Drive^{IT}
Low Voltage
AC Drives

User's Ma
for type AC
frequency conv
from 0.12 to 2.2

ACS140 Frequency Con

User's M

Safety

Warning! Only a competent electrician may install the ACS140.

Warning! Dangerous voltages are present when mains supply is connected. Wait at least 5 minutes after disconnecting the supply before removing the cover. Measure the voltage at DC terminals (U_{c+}, U_{c-} servicing the unit (see G).

Warning! Even when the motor is stopped there are dangerous voltages present at Power Circuit terminals U1, V1, W1 (L,N) and U2, V2, W2 and U_{c+}, U_{c-}.

Warning! Even when the ACS140 is powered down, there may be dangerous external voltages at relay terminals RO1A, RO1B, RO2A, RO2

Warning! The ACS140 is not a field repairable unit. Never attempt repair a broken unit; contact the supplier for replacement of the unit.

Warning! The ACS140 will start up automatically after an input volt interruption if the external run command is on.

Warning! When the control terminals of two or more ACS100/140/ 160/400 units are connected in parallel, the auxiliary voltage for these con connections must be taken from a single source which can either be one o the units or an external supply.

Table of Contents

Installation

Study this manual carefully before proceeding. Failure to observe the warnings and instructions given may cause a malfunction or personal hazard.

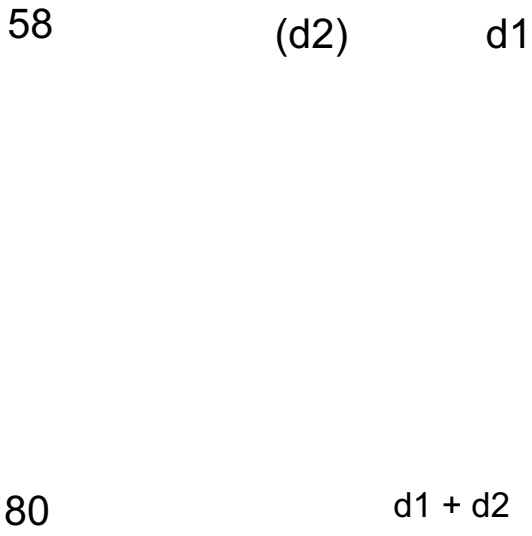
1	CHECK the environment.	See A
2	INSTALL the ACS140.	See B
3	REMOVE the cover.	See I
4	ATTACH a warning sticker in the language of your choice.	See I
5	IDENTIFY power and control terminals.	See F
6	CHECK voltage supply.	See I
7	CHECK the motor.	See
8	CHECK the DIP switch.	See I

Reference Sections

A Environmental Limits

ACS140	Stationary Use	Storage and Tran in the Protective
Installation Site Altitude	• 0...1000 m if P_N and I_2 100% • 1000...2000 m if P_N and I_2 derated 1% every 100 m above 1000 m	-
Ambient Temperature	• 0...40 °C (0...30 °C if f_{sw}=16 kHz) • max. 50 °C if P_N and I_2 derated to 80% and f_{sw} = 4 kHz	-40...+70 °C
Relative Humidity	<95% (non condensing)	
Contamination Levels (IEC 721-3-3)	No conductive dust allowed. The ACS140 should be installed in clean and dry free from dripping water, according to IP classific Cooling air must be clean, free from corrosive ma and electrically conductive dust (pollution degree The installation room must be locked or tool-oper	
	• chemical gases: Class 3C2 • solid particles: Class 3S2	Storage • chemical gase 1C2 • solid particles: Transportation • chemical gase 2C2 • solid particles:

B Dimensions (mm)



Frame Size	200 V Series						Wei
IP 20	h1	h2	h3	d1	(d2)	d1+d2	1~
A	126	136	146	117	32	149	0.9
B	126	136	146	117	69	186	1.2
C	198	208	218	117	52	169	1.6
D	225	235	245	124	52	176	1.9
H	126	136	146	119	0	119	0.8
	400 V Series						
A	126	136	146	117	32	149	-
B	126	136	146	117	69	186	-
C	198	208	218	117	52	169	-
D	225	235	245	124	52	176	-
H	126	136	146	119	0	119	-

C Installing the ACS140

Warning! Before installing the ACS140 ensure that the mains su
to the installation is off.

Standard Series (Frame sizes A, B, C and D)

Install the ACS140 vertically. Leave 25 mm free space above and belo
unit. Ensure that there is sufficient cool air in the cabinet to compensate fo
the power losses (power and control circuits) listed at the end of section R
"Technical Data".

Wall mounting

Use M4 screws.

DIN rail (35 mm)

Press the lever on top of the unit while installing on / removing from DIN ra

Flange mounting

The ACS140 can be installed so that the heat sink is in an air duct. The power circuit losses will then be dissipated outside leaving only the cor circuit losses to be dissipated inside (see R).

Heatsinkless Series (Frame size H)

Note! The frame size H does not include the heatsink. The heatsinkless ACS140 is intended for applications where an external he is available. Ensure that the area of installation fulfils the heat dissipati requirements.

Mounting Surface Requirements

Install the heatsinkless ACS140 on an uncoated, clean metallic surface fulfils the following requirements:

- A minimum thickness of 3 mm.
- The surface must be stiff and flat. (max. flatness error 0.1 and max. roughness R_a 3.2 µm)

Heat Dissipation Requirements

Ensure that the mounting surface is capable of conducting power losse from the power circuit into the environment. The maximum temperature the mounting plate may not exceed 80 °C under any circumstances.

The table below gives the power losses and minimum surface area requirements, when a 3 mm plate, capable of dissipating heat from bot sides, is used as a heatsink (max. ambient temperature 40 °C). The 3 mm steel plate is only one example, any kind of external heatsink can be used it meets the mounting surface and heat dissipation requirements.

Converter Type	Power Loss (W)	Minimum Area H (mm x mm)
ACS141-H18-1	7	150 x 150
ACS141-H25-1	10	180 x 180
ACS141-H37-1	12	200 x 200
ACS141-H75-1	13	210 x 210
ACS141-1H1-1	19	250 x 250
ACS141-1H6-1	27	300 x 300
ACS143-H75-3	14	220 x 220
ACS143-1H1-3	20	260 x 260
ACS143-1H6-3	27	300 x 300
ACS143-2H1-3	39	500 x 500

Mechanical Installation

- Clean the mounting surface.
- Apply thermal grease between the ACS140 and the mounting surfa
- Use M4 screws, mounting torque 1-1.5 Nm.

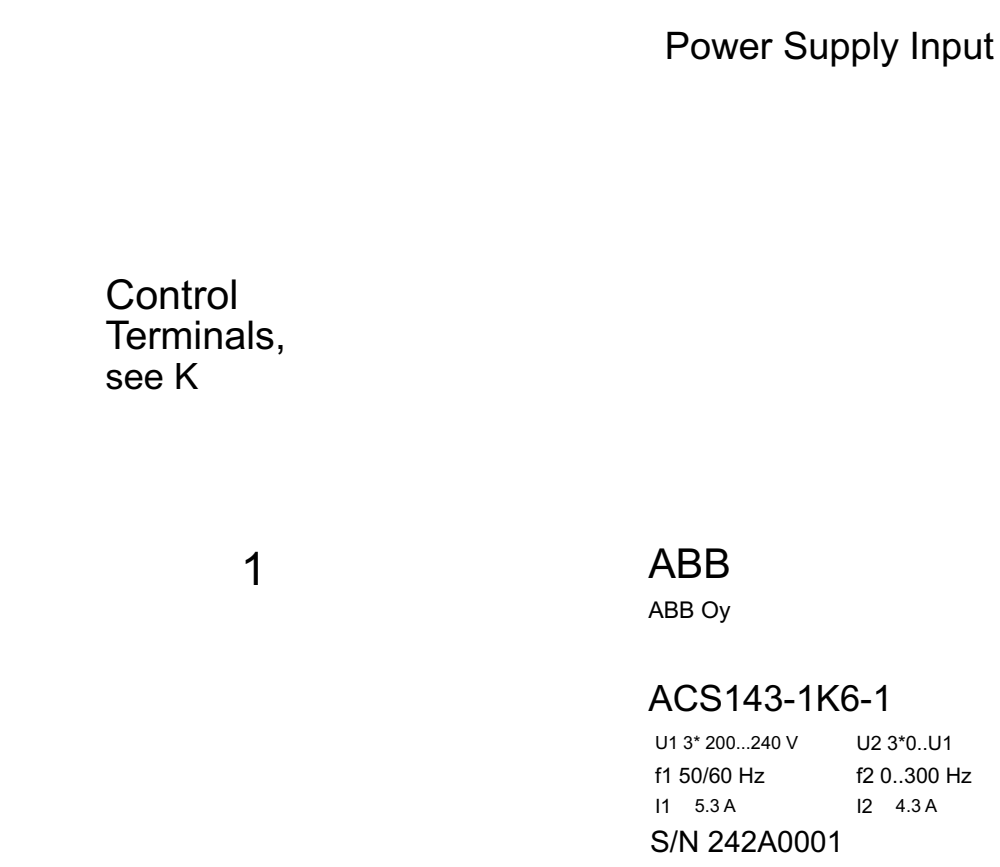
D Removing the Cover

1 Press the four snap-on buttons on the top and bottom corners of the
simultaneously.
2 Remove the cover.

E Attaching a Warning Sticker

The packing box includes warning stickers in different languages. Attac
warning sticker in the language of your choice to the place on the inside
plastic skeleton as indicated above, in section G, "Terminal Interface".

G Terminal Interface



H Type Designation Label and Code Key

Supply:
ACS141 = 1 ~
ACS143 = 3 ~

ACS141-xxx-1 = 200 V
ACS141-xxx-3 = 400 V

Power:
1K6 = 1.6 kVA standard series (frames A, B, C and D)
1H6 = 1.6 kVA heatsinkless series (frame H)

ABB

ABB Oy

ACS143-1K6-1
U1 3*200...240V U2 3*0..U1
f1 50/60 Hz f2 0..300 Hz
I1 5.3 A I2 4.3 A

S/N 242A0001

Seria
S/N 2
2= Ye
42 = W
A000

I Floating Network

If the supply network is floating (IT network) remove the groundin
screw (GND). Failure to do so may cause danger or damage the un

GND

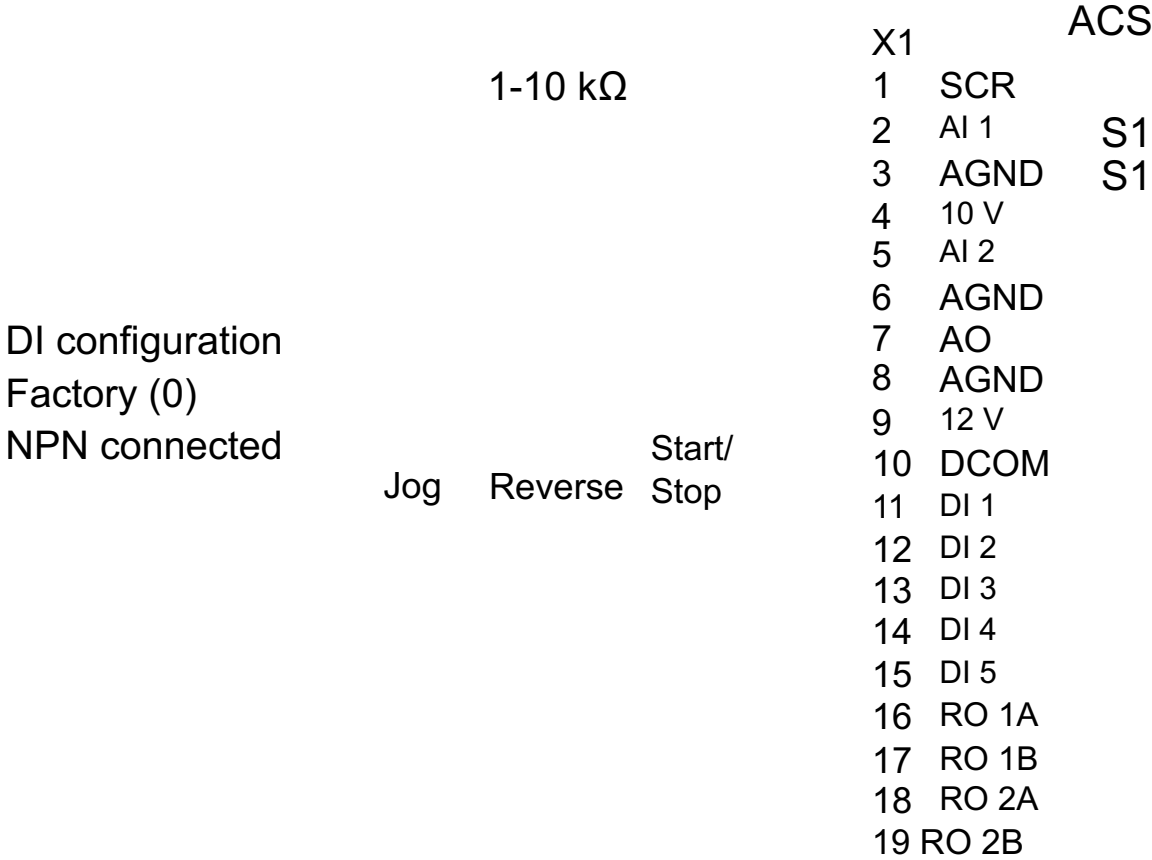
K Control Terminals

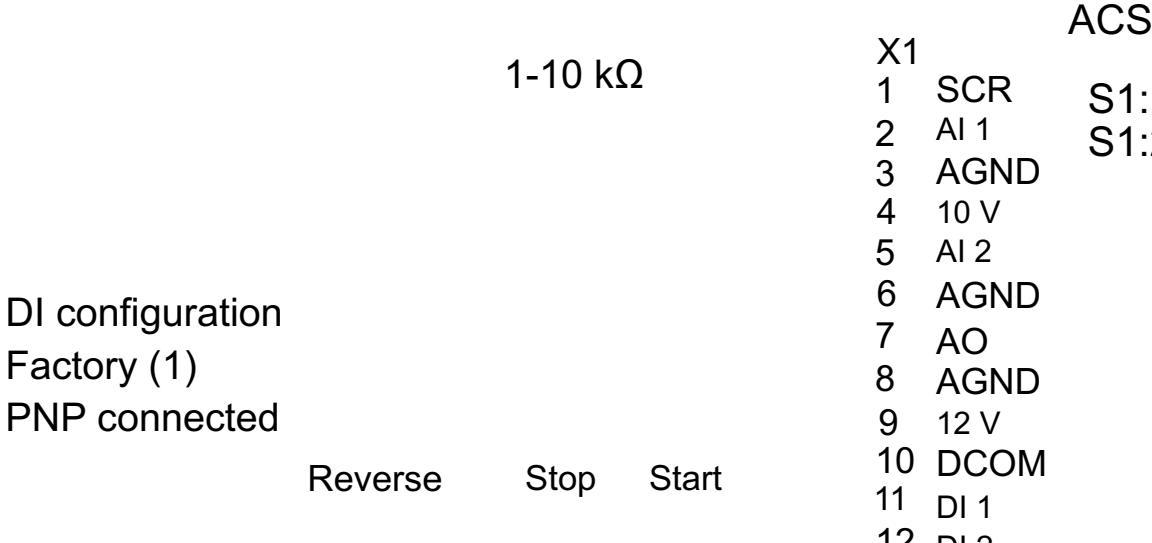
The signal types of analogue inputs AI1 and AI2 are selected with DIP switches S1:1 and S1:2, S1 off = voltage signal, S1 on = current signal.

No.	Identification	Description
1	SCR	Terminal for signal cable screen. (Connected internally to frame earth
2	AI 1	Analogue input channel 1, programmable. Default: 0 - 10 V (R_i = 190 kΩ) (S1:1:U) <=> 0 - 50 Hz output fr 0- 20 mA (R_i = 500 Ω) (S1:1:I) <=> 0 - 50 Hz output frequency Resolution 0.1 % accuracy ±1 %.
3	AGND	Analogue input circuit common. (Connected internally to frame earth 1 MΩ.)
4	10 V	10 V/10 mA reference voltage output for analogue input potentiomete accuracy ±2 %.
5	AI 2	Analogue input channel 2, programmable. Default: 0 - 10 V (R_i = 190 kΩ) (S1:2:U) 0 - 20 mA (R_i = 500 Ω) (S1:2:I) Resolution 0.1 % accuracy ±1 %.
6	AGND	Analogue input circuit common. (Connected internally to frame earth 1 MΩ.)
7	AO	Analogue output, programmable. Default: 0-20 mA (load < 500 Ω) <=>0-50 Hz Accuracy: ± 3 % typically.
8	AGND	Common for DI return signals.
9	12 V	Aux. voltage output 12 V DC / 100 mA (reference to AGND). Short circuit protected.
10	DCOM	Digital input common. To activate a digital input, there must be (or -12 V) between that input and DCOM. The 12 V may be provided by th ACS140 (X1:9) as in the connection examples (see L) or by an extern 12-24 V (max 28 V) source of either polarity.

