ACS 800

Supplement
Extruder Control Application Program

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Introduction to the manual

Chapter overview

This chapter instructs where to read the safety instructions and gives general information on the manual.

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 Hardware Manual.
- Read the software function specific warnings and notes before changing the default settings of the function. For each function, the warnings and notes are given in the subsection describing the related user-adjustable parameters.

Compatibility

The manual is compatible with ACS 800 Extruder Control Application Program 7.x.

Reader

The reader of the manual is expected to know the standard electrical wiring practices, electronic components, and electrical schematic symbols.

Contents

This supplement describes the operation and the settings of the Extruder Control Application Program. The rest of the program is equal to the ACS800 Standard Application Program which is documented in the *Firmware Manual for ACS800 Standard Application Program* (3AFE 64527592 [English]).

The supplement contains the following chapters:

- *Program features* describes the operation of the Extruder Control Application Program.
- *Parameters* describes the user adjustable settings for tuning the operation of the Extruder Control Application Program.

Related documents

Firmware Manual for ACS 800 Standard Application Program (3AFE 64527592 [English]).

Hardware Manual (appropriate Hardware Manual is delivered with the drive).

Option manuals (appropriate option manual is delivered with the option device).

Program features

Chapter overview

The chapter describes the main features, the default control connections and the control location selection of the ACS 800 Extruder Control Application Program.

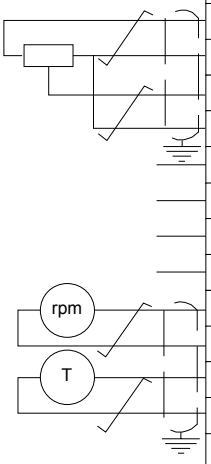
Main features

The Extruder Control Application Program controls the operation of the screw extruder. Extruders are used in the plastics industry for converting raw melt plastics into powder, pellets, pipes, etc.

The main features of the extruder application are

- Accurate sensorless speed control
- Several control devices can be connected to the drive. The change between the devices is easy. See subsection *Control locations* and parameter group 11.
- Torque limitation function protects the extruder screw and gear. See parameter group 20.
- Among other speed control options it is possible to control the speed through two digital inputs (motor potentiometer function). Two adjustable ramp times are available for the motor potentiometer function. See parameter group 22.
- Stall protection function protects the extruder screw and gear. See groups 07 and 36

