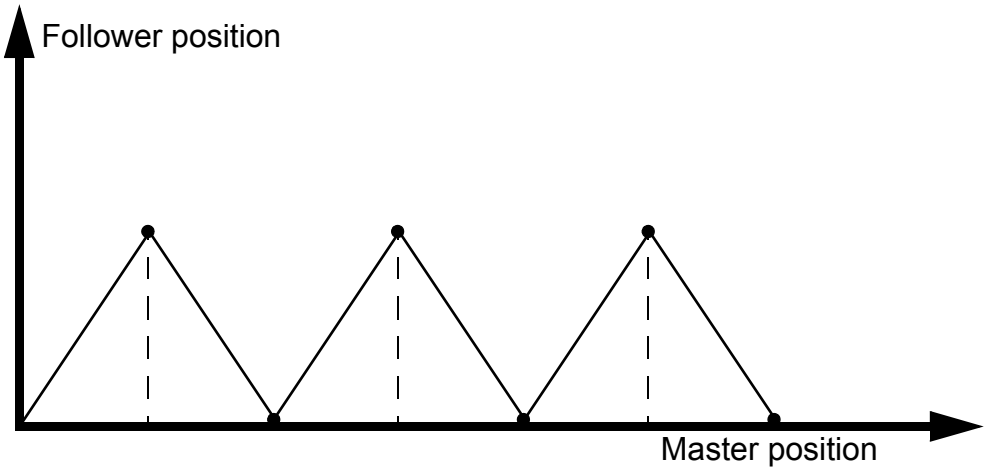
Traverse control

For example, in cable manufacturing, winders are used for winding cable onto a reel. In the following example, a CAM table is used for moving the follower back and forth from left to right so that the cable is wound evenly onto the reel.

Measurement of the cable movement can be simulated by using the virtual master function which creates position information based on the given speed.



Traverse control



Cyclic load compensation in an amusement park ride

The CAM can be used in applications where a rotating eccentric mass causes variation in rotational speed. In cyclic load compensation, the CAM data table is based on measured, calculated or estimated torque of the rotating object at each stage of the rotation. The CAM data table compensates for the torsional variance by accelerating and decelerating the object according to the rotational profile of the object.

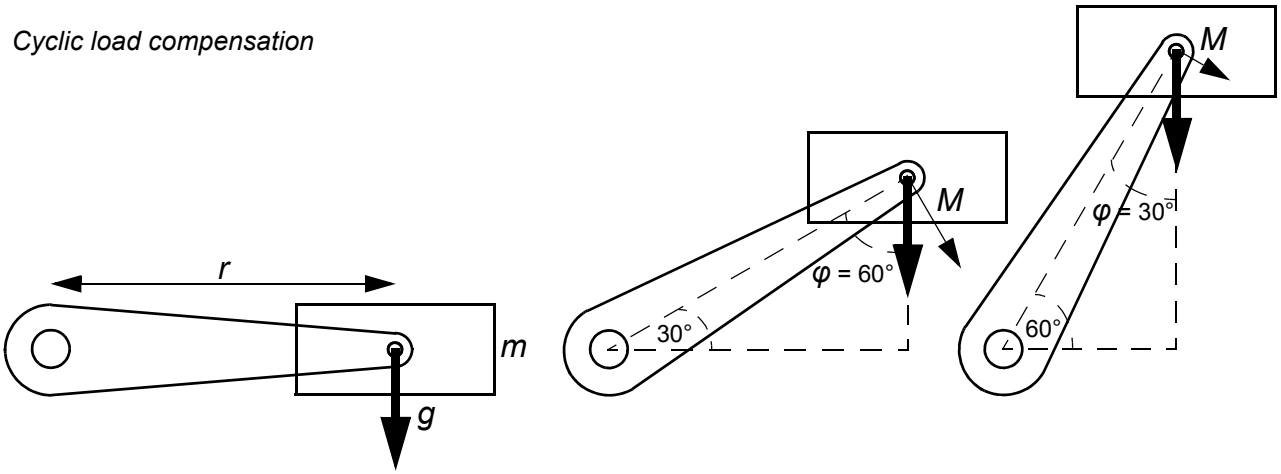
This type of torsional variance is common in amusement park rides. Although the ride may have a counterweight to offset the eccentric mass, there is always variance in the total mass because the number of people and their total mass is different each time the ride is used. Therefore, cyclic load compensation may be necessary.

The downward force *F* equals mass *m* times the Earth's gravity *g*. When the force vector is perpendicular to the shaft, the torque *M* equals *F* times *r*. At other times, the perpendicular component of the force can be calculated with sin(*φ*), where *φ* is the angle between the shaft and the force vector. Therefore:

$M = Fr \cdot \sin(\varphi)$

To offset the torsional variance, a torque equal in magnitude but opposite in direction must be applied to the shaft. Therefore, the CAM table for the application resembles the sine wave.