DI Configuration		Factory (0)	Factory (1)
11	DI 1	Start. Activate to start. Motor will ramp up to frequency reference. Disconnect to stop. Motor will coast to stop.	Start. If DI 2 is activated activation of DI 1 starts t
12	DI 2	Reverse. Activate to reverse rotation	Stop. Momentary inacti

L Connection Examples





N Power On

When power is supplied to the ACS140, the green LED comes on.

Note! Only three power-ups in five minutes are allowed.

Note! Before increasing motor speed, check that the motor is running i
desired direction.

O Protection Features

The ACS140 has a number of protective features:

- Overcurrent
- Overvoltage
- Undervoltage
- Overtemperature
- Output earth fault
- Output short circuit
- Input phase loss (3~)
- Power loss ride through (500
- I/O terminal short circuit prote
- Long-term overcurrent limit tri
- Short-term current limit 150 %
- Motor overload protection (se
- Stall protection

The ACS140 has the following LED alarm and fault indicators, for location
LED alarm indicators, see section G.

If the ACS100-PAN control panel is connected, see "Diagnostics"
page 81.

Red LED: off
Green LED: blinking

ABNORMAL CONDITION

ABNORMAL CONDITION:
- ACS140 cannot fully follow control commands.
- Blinking lasts 15 seconds.

POSSIBLE CAUSES:
- Acceleration or deceleration too fast in relation to load torq requirement.
- A short voltage interruption.

Red LED: on

FAULT

P Motor Overload Protection

If the motor current I_{out} exceeds the nominal current I_{nom} of the m
(parameter 9906) for a prolonged period, the ACS140 automatically pro
the motor from overheating by tripping.

The trip time depends on the extent of the overload (I_{out} / I_{nom}),
frequency and nominal motor frequency f_{nom}. Times given apply to
start".

The ACS140 provides overload protection in accordance with the Natio
Electric Code (US). The default setting of motor thermal protection is C
For more information, see Group 30: Fault Functions on page 64.

I_{out} / I_{nom}	Trip time
1.5	180 s
1.0	300 s
0.5	600 s
0	∞

Output fre

0 35 Hz

Q Loadability of ACS140

In the event of an output overload, the ACS140 will trip.

R Type Series and Technical Data

Standard 200 V series

Nominal motor P_N		kW	0.12	0.18	0.25	0.
1~ Input		ACS141-	K18-1	K25-1	K37-1	K
3~ Input		ACS143-	-	-	-	K
Frame size			A			
Nominal ratings (See H)		Unit				
Input voltage U_1		V	200 V-240 V ±10 % 50/60 Hz (ACS141: 1~, ACS143: 3~)			
Continuous output current I_2 (4 kHz)		A	1.0	1.4	1.7	2.
Continuous output current I_2 (8 kHz)		A	0.9	1.3	1.5	2.
Continuous output current I_2 (16 kHz)		A	0.8	1.1	1.3	1.
Max. output current $I_{2\,max}$ (4 kHz)		A	1.5	2.1	2.6	3.
Max. output current $I_{2\,max}$ (8 kHz)		A	1.4	2.0	2.3	3.
Max. output current $I_{2\,max}$ (16 kHz)		A	1.1	1.5	1.9	2.
Output voltage U_2		V	0 - U_1 3~			
Input current I_1 1~		A	2.7	4.4	5.4	6.
Input current I_1 3~		A	-	-	-	3.
Switching frequency		kHz	4 (Standard) 8 (Low noise *) 16 (Silent **)			
Protection limit			(See P)			

Standard 200 V series

Nominal motor P_N	kW	0.75	1.1	1.5
1~ Input	ACS141-	1K6-1	2K1-1	2K7-1
3~ Input	ACS143-	1K6-1	2K1-1	2K7-1
Frame size		B	C	
Nominal ratings (See H)	Unit			
Input voltage U_1	V	200 V-240 V ±10 % 50/60 Hz (ACS141: 1~, ACS143: 3~)		
Continuous output current I_2 (4 kHz)	A	4.3	5.9	7.0
Continuous output current I_2 (8 kHz)	A	3.9	5.3	6.3
Continuous output current I_2 (16 kHz)	A	3.2	4.4	5.3
Max. output current $I_{2\,max}$ (4 kHz)	A	6.5	8.9	10.5
Max. output current $I_{2\,max}$ (8 kHz)	A	5.9	8.0	9.5
Max. output current $I_{2\,max}$ (16 kHz)	A	4.7	6.5	7.7
Output voltage U_2	V	$0 - U_1$ 3~		
Input current I_1 1~	A	10.8	14.8	18.2
Input current I_1 3~	A	5.3	7.2	8.9
Switching frequency	kHz	4 (Standard) 8 (Low noise *) 16 (Silent **)		
Protection limits	(See P)			

Standard 400 V series

Nominal motor P_N	kW	0.37	0.55	0.75	1.1	1.5
3~ Input	ACS143-	K75-3	1K1-3	1K6-3	2K1-3	2K
Frame size		A		B	C	
Nominal ratings (See H)	Unit					
Input voltage U_1	V	380V - 480V ±10 % 50/60 Hz (ACS143: 3~)				
Continuous output current I_2 (4 kHz)	A	1.2	1.7	2.0	2.8	3.6
Continuous output current I_2 (8 kHz)	A	1.1	1.5	1.8	2.5	3.2
Continuous output current I_2 (16 kHz)	A	0.9	0.9	1.5	1.5	2.7
Max. output current $I_{2\,max}$ (4 kHz)	A	1.8	2.6	3.0	4.2	5.4
Max. output current $I_{2\,max}$ (8 kHz)	A	1.7	2.3	2.7	3.8	4.8
Max. output current $I_{2\,max}$ (16 kHz)	A	1.3	1.9	2.2	3.1	4.0
Output voltage U_2	V	0 - U_1				
Input current I_1 3~	A	2.0	2.8	3.6	4.8	5.8
Switching frequency	kHz	4 (Standard) 8 (Low noise *) 16 (Silent **)				
Protection limits	(See P)					
Overcurrent (peak)	A	4.2	5.6	6.6	9.2	11.
Overvoltage: Trip limit	V DC	842 (corresponds to 595 V input)				

Heatsinkless 200 V series

Nominal motor P_N	kW	0.12	0.18	0.25	0.37	0.5
1~ Input	ACS141-	H18-1	H25-1	H37-1	H75-1	1H
Frame size		H				
Nominal ratings (See H)	Unit					
Input voltage U_1	V	200 V-240 V ±10 % 50/60 Hz (ACS141: 1~)				
Continuous output current I_2 (4 kHz)	A	1.0	1.4	1.7	2.2	3.0
Continuous output current I_2 (8 kHz)	A	0.9	1.3	1.5	2.0	2.7
Continuous output current I_2 (16 kHz)	A	0.8	1.1	1.3	1.7	2.3
Max. output current $I_{2\,max}$ (4 kHz)	A	1.5	2.1	2.6	3.3	4.5
Max. output current $I_{2\,max}$ (8 kHz)	A	1.4	2.0	2.3	3.0	4.1
Max. output current $I_{2\,max}$ (16 kHz)	A	1.1	1.5	1.9	2.4	3.3
Output voltage U_2	V	0 - U_1 3~				
Input current I_1 1~	A	2.7	4.4	5.4	6.9	9.0
Switching frequency	kHz	4 (Standard) 8 (Low noise *) 16 (Silent **)				
Protection limits	(See P)					
Overcurrent (peak)	A	3.2	4.5	5.5	7.1	9.7
Overvoltage: Trip limit	V DC	420 (corresponds to 295 V input)				

Heatsinkless 400 V series

Nominal motor P_N	kW	0.37	0.55	0.75
3~ Input	ACS143-	H75-3	1H1-3	1H6-3
Frame size		H		
Nominal ratings (See H)	Unit			
Input voltage U_1	V	380V - 480V ±10 % 50/60 Hz (ACS143: 3~)		
Continuous output current I_2 (4 kHz)	A	1.2	1.7	2.0
Continuous output current I_2 (8 kHz)	A	1.1	1.5	1.8
Continuous output current I_2 (16 kHz)	A	0.9	0.9	1.5
Max. output current $I_{2\,max}$ (4 kHz)	A	1.8	2.6	3.0
Max. output current $I_{2\,max}$ (8 kHz)	A	1.7	2.3	2.7
Max. output current $I_{2\,max}$ (16 kHz)	A	1.3	1.9	2.2
Output voltage U_2	V	0 - U_1		
Input current I_1 3~	A	2.0	2.8	3.6
Switching frequency	kHz	4 (Standard) 8 (Low noise *) 16 (Silent **)		
Protection limits	(See P)			
Overcurrent (peak)	A	4.2	5.6	6.6
Overvoltage: Trip limit	V DC	842 (corresponds to 595 V input)		

S Product Conformity

CE Marking

The ACS140 complies with the requirements of the European

- Low Voltage Directive 73/23/EEC with amendments
- EMC Directive 89/336/EEC with amendments

Corresponding declarations and a list of main standards are available o request.

Note! See "ACS140 EMC Instructions" on page 85.

A frequency converter and a Complete Drive Module (CDM) or a Basic Dri Module (BDM), as defined in IEC 61800-2, is not considered as a safet related device mentioned in the Machinery Directive and related harmo standards. The CDM/BDM/frequency converter can be considered as a of safety device if the specific function of the CDM/BDM/frequency con fulfils the requirements of the particular safety standard. The specific function of the CDM/BDM/frequency converter and the related safety standard is mentioned in the documentation of the equipment.

UL, ULc and C-Tick Markings

The ACS140 has UL, cUL and C-Tick markings for all power ranges, ex C-Tick for ACS140 frame size H.

The ACS140 is suitable for use on a circuit capable of delivering not more than 65,000 RMS symmetrical ampers (65 kA).

The ACS140 inverter must be connected to a source with 4 kV over voltag control for 230 V AC units and 6 kV over voltage control for 480 V AC units

U Accessories

ACS100-PAN
Control panel.

PEC-98-0008
Panel Extension Cable kit for use with the ACS100/ACS140/ACS400.

ACS140 RS485/232 Adapter

ABC-PDP
Fieldbus adapter for ProfiBus DP, requires the use of RS485/232 adapt

ABC-DEV
Fieldbus adapter for DeviceNet, requires the use of RS485/232 adapte

ACS100/140-IFxx-, ACS140-IFxx-, ACS100-FLT-, ACS140-FLT-
RFI input filters.

ACS-CHK-, SACLxx
Input/output chokes.

ACS-BRK-x
Braking units.

ACS-BRK-xx
Braking choppers.

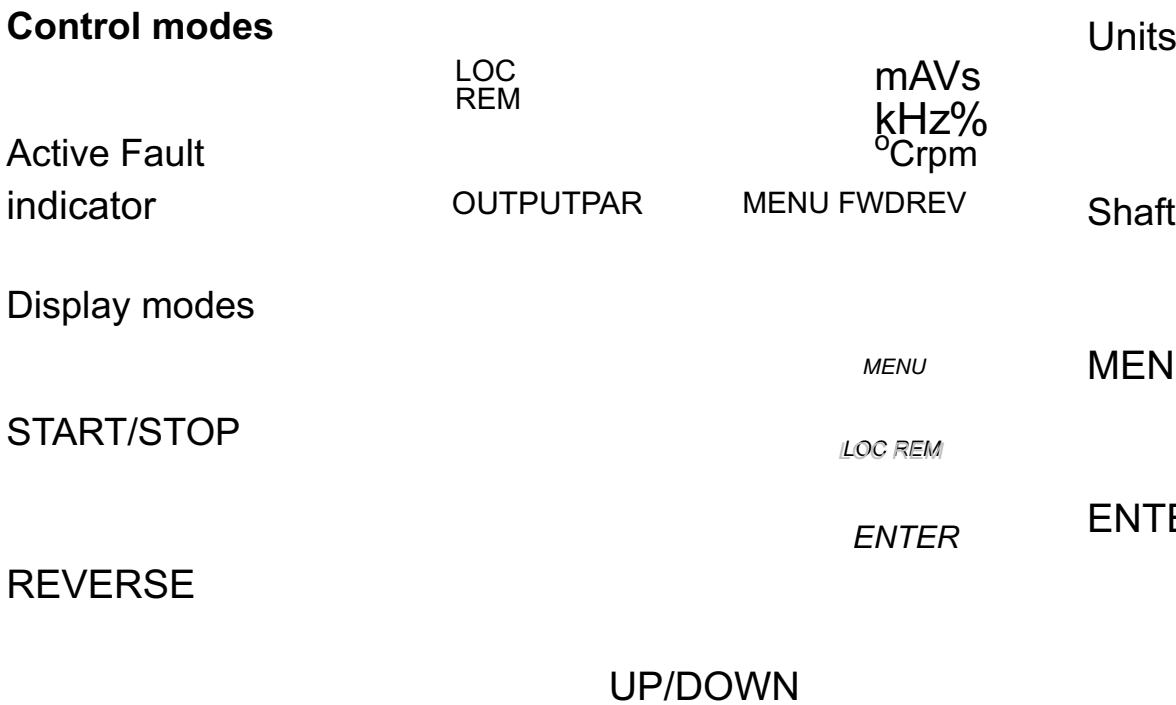
NEMA1/IP21 Installation Kit

ACS140 is supported by DriveWare [?]tools
Please contact your supplier.

Programming

Control Panel

The control panel can be connected to and detached from the converter a
any time. The panel can be used to copy parameters to other ACS140 with
the same software revision (parameter 3301).



Control Modes

The very first time the drive is powered up, it is controlled from the Control
Terminals (remote control, REM). The ACS140 is controlled from the contr
panel when the drive is in local control (LOC).

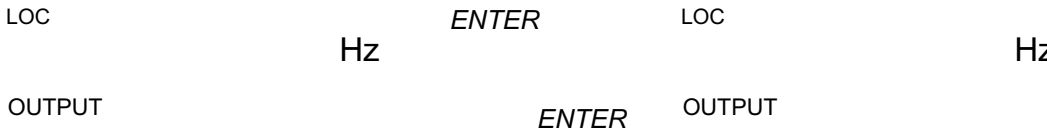
Switch to local control (LOC) by pressing and holding the MENU and ENT

Output Display

When the control panel is powered up, the panel displays the actual out
frequency. Whenever the MENU button is pressed and held, the control
resumes this OUTPUT display.

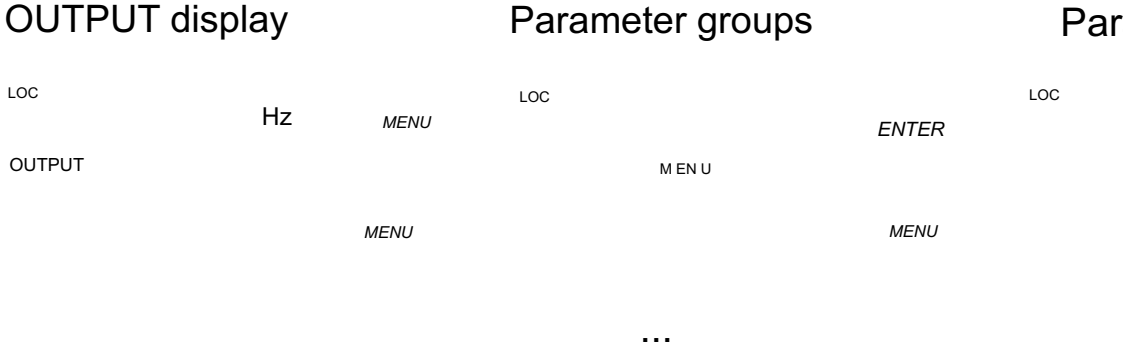
To toggle between output frequency and output current, press the UP o
DOWN button.

To set the output frequency in local control (LOC), press ENTER. Press
the UP/DOWN buttons changes the output immediately. Press ENTER
to return to OUTPUT display.



Menu Structure

ACS140 has a large number of parameters. Of these, only the so-called
basic parameters are initially visible. The menu function -LG- is used to
make the full parameter set visible.



Menu Functions

Scroll the Parameter groups for the desired menu function. Press and hold ENTER until the display blinks to start the function.

Note! Parameter copying does not affect all parameters. The excluded parameters are: 9905 MOTOR NOM VOLT , 9906 MOTOR NOM CURR , 99 NOM FREQ , 9908 MOTOR NOM SPEED , 5201 STATION ID . See "ACS140 Complete Parameter List" on page 39, for a description of the parameters.