Default control connections

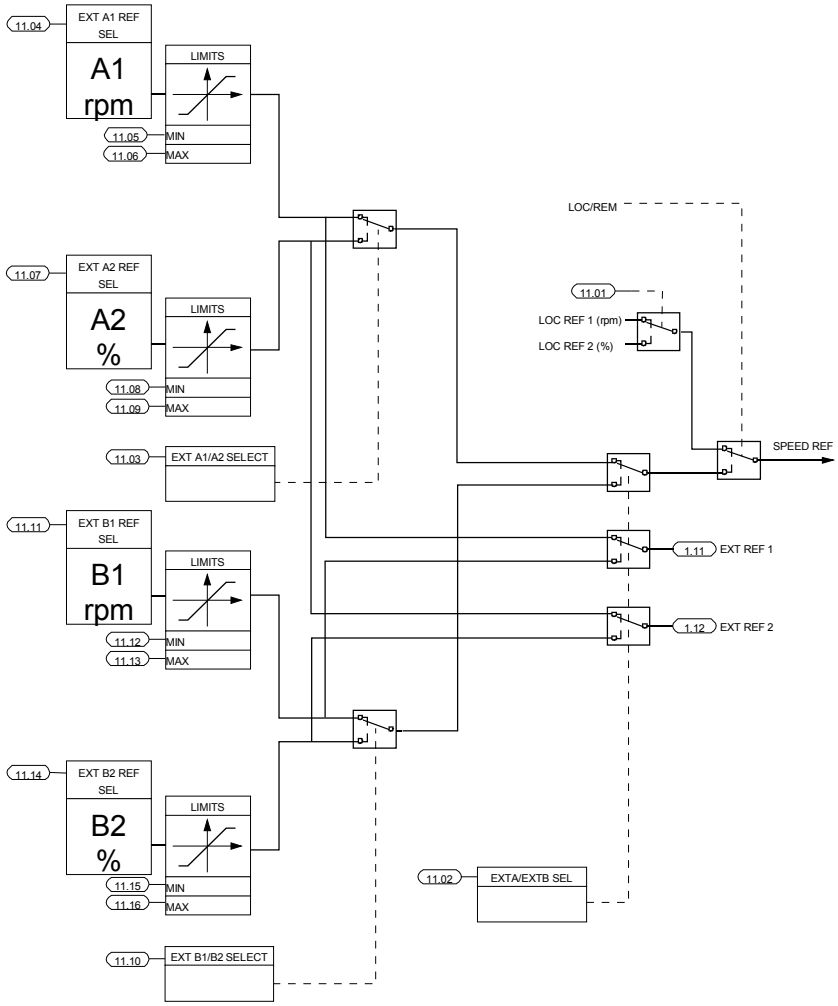


Terminal Block X20		
1	VREF	Reference voltage -10 VDC 1 kohm ≤ R_L ≤ 10 kohm
2	GND	
Terminal Block X21		
1	VREF	Reference voltage +10 VDC 1 kohm ≤ R_L ≤ 10 kohm
2	GND	
3	AI1+	Speed reference 0 ... 10 V, Rin > 200 kohm
4	AI1-	
5	AI2+	By default, not in use 0(4) ... 20 mA, Rin = 100 ohm
6	AI2-	
7	AI3+	By default, not in use 0(4) ... 20 mA, Rin = 100 ohm
8	AI3-	
9	AO1+	Motor Speed, 0(4) … 20 mA <-> 0 … Motor nom. speed
10	AO1-	
11	AO2+	Motor Torque 0(4) … 20 mA <-> 0 … Motor nom. torque
12	AO2-	
Terminal Block X22		
1	DI1	Stop/Start
2	DI2	Run Enable
3	DI3	
4	DI4	
5	DI5	Accel/Decel ½
6	DI6	
7	+24 VDC	+24 VDC max. 100 mA
8	+24 VDC	
9	DGND	Digital ground
10	DGND2	Digital ground
11	DI IL	Start interlock (0 = stop)
Terminal Block X23		
1	+24 VDC	Aux. voltage output 24 VDC, 250 mA
2	GND	
Terminal Block X25		
1	RO11	Relay output 1
2	RO12	
3	RO13	**Ready**
Terminal Block X26		
1	RO21	Relay output 2
2	RO22	
3	RO23	**Run**
Terminal Block X27		
1	RO31	Relay output 3
2	RO32	
3	RO33	**Fault (-1)**

Control connections.dsf

Control locations

Four external control locations can be defined for the drive. The picture below shows the selection between the locations from the speed reference chain point of view. The principle is also valid for the start and stop signals.



Control Locations.dsf

Parameters

Chapter overview

This chapter explains the function and valid selections of the parameters.

Terms and abbreviations

Term	Definition
FbEq	Fieldbus equivalent. Shows how the value on control panel is converted to a integer value when communicated over a serial communication link (fieldbus interface).
Def	Default value
Type	Data type
B	Data type boolean
I	Data type integer
Pb	Data type packed boolean
R	Data type real

Actual signals table

Index	Name/Selection	Description	FbEq/Def/Type
07		The sources for external start, stop and direction control	
07.01	STALL FAULTS	Shows the status of the fault bits associated to the stall functions. Bit 0: 1= Stall 2 active. Bit 1: 1= Stall 3 active.	Pb
07.02	STALL WARNINGS	Shows the status of the warning bits associated to the stall functions. Bit 0: 1= Stall 2 active. Bit 1: 1= Stall 3 active.	Pb