Cyclic load compensation

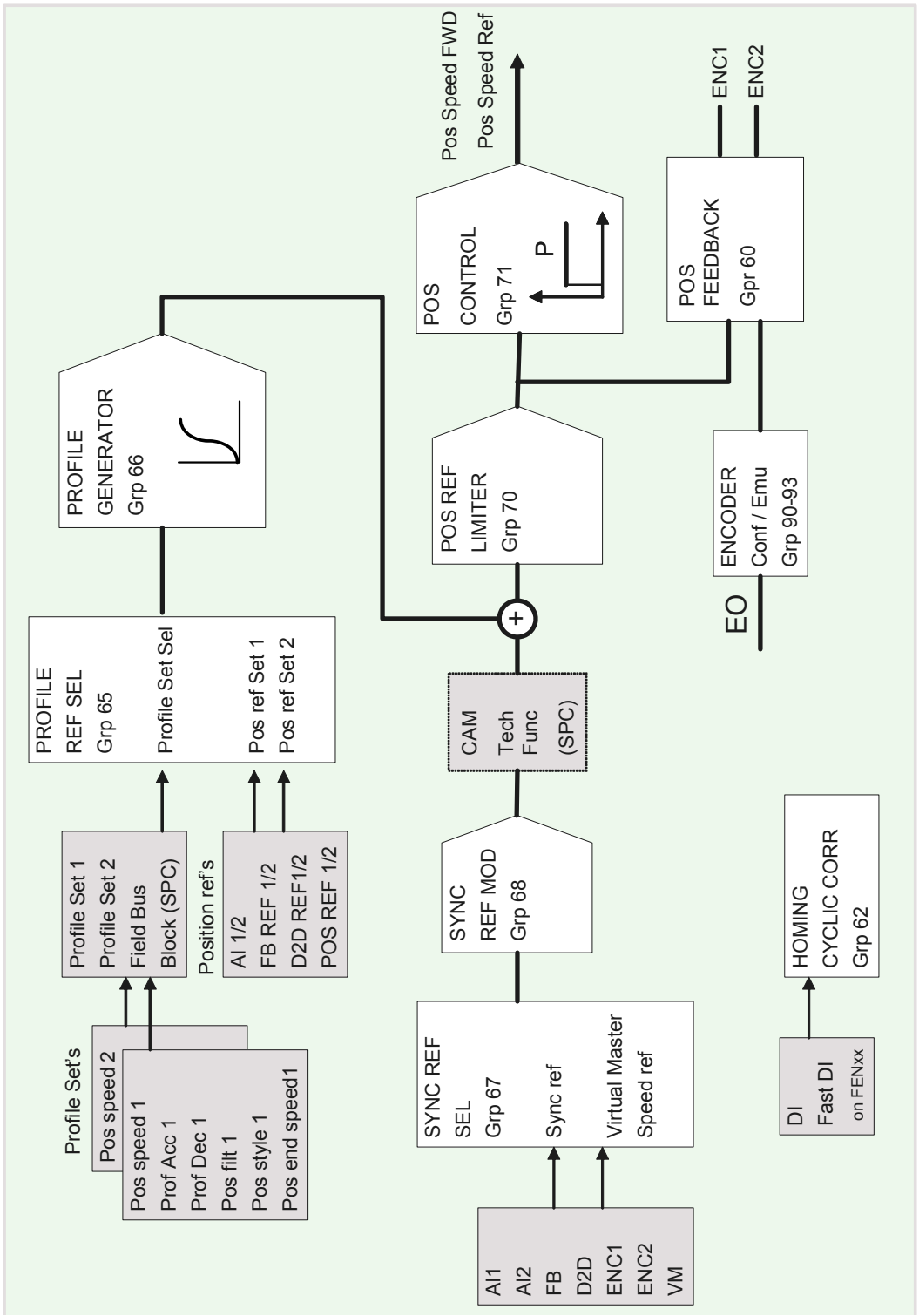


The component of the force that is perpendicular to the shaft determines the torque at a given moment.

The control block diagram for cyclic load compensation is presented in *Cyclic load compensation chain* on page *39*.

CAM control diagram (synchron reference chain)

The following control diagram applies to mechanical axis synchronization (eg, rotary axis flying shear or traverse control).



Start-up

What this chapter contains

This chapter describes the basic commissioning procedure of the application. These instructions are intended for a demo case configuration with which the functionality of the CAM application can be tested.

How to commission the application

If an alarm or a fault is generated during the commissioning, see chapter *Fault tracing* on page *33* (faults generated by the CAM control program) or chapter *Fault tracing* in the drive *Firmware Manual* (other alarms and faults) for the possible causes and remedies.