Copy parameters from panel to drive (download)

Press & hold

ENTER

MENU

Note! Drive must be stopped and in local control. Parameter 1602 PARAMETER LOCK must be set to 1 (OPEN).

Copy parameters from drive to panel (upload)

Press & hold

ENTER

MENU

Note! Drive must be stopped and in local control. Parameter 1602 PARAMETER LOCK must be set to 1 (OPEN).

Select between basic and full menu

Press & hold

ENTER

MENU

Visible if Full

Resetting the Drive from the Control Panel

When the red LED of the ACS140 is on or blinking, a fault is active.

To reset a fault when the red LED is on, press the START/STOP button.
Caution! This may start the drive, when in remote control.

To reset a fault when the red LED is blinking, turn the power off.
Caution! Turning the power on again may start the drive immediately.

The relevant fault code (see Diagnostics) flashes in the panel display u
fault is reset or the display is "cleared".

You can "clear" the display without resetting the fault by pressing any butto
The word FAULT will be displayed.

Note! If no other button is pressed within 15 seconds and the fault is still active, the fault code will be displayed again.

After a power failure, the drive will revert to the same control mode (LOC o
REM) as before the power failure.

ACS140 Basic Parameters

ACS140 has a large number of parameters. Of these, only the so called basic parameters are initially visible.

Setting up only a few basic parameters is sufficient in applications where t preprogrammed application macros of the ACS140 can provide all desired functionality. For a full description of programmable features provided by th ACS140, see "ACS140 Complete Parameter List" starting on page 39.

The following table lists the basic parameters.

S = Parameters can be modified only when the drive is stopped.

Code Name

Group 99
START-UP DATA

9902 APPLIC MACRO

Selects application macro.Sets parameter values to their default values. Refer to "Application Macros" starting on page 29, for detailed description of each macro.

0 =	FACTORY MACRO	4 =	MOTOR POT
1 =	ABB STANDARD	5 =	HAND - AUTO
2 =	3-WIRE	6 =	PID CONTROL
3 =	ALTERNATE	7 =	PREMAGN

Default value: 0 (FACTORY MACRO)

9905 MOTOR NOM VOLT

Nominal motor voltage from motor rating plate. Range of this parameter depends on the type of the ACS140 (200/400 V unit).

Selection for 200 V units:	Selection for 400V units:
200, 208, 220, 230, 240 V	380, 400, 415, 440, 460, 480 V

Default value for 200 V unit: 230 V

Code Name

Group 01
OPERATING DATA

0128 LAST FAULT
Last recorded fault (0 = no fault). See "Diagnostics" starting on page 81.

Can be cleared with the control panel by pressing UP and DOWN buttons simultaneously when in parameter set mode.

Group 10
COMMAND INPUTS

1003 DIRECTION
Rotation direction lock.

1 = FORWARD
2 = REVERSE
3 = REQUEST

If you select REQUEST, the direction is set according to the given direction command.

Default: 3 (REQUEST)

Group 11
REFERENCE SELECT

1105 EXT REF 1 MAX
Maximum frequency reference in Hz.

Range: 0 -300 Hz

Default value: 50 Hz

Group 12
CONSTANT SPEEDS

1202 CONST SPEED 1

Range for all constant speeds: 0 - 300 Hz

Default value: 5 Hz

1203 CONST SPEED 2

Default value: 10 Hz

Code Name

Group 13
ANALOGUE INPUTS

1301 MINIMUM AI1

Minimum value of AI1 in per cent. Defines relative analogue input value where frequency reference reaches minimum value.

Range: 0 - 100 %

Default value: 0 %

Group 15
ANALOGUE OUTPUT

1503 AO CONTENT MAX

Defines output frequency where analogue output reaches 20 mA.

Range: 0 -300 Hz.

Default value: 50 Hz

Note! Analogue output content is programmable. Values given here are valid only if other analogue output configuration parameters have not been modified. Description of all parameters is given in "ACS140 Complete Parameter List" starting on page 39.

Group 20
LIMITS

2003 MAX CURRENT

Maximum output current.

Range: 0.5* I_N - 1.5* I_N, where I_N is nominal current of the ACS140.

Default value: 1.5 * I_N

2008 MAXIMUM FREQ

Maximum output frequency.

Range: 0 - 300 Hz

Default value: 50 Hz

The table continues on the ne

Code Name

Group 21
START/STOP

2102 STOP FUNCTION
Conditions during motor stopping.

1 = COAST
Motor coasts to stop.

2 = RAMP
Ramp deceleration as defined by the active deceleration time 2203
DECELER TIME 1 or 2205 DECELER TIME 2.

Default value: 1 (COAST)

Group 22
ACCELER/DECELER

2202 ACCELER TIME 1
Ramp 1: time from zero to maximum frequency (0 - MAXIMUM FREQ

Range for all ramp time parameters is 0.1 - 1800 s.

Default value: 5.0 s

2203 DECELER TIME 1
Ramp 1: time from maximum to zero frequency (MAXIMUM FREQ - 0

Default value: 5.0 s

2204 ACCELER TIME 2
Ramp 2: time from zero to maximum frequency (0 - MAXIMUM FREQ

Default value: 60.0 s

2205 DECELER TIME 2
Ramp 2: time from maximum to zero frequency (MAXIMUM FREQ - 0

Default value: 60.0 s

Group 26
MOTOR CONTROL

2606 U/f RATIO
U/f below field weakening point.

1 = LINEAR
2 = SQUARE

Application Macros

Application Macros are preprogrammed parameter sets. They minimise th number of different parameters to be set during start-up. The Factory Mac is the factory-set default macro.

Note! The Factory Macro is intended for applications where there is no control panel available. If using the Factory Macro with control panel nc that the parameters whose value depend on the digital input DI4 cannc be modified from the panel.

Parameter Values

Selecting an application macro with parameter 9902 APPLIC MACRO other parameters (except group 99 start-up data parameters, the paramet lock 1602 and group 52 serial communication parameters) to their default values.

Default values of certain parameters depend on the selected macro. Thes are listed with the description of each macro. Default values for other parameters are given in "ACS140 Complete Parameter List" starting on pa 39.

Connection Examples

In the following connection examples please note:

- All the digital inputs are connected using negative logic.
- The signal types of analogue inputs AI1 and AI2 are selected with DIP switches S1:1 and S1:2.

Frequency reference is given with	DIP switch S1:1 or S1:2

Application Macro Factory (0)

This macro is intended for applications where there is no control panel available. It provides a general purpose 2-wire I/O configuration.

The value of parameter 9902 is 0. DI4 is not connected.

Input signals

- Start, stop and direction (DI1,2)
- Analogue reference (AI1)
- Constant speed 1 (DI3)
- Ramp pair 1/2 selection (DI5)

Output signals

- An. output AO: Frequency
- Relay output 1: Fault
- Relay output 2: Running

DIP

S1

Control Terminals	Function
1 SCR	
2 AI 1	External reference 1; 0...10 V <=> 0...50 H
3 AGND	
4 10 V	Reference voltage 10 VDC
5 AI 2	Not used
6 AGND	
7 AO	Output frequency 0...20 mA <=> 0...50 Hz
8 AGND	
9 +12 V	+12 VDC
10 DCOM	
11 DI 1	Start/Stop. Activate to start ACS140
12 DI 2	Fwd/Rev. Activate to reverse rotation dir
13 DI 3	Constant speed 1. Default: 5Hz
14 DI 4	Leave unconnected!*
15 DI 5	Ramp pair selection. Activate to select ram Defaults: 5 s (ramp pair 1), 60 s (ramp pair 2
16 RO 1A	R
17 RO 1B	
18 RO 2A	R
19 RO 2B	Ru

Application Macro Factory (1)

This macro is intended for applications where there is no control panel available. It provides a general purpose 3-wire I/O configuration.

The value of parameter 9902 is 0. DI 4 is connected.

Input signals	Output signals	DIP swit
• Start, stop and direction (DI1,2,3)	• An. output AO: Frequency	
• Analogue reference (AI1)	• Relay output 1: Fault	S1:1:U
• Ramp pair 1/2 selection (DI5)	• Relay output 2: Running	

Control Terminals	Function
1 SCR	
2 AI 1	External reference1; 0...10 V <=> 0...50 Hz
3 AGND	
4 10 V	Reference voltage 10 VDC
5 AI 2	Not used
6 AGND	
7 AO	Output frequency 0...20 mA <=> 0...50 Hz
8 AGND	
9 +12 V	+12 VDC
10 DCOM	
11 DI 1	Momentary activation with DI2 activated: S
12 DI 2	Momentary deactivation: Stop
13 DI 3	Fwd/Rev; Activate to reverse rotation direct
14 DI 4	Has to be connected!*
15 DI 5	Ramp pair selection. Activate to select ramp p Defaults: 5 s (ramp pair 1), 60 s (ramp pair 2)
16 RO 1A	Rel
17 RO 1B	F
18 RO 2A	Rel
19 RO 2B	Runni

Application Macro ABB Standard

This general purpose macro provides a general purpose 2-wire I/O configuration. It gives two more preset speeds compared to Factory Ma (0).

The value of parameter 9902 is 1.

Input signals
- Start, stop and direction (DI1,2)
- Analogue reference (AI1)
- Preset speed selection (DI3,4)
- Ramp pair 1/2 selection (DI5)

Output signals
- An. output AO: Frequency
- Relay output 1: Fault
- Relay output 2: Running

DIP s

S1:

mA

Control Terminals		Function
1	SCR	
2	AI 1	External reference1; 0...10 V <=> 0...
3	AGND	
4	10 V	Reference voltage 10 VDC
5	AI 2	Not used
6	AGND	
7	AO	Output frequency 0...20 mA <=> 0...5
8	AGND	
9	+12 V	+12 VDC
10	DCOM	
11	DI 1	Start/Stop: Activate to start
12	DI 2	Fwd/Rev: Activate to reverse rotatio
13	DI 3	Constant speed selection*
14	DI 4	Constant speed selection*
15	DI 5	Ramp pair selection. Activate to selec pair 2. Defaults: 5 s / 60 s (ramp pair 1/
16	RO 1A	R
17	RO 1B	
18	RO 2A	R
19	RO 2B	Ru

Application Macro 3-wire

This macro is intended for those applications where the drive is controlled using momentary push-buttons. It gives two more preset speeds compare Factory Macro (1) by using DI4 and DI5.

The value of parameter 9902 is 2.

Input signals	Output signals	DIP sw
• Start,stop and direction (DI1,2,3)	• An. output AO: Frequency	S1:1:U
• Analogue reference (AI1)	• Relay output 1: Fault	
• Preset speed selection (DI4,5)	• Relay output 2: Running	

Control Terminals	Function
1 SCR	
2 AI 1	External reference1; 0...10 V <=> 0...50 H
3 AGND	
4 10 V	Reference voltage 10 VDC
5 AI 2	Not used
6 AGND	
7 AO	Output frequency 0...20 mA <=> 0...50 Hz
8 AGND	
9 +12 V	+12 VDC
10 DCOM	
11 DI 1	Momentary activation with DI2 activated
12 DI 2	Momentary deactivation: Stop
13 DI 3	Activate to reverse rotation: Fwd/Rev
14 DI 4	Constant speed select*
15 DI 5	Constant speed select*
16 RO 1A	Rela
17 RO 1B	F
18 RO 2A	Rela
19 RO 2B	Runni

*Constant speed selection 0 = open, 1 = connected

Application Macro Alternate

This macro offers an I/O configuration that is adopted to a sequence of DI control signals used when alternating the direction of rotation of the driv

The value of parameter 9902 is 3.

Input signals
- Start, stop and direction (DI1,2)
- Analogue reference (AI1)
- Preset speed selection (DI3,4)
- Ramp pair 1/2 selection (DI5)

Output signals
- An. output AO: Frequency
- Relay output 1: Fault
- Relay output 2: Running

DIP s

S1:

Control Terminals		Function
1	SCR	
2	AI 1	External reference1; 0...10 V <=> 0..
3	AGND	
4	10 V	Reference voltage 10 VDC
5	AI 2	Not used
6	AGND	
7	AO	Output frequency 0...20 mA <=> 0...5
8	AGND	
9	+12 V	+12 VDC
10	DCOM	
11	DI 1	Start fwd; If DI1 state is the same as DI2, d
12	DI 2	Start reverse
13	DI 3	Constant speed select*
14	DI 4	Constant speed select*
15	DI 5	Ramp pair selection. Activate to sele pair 2. Defaults: 5 s / 60 s (ramp pair 1
16	RO 1A	
17	RO 1B	
18	RO 2A	
19	RO 2B	

Ru

Application Macro Motor Potentiometer

This macro provides a cost-effective interface for PLCs that vary the speed
the drive using only digital signals.

The value of parameter 9902 is 4.

Input signals
- Start, stop and direction (DI1,2)
- Reference up (DI3)
- Reference down (DI4)
- Preset speed selection (DI5)

Output signals
- An. output AO: Frequency
- Relay output 1: Fault
- Relay output 2: Running

	Control Terminals		Function
	1	SCR	
	2	AI 1	Not used
	3	AGND	
	4	10 V	Reference voltage 10 VDC
	5	AI 2	Not used
	6	AGND	
mA	7	AO	Output frequency 0...20 mA <=> 0...50 H
	8	AGND	
	9	+12 V	+12 VDC
	10	DCOM	
	11	DI 1	Start/Stop: Activate to start ACS140
	12	DI 2	Forward/Reverse: Activate to reverse direction
	13	DI 3	Reference up: Activate to increase refe
	14	DI 4	Reference down: Activate to decrease reference*
	15	DI 5	Constant speed 1
	16	RO 1A	Rela
	17	RO 1B	F
	18	RO 2A	Rela
	19	RO 2B	Runni

Application Macro Hand - Auto

This macro offers an I/O configuration that is typically used in HVAC applications.

The value of parameter 9902 is 5.

Input signals	Output signals	DIP s
• Start/stop(DI1,5) and rev (DI2,4)	• An. output AO: Frequency	
• Two an. references (AI1,AI2)	• Relay output 1: Fault	S1:
• Control location selection (DI3)	• Relay output 2: Running	S1:

	Control Terminals		Function
	1	SCR	
	2	AI 1	External reference 1: 0...10 V <=> 0. (Hand Control)
	3	AGND	
	4	10 V	Reference voltage 10 VDC
	5	AI 2	External reference 2: 0...20 mA <=> (Auto Control)
	6	AGND	
mA	7	AO	Output frequency 0...20 mA <=> 0...5
	8	AGND	
	9	+12 V	+12 VDC
	10	DCOM	
	11	DI 1	Start/Stop: Activate to start ACS140
	12	DI 2	Forward/Reverse: Activate to rever tion direction (Hand)
	13	DI 3	EXT1/EXT2 Select: Activate to sele Control
	14	DI 4	Forward/Reverse: Activate to rever tion direction (Auto)
	15	DI 5	Start/Stop: Activate to start ACS140

Application Macro PID Control

This macro is intended for use with different closed-loop control systems such as pressure control, flow control, etc.

The value of parameter 9902 is 6.

Input signals
- Start/stop (DI1)
- Analogue reference (AI1)
- Actual value (AI2)
- Control location selection (DI2)
- Constant speeds (DI4,5)

Output signals
- An. output AO: Frequency
- Relay output 1: Fault
- Relay output 2: Running

DIP swi

S1:1:U
S1:2: I

		Control Terminals	Function
		1 SCR	
		2 AI 1	EXT1 (Manual) or EXT2 (PID) reference; 0...1
		3 AGND	
		4 10 V	Reference voltage 10 VDC
PT		5 AI 2	Actual signal; 0...20 mA (PID)
		6 AGND	
	mA	7 AO	Output frequency 0...20 mA <=> 0...50 Hz
		8 AGND	
		9 +12 V	+12 VDC
		10 DCOM	
		11 DI 1	Start/Stop: Activate to start ACS140*
		12 DI 2	EXT1/EXT2 select: Activate to select PID co
		13 DI 3	Not Used
		14 DI 4	Three constant speeds (1..3) are selected with digital inputs DI4 and DI5; not used if PID cont
		15 DI 5	Three constant speeds (1..3) are selected with digital inputs DI4 and DI5; not used if PID cont
		16 RO 1A	Rel
		17 RO 1B	
		18 RO 2A	Rel
		19 RO 2B	Runn

Application Macro Premagnetise

This macro is intended for those applications where the drive must start quickly. Building up the flux in the motor always takes time. With the Premagnetise Macro, this delay can be eliminated.

The value of parameter 9902 is 7.