Parameters table

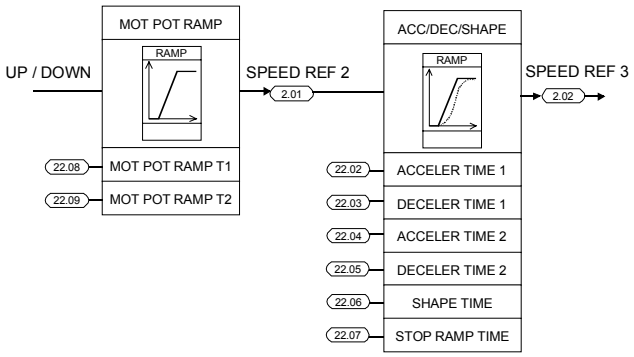
Index	Name/Selection	Description	FbEq/Def/Type
10	START/STOP/DIR	The sources for external start, stop and direction control	
10.01	EXT A1STRT/STP/DIR	Defines the connection and source of the start, stop and direction commands for external control location EXT A1. See the block diagram in chapter *Program features*.	IL
	NOT SEL	No start, stop and direction command source	1
	DI1	Start and stop through digital input DI1. 0 = stop; 1 = start. Direction is fixed according to parameter 10.05. **WARNING!** After a fault reset, the drive will start if the start signal is on.	2 (Def)
	DI1,2	Start and stop through digital input DI1. 0 = stop, 1 = start. Direction through digital input DI2. 0 = forward, 1 = reverse. To control direction, parameter 10.05 must be REQUEST. **WARNING!** After a fault reset, the drive will start if the start signal is on.	3

Index	Name/Selection	Description	FbEq/Def/Type
	DI1P,2P	Pulse start through digital input DI1. 0 -> 1: Start. Pulse stop through digital input DI2. 1 -> 0: Stop. Direction of rotation is fixed according to parameter 10.05.	4
	DI1P,2P,3	Pulse start through digital input DI1. 0 -> 1: Start. Pulse stop through digital input DI2. 1 -> 0: Stop. Direction through digital input DI3. 0 = forward, 1 = reverse. To control direction, parameter 10.05 must be REQUEST.	5
	DI1P,2P,3P	Pulse start forward through digital input DI1. 0 -> 1: Start forward. Pulse start reverse through digital input DI2. 0 -> 1: Start reverse. Pulse stop through digital input DI3. 1 -> 0: stop. To control the direction, parameter 10.05 must be REQUEST.	6
	DI6	See selection DI1.	7
	DI6,5	See selection DI1,2. DI6: Start/stop, DI5: direction.	8
	KEYPAD	Control panel. To control the direction, parameter 10.05 must be REQUEST.	9
	COMM.CW	Communication module (serial communication link)	10
	DI7	See selection DI1.	11
	DI7,8	See selection DI1,2.	12
	DI7P,8P	See selection DI1P,2P.	13
	DI7P,8P,9	See selection DI1P,2P,3.	14
	DI7P,8P,9P	See selection DI1P,2P,3P.	15
10.02	EXT A2STRT/STP/DIR	Defines the connection and source of the start, stop and direction commands for external control location EXT A2. See the block diagram in chapter *Program features*.	IL
	NOT SEL	See parameter 10.01.	1 (Def)
	…	…	…
	DI7P,8P,9P	See parameter 10.01.	15
10.03	EXT B1STRT/STP/DIR	Defines the connection and source of the start, stop and direction commands for external control location EXT B1. See the block diagram in chapter *Program features*.	IL
	NOT SEL	See parameter 10.01.	1 (Def)
	…	…	…
	DI7P,8P,9P	See parameter 10.01.	15
10.04	EXT B2STRT/STP/DIR	Defines the connection and source of the start, stop and direction commands for external control location EXT B2. See the block diagram in chapter *Program features*.	IL
	NOT SEL	See parameter 10.01.	1 (Def)
	…	…	…
	DI7P,8P,9P	See parameter 10.01.	15
10.05	DIRECTION	Enables the control of direction of rotation of the motor, or fixes the direction.	IL
	FORWARD	Fixed to forward.	1 (Def)
	REVERSE	Fixed to reverse.	2
	REQUEST	Direction of rotation control allowed.	3
11	REFERENCE SELECT	Panel reference type, external control location selection and external reference sources and limits	
11.01	KEYPAD REF SEL	Selects the type of the reference given from panel.	IL
	REF1(rpm)	Speed reference in rpm. (Frequency reference (Hz) if parameter 99.04 is SCALAR.)	1 (Def)
	REF2(%)	%-reference.	2