DRIVE COMMISSIONING		
☐	Commission the drive according to the start-up instructions in the drive *Firmware Manual*. Ensure that the following parameters have appropriate values:	
☐	Firmware limits: • 20.01 MAXIMUM SPEED • 20.02 MINIMUM SPEED • 20.06 MAXIMUM TORQUE • 20.07 MINIMUM TORQUE	*Firmware Manual*
☐	Firmware parameter groups for drive control: • 10 DRIVE LOGIC (Start function and start/stop source)	*Firmware Manual*
APPLICATION COMMISSIONING		
The following start-up data can be used to set up a speed synchronization CAM application to be used with the CAM control program. **Note:** A custom application is needed for cyclic load compensation.		
Entering motor data		
☐	Set up motor parameters.	*Firmware Manual*
☐	Perform ID run.	*Firmware Manual*
Encoder configuration		
☐	Configure an encoder for speed measurement as per the start-up instructions in the *Firmware Manual*.	*Firmware Manual*
If a second encoder is not used as the synchron reference, set the following two parameters:		
☐	Set 67.1 SYNC REF SEL to VIRT MAST.	

☐	Set 67.2 VIRT MAS REF SEL to AI1.	
☐	In DriveCam, download a profile into the drive.	
Set I/O board DIs		
☐	Set DI2 (SYNCHRON MODE) to TRUE.	
☐	Set DI4 (CAM ENABLE) to TRUE.	
☐	Set DI5 (CAM START) to TRUE.	
Test start		
☐	Start the drive with DI1.	
☐	Set the speed of the synchron reference virtual master with AI1.	
The drive executes the CAM profile with speed given in AI1.		

Default control connections

What this chapter contains

This chapter shows the default control connections of the JCU Control Unit.

More information on the connectivity of the JCU is given in the *Hardware Manual* of the drive.

The figure below shows the default external control connections for the CAM control.

Notes:

*Total maximum current: 200 mA

1) Selected by parameter 12.01 DIO1 CONF.

2) Selected by parameter 12.02 DIO2 CONF.

3) Selected by parameter 12.03 DIO3 CONF.

4) Selected by jumper J1.

5) See the drive *Firmware Manual*.

Current:

J1/2

Voltage:

J1/2 

		X1
External power input 24 V DC, 1.6 A	+24VI	1
	GND	2
		X2
Relay output: **Brake close/open** 250 V AC / 30 V DC 2 A	NO	1
	COM	2
	NC	3
		X3
+24 V DC*	+24VD	1
Digital I/O ground	DGND	2
Digital input 1: **Stop/start** (par. 10.02 and 10.05)	DI1	3
Digital input 2: **EXT1/EXT2** (par. 34.01) 6)	DI2	4
+24 V DC*	+24VD	5
Digital I/O ground	DGND	6
Digital input 3: **Fault reset** (par. 10.08) 6)	DI3	7
Digital input 4: **CAM enable** (par *80.01*)	DI4	8
+24 V DC*	+24VD	9
Digital I/O ground	DGND	10
Digital input 5: **CAM start** (par *80.02*)	DI5	11
Digital input 6: Not connected	DI6	12
+24 V DC*	+24VD	13
Digital I/O ground	DGND	14
Digital input/output 1 1): **Ready**	DIO1	15
Digital input/output 2 2): **Running**	DIO2	16
+24 V DC*	+24VD	17
Digital I/O ground	DGND	18
Digital input/output 3 3): **Fault**	DIO3	19
		X4
Reference voltage (+)	+VREF	1
Reference voltage (–)	–VREF	2
Ground	AGND	3
Analogue input 1 (mA or V) 4): **Speed reference** (par. 24.01) 5)	AI1+	4
	AI1–	5
Analogue input 2 (mA or V): Not connected	AI2+	6
	AI2–	7
AI1 current/voltage selection		J1
AI2 current/voltage selection		J2
Thermistor input	TH	8
Ground	AGND	9
Analogue output 1 (mA): **Output current**	AO1 (I)	10
Analogue output 2 (V): **Actual speed**	AO2 (U)	11
Ground	AGND	12
		X5
Drive-to-drive link termination		J3
Drive-to-drive link	B	1
	A	2
	BGND	3
		X6
Safe torque off. Both circuits must be closed for the drive to start. See the appropriate drive *Hardware Manual*.	OUT1	1
	OUT2	2
	IN1	3
	IN2	4
Control panel connection		**X7**

Actual signals and parameters

What this chapter contains

The chapter describes the actual signals and parameters related to the CAM control program. For other actual signals and parameters, refer to the drive *Firmware Manual*.

The range and default value, when applicable, as well as a page number for more detailed information are given for each signal and parameter. The page number refers to the related technology function block in chapter *CAM technology function block* on page *25*.

Terms and abbreviations

The table defines the terms and abbreviations used in the parameter and actual signal tables.