Input signals
- Start, stop and direction (DI1,2)
- Analogue reference (AI1)
- Preset speed selection (DI3,4)
- Premagnetise (DI5)

Output signals
- An. output AO: Frequency
- Relay output 1: Fault
- Relay output 2: Running

DIP s

S1:

	Control Terminals		Function
	1	SCR	
	2	AI 1	External reference1: 0...10 V <=> 0...
	3	AGND	
	4	10 V	Reference voltage 10 VDC
	5	AI 2	Not used
	6	AGND	
mA	7	AO	Output frequency 0...20 mA <=> 0...5
	8	AGND	
	9	+12 V	+12 VDC
	10	DCOM	
	11	DI 1	Start/Stop: Activate to start ACS140
	12	DI 2	Fwd/Rev: Activate to reverse rotatio
	13	DI 3	Constant speed select*
	14	DI 4	Constant speed select*
	15	DI 5	Premagnetise: Activate to start pren
	16	RO 1A	
	17	RO 1B	
	18	RO 2A	
	19	RO 2B	

Ru

ACS140 Complete Parameter List

Initially, only the so called basic parameters (shaded grey in Table 1) are visible. The menu function -LG- is used to make the full parameter set visi

S = Parameters can be modified only when the drive is stopped.
M = Default value depends on the selected macro (*).

Table 1 Full parameter set.

Code	Name	Range	Resolution	Default	Use
Group 99 START-UP DATA					
9902	APPLIC MACRO	0-7	1	0 (FACTORY)	
9905	MOTOR NOM VOLT	200, 208,220, 230, 240,380, 400, 415,440, 460, 480 V	1 V	230/400 V	
9906	MOTOR NOM CURR	0.5*I_N - 1.5*I_N	0.1 A	I_N	
9907	MOTOR NOM FREQ	0-300 Hz	1 Hz	50 Hz	
9908	MOTOR NOM SPEED	0-3600 rpm	1 rpm	1440 rpm	
Group 01 OPERATING DATA					
0102	SPEED	0-9999 rpm	1 rpm	-	
0103	OUTPUT FREQ	0-300 Hz	0.1 Hz	-	
0104	CURRENT	-	0.1 A	-	
0105	TORQUE	-100 - 100 %	0.1 %	-	
0106	POWER	-	0.1 kW	-	
0107	DC BUS VOLTAGE	0-679 V	0.1 V	-	
0109	OUTPUT VOLTAGE	0-480 V	0.1 V	-	
0110	ACS 140 TEMP	0-150 °C	0.1 °C	-	
0111	EXT REF 1	0-300 Hz	0.1 Hz	-	
0112	EXT REF 2	0-100 %	0.1 %	-	
0113	CTRL LOCATION	0-2	1	-	

Code	Name	Range	Resolution	Default	U
Group 10 COMMAND INPUTS					
1001	EXT1 COMMANDS	0-10	1	2/4	
1002	EXT2 COMMANDS	0-10	1	0 (NOT SEL)	
1003	DIRECTION	1-3	1	3 (REQUEST)	
Group 11 REFERENCE SELECT					
1101	KEYPAD REF SEL	1-2	1	1 (REF1(Hz))	
1102	EXT1/EXT2 SEL	1-8	1	6 (EXT1)	
1103	EXT REF 1 SELECT	0-11	1	1 (AI1)	
1104	EXT REF 1 MIN	0-300 Hz	1 Hz	0 Hz	
1105	EXT REF 1 MAX	0-300 Hz	1 Hz	50 Hz	
1106	EXT REF 2 SELECT	0-11	1	0 (KEYPAD)	
1107	EXT REF 2 MIN	0-100 %	1 %	0 %	
1108	EXT REF 2 MAX	0-500 %	1 %	100 %	
1109	CONST EXT REF 1	0-300 Hz	0.1 Hz	50 Hz or 60 Hz	
1110	CONST EXT REF 2	0-100 %	0.1 %	40 %	
Group 12 CONSTANT SPEEDS					
1201	CONST SPEED SEL	0-10	1	3/0	
1202	CONST SPEED 1	0-300 Hz	0.1 Hz	5 Hz	
1203	CONST SPEED 2	0-300 Hz	0.1 Hz	10 Hz	
1204	CONST SPEED 3	0-300 Hz	0.1 Hz	15 Hz	
1205	CONST SPEED 4	0-300 Hz	0.1 Hz	20 Hz	
1206	CONST SPEED 5	0-300 Hz	0.1 Hz	25 Hz	
1207	CONST SPEED 6	0-300 Hz	0.1 Hz	40 Hz	
1208	CONST SPEED 7	0-300 Hz	0.1 Hz	50 Hz	
Group 13					

Code	Name	Range	Resolution	Default	Use
1506	FILTER AO	0-10 s	0.1 s	0.1 s	
Group 16 SYSTEM CONTROLS					
1601	RUN ENABLE	0-6	1	0 (NOT SEL)	
1602	PARAMETER LOCK	0-2	1	1 (OPEN)	
1604	FAULT RESET SEL	0-7	1	6 (START / STOP)	
1608	DISPLAY ALARMS	0-1	1	0 (NO)	
Group 20 LIMITS					
2003	MAX CURRENT	$0.5*I_N$ - $1.5*I_N$	0.1 A	$1.5*I_N$	
2005	OVERVOLT CTRL	0-1	1	1 (ENABLE)	
2006	UNDERVOLT CTRL	0-2	1	1 (ENABLE TIME)	
2007	MINIMUM FREQ	0-300 Hz	1 Hz	0 Hz	
2008	MAXIMUM FREQ	0-300 Hz	1 Hz	50 Hz	
Group 21 START/STOP					
2101	START FUNCTION	1-4	1	1 (RAMP)	
2102	STOP FUNCTION	1-2	1	1 (COAST)	
2103	TORQ BOOST CURR	$0.5*I_N$ - $2.0*I_N$	0.1 A	$1.2*I_N$	
2104	STOP DC INJ TIME	0-250 s	0.1 s	0 s	
2105	PREMAGN SEL	0-6	1	0 (NOT SEL)	
2106	PREMAGN MAX TIME	0-25.0 s	0.1 s	2.0 s	
2107	START INHIBIT	0-1	1	1 (ON)	
Group 22 ACCEL/DECEL					
2201	ACC/DEC 1/2 SEL	0-5	1	5 (DI5)	
2202	ACCELER TIME 1	0.1-1800 s	0.1; 1 s	5 s	

Code	Name	Range	Resolution	Default	U
2607	SLIP COMP RATIO	0-250 %	1 %	0 %	
	Group 30 FAULT FUNCTIONS				
3001	AI<MIN FUNCTION	0-3	1	1 (FAULT)	
3002	PANEL LOSS	1-3	1	1 (FAULT)	
3003	EXTERNAL FAULT	0-5	1	0 (NOT SEL)	
3004	MOT THERM PROT	0-2	1	1 (FAULT)	
3005	MOT THERM TIME	256-9999 s	1 s	500 s	
3006	MOT LOAD CURVE	50-150 %	1 %	100 %	
3007	ZERO SPEED LOAD	25-150 %	1 %	70 %	
3008	BREAK POINT	1-300 Hz	1 Hz	35 Hz	
3009	STALL FUNCTION	0-2	1	0 (NOT SEL)	
3010	STALL CURRENT	$0.5*I_N$ - $1.5*I_N$	0.1 A	$1.2*I_N$	
3011	STALL FREQ HI	0.5-50 Hz	0.1 Hz	20 Hz	
3012	STALL TIME	10-400 s	1 s	20 s	
3013	AI1 FAULT LIMIT	0-100 %	1 %	0 %	
3014	AI2 FAULT LIMIT	0-100 %	1 %	0 %	
	Group 31 AUTOMATIC RESET				
3101	NR OF TRIALS	0-5	1	0	
3102	TRIAL TIME	1.0-180.0 s	0.1 s	30 s	
3103	DELAY TIME	0.0-3.0 s	0.1 s	0 s	
3104	AR OVERCURRENT	0-1	1	0 (DISABLE)	
3105	AR OVERVOLTAGE	0-1	1	0 (DISABLE)	
3106	AR UNDERVOLTAGE	0-1	1	0 (DISABLE)	
3107	AR AI <MIN	0-1	1	0 (DISABLE)	
	Group 32 SUPERVISION				

Code	Name	Range	Resolution	Default	Use
4008	ACT2 INPUT SEL	1-2	1	2 (AI2)	
4009	ACT1 MINIMUM	0-1000 %	1 %	0 %	
4010	ACT1 MAXIMUM	0-1000 %	1 %	100 %	
4011	ACT2 MINIMUM	0-1000 %	1 %	0 %	
4012	ACT2 MAXIMUM	0-1000 %	1 %	100 %	
4013	PID SLEEP DELAY	0.0-3600 s	0.1; 1 s	60 s	
4014	PID SLEEP LEVEL	0.0-120 Hz	0.1 Hz	0 Hz	
4015	WAKE -UP LEVEL	0.0-100 %	0.1 %	0 %	
4019	SET POINT SEL	1-2	1	2 (EXTERNAL)	
4020	INTERNAL SETPNT 1	0.0-100.0 %	0.1 %	40 %	
4021	INTERNAL SETPNT 2	0.0-100.0 %	0.1 %	80 %	
4022	INTERNAL SETPNT SEL	1-7	1	6 (SETPNT1)	

Group 52 SERIAL COMM

For descriptions of parameters in this group, refer to ACS140 RS485 and RS232 *Adapter Installation and Start-up Guide.*

Basic parameters are marked with a thick border as in the following:

nnnn XXXX

Group 99: Start-up Data

The Start-up Data parameters are a special set of parameters for settin
the ACS140 and for entering motor information.

Code Description

9902 APPLIC MACRO

Application macro selection. This parameter is used to select the Applicati
Macro which will configure the ACS140 for a particular application. Refer t
"Application Macros" on page 29, for a list and description of available
Application Macros.

9905 MOTOR NOM VOLT

Nominal motor voltage from motor rating plate. This parameter sets the
maximum output voltage supplied to motor by ACS140. MOTOR NO
the frequency at which output voltage is equal to the MOTOR NOM V
ACS140 cannot supply the motor with a voltage greater than the mains vo
See Figure 1.

9906 MOTOR NOM CURR

Nominal motor current from rating plate. The allowed range is 0.5 · I
of ACS140.

9907 MOTOR NOM FREQ

Nominal motor frequency from rating plate (field weakening point).
See Figure 1.

9908 MOTOR NOM SPEED

Nominal motor speed from rating plate.

Output voltage

MOTOR NOM VOLT

Group 01: Operating Data

Actual Signals monitor ACS140 functions. They do not affect the performance of the ACS140. Actual Signal values are measured or calculated by the drive and they cannot be set by the user.

Code Description

0102 SPEED
Displays the calculated speed of the motor (rpm).

0103 OUTPUT FREQ
Displays the frequency (Hz) applied to the motor. (Also shown in OUTPUT display.)

0104 CURRENT
Displays the motor current, as measured by the ACS140.
(The same value that is shown by the OUTPUT display mode.)

0105 TORQUE
Output torque. Calculated value of torque on motor shaft in % of motor nomin torque.

0106 POWER
Displays the measured motor power in kW.
Note! ACS100-PAN will not display the unit ("kW").

0107 DC BUS VOLTAGE
Displays the DC bus voltage, as measured by the ACS140. The voltage is displayed in Volts DC.

0109 OUTPUT VOLTAGE
Displays the voltage applied to the motor.

0110 ACS 140 TEMP
Displays the temperature of the ACS140 heatsink in degrees centigrade.

0111 EXT REF 1
Displays the selected Hz reference that the reference selection block forward to the ramp generator.

0112 EXT REF 2
As parameter 0111 scaled to per cent (%), except when PID controller is on, then the PID setpoint controller is displayed.

0113 CTRL LOCATION

Code Description

0121 DI5 & RELAYS

Status of digital input 5 and relay outputs. 1 indicates that the relay is ener
and 0 indicates that the relay is de-energised.

DI 5
Relay 2 status
Relay 1 status

0122 AO

Value of analogue output signal in milliamperes.

0124 ACTUAL VALUE 1

PID Controller actual value 1 (ACT1), displayed in per cent (%).

0125 ACTUAL VALUE 2

PID Controller actual value 2 (ACT2), displayed in per cent (%).

0126 CONTROL DEV

Displays the difference between the reference value and the actual value
PID process controller, displayed in per cent (%).

0127 ACTUAL VALUE

Feedback signal (actual value) for PID controller, displayed in per cent (%

0128 LAST FAULT

Last recorded fault (0=no fault). See "Diagnostics" on page 81.
Can be cleared with the control panel by pressing UP and DOWN buttons
simultaneously when in parameter set mode.

0129 PREVIOUS FAULT

Previous recorded fault. See "Diagnostics" on page 81.
Can be cleared with the control panel by pressing UP and DOWN buttons
simultaneously when in parameter set mode.

0130 OLDEST FAULT

Oldest recorded fault. See "Diagnostics" on page 81.
Can be cleared with the control panel by pressing UP and DOWN buttons
simultaneously when in parameter set mode.

Group 10: Command Inputs

Start, Stop and Direction commands can be given from the control panel c
from two external locations (EXT1, EXT2). The selection between the tw
external locations is made with parameter 1102 EXT1/EXT2 SEL. For
information on control locations refer to "APPENDIX" on page 93.

Code Description

1001 EXT1 COMMANDS

Defines the connections and the source of Start/Stop/Direction commands for
External control location 1 (EXT1).

0 = NOT SEL
No Start/Stop/Direction command source for EXT1 is selected.

1 = DI1
Two-wire Start/Stop connected to digital input DI1. DI1 deactivated = Stop;
DI1 activated = Start. *

2 = DI1,2
Two-wire Start/Stop, Direction. Start/Stop is connected to digital input DI1 as
above. Direction is connected to digital input DI2. DI2 deactivated = Forward;
DI2 activated = Reverse. To control direction, value of parameter 1003
DIRECTION should be REQUEST.

3 = DI1P,2P
Three-wire Start/Stop. Start/Stop commands are given by means of momenta
push-buttons (the P stands for "pulse"). The Start push-button is normally ope
and connected to digital input DI1. The Stop push-button is normally closed, a
connected to digital input DI2. Multiple Start push-buttons are connected in
parallel; multiple Stop push-buttons are connected in series. *,**

4 = DI1P,2P,3
Three-wire Start/Stop, Direction. Start/Stop connected as with DI1P,2P. Direct
is connected to digital input DI3. DI3 deactivated = Forward; DI3 activated =
Reverse. To control Direction, value of parameter 1003 DIRECTION sh
REQUEST. **

5 = DI1P,2P,3P
Start Forward, Start Reverse, and Stop. Start and Direction commands are gi
simultaneously with two separate momentary push-buttons (the P stands for
"pulse"). The Stop push-button is normally closed, and connected to digital in
DI3. The Start Forward and Start Reverse push-buttons are normally open, a
connected to digital inputs DI1 and DI2 respectively. Multiple Start push-butto

1002 EXT2 COMMANDS

Defines the connections and the source of Start, Stop and Direction comm
for external control location 2 (EXT2).

Refer to parameter 1001 EXT1 COMMANDS above.

1003 DIRECTION

1 = FORWARD
2 = REVERSE
3 = REQUEST

Rotation direction lock. This parameter allows you to fix the direction of rot
of the motor to forward or reverse. If you select 3 (REQUEST), the di
according to the given direction command.

Group 11: Reference Select

Reference commands can be given from the control panel or from two external locations. The selection between the two external locations is ma with parameter 1102 EXT1/EXT2 SEL. For more information on control locations, refer to "APPENDIX" on page 93.

Code Description

1101 KEYPAD REF SEL

Selection of active control panel reference in local control mode.

1 = REF1 (Hz)
Control panel reference is given in Hz.

2 = REF2 (%)
Control panel reference is given as a percentage (%).

1102 EXT1/EXT2 SEL

Sets the input used for selecting the external control location, or fixes it to or EXT2. The external control location of both Start/Stop/Direction commands and reference is determined by this parameter.

1...5 = DI1...DI5
External control location 1 or 2 is selected according to the state of the select digital input (DI1 ... DI5), where deactivated = EXT1 and activated =

6 = EXT1
External control location 1 (EXT1) is selected. The control signal sources f EXT1 are defined with parameter 1001 (Start/Stop/Direction commands) and parameter 1103 (reference).

7 = EXT2
External control location 2 (EXT2) is selected. The control signal sources f EXT2 are defined with parameter 1002 (Start/Stop/Direction commands) and parameter 1106 (reference).

8 = COMM
External control location 1 or 2 is chosen through serial communication.

1103 EXT REF1 SELECT

This parameter selects the signal source of external reference 1.

0 = KEYPAD
Reference is given from the control panel.