Index	Name/Selection	Description	FbEq/Def/Type
11.02	EXTA/EXTB SELECT	Defines the source from which the drive reads the signal that selects between the two external control locations EXT A and EXT B. See the block diagram in chapter *Program features*.	IL
	DI1	Digital input DI1. DI1 = 0: EXT A. DI1 = 1: EXT B.	1
	DI2	See selection DI1.	2
	DI3	See selection DI1.	3
	DI4	See selection DI1.	4
	DI5	See selection DI1.	5
	DI6	See selection DI1.	6
	EXTA	External control location EXT A.	7 (Def)
	EXTB	External control location EXT B.	8
	COMM.CW	Communication module (serial communication link)	9
	DI7	See selection DI1.	10
	DI8	See selection DI1.	11
	DI9	See selection DI1.	12
	DI10	See selection DI1.	13
	DI11	See selection DI1.	14
	DI12	See selection DI1.	15
11.03	EXT A1/A2 SELECT	Defines the source from which the drive reads the signal that selects between the two external control locations EXT A1 and EXT A2. See the block diagram in chapter *Program features*.	IL
	DI1	See parameter 11.02.	1
	…	See parameter 11.02.	…
	EXTA1	External control location EXT A1.	7 (Def)
	EXTA2	External control location EXT A2.	8
	…	See parameter 11.02.	…
	DI12	See parameter 11.02.	15
11.04	EXT A1 REF SEL	Selects the source for the external reference EXT A1 REF. See the block diagram in chapter *Program features*.	IL
	KEYPAD	Control panel. The first line on the display shows the reference value.	1
	AI1	Analogue input AI1. **Note:** If the signal is bipolar (±10 VDC), use the selection AI1 BIPOLAR. (The selection AI1 ignores the negative signal range.)	2 (Def)
	AI2	Analogue input AI2.	3
	AI3	Analogue input AI3.	4
	AI1/JOYST	Unipolar analogue input AI1 as joystick. The minimum input signal runs the motor at the maximum reference in the reverse direction, the maximum input at the maximum reference in the forward direction.	5
	AI2/JOYST	See AI1/JOYST.	6
	AI1+AI3	Summation of analogue input AI1 and AI3	7
	AI2+AI3	Summation of analogue input AI2 and AI3	8
	AI1-AI3	Subtraction of analogue input AI1 and AI3	9
	AI2-AI3	Subtraction of analogue input AI2 and AI3	10
	AI1*AI3	Multiplication of analogue input AI1 and AI3	11
	AI2*AI3	Multiplication of analogue input AI2 and AI3	12
	MIN(AI1,AI3)	Minimum of analogue input AI1 and AI3	13
	MIN(AI2,AI3)	Minimum of analogue input AI2 and AI3	14
	MAX(AI1,AI3)	Maximum of analogue input AI1 and AI3	15