Term	Definition
Actual signal	Signal measured or calculated by the drive. Can be monitored by the user. No user setting possible.
Parameter	A user-adjustable operation instruction of the drive.
Val./Def.	On a parameter row: Parameter default value. On rows under the parameter row: Parameter alternative values (for parameters with value names).
Page	Page in chapter *CAM technology function block* where the signal or parameter is listed as an input or output to a technology function block. More information on the signal or parameter, for example type, unit and fieldbus equivalent are shown there.
C.False, C.True	When adjusting a bit pointer parameter on the control panel, value 0 (FALSE) is displayed as “C.FALSE” and value 1 (TRUE) as “C.TRUE”. See also *Bit ptr* on page *27*.
P.xx.yy	A value pointer points to the value of another parameter/signal. The source parameter is given in format **P.xx.yy**, where xx = parameter group, yy = parameter index. See also *Val ptr* on page *27*.

<table>
<tr><th>Index</th><th>Name/Value</th><th>Description</th><th>Val./Def.</th><th>Page</th></tr>
<tr><td colspan="2">05 CAM STATUS</td><td>Signals for monitoring the CAM (read-only)</td><td></td><td></td></tr>
<tr><td>5.01</td><td>CAM OUTPUT</td><td>CAM output value.</td><td></td><td>31</td></tr>
<tr><td></td><td>-32768…32768</td><td>Range. The unit varies.</td><td></td><td></td></tr>
<tr><td>5.02</td><td>CAM X AXIS VAL</td><td>CAM master axis value.</td><td></td><td>-</td></tr>
<tr><td></td><td>-32768…32768</td><td></td><td></td><td></td></tr>
<tr><td>5.03</td><td>CAM USED DISK</td><td>CAM disk number currently in use. The value is zero when no disk has been run.</td><td></td><td>-</td></tr>
<tr><td></td><td>0…32</td><td>CAM disk number in use.</td><td></td><td></td></tr>
<tr><td>5.04</td><td>CAM STATUS</td><td>The status of CAM.
<table><tr><th>Bit</th><th>Name</th><th>Val.</th><th>Description</th></tr><tr><td>0</td><td>Enable</td><td>0</td><td>CAM is not enabled.</td></tr><tr><td></td><td></td><td>1</td><td>CAM is enabled.</td></tr><tr><td>1</td><td>Start</td><td>0</td><td>CAM is not started.</td></tr><tr><td></td><td></td><td>1</td><td>CAM is started.</td></tr><tr><td>2</td><td>Running</td><td>0</td><td>CAM is not running.</td></tr><tr><td></td><td></td><td>1</td><td>CAM is running.</td></tr><tr><td>3</td><td>SingleShotDone</td><td>0</td><td>CAM not stopped.</td></tr><tr><td></td><td></td><td>1</td><td>Single shot done or CAM stopped.</td></tr><tr><td>4</td><td>StartPending</td><td>0</td><td>CAM start not pending.</td></tr><tr><td></td><td></td><td>1</td><td>New CAM start is pending.</td></tr><tr><td>5</td><td>OffsetsReady</td><td>0</td><td>Not ready to run.</td></tr><tr><td></td><td></td><td>1</td><td>CAM is ready to run after changed offsets.</td></tr><tr><td>6</td><td>PresetDone</td><td>0</td><td>CAM preset is not done.</td></tr><tr><td></td><td></td><td>1</td><td>CAM preset is done.</td></tr><tr><td>7…15</td><td>Not used</td><td></td><td></td></tr></table></td><td>0b00000</td><td>31</td></tr>
<tr><td>5.05</td><td>CAM ERROR</td><td>Shows system errors in CAM.</td><td>0</td><td>31</td></tr>
<tr><td></td><td>no error</td><td>No errors.</td><td>0</td><td></td></tr>
<tr><td></td><td>ERROR_FILE_ NOT_FOUND</td><td>CAM data file not found.</td><td>1</td><td></td></tr>
<tr><td></td><td>ERROR_FILE_ LOAD_FAIL</td><td>CAM data file loading failed.</td><td>2</td><td></td></tr>
<tr><td></td><td>ERROR_OUT_ OF_MEMORY</td><td>Not enough memory. The CAM data file size is too large to load.</td><td>3</td><td></td></tr>
<tr><td>5.06</td><td>CAM SP STAT</td><td>The NeedToPreset bit is TRUE if the synchron mode is not used and the relative mode is used. By default, NeedToPreset is the CAM preset command bit.
<table><tr><th>Bit</th><th>Name</th><th>Val.</th><th>Description</th></tr><tr><td>0</td><td>NeedToPreset</td><td>0</td><td>CAM preset is not used.</td></tr><tr><td></td><td></td><td>1</td><td>Enable CAM preset.</td></tr></table></td><td></td><td>-</td></tr>
</table>