1 = AI 1
Reference is given through analogue input 1.

2 = AI 2
Reference is given through analogue input 2.

3 = AI1/ JOYST; 4 = AI2/ JOYST
Reference is given through analogue input 1 (or 2 accordingly) configured
joystick. The minimum input signal runs the drive at maximum reference in
reverse direction. The maximum input signal runs the drive at maximum
reference in the forward direction (See Figure 2). See also parameter 100
DIRECTION.

Caution: Minimum reference for joystick should be 0.3 V (0.6 mA) or highe
0 ... 10 V signal is used, the ACS140 will operate at maximum reference in
reverse direction if the control signal is lost. Set parameter 3013 A
or 3014 AI2 FAULT LIMIT to a value 3 % or higher, and parameter 3001
FUNCTION to 1 (FAULT), and the ACS140 will stop in case the control sign
lost.

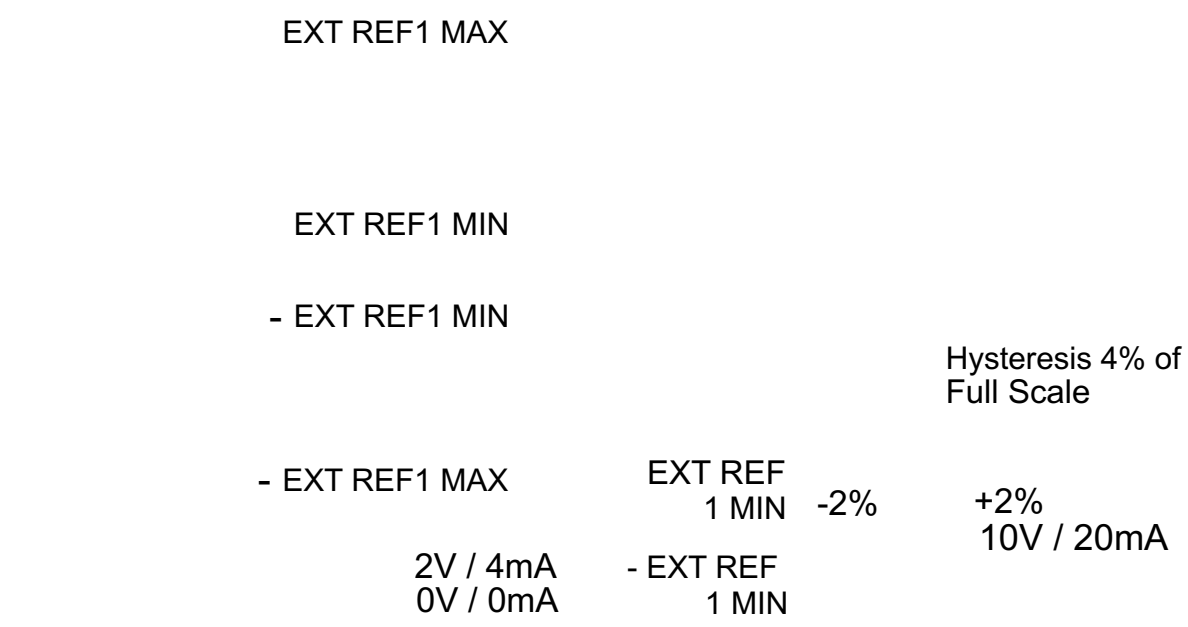


Figure 2 Joystick control. Maximum for external reference 1 is set with Parameter 1105 and minimum with Parameter 1104

1105 EXT REF1 MAX

Sets the maximum frequency reference for external reference 1 in Hz. When analogue input signal is at maximum, external reference 1 equals to MAX. See Figure 3.

1106 EXT REF2 SELECT

This parameter selects the signal source for external reference 2. The alternatives are the same as with external reference 1, see parameter 1103 REF1 SELECT.

1107 EXT REF2 MIN

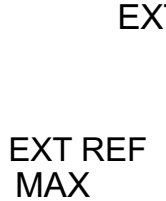
Sets the minimum reference in %. When analogue input signal is at minimum value external reference 2 equals to EXT REF 2 MIN. See Figure 3.

- If the PID Control macro is selected, this parameter sets the minimum process reference.
- If any other macro than PID is selected, this parameter sets the minimum frequency reference. This value is given as a percentage of the maximu frequency.

1108 EXT REF2 MAX

Sets the maximum reference in %. When analogue input signal is at maximu external reference 2 equals to EXT REF 2 MAX. See Figure 3.

- If the PID Control macro is selected, this parameter sets the maximum process reference.
- If any other macro than PID Control is selected, this parameter sets the maximum frequency reference. This value is given as percentage of maximum frequency.



Group 12: Constant Speeds

The ACS140 has 7 programmable constant speeds, ranging from 0 to 300 Hz. Negative speed values cannot be given for constant speeds.

Constant speed selections are ignored if the process PID reference is followed (see PID Control Macro).

Note! Parameter 1208 CONST SPEED 7 acts also as a so-called fault s which may be activated if the control signal is lost. Refer to parameter 3 AI<MIN FUNCTION and parameter 3002 PANEL LOSS .

Code Description

1201 CONST SPEED SEL

This parameter defines which digital inputs are used to select Constant Sp

0 = NOT SEL

Constant speed function disabled.

1...5 = DI1...DI5

Constant Speed 1 is selected with digital inputs DI1-DI5. Digital input activ = Constant Speed 1 activated.

6 = DI1,2

Three Constant Speeds (1 ... 3) are selected with two digital inputs. Constant Speed selection with digital inputs DI1,2.

Table 2 Constant Speed selection with digital inputs DI1,2.

DI1	DI2	Function
0	0	No constant speed
1	0	Constant speed 1 (1202)
0	1	Constant speed 2 (1203)
1	1	Constant speed 3 (1204)

0 = DI deactivated, 1 = DI activated

7 = DI3,4

Three Constant Speeds (1 ... 3) are selected with two digital inputs as in D

8 = DI4,5

Group 13: Analogue Inputs

Code Description

1301 MINIMUM AI1

Relative minimum value of AI1 (%). Value corresponds to minimum reference set by parameter 1104 EXT REF 1 MIN or 1107 EXT REF 2 MIN.

See Figure 3 on page 51

1302 MAXIMUM AI1

Maximum value of AI1 (%). Value corresponds to maximum reference set by parameter 1105 EXT REF 1 MAX or 1108 EXT REF 2 MAX.

See Figure 3 on page 51.

1303 FILTER AI1

Filter time constant for analogue input AI1. As the analogue input value changes, 63 % of the change takes place within the time specified by this parameter.

Note! Even if you select 0 s for the filter time constant, the signal is still filtered with a time constant of 25 ms due to the signal interface hardware. This cannot be changed by any parameters.

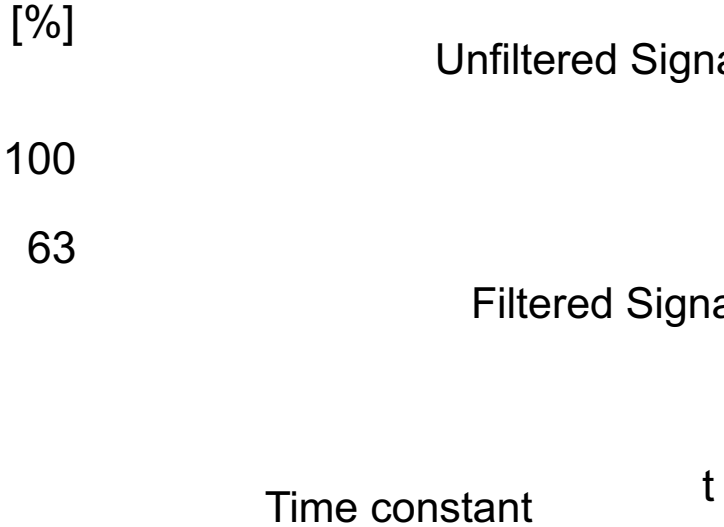


Figure 4 Filter time constant for analogue input AI1.

1304 MINIMUM AI2

Minimum value of AI2 (%). Value corresponds to minimum reference set by parameter 1104 EXT REF 1 MIN or 1107 EXT REF 2 MIN.

1305 MAXIMUM AI2

Maximum value of AI2 (%). Value corresponds to maximum reference set by

Group 14: Relay Outputs

Code Description

1401 RELAY OUTPUT 1

Relay output 1 content.
Selects which information is indicated with relay output 1.

0 = NOT SEL
Relay is not used and is de-energised.

1 = READY
The ACS140 is ready to function. The relay is energised unless no run ena
signal is present or a fault exists and supply voltage is within range.

2 = RUN
Relay energised when the ACS140 is running.

3 = FAULT (-1)
Relay energised when power is applied, and de-energised upon a fault trip

4 = FAULT
Relay energised when a fault is active.

5 = ALARM
Relay energised when an alarm (AL10-22) is active.

6 = REVERSED
Relay energised when motor rotates in reverse direction.

7 = SUPRV1 OVER
Relay energised when first supervised parameter (3201) exceeds the limit
(3203). See "Group 32: Supervision" on page 69.

8 = SUPRV1 UNDER
Relay energised when first supervised parameter (3201) drops below the l
(3202). See "Group 32: Supervision" on page 69.

9 = SUPRV2 OVER
Relay energised when second supervised parameter (3204) exceeds the l
(3206). See "Group 32: Supervision" on page 69.

10 = SUPRV2 UNDER
Relay energised when second supervised parameter (3204) drops below t
limit (3205). See "Group 32: Supervision" on page 69.

11 = AT SET POINT
Relay energised when output frequency is equal to reference frequency.

1402 RELAY OUTPUT 2

Relay output 2 content. Refer to parameter 1401

Group 15: Analogue Output

Analogue output is used to output the value of any parameter of the Operating Data group (Group 1) as a current signal. Output current minimu and maximum values are configurable, as are the allowed minimum and maximum values for the observed parameter.

If analogue output content maximum value (parameter 1503) is set to less than minimum value (parameter 1502), output current is inversely proportional to the value of the observed parameter.

Code Description

1501 AO CONTENT
: Content for analogue output. Number of any parameter of the Operating Data group (Group 01).

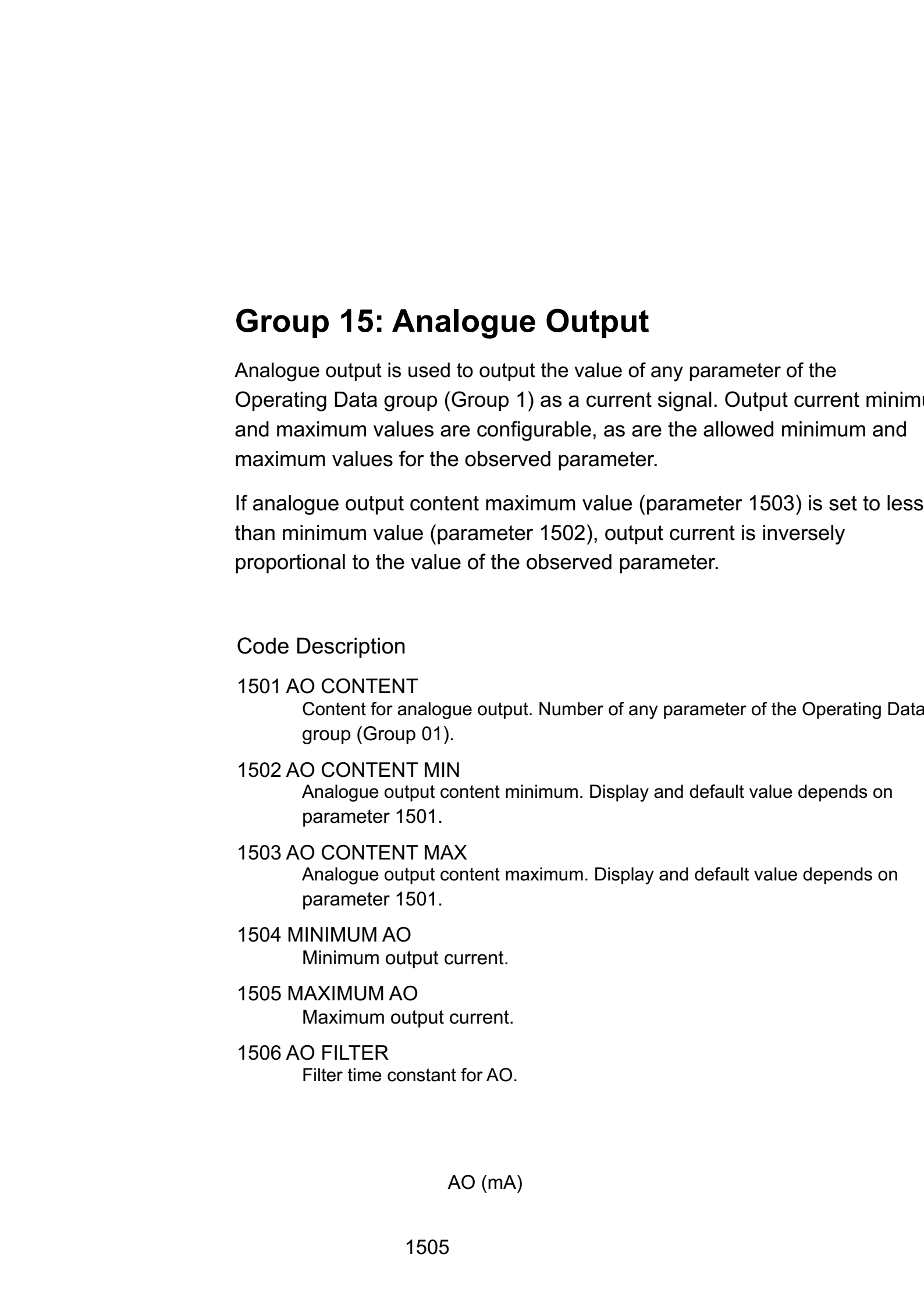
1502 AO CONTENT MIN
: Analogue output content minimum. Display and default value depends on parameter 1501.

1503 AO CONTENT MAX
: Analogue output content maximum. Display and default value depends on parameter 1501.

1504 MINIMUM AO
: Minimum output current.

1505 MAXIMUM AO
: Maximum output current.

1506 AO FILTER
: Filter time constant for AO.



Group 16: System Controls

Code Description

1601 RUN ENABLE

Selects the source of the run enable signal.

0 = NOT SEL
The ACS140 is ready to start without an external run enable signal.

1...5 = DI1 ... DI5
To activate the run enable signal, the selected digital input must be activat
the voltage drops and deactivates the selected digital input, the ACS140 w
coast to stop and not start until the run enable signal resumes.

6 = COMM
The run enable signal is given through serial communication.

1602 PARAMETER LOCK

0 = LOCKED
Control panel START/STOP and REVERSE buttons and parameter modifi
disabled. Parameter value viewing is allowed.

1 = OPEN
Panel operations are allowed.

2 = NOT SAVED
Modified values not stored in permanent memory.

Note! Option 0 (LOCKED) can be selected only in remote mode.

Note! This parameter is not affected by macro selection.

1604 FAULT RESET SEL

Fault reset source.

Note! Fault reset is always possible with control panel.

0 = KEYPAD ONLY
Fault reset is executed from the control panel keypad.

1...5 = DI1 ... DI5
Fault reset is executed from a digital input. Reset is activated by deactivati
input.

6 = START /STOP
Fault reset is activated by Stop command.

7 = COMM

Group 20: Limits

Code Description

2003 MAX CURRENT

Maximum output current.

The maximum output current that the ACS140 will supply to the motor. The default value is 1.5 * I_N.

2005 OVERVOLT CTRL

DC overvoltage controller enable.

Fast braking of a high inertia load causes the DC bus voltage to rise to the overvoltage control limit. To prevent the DC voltage from exceeding the limit, t overvoltage controller automatically decreases the braking torque.

Caution! If a braking chopper and a braking resistor are connected to the ACS140, this parameter value must be set to 0 to ensure proper operation of the chopper.

0 = DISABLE

1 = ENABLE

2006 UNDERVOLT CTRL

DC undervoltage controller enable.

If the DC bus voltage drops due to loss of input power, the undervoltage controller will decrease the motor speed in order to keep the DC bus voltage above the lower limit. By decreasing the motor speed, the inertia of the load w cause regeneration back into the ACS140, thus keeping the DC bus charged, and preventing an undervoltage trip. This will increase power loss ride-throug on systems with a high inertia, such as a centrifuge or fan.

0 = DISABLE

1 = ENABLE (TIME)

Enable with 500 ms time limit for operation.

2 = ENABLE

Enable without time limit for operation.

2007 MINIMUM FREQ

Operating range minimum output frequency.

Note! Keep MINIMUM FREQ ≤ MAXIMUM FREQ .