Index	Name/Selection	Description	FbEq/Def/Type
	MAX(AI2,AI3)	Maximum of analogue input AI2 and AI3	16
	DI3U,4D(R)	Digital input 3: Reference increase. Digital input DI4: Reference decrease. Stop command or power switch off resets the reference to zero.	17
	DI3U,4D	Digital input 3: Reference increase. Digital input DI4: Reference decrease. The program stores the active speed reference (not reset by a stop command or power switch-off).	18
	DI5U,6D	See DI3U,4D.	19
	COMM. REF	Fieldbus reference REF1	20
	COMMREF1+AI1	Summation of fieldbus reference REF1 and analogue input AI1	21
	COMMREF1*AI1	Multiplication of fieldbus reference REF1 and analogue input AI1	22
	FAST COMM	As with the selection COMM. REF, except the following differences: - shorter communication cycle time when transferring the reference to the core motor control program (6 ms -> 2 ms) - the direction cannot be controlled through interfaces defined by parameters 10.01 to 10.04, nor with the control panel. - parameter group 25 CRITICAL SPEEDS is not effective **Note:** If any of the following selections is true, the selection is not effective. Instead, the operation is according to COMM. REF. - parameter 99.02 is PID - parameter 99.04 is SCALAR - parameter 40.14 has value PROPORTIONAL or DIRECT	23
	COMMREF1+AI5	See selection COM.REF1+AI1 (AI5 used instead of AI1).	24
	COMMREF1*AI5	See selection COM.REF1*AI1 (AI5 used instead of AI1).	25
	AI5	Analogue input AI5	26
	AI6	Analogue input AI6	27
	AI5/JOYST	See AI1/JOYST.	28
	AI6/JOYST	See AI1/JOYST.	29
	AI5+AI6	Summation of analogue input AI5 and AI6	30
	AI5-AI6	Subtraction of analogue input AI5 and AI6	31
	AI5*AI6	Multiplication of analogue input AI5 and AI6	32
	MIN(AI5,AI6)	Lower of analogue input AI5 and AI6	33
	MAX(AI5,AI6)	Higher of analogue input AI5 and AI6	34
	DI11U,12D(R)	See DI3U,4D(R).	35
	DI11U,12D	See DI3U,4D.	36
	AI1 BIPOLAR	Bipolar analogue input AI1 (-10 … 10 V).	37
11.05	EXT A1 REF MIN	Defines the minimum limit for the external reference EXT A1 REF.	0 (Def) / R
	0 … 18000 rpm	Limit value	0 … 18000
11.06	EXT A1 REF MAX	Defines the minimum limit for the external reference EXT A1 REF.	1500 (Def) / R
	0 … 18000 rpm	Limit value	0 … 18000
11.07	EXT A2 REF SEL	Selects the source for the external reference EXT A2 REF. See the block diagram in chapter *Program features*.	
	KEYPAD	See parameter 11.04.	1 (Def)
	…	…	…
	AI1 BIPOLAR	See parameter 11.04.	37
11.08	EXT A2 REF MIN	Defines the minimum limit for the reference EXT A2 REF.	0 (Def) / R
	0 … 100 %	Limit value	0 … 100
11.09	EXT A2 REF MAX	Defines the maximum limit for the reference EXT A2 REF.	100 (Def) / R

Index	Name/Selection	Description	FbEq/Def/Type
	0 … 600 %	Limit value	0 … 600
11.10	EXT B1/B2 SELECT	Defines the source from which the drive reads the signal that selects between the two external control locations EXT B1 and EXT B2. See the block diagram in chapter *Program features*.	IL
	DI1	See parameter 11.02.	1
	…	See parameter 11.02.	…
	EXTB1	External control location EXT B1.	7 (Def)
	EXTB2	External control location EXT B2.	8
	…	See parameter 11.02.	…
	DI12	See parameter 11.02.	15
11.11	EXT B1 REF SEL	Selects the source for the external reference EXT B1 REF. See the block diagram in chapter *Program features*.	
	KEYPAD	See parameter 11.04.	1
	AI1	See parameter 11.04.	2 (Def)
	…	…	…
	AI1 BIPOLAR	See parameter 11.04.	37
11.12	EXT B1 REF MIN	Defines the minimum limit for the reference EXT B1 REF.	0 (Def) / R
	0 … 18000 rpm	Limit value	0 … 18000
11.13	EXT B1 REF MAX	Defines the maximum limit for the reference EXT B1 REF.	1500 (Def) / R
	0 … 18000 rpm	Limit value	0 … 18000
11.14	EXT B2 REF SEL	Selects the source for the external reference EXT B2 REF. See the block diagram in chapter *Program features*.	
	KEYPAD	See parameter 11.04.	1 (Def)
	…	…	…
	AI1 BIPOLAR	See parameter 11.04.	37
11.15	EXT B2 REF MIN	Defines the minimum limit for the reference EXT B2 REF.	0 (Def) / R
	0 … 100 %	Limit value	0 … 100
11.16	EXT B2 REF MAX	Defines the maximum limit for the reference EXT B2 REF.	100 (Def) / R
	0 … 600 %	Limit value	0 … 600
20	LIMITS	Drive operation limits	
20.13	TORQUE LIMIT SEL	Selects the torque limit for the drive.	
	PAR 20.14	Parameter 20.14 (Limit 1)	1 (Def)
	DI1	DI1 = 0: Parameter 20.14 (Limit 1) DI1 = 1: Parameter 20.15 (Limit 2)	2
	DI2	See selection DI1.	3
	…	…	…
	DI12	See selection DI1.	13
	DI1,2	If DI1 = 0 and DI2 = 0: Parameter 20.14 (Limit 1) If DI1 = 1 and DI2 = 0: Parameter 20.15 (Limit 2) If DI1 = 0 and DI2 = 1: Parameter 20.16 (Limit 3) If DI1 = 1 and DI2 = 1: Parameter 20.17 (Limit 4)	14
	DI3,4	See DI1,2.	15
	…	…	…
	DI11,12	See DI1,2.	19
	AI1	Limit is read through analogue input AI1. See parameter 20.18 (scaling).	20
	AI2	See AI1.	21
	…	…	…