Index	Name/Value	Description	Val./Def.	Page
	0	NeedToPreset	0	
80 CAM_DISK		CAM control		
80.01	CAM ENABLE	Pointer to CAM enable command bit. The default is parameter 2.01 bit 3 which corresponds to DI4.	2.01.03	*31*
80.02	CAM START	Pointer to CAM start command bit. The default is parameter 2.01 bit 4 which corresponds to DI5.	2.01.04	*31*
80.03	CAM SELECTOR	CAM disk selector. Up to 32 different CAMs.	1	*31*
	0	No CAM selected; input goes directly to output.		
	1…32	The number of CAM selected.		
80.04	CAM PRESET	Pointer to CAM preset command bit. The default is parameter 5.06 CAM SP STAT bit 0 (NeedToPreset).	5.06.00	*31*
80.05	PRESET FUNC	Determines if OUT remains at preset after an update cycle has elapsed.	0	-
	0	Normal. In this mode, OUT remains at preset as long as the preset source bit (determined by 80.04) is TRUE.		
	1	Pulse. OUT remains at preset until an update cycle (ie, the time level of the technology block) has elapsed.		
80.06	PRESET VAL PTR	Pointer to the parameter that determines the CAM preset value. The default is parameter 4.16 SYNC REF G.	4.16	-
80.07	PRESET VALUE	Can be used as a constant value for CAM preset if parameter 80.06 is set to 80.07, ie to point at this parameter.	0	*31*
	-32768…32767	The unit varies.		
80.08	MAX OFFSET1	Master maximum position offset 1. The offset value is added to the maximum value in CAM data file.	0	*31*
	-32768…32767	The unit varies.		
…	…	…		
80.11	MAX OFFSET4	Master maximum position offset 4.	0	*31*
	-32768…32767	The unit varies.		

CAM technology function block

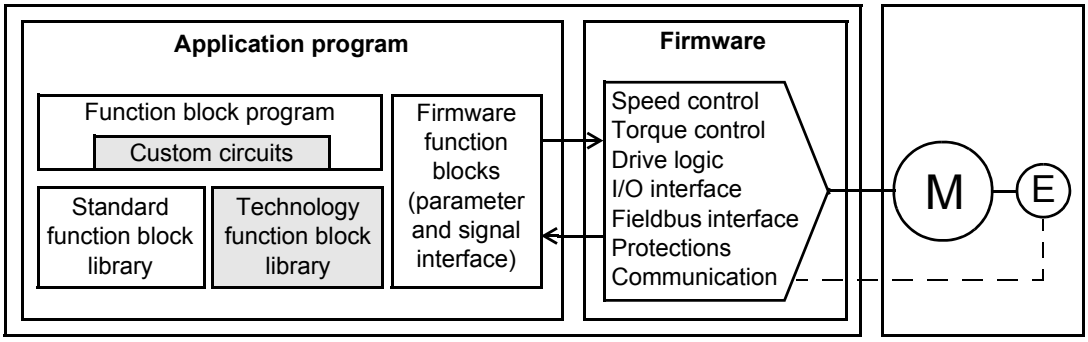
What this chapter contains

This chapter describes the CAM technology function block and lists the associated input and output signals and parameters.

General

The drive control program is divided into two parts:

- firmware program
- application program.



Drive control program

The firmware program performs the main control functions, including speed and torque control, drive logic (start/stop), I/O, feedback, communication and protection functions. Firmware functions are configured and programmed with parameters. The functions of the firmware program can be extended with the application program. Application programs are built out of function blocks: Firmware, standard and technology function blocks.

Technology function blocks are application specific blocks. Custom circuits are application specific blocks built with standard blocks. Technology function blocks are fixed while custom circuits can be modified by the user.

Firmware function blocks and standard function blocks are described in the drive *Firmware Manual*. The CAM technology function block is described in this supplement.

The drive supports two different programming methods:

- parameter programming
- programming with function blocks based on the IEC-61131 standard.

Actual signals

Actual signals are signals measured or calculated by the drive. They are normally used for monitoring and diagnostics, and cannot be adjusted by the user. CAM-specific actual signals are in group 5.

For additional signal data, e.g. description, see chapter *Actual signals and parameters* on page *21*.

Parameters

Parameters are user-adjustable operation instructions of the drive. CAM-specific actual signals are in group 80.

For additional parameter data, e.g. description and possible value selection list, see chapter *Actual signals and parameters* on page *21*.