2008 MAXIMUM FREQ

Operating range maximum output frequency.

Group 21: Start/Stop

ACS140 supports several start and stop modes, including flying start ar
torque boosting at start. DC current can be injected either before the sta
command (premagnetising) or automatically right after the start comma
(starting with DC hold).

DC hold can be used when stopping the drive with ramp. If drive is stoppin
by coasting, DC brake can be used.

Note! Too long a DC injection time or premagn max time causes the motor
heat up.

Code Description

2101 START FUNCTION

Conditions during motor acceleration.

1 = RAMP

Ramp acceleration as set.

2 = FLYING START

Flying start. Use this setting if the motor is already rotating and the drive w
start smoothly at the current frequency.

3 = TORQUE BOOST

Automatic torque boost might be necessary in drives with high starting torq
Torque boost is only applied at start. Boosting is stopped when output freq
exceeds 20 Hz or when output frequency is equal to reference. See also
parameter 2103 TORQ BOOST CURR .

4 = FLY + BOOST

Activates both the flying start and torque boost.

2102 STOP FUNCTION

Conditions during motor deceleration.

1 = COAST

Motor coasts to stop.

2 = RAMP

Ramp deceleration as defined by the active deceleration time 2203
TIME 1 or 2205 DECELER TIME 2.

2103 TORQ BOOST CURR

Code Description

2107 START INHIBIT

Start inhibit control. Start inhibit means that a pending start command is ignor

when:

- fault is reset, or
- Run Enable activates while start command is active, or
- mode change from local to remote takes place, or
- mode change from remote to local takes place, or
- switch from EXT1 to EXT2 takes place, or
- switch from EXT2 to EXT1 takes place.

0 = OFF

Start inhibit control disabled. Drive will start after fault is reset, Run Enable is activated or mode is changed while there is a pending start command.

1 = ON

Start inhibit control enabled. Drive will not start after fault is reset, Run Enable activated or mode is changed. In order to start the drive again, give start command anew.

Group 22: Accel/Decel

Two acceleration/deceleration ramp pairs can be used. If both ramp pai
used, selection can be made between these in run time through a digita
input. The S curve of the ramps is adjustable.

Code Description

2201 ACC/DEC 1/2 SEL

Selects the source for the ramp pair selection signal.

0 = NOT SEL
The first ramp pair is used (ACCELER TIME 1/DECELER TIME 1).

1...5 = DI1...DI5
Ramp pair selection is done through a digital input (DI1 to DI5).
Digital input deactivated = Ramp pair 1 (ACCELER TIME 1/DECELER T
used.
Digital input activated = Ramp pair 2 (ACCELER TIME 2/DECELER TIME

Note! Ramp pair selection is not followed under serial link control.

2202 ACCELER TIME 1

Ramp 1: time from zero to maximum frequency (0 - MAXIMUM FREQ

2203 DECELER TIME 1

Ramp 1: time from maximum frequency to zero (MAXIMUM FREQ - 0

2204 ACCELER TIME 2

Ramp 2: time from zero to maximum frequency (0 - MAXIMUM FREQ

2205 DECELER TIME 2

Ramp 2: time from maximum frequency to zero (MAXIMUM FREQ - 0

2206 RAMP SHAPE

Acceleration/deceleration ramp shape selection.

0 = LINEAR
1 = FAST S CURVE
2 = MEDIUM CURVE
3 = SLOW S CURVE

Group 25: Critical Freq

In some mechanical systems, certain speed ranges can cause resonance problems. With this parameter group, it is possible to set up to two differen speed ranges that the ACS140 will skip over.

Note! When the PID Control macro is used, critical frequencies are ignore

Code Description

2501 CRIT FREQ SEL
Critical frequencies activation.
0 = OFF
1 = ON

2502 CRIT FREQ 1 LO
Critical frequency 1 start.
Note! If LOW > HI, no critical frequency lock-out will happen.

2503 CRIT FREQ 1 HI
Critical frequency 1 end.

2504 CRIT FREQ 2 LO
Critical frequency 2 start.

2505 CRIT FREQ 2 HI
Critical frequency 2 end.
Note! If LOW > HI, no critical frequency lock-out will happen.

Example: A fan system vibrates badly from 18 Hz to 23 Hz and from 46 Hz to 52 Hz. Set the parameters as follows:

CRIT FREQ 1 LO = 18 Hz and CRIT FREQ 1 HI = 23 Hz
CRIT FREQ 2 LO = 46 Hz and CRIT FREQ 2 HI = 52 Hz

f_{output}
[Hz]

Group 26: Motor Control

Code Description

2603 IR COMPENSATION

IR compensation voltage at 0 Hz.

Note! IR compensation should be kept as low as possible to prevent overheating.
Refer to Table 4.

Table 4 Typical IR compensation valu

200 V Units					
P_N / kW	0.12	0.18	0.25		
IR comp / V	30	27	25		
200 V Units					
P_N / kW			0.75	1.1	
IR comp / V			18	16	
400 V Units					
P_N / kW	0.37	0.55	0.75	1.1	
IR comp / V	37	33	30	27	

2604 IR COMP RANGE

IR compensation range. Defines frequency after which IR compensation is

2605 LOW NOISE

Motor acoustical noise option.

0 = STANDARD (switching frequency 4 kHz)

1 = LOW NOISE (switching frequency 8 kHz)

2 = SILENT (switching frequency 16 kHz)

Note! When the low noise (8 kHz) setting is used, the maximum loadability the ACS140 is I_2 at 30 °C ambient temperature or 0.9 * I_2 at 40 °C. silent (16 kHz) setting is used, the maximum loadability is 0.75 * I_2 ambient temperature. (except ACS143-1K1-3, ACS143-2K1-3, ACS143 and ACS143-2H1-3 then the maximum loadability is 0.55 * I_2 at 30

2606 U/F RATIO

U/f ratio below field weakening point.

1 = LINEAR

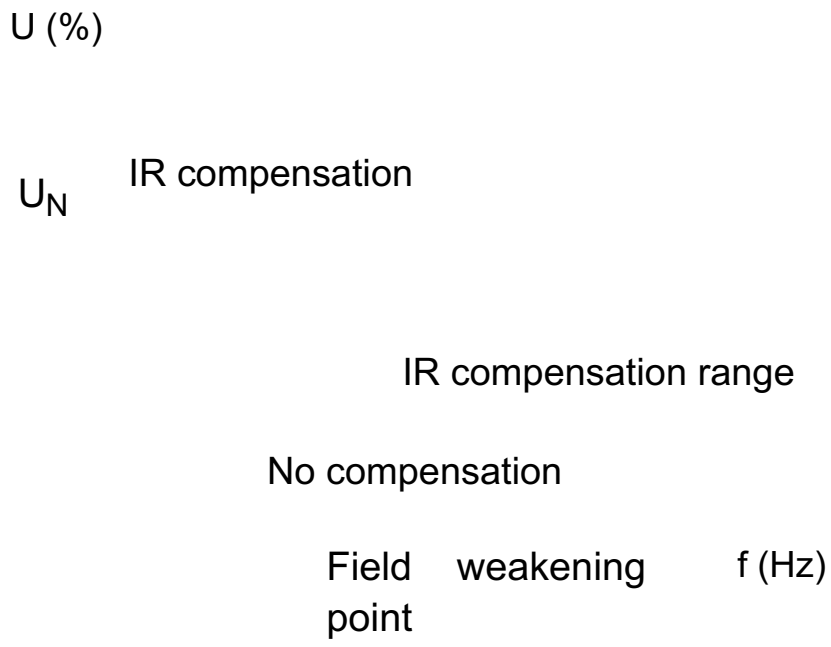


Figure 8 Operation of IR compensation.

Group 30: Fault Functions

ACS140 can be configured to respond as desired to certain abnormal external conditions: analogue input fault, external fault signal and panel

In these cases, the drive can either continue operation at current speed a set constant speed while showing an alarm, ignore the condition, or tr a fault and stop.

Motor thermal protection parameters 3004 - 3008 provide a means of adjusting the motor load curve. For example, limiting the load near zero speed might be necessary if the motor does not have a cooling fan.

Stall protection (parameters 3009 - 3012) includes parameters for stall frequency, stall time and current.

Code Description

3001 AI<MIN FUNCTION

Operation in case of AI signal drops below fault limit 3013 AI1 FAUL 3014 AI2 FAULT LIMT .

0 = NOT SEL
No operation.

1 = FAULT
A fault indication is displayed and the ACS140 coasts to stop.

2 = CONST SPEED 7
A warning indication is displayed and the speed is set according to parame 1208 CONST SPEED 7.

3 = LAST SPEED
A warning indication is displayed and the speed is set to the level the ACS was last operating at. This value is determined by the average speed over last 10 seconds.

Caution: If you select CONST SPEED 7 or LAST SPEED , make sure that continue operation in case analogue input signal is lost.

3002 PANEL LOSS

Operation in case of control panel loss fault.

1

Code Description

3004 MOTOR THERM PROT

Motor overtemperature function. This parameter defines the operation of the motor thermal protection function which protects the motor from overheating.

0 = NOT SEL

1 = FAULT

Displays a warning indication at the warning level (97.5 % of the nominal valu
Displays a fault indication when the motor temperature reaches the 100 % lev
The ACS140 coasts to stop.

2 = WARNING

A warning indication is displayed when the motor temperature reaches the warning level (95 % of the nominal value).

3005 MOT THERM TIME

Time for 63 % temperature rise.This is the time within which the motor temperature reaches 63 % of the final temperature rise. Figure 9 shows moto thermal time definition.

If thermal protection according to UL requirements for NEMA class motors is desired, use this rule of thumb - MOTOR THERM TIME equals 35 times t6 (seconds is the time that the motor can safely operate at six times its rated current, given by the motor manufacturer). The thermal time for a Class 10 tri curve is 350 s, for a Class 20 trip curve 700 s and for a Class 30 trip curve 1050 s.

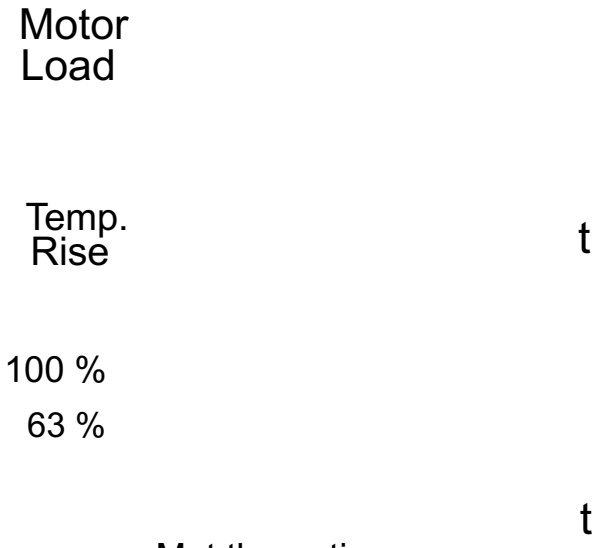


Figure 9 Motor thermal time.

Code Description

3009 STALL FUNCTION

This parameter defines the operation of the stall protection. The protection
activated if the output current becomes too high compared to output freque
refer to Figure 11.

0 = NOT SEL
Stall protection is not used.

1 = FAULT
When the protection is activated the ACS140 coasts to stop. Fault indicatio
displayed.

2 = WARNING
A warning indication is displayed. The indication disappears in half the time
by parameter 3012 STALL TIME .

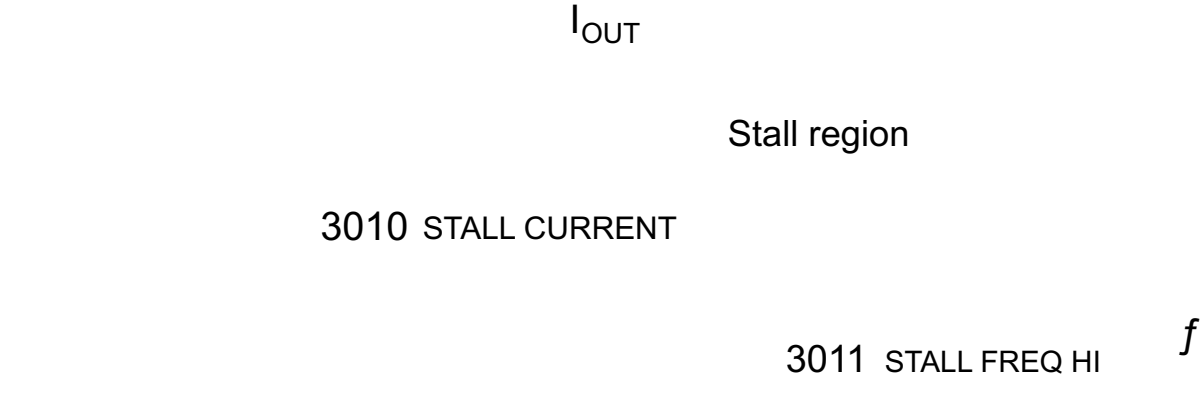


Figure 11 Motor stall protection.

3010 STALL CURRENT

Current limit for stall protection. Refer to Figure 11.

3011 STALL FREQ HI

This parameter sets the frequency value for the stall function.
Refer to Figure 11.

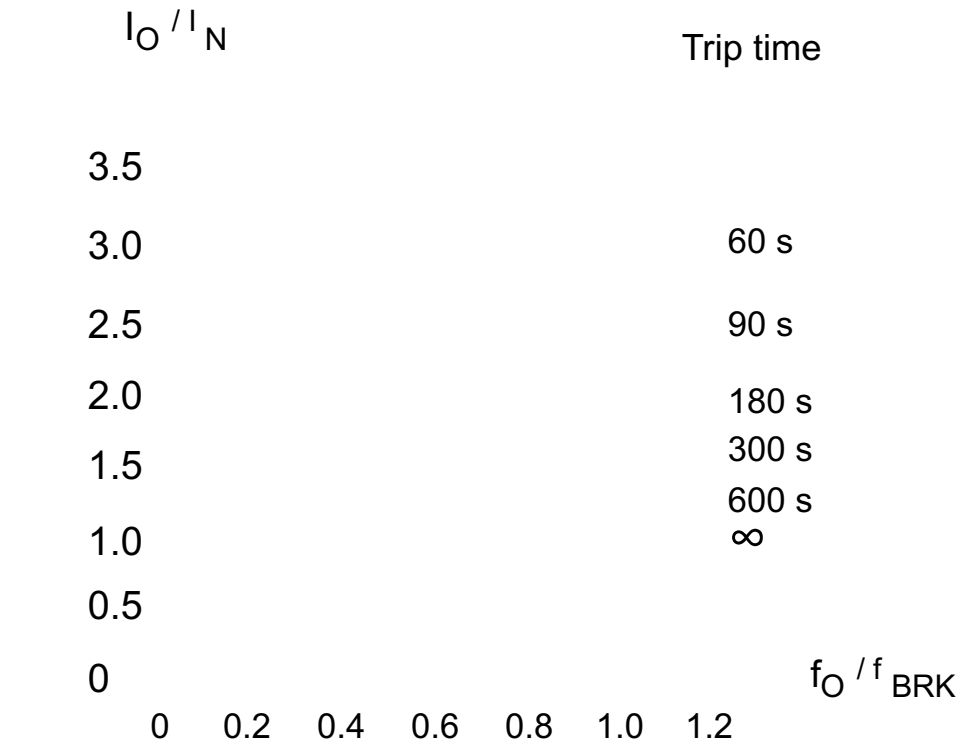
3012 STALL TIME

This parameter sets the time value for the stall function.

3013 AI1 FAULT LIMIT

Fault level for analogue input 1 supervision.
See parameter 3001 AI<MIN FUNCTION .

3014 AI2 FAULT LIMIT



I_O = output current
I_N = nominal current of the motor
f_O = output frequency
f_{BRK} = break point frequency (parameter 3008 BREAK P

Figure 12 Thermal protection trip times when parameters 3005 MO TIME, 3006 MOT LOAD CURVE and 3007 ZERO SPEED LOAD have defa

Group 31: Automatic Reset

The automatic reset system can be used for resetting overcurrent, overvoltage, undervoltage and analogue input loss faults automatically. Number of allowed automatic reset operations within a certain time is selectable.

Warning! If parameter 3107 AR AI<MIN is enabled, the drive r even after a long stop when the analogue input signal is restored. Ensure t the use of this feature will not cause physical injury and/or damage equipment.

Code Description

3101 NR OF TRIALS

Sets the number of allowed autoresets within a certain time. The time is de with parameter 3102 TRIAL TIME . The ACS140 prevents additional auto and remains stopped until a successful reset is performed from the control or from a place selected by parameter 1604 FAULT RESET SEL .