Index	Name/Selection	Description	FbEq/Def/Type
	AI5	See AI1.	24
20.14	TORQUE LIMIT 1	Defines maximum torque limit 1. See parameter 20.13.	300 (Def) / R
	0 … 600 %	Limit in percent of the motor nominal torque	0 … 600
20.15	TORQUE LIMIT 2	Defines maximum torque limit 2. See parameter 20.13.	300 (Def) / R
	0 … 600 %	Limit in percent of the motor nominal torque	0 … 600
20.16	TORQUE LIMIT 3	Defines maximum torque limit 3. See parameter 20.13.	300 (Def) / R
	0 … 600 %	Limit in percent of the motor nominal torque	0 … 600
20.17	TORQUE LIMIT 4	Defines maximum torque limit 4. See parameter 20.13.	300 (Def) / R
	0 … 600 %	Limit in percent of the motor nominal torque	0 … 600
20.18	AI TORQ LIM SCALE	Defines the scaling factor for the torque limit read through an analogue input. See parameter 20.13. The equation below shows how the scaling factor affects. $T_{\lim} = \frac{K}{100\%} \cdot \frac{(AI - AI_{\min})}{(AI_{\max} - AI_{\min})} \cdot T_N$ T_{lim} = Torque limit K = Scaling factor in percent (this parameter) AI = Value of analogue input AI_{max} = Maximum limit defined for the analogue input (parameter value) AI_{min} = Minimum limit defined for the analogue input (parameter value) T_N = Motor nominal torque	300 (Def) / R
	0 … 600 %	Scaling factor	0 … 600
22	ACCEL/DECEL	Acceleration and deceleration times	
22.08	MOT POT RAMP T1	Defines the acceleration and deceleration ramp time 1 for the motor potentiometer function (= one digital input accelerates the drive, another input decelerates). The function can be activated for each reference by the parameter that defines the source for the external reference. During the ramp time, if the accelerate input is on, the drive accelerates from the minimum reference limit to the maximum reference limit. When the decelerate input is on, the drive decelerates (ramp time is the same as during acceleration). See the parameter settings that define the limits for the external reference.	3 (Def) / R
		Note 1: The basic ramps that are defined by group 22 parameters are still in effect: The longer ramp time (motor potentiometer ramp or the basic ramp) in the speed reference chain determines the actual ramp in use. See the figure below.  **Note 2:** When stopping by a ramp, the used stopping ramp is the one valid according to the settings in group 22.	
	0 … 1800 s	Ramp time	0 … 1800