Terms in the parameter/signal tables

Term	Definition
Actual signal	Signal measured or calculated by the drive. Can be monitored by the user. No user setting is possible.
Data len.	Length of data for fieldbus. May be different from the actual data length in the drive software.
Def	Default value
Enum	Enumerated list, i.e. selection list
FbEq	Fieldbus equivalent: The scaling between the value shown on the panel and the integer used in serial communication
INT32	32-bit integer value (31 bits + sign)
Bit ptr	Bit pointer. A bit pointer parameter points to the value of a bit in another signal, or can be fixed to 0 (FALSE) or 1 (TRUE). When adjusting a bit pointer parameter on the optional control panel, CONST is selected in order to fix the value to 0 (displayed as “C.FALSE”) or 1 (“C.TRUE”). POINTER is selected to define a source from another signal. A pointer value is given in format **P.xx.yy.zz**, where xx = parameter group, yy = parameter index, zz = bit number. Example: Digital input DI4, 2.01 DI STATUS bit 4, is used as the enable for CAM block.
Val ptr	Value pointer. A value pointer points to the value of another parameter/signal. The source parameter is given in format **P.xx.yy**, where xx = parameter group, yy = parameter index. Example: Signal 4.16 SYNC REF G is used as the source for presetting the CAM block.
P.	Page in chapter *Actual signals and parameters* where the description and possible value selection list for the signal or parameter are shown
Parameter	A user-adjustable operation instruction of the drive
Pb	Packed boolean
PT	Parameter protection type. See WP and WPD.
REAL	16-bit value 16-bit value (31 bits + sign) = integer value = fractional value
REAL24	8-bit value 24-bit value (31 bits + sign) = integer value = fractional value
Signal	See Actual signal.
Type	Data type. See Enum, INT32, Bit ptr, Val ptr, Pb, REAL, REAL24, UINT32.
UINT32	32-bit unsigned integer value
WP	Write protected parameter (i.e. read only)
WPD	Write protected parameter while the drive is running

Fieldbus equivalent

Serial communication data between fieldbus adapter and drive is transferred in integer format. Thus the drive actual and reference signal values must be scaled to 16/32-bit integer values. Fieldbus equivalent defines the scaling between the signal value and the integer used in serial communication.

All the read and sent values are limited to 16/32 bits.

Fieldbus addresses

For FPBA-01 Profibus Adapter, FDNA-01 DeviceNet Adapter and FCAN-01 CANopen Adapter, see the *User's Manual* of the fieldbus adapter module.

Pointer parameter format in fieldbus communication

Value and bit pointer parameters are transferred between the fieldbus adapter and drive as 32-bit integer values.

32-bit integer value pointers

When value pointer parameter is connected to the value of another parameter or signal, the format is as follows:

	Bit			
	30…31	**16…29**	**8…15**	**0…7**
Name	Source type	Not in use	Group	Index
Value	1	-	1…255	1…255
Description	Value pointer is connected to parameter/signal.	-	Group of source parameter	Index of source parameter

When value pointer parameter is connected to a application program, the format is as follows:

	Bit		
	30…31	**24…29**	**0…23**
Name	Source type	Not in use	Address
Value	2	-	$0…2^{23}$
Description	Value pointer is connected to application program.	-	Relative address of application program variable

Note: Value pointer parameters connected to a application program cannot be set through fieldbus (i.e. read access only).

32-bit integer bit pointers

When bit pointer parameter is connected to value 0 or 1, the format is as follows:

	Bit		
	30…31	**16…29**	**0**
Name	Source type	Not in use	Value
Value	0	-	0…1
Description	Bit pointer is connected to 0/1.	-	0 = False, 1 = True

When bit pointer is connected to a bit value of another signal, the format is as follows:

	Bit				
	30…31	**24…29**	**16…23**	**8…15**	**0…7**
Name	Source type	Not in use	Bit sel	Group	Index
Value	1	-	0…31	2…255	1…255
Description	Bit pointer is connected to signal bit value.	-	Bit selection	Group of source parameter	Index of source parameter