3102 TRIAL TIME

The time within which a limited number of fault autoresets is allowed. The allowed number of faults per this time period is given with parameter 3101 TRIALS.

3103 DELAY TIME

This parameter sets the time that the ACS140 will wait after a fault occurs befo attempting to reset. If set to zero, the ACS140 will reset immediately.

3104 AR OVERCURRENT

0 = DISABLE
1 = ENABLE

If 1 is selected, the fault (motor overcurrent) is reset automatically after the set by parameter 3103, and the ACS140 resumes normal operation.

3105 AR OVERVOLTAGE

0 = DISABLE
1 = ENABLE

If 1 is selected, the fault (DC bus overvoltage) is reset automatically after t

Group 32: Supervision

Parameters of this group are used together with relay output parameters 1401 RELAY OUTPUT 1 and 1402 RELAY OUTPUT 2. Any two parameters Operating Data group (Group 1) can be supervised. Relays can be configured to be energised when the values of supervised parameters are either too low or too high.

Code Description

3201 SUPERV 1 PARAM
First supervised parameter number of the Operating Data group (Group 01).

3202 SUPERV 1 LIM LO
First supervision limit low. Display of this parameter depends on selected sup vised parameter (3201).

3203 SUPERV 1 LIM HI
First supervision limit high. Display of this parameter depends on selected supervised parameter (3201).

3204 SUPERV 2 PARAM
Second supervised parameter number of the Operating Data group (Group 0

3205 SUPERV 2 LIM LO
Second supervision limit low. Display of this parameter depends on selected supervised parameter (3204).

3206 SUPERV 2 LIM HI
Second supervision limit high. Display of this parameter depends on selected supervised parameter (3204).

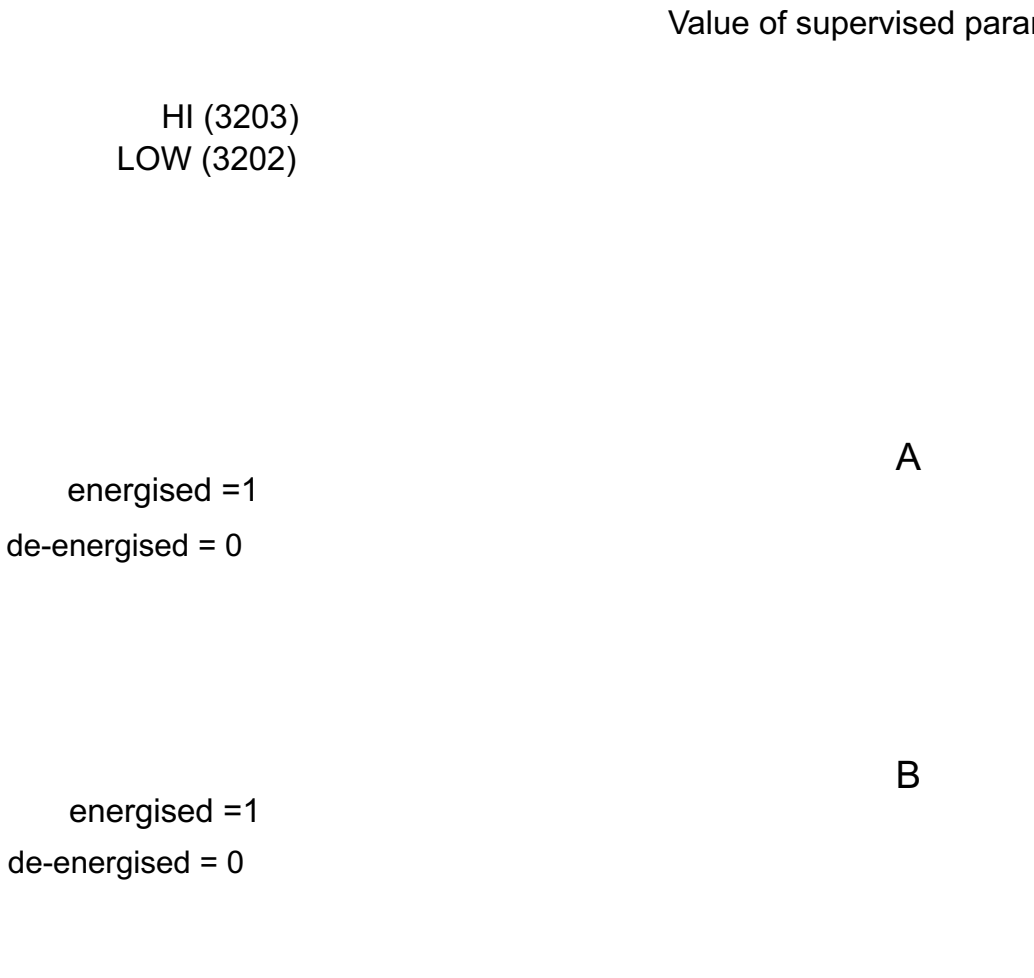


Figure 14 Operating data supervision using relay outputs, when

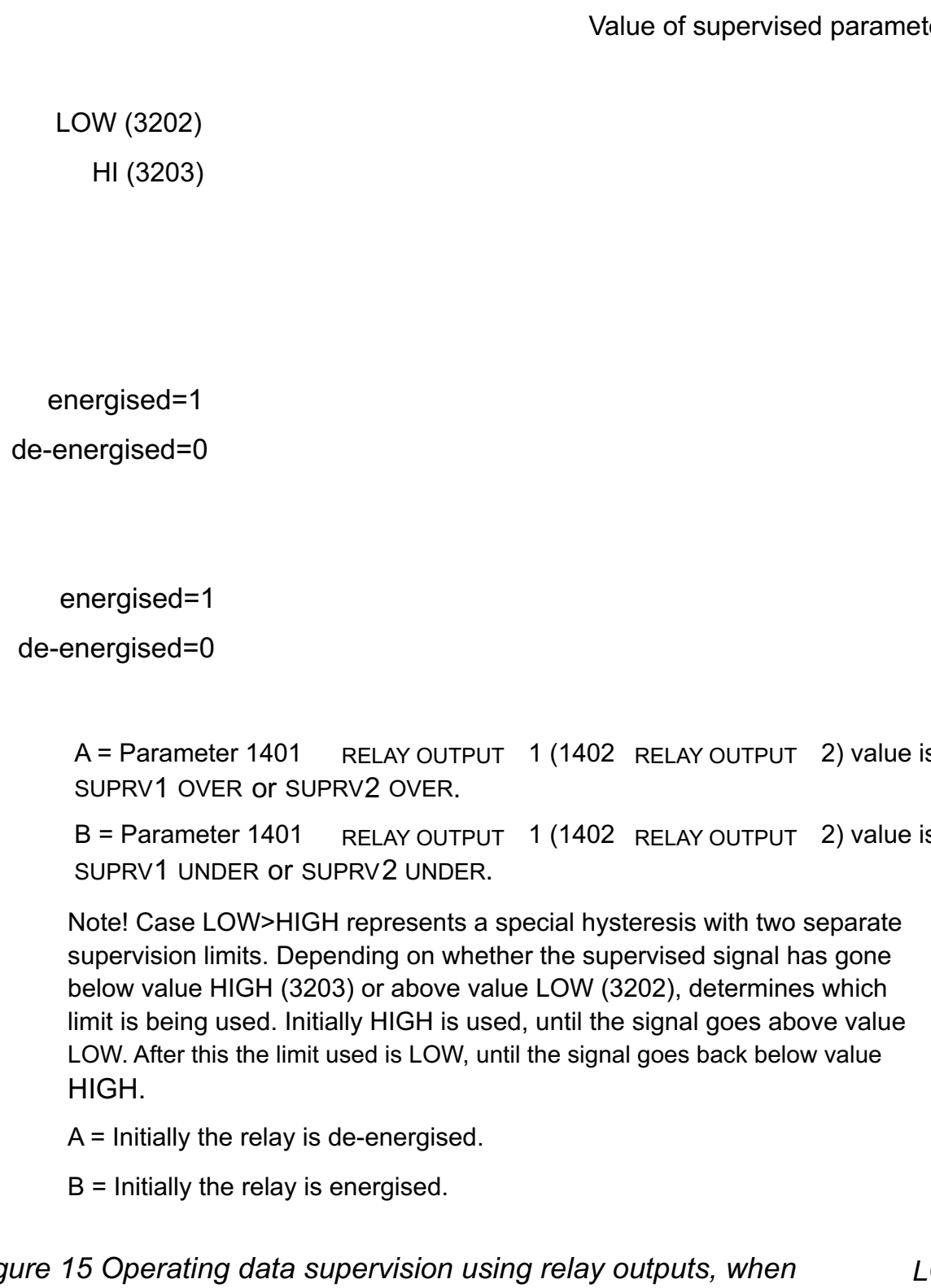


Figure 15 Operating data supervision using relay outputs, when L

Group 33: Information

Code Description

3301 SW VERSION
Software version.

3302 TEST DATE
Displays the test date of the ACS140 (yy.ww).

Group 40: PID Control

The PID Control Macro allows the ACS140 to take a reference signal (setpoint) and an actual signal (feedback), and automatically adjust the sp of the drive to match the actual signal to the reference. Figure 26 on page 96 (APPENDIX) shows the connections of internal signals when the PID Con macro is selected.

Code Description

4001 PID GAIN

This parameter defines the gain of the PID Controller. The setting range is 0.1... 100. If you select 1, a 10 % change in error value causes the PID Controller output to change by 10 %.

Table 5 Effect of gain when MAXIMUM FREQ *is 50 Hz.*

PID Gain	Frequency Change for a 10 % Change in Error	Frequency Cha a 50 % Change in
0.5	2.5 Hz	12.5 Hz
1.0	5 Hz	25 Hz
3.0	15 Hz	50 Hz *

* Limited by parameter 2008 MAXIMUM FREQ .

4002 PID INTEG TIME

PID controller integration time. Defined as the time in which the maximum output is achieved if a constant error value exists and the gain is 1. Integratio time 1 s denotes that a 100 % change is achieved in 1 s.

Control deviation

Gain

PID Controller Outpu

Gain

Code Description

4005 ERROR VALUE INV

Process error value inversion. Normally, a decrease in feedback signal cau
an increase in drive speed. If a decrease in feedback signal is desired to c
a decrease in speed, set ERROR VALUE INV to 1 (YES).

0 = NO

1 = YES

4006 ACTUAL VAL SEL

PID controller feedback (actual) signal selection. Feedback signal can be a
combination of two actual values ACT1 and ACT2. Source for actual va
selected by parameter 4007 and source for actual value 2 is selected by
parameter 4008.

1 = ACT1

Actual value 1 is used as the feedback signal.

2 = ACT1-ACT2

Difference of actual values 1 and 2 is used as the feedback signal.

3 = ACT1+ACT2

Sum of actual values 1 and 2.

4 = ACT1*ACT2

Product of actual values 1 and 2.

5 = ACT1/ACT2

Quotient of actual values 1 and 2.

6 = MIN (A1, A2)

Smaller of actual values 1 and 2.

7 = MAX (A1, A2)

Greater of actual values 1 and 2.

8 = sq (A1-A2)

Square root of difference of actual values 1 and 2.

9 = sqA1 + sqA2

Sum of square roots of actual values 1 and 2.

4007 ACT1 INPUT SEL

Source for actual value 1 (ACT1).

1 = AI 1

Analogue input 1 is used as actual value 1.

2 = AI 2

Analogue input 2 is used as actual value 1.

Code Description

4009 ACT1 MINIMUM

Minimum value for actual value 1 (ACT1). The setting range is -1000 to +10
Refer to Figure 16 and to Group 13 parameters for analogue input minimum a
maximum settings.

4010 ACT1 MAXIMUM

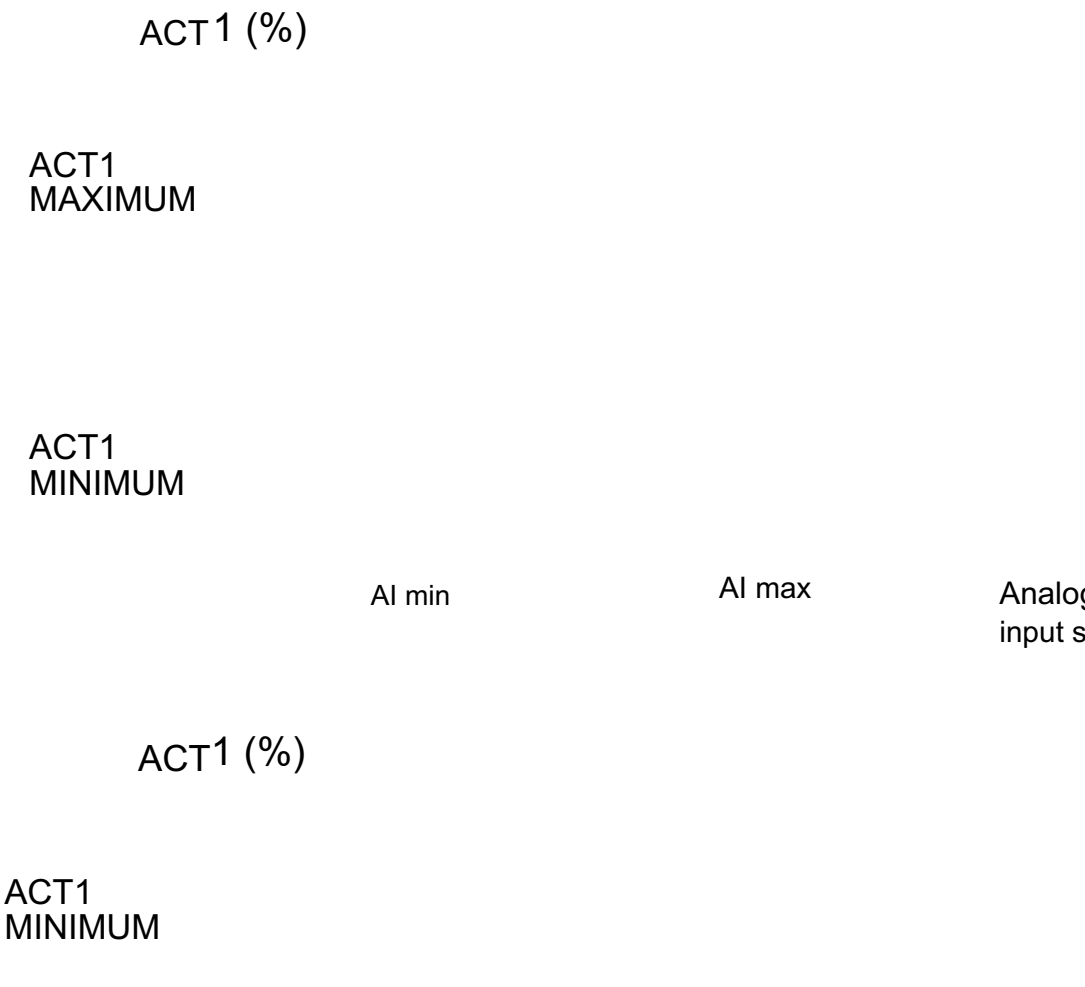
Maximum value for actual value 1 (ACT1). The setting range is -1000 to +
%. Refer to Figure 16 and to Group 13 parameters for analogue input minimu
and maximum settings.

4011 ACT2 MINIMUM

Minimum value for actual value 2 (ACT2). Refer to parameter 4009.

4012 ACT2 MAXIMUM

Maximum value for actual value 2 (ACT2). Refer to parameter 4010.



Code Description

4013 PID SLEEP DELAY

Time delay for the sleep function, see Figure 17. If the ACS140 output frequency is below a set level (parameter 4014 SLEEP LEVEL) longe SLEEP DELAY , ACS140 is stopped.

4014 PID SLEEP LEVEL

Level for activation of sleep function, see Figure 17. When the ACS140 ou frequency falls below the sleep level, the sleep delay counter is started. W the ACS140 output frequency rises above the sleep level, the sleep delay counter is reset.

Note! Sleep level comparison is also inverted when error value is inverted parameter 4005 ERROR VALUE INV .

4015 WAKE-UP LEVEL

Level for deactivation of sleep function. This parameter sets a process act value limit for the sleep function (see Figure 17).The limit floats with the pr reference.

Non-inverted error value (parameter 4005 = 0)

Applied wake-up level is according to the following formula:

Limit = parameter 1107 +
parameter 4015 * (set point - parameter 1107) /
(parameter 1108 - parameter 1107)

When the actual value is less than or equal to this value, the sleep functio de-activated. See Figure 18.

Inverted error value (parameter 4005 = 1)

Applied wake-up level is according to the following formula:

Limit = parameter 1108 +
parameter 4015 * (parameter 1108 - setpoint) /
(parameter 1108 - parameter 1107)

When the actual value is higher than or equal to this value, the sleep funct de-activated. See Figure 19.