Index	Name/Selection	Description	FbEq/Def/Type
22.09	MOT POT RAMP T2	Defines the acceleration and deceleration ramp time 2 for the motor potentiometer function. See parameter 22.08.	3 (Def) / R
	0 … 1800 s	Ramp time	0 … 1800
36	MOTOR STALL 2, 3	Stall protection settings	
36.01	STALL 2 FUNC	Defines how the drive acts when the stall 2 function activates. The function operates as follows: When the motor torque and the drive output frequency meet the conditions below, the stall function evokes and starts the stall time counter. The counter counts up when the conditions are valid and down (to zero) when the condition is not valid. If the counted time exceeds the stall 2 time (parameter 36.04), the drive acts as this parameter defines. **Conditions for the stall function** [abs(1.03 FREQUENCY) < 36.02 STALL 2 FREQ LIM] AND [abs(1.05 TORQUE) > 36.03 STALL 2 TORQ LIM]	
	NO	Stall detection is not active.	1 (Def)
	ALARM	If the function evokes, the drive generates an alarm MOTOR STALL 2.	2
	FAULT	If the function evokes, the drive trips to a fault and generates a fault message MOTOR STALL 2.	3
36.02	STALL 2 FREQ LIM	Defines the frequency limit for the stall 2 function. See parameter 36.01.	5 (Def) / R
	0 … 100 Hz	Frequency limit	0 … 100
36.03	STALL 2 TORQ LIM	Defines the torque limit for the stall 2 function. See parameter 36.01.	110 (Def) / R
	0 … 600 %	Torque limit in percent of the motor nominal torque	0 … 600
36.04	STALL 2 TIME	Defines the time for the stall 2 function. See parameter 36.01.	1.0 (Def) / R
	0.2 … 600 s	Time value	0.2 … 600
36.05	STALL 3 FUNC	Defines how the drive acts when the stall 3 function activates. The operation is the same as for the stall 2 function. See parameter 36.01.	R
	NO	Stall 3 detection is not active.	1 (Def)
	ALARM	If the function evokes, the drive generates an alarm MOTOR STALL 3.	2
	FAULT	If the function evokes, the drive trips to a fault and generates a fault message MOTOR STALL 3.	3
36.06	STALL 3 FREQ LIM	Defines the frequency limit for the stall 3 function. See parameter 36.05.	5 (Def) / R
	0 … 100 Hz	Frequency limit	0 … 100
36.07	STALL 3 TORQ LIM	Defines the torque limit for the stall 3 function. See parameter 36.05.	110 (Def) / R
	0 … 600 %	Torque limit in percent of the motor nominal torque	0 … 600
36.08	STALL 3 TIME	Defines the time for the stall 3 function. See parameter 36.05.	1.0 (Def) / R
	0.2 … 600.0 s	Time value	0 … 600

Parameter differences between the Extruder and Standard programs

The table below shows how the parameters and parameter values differ.

Index	Standard program	Extruder program
1.13	LOC, EXT1, EXT2	LOC, EXTA1, EXTA2, EXTB1, EXTB2
Group 7	-	Stall alarms and faults
Group 9	Adaptive actual values	-
Group 10	Standard Strt/Stp/Dir	Extruder Strt/Stp/Dir
Group 11	Standard external reference select	Extruder external reference select
Group 20	Standard limits for torque	Extruder limits for torque
Group 36	-	Motor stall functions 2 and 3
15.01	Selection PARAM 15.11	-
15.06	Selection PARAM 15.12	-
15.11	Selection AO1 PTR	-
15.12	Selection AO2 PTR	-
16.01	Selection PARAM 16.08	-
16.08	RUN ENA PTR	-
22.01	Selection PAR 22.08&09	-
22.08	ACC PTR	MOT POT RAMP T1
22.09	DEC PTR	MOT POT RAMP T2
40.07	Selection PAR 40.25	-
40.25	ACTUAL 1 PTR	-
Group 83	ADAPT PRG CTRL	-
Group 84	ADAPTIVE PROGRAM	-
Group 85	USER CONSTANTS	-
96.01	Selection PARAM 96.11	-
96.06	Selection PARAM 96.12	-
96.11	EXT AO1 PTR	-
96.12	EXT AO2 PTR	-
98.09	Selection REPL DI1,2 and REPL DI1,2,3	-
98.10	Selection REPL DI3,4 and REPL DI4,5,6	-
98.11	Selection REPL DI5,6	-

The table below shows how the default parameter values differ.

Parameter	Stdandard program	Extruder program
10.01 EXT(A)1 STRT/STP/DIR	DI1,2	DI1
12.01 CONST SPEED SEL	DI5,6	NOT SEL
15.06 ANALOGUE OUTPUT 2	CURRENT	TORQUE
16.01 RUN ENABLE	YES	DI2
22.01 ACC/DEC SEL	DI4	DI5
99.02 APPLICATION MACRO	FACTORY	EXTRUDER

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ABB Oy
AC Drives
P.O.Box 184
FIN-00381 HELSINKI
FINLAND
Telephone + 358 10 22 11
Fax + 358 10 22 22681
Internet http://www.abb.com

ABB Inc.
Drives and Power Electronics
16250 West Glendale Drive
New Berlin, WI 53151
USA
Telephone 262 785-8378
800 243-4384
Fax 262 780-5135