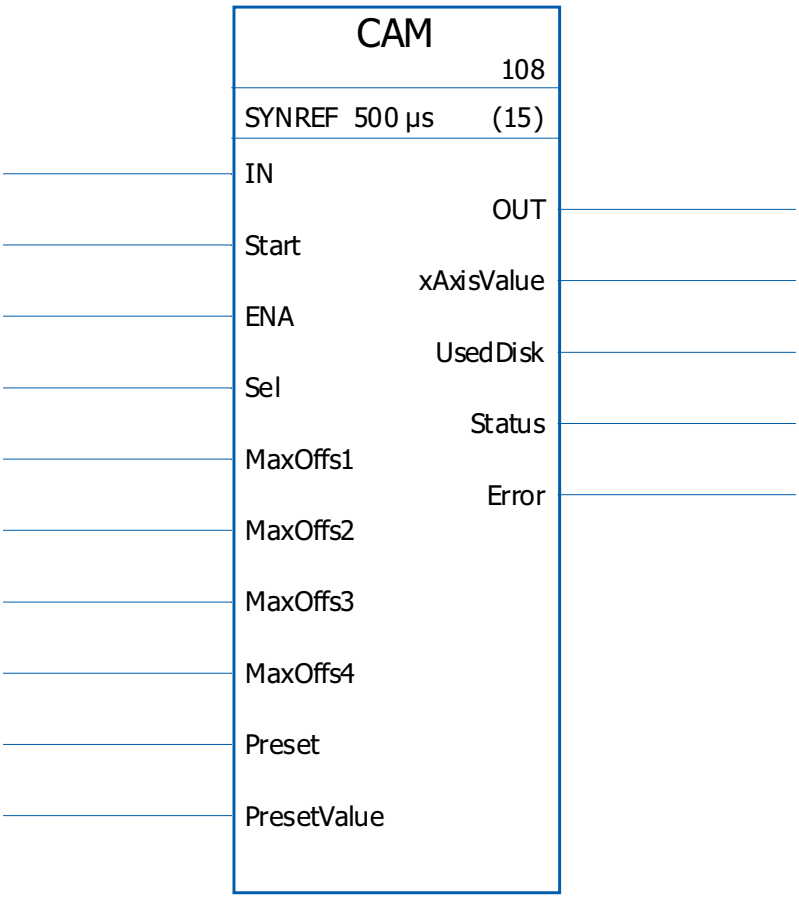
When bit pointer parameter is connected to a application program, the format is as follows:

	Bit		
	30…31	**24…29**	**0…23**
Name	Source type	Bit sel	Address
Value	2	0…31	$0…2^{23}$
Description	Bit pointer is connected to application program.	Bit selection	Relative address of application program variable

Note: Bit pointer parameters connected to a application program cannot be set through fieldbus (i.e. read access only).

CAM

Technology block



Description

The CAM technology block establishes a non-linear relationship between the master drive and follower drive. See *CAM overview* on page *9*.

Inputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT
n/a	Data input (IN)	Val ptr	-32768…32768	-	1 = 1	-	32	-	-
80.01	CAM enable (ENA)	Bit ptr	-	-	1 = 1	23	32	-	-
80.02	CAM start (START)	Bit ptr	-	-	1 = 1	23	32	-	-
80.03	CAM selector (Sel)	Val ptr	0…32	-	1 = 1	23	32	1	-
80.04	CAM preset (Preset)	Bit ptr	-	-	1 = 1	23	32	0	-
80.07	Preset value (PresetValue)	Val ptr	-32768…32768	*	1 = 10	23	32	0	-
80.08	Max offset 1 (MaxOffs1)	Val ptr	-32768…32768	*	1 = 10	23	32	0	-
80.09	Max offset 2 (MaxOffs2)	Val ptr	-32768…32768	*	1 = 10	23	32	0	-
80.10	Max offset 3 (MaxOffs3)	Val ptr	-32768…32768	*	1 = 10	23	32	0	-
80.11	Max offset 4 (MaxOffs4)	Val ptr	-32768…32768	*	1 = 10	23	32	0	-
* The unit depends on the value of the parameter 60.05									

Outputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT
5.01	Data output (Out)	REAL	-32768…32768	*	PosScaling	22	-	0.120	-
5.04	CAM status (Status)	Pb	0…31	-	1 = 1	22	32	0b00000	-
5.05	CAM error (Error)	Enum	0…3	-		22	16	No error	-
* The unit depends on the value of the parameter 60.05									

Fault tracing

What this chapter contains

The chapter lists the alarm and fault messages generated by the CAM control program only. Messages are listed with the possible cause and corrective actions. For the listing of other alarm and fault messages, see the drive *Firmware Manual*.

Safety

WARNING! Only qualified electricians are allowed to maintain the drive. Read the *Safety Instructions* on the first pages of the drive *Firmware Manual* before you start working with the drive.

Alarm and fault indications

An alarm or a fault message indicates an abnormal drive status. You can identify and correct most alarm and fault causes using this information. If not, contact an ABB representative.

The four-digit code number in brackets after the message is for the fieldbus communication.

The alarm/fault code is displayed on the 7-segment display of the drive. The following table describes the indications given by the 7-segment display.

Display	Meaning
“E” followed by error code	System error. See the drive *Hardware Manual*.
“A” followed by error code	Alarm. See the *Firmware Manual*. There are no CAM-specific alarms.
“F” followed by error code	Fault. See section *Fault messages* on page *35*.

How to reset

The drive can be reset either by pressing the reset key on the PC tool ( ) or control panel (***RESET***) or switching the supply voltage off for a while. When the fault has been removed, the motor can be restarted.

A fault can also be reset from an external source by parameter 10.08 FAULT RESET SEL.

Fault history

When a fault is detected, it is stored in the fault logger with a time stamp. The fault history stores information on the 16 latest faults of the drive. Three of the latest faults are stored at the beginning of a power switch off.

Signals 8.01 ACTIVE FAULT and 8.02 LAST FAULT store the fault codes of the most recent faults.

Alarms can be monitored with alarm words 8.05…8.07 ALARM WORD 1…3. Alarm information is lost at power switch off or fault reset.

Fault messages

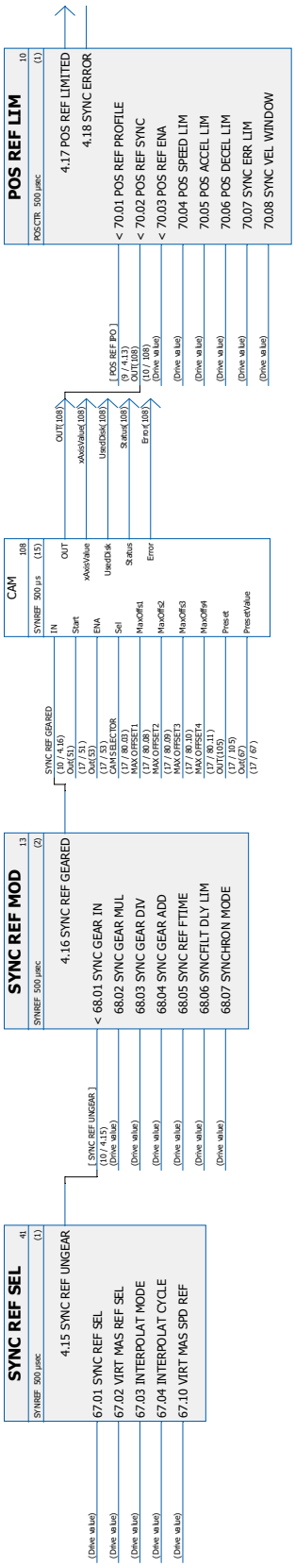
Code	Alarm (fieldbus code)	Cause	What to do
56	TECH LIB CRITICAL (0x6382)	CAM is enabled although no CAM data has been downloaded.	Load a profile into the drive. The drive reboots and the fault is reset.

Control block diagrams

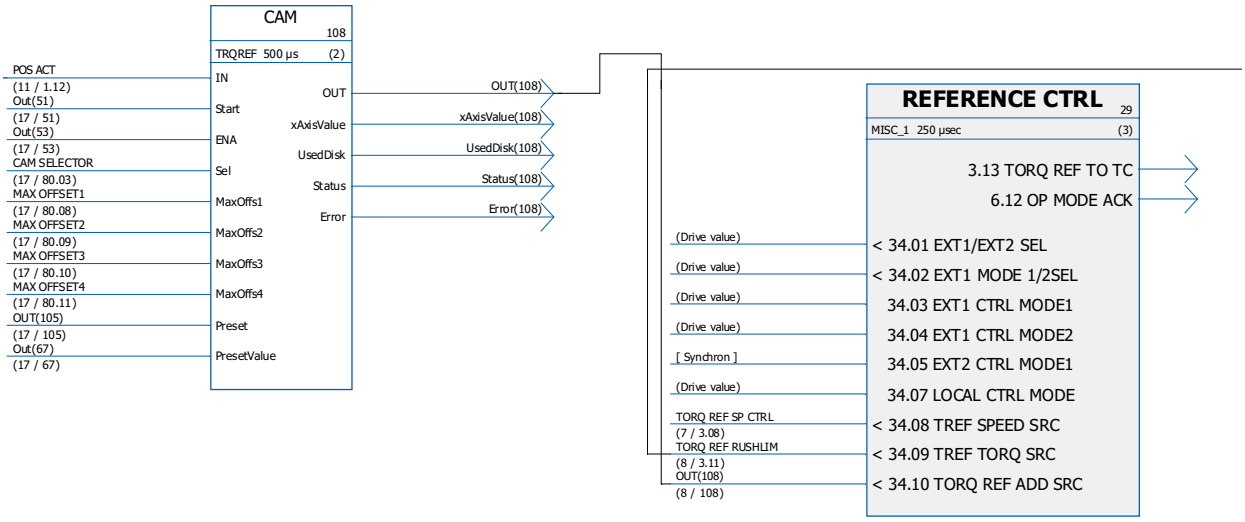
What this chapter contains

This chapter presents the application program pages containing the CAM control program technology block.

Synchron reference chain



Cyclic load compensation chain



Further information

Product and service inquiries

Address any inquiries about the product to your local ABB representative, quoting the type designation and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to www.abb.com/drives and selecting *Sales, Support and Service network*.

Product training

For information on ABB product training, navigate to www.abb.com/drives and select *Training courses*.

Providing feedback on ABB Drives manuals

Your comments on our manuals are welcome. Go to www.abb.com/drives and select *Document Library – Manuals feedback form (LV AC drives)*.

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3AUA0000036661 Rev A EN 2011-02-01