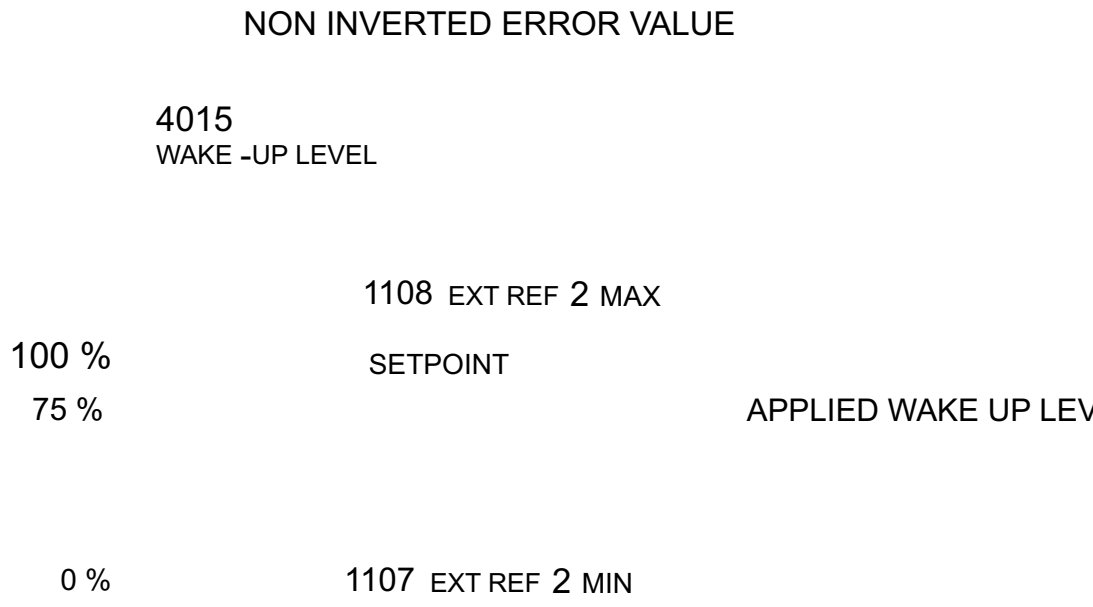
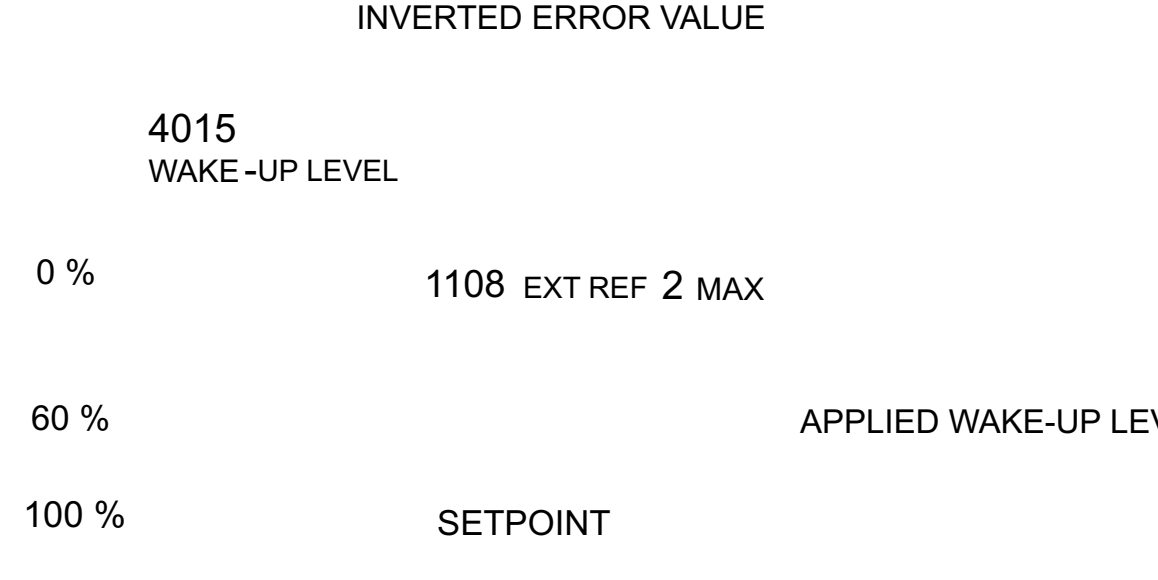


Figure 18 Example of how the applied wake-up level floats with the set po
here parameter 4015 WAKE-UP LEVEL equals to 75 %, PID control non-
case.



Code Description

4019 SET POINT SEL

Set point selection. Defines the reference signal source for the PID control

Note! When PID regulator is by-passed (parameter 8121 REG BYPAS parameter has no significance.

1 = INTERNAL
Process reference is a constant value set with parameters 4020 IN SETPNT1, 4021 INTERNAL STPNT 2, 4022 INTERNAL SETPNT SEL .

2 = EXTERNAL
Process reference is read from a source defined with parameter 1106 SELECT. The ACS140 must be in remote mode (REM is shown on control display).*

* Process reference to PID controller can also be given from the control pa local mode (LOC is shown on control panel display) if the panel reference given as percentage, i.e. value of parameter 1101 KEYPAD REF SEL (%)).

4020, 2021 INTERNAL SETPNT1, iNTERNAL SETPNT2
Sets a constant process reference (%) for the PID controller. PID controlle follows either one of these references if parameter 4019 SET POINT 1 (INTERNAL), see also parameter 4022 INTERNAL SETPNT SEL .

4022 INTERNAL SETPNT SEL

Selects the internal setpoint.

1..5 = DI1..5
Internal setpoint selection is done through digital input (DI1 to DI5). When input is deactivated, parameter 4020 INTERNAL SETPNT 1 is being use digital input is activated, parameter 4021 INTERNAL SETPNT 2 is being

6 = SETPNT1
4020 INTERNAL SETPNT 1 is used as internal setpoint.

7 = SETPNT2
4021 INTERNAL SETPNT 2 is used as internal setpoint.

Group 52: Serial Communication

The serial communication link of the ACS140 uses Modicon Modbus protocol. For description of the ACS140 serial communication capabilities, well as for the descriptions of the parameters of this group, refer to ACS14 *RS485 and RS232 Adapter Installation and Start-up Guide.*

Diagnostics

General

This chapter describes the various diagnostic displays of the control panel and lists the most common causes for the particular display. If the fault cannot be resolved by the given instructions, contact an ABB service representati

Caution! Do not attempt any measurement, parts replacement or other service procedures not described in this manual. Such actions will void guarantee, endanger correct operation, and increase downtime and exper

Alarm and Fault displays

The seven-segment display unit of control panel indicates alarms and fault using codes "ALxx" or "FLxx", where xx is the corresponding alarm or fault code.

Alarms 1-7 arise from button operation. Green LED blinks for AL10-21, meaning that the ACS140 cannot fully follow the control commands. The faults are indicated by red LED.

The alarm and fault messages disappear by pressing MENU, ENTER or th arrow buttons of the control panel. The message will reappear after a few seconds if the keypad is not touched and the alarm or fault is still active.

Last three fault codes are stored into parameters 0128-0130. These fault memories can be cleared from the control panel by pressing UP and DOW buttons simultaneously in parameter set mode.

Fault Resetting

Faults that are indicated by a red blinking LED are reset by turning the power off for a while. Other faults (indicated by red static LED) can be reset either from the control panel, by digital input or serial communication, or switchin the supply voltage off for a while. When the fault has been removed, the

Table 6 Alarms.

Code	Description
AL 1	Parameter upload/download failed.
AL 2	Operation not allowed while start is active.
AL 3	Operation not allowed in current control mode (Local or Remote).
AL 5	Start/Stop/Direction or reference from control panel is not followed. P causes: • Remote mode: parameters disable the buttons (See APPENDIX. • Local mode: START/STOP button interlocked from digital inputs.
AL 6	Operation not allowed. Parameter 1602 PARAMETER LOCK is a
AL 7	Use of factory macro disables operation.
AL10*	Overcurrent controller active.
AL11*	Overvoltage controller active.
AL12*	Undervoltage controller active.
AL13	Direction lock. See parameter 1003 DIRECTION.
AL14	Serial communication loss alarm, see ACS140 RS485 and RS232 Ad *Installation and Start-up Guide.*
AL15*	Modbus exception response is sent through serial communication
AL16	Analogue input 1 loss. Analogue input 1 value is less than MIN (1301). See also parameters 3001 AI<MIN FUNCTION and 3013 LIMIT.
AL17	Analogue input 2 loss. Analogue input 2 value is less than MIN (1306). See also parameters 3001 AI<MIN FUNCTION and 3014 LIMIT.
AL18*	Panel loss. Panel is disconnected when Start/Stop/Dir or reference is coming from panel. See parameter 3002 PANEL LOSS and APP
AL19*	Hardware overtemperature (at 95 % of the trip limit).
AL20*	Motor overtemperature (at 95 % of the trip limit), see 3004 MO PROT.
AL21	Motor stall alarm. See parameter 3009 STALL FUNCTION .

Note! Alarms (*) will be shown only if parameter 1608 DISPLAY AL
to 1(YES).

Table 7 Faults.

Code	Description
FL 1	Overcurrent: • Possible mechanical problem. • Acceleration and/or deceleration times may be too short. • Supply disturbances.
FL 2	DC overvoltage: • Input voltage too high. • Deceleration time may be too short.
FL 3	ACS140 overtemperature: • Ambient temperature too high. • Severe overload.
FL 4 *	Fault current: • Output earth fault (200 V units). • Short circuit. • Supply disturbances.
FL 5	Output overload.
FL 6	DC undervoltage.
FL 7	Analogue input 1 fault. Analogue input 1 value is less than M AI1 (1301). See also parameters 3001 AI<MIN FUNCTION and FAULT LIMIT .
FL 8	Analogue input 2 fault. Analogue input 2 value is less than M AI2 (1304). See also parameters 3001 AI<MIN FUNCTION and FAULT LIMIT .
FL 9	Motor overtemperature. See parameters 3004-3008.
FL10	Panel loss. Panel is disconnected when Start/Stop/Dir or reference coming from panel. See parameter 3002 PANEL LOSS and AP Note! If FL10 is active when the power is turned off, the ACS140 wil start in remote control (REM) when the power is turned back on.
FL11	Parameters inconsistent. Possible fault situations: • MINIMUM AI1 > MAXIMUM AI1 (parameters 1301 and 1302) • MINIMUM AI2 > MAXIMUM AI2 (parameters 1304 and 1305) • MINIMUM FREQ > MAXIMUM FREQ (parameters 2007 and 2008
FL12	Motor stall. See parameter 3009 STALL FUNCTION .
FL13	Serial communication loss.
FL14	External fault is active. See parameter 3003 EXTERNAL FAULT

ACS140 EMC Instructions

Mandatory Installation Instruction According to the EMC Directive type ACS140 frequency converters

Follow the instructions given in the ACS140 User´s Manual and the instructions delivered with different accessories.

CE Marking

A CE mark is attached to ACS140 frequency converters to verify that the u follows the provisions of the European Low Voltage and EMC Directive (Directive 73/23/EEC, as amended by 93/68/EEC and Directive 89/336 EEC, as amended by 93/68/EEC).

The EMC Directive defines the requirements for immunity and emission electrical equipment used in European Economic Area. The EMC produ standard EN 61800-3 covers the requirements stated for frequency converters. ACS140 frequency converters comply with the requirem stated in EN 61800-3 for Second Environment and First Environment.

Product standard EN 61800-3 (Adjustable speed electrical power drive systems - Part 3: EMC product standard including specific test method defines First Environment as environment that includes domestic premises. It also includes establishments directly connected without intermediate transformers to a low voltage power supply network which supplies buildings used for domestic purposes. The Second Environ includes establishments other than those directly connected to a low vo power supply network which supplies buildings used for domestic purp

C-Tick Marking

A C-tick mark is attached to ACS140 frequency converters (pending for heatsinkless series) to verify that the unit follows the provisions of the

Cabling Instructions

Keep individual unscreened wires between the cable clamps and the s terminals as short as possible. Route control cables away from power cables.

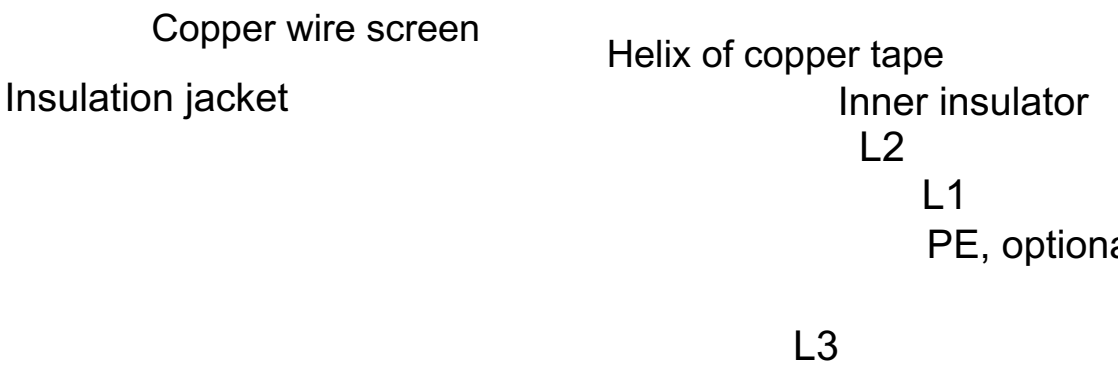
Mains Cable

A three conductor cable (single phase and neutral with protective earth four conductor cable (three phase with protective earth) are recommen for the mains cabling. Shielding is not necessary. Dimension the cables fuses in accordance with the input current. Always pay attention to loca legislation when sizing the cables and fuses.

The mains input connectors are at the top of the converter unit. Mains cab routing must be done so that the distance from the sides of the converter i at least 20 cm to avoid excessive radiation to the mains cable. In the case screened cable twist the cable screen wires together into a bundle not lon than five times its width and connect to the PE terminal of the converter. (PE terminal of input filter, if present.)

Motor Cable

The motor cable must be a symmetrical three conductor cable with a concentric PE conductor or a four conductor cable with a concentric sh Minimum requirement for the motor cable screen is presented in Figure



At the motor end the motor cable screen must be earthed 360 degrees wit
an EMC cable gland (e.g. ZEMREX SCG Screened cable glands) or th
screen wires must be twisted together into a bundle not longer than five
times its width and connected to the PE terminal of the motor.

Control Cables

Control cables must be multi-core cables with a braided copper wire sc

The screen must be twisted together into a bundle not longer than five tim
its width and connected to terminal X1:1.

Route the control cables as far away as possible from the mains and moto
cables (at least 20 cm). Where control cables must cross power cables
make sure they are at an angle as near 90 degrees as possible. Also the
cable routing must be done so that the distance from the sides of the
converter is at least 20 cm to avoid excessive radiation to the cable.

A double shielded twisted pair cable is recommended for the analogue
signals. Employ one individually shielded pair for each signal. Do not u
common return for different analogue signals.

A double shielded cable is the best alternative for low voltage digital sig
but single shielded twisted multipair cable is also usable (see Figure 22

Figure 22 A double shielded twisted pair cable on the left and a single shielded twisted multipair cable on the right.

The analogue and digital input signals should be run in separate, scree
cables.

Additional Instructions to Comply with EN6180
First Environment, Restricted Distribution, and
NZS 2064, 1997, Class A

Note! AS/NZS 2064, 1997, Class A is valid for types ACS143-xKx-3.

Always use optional RFI filter as specified in Table 8 and 9 and follow the instructions in the filter package for all cable screen connections.

The filters with regular cable lengths are shown in Table 8 and the filters w extra long cable lengths in Table 9.

The motor cable lengths have to be limited as specified in Table 8 and 9. A the motor end, the cable screen must be earthed 360 degrees with an EM cable gland (e.g. Zemrex SCG screened cable glands).

Table 8 Maximum motor cable lengths with input filter ACS100/140-IFA -IFCD-1, or ACS140-IFAB-3, -IFCD-3 and switching frequency 4 kHz, 8 or 16 kHz.

Converter type	ACS100/140-IFAB-1		1
	4 kHz	8 kHz	
ACS141-K18-1, -H18-1	30 m	20 m	
ACS141-K25-1, -H25-1	30 m	20 m	
ACS141-K37-1, -H37-1	30 m	20 m	
ACS141-K75-1, -H75-1	30 m	20 m	
ACS141-1K1-1, -1H1-1	30 m	20 m	
ACS141-1K6-1, -1H6-1	30 m	20 m	

Table 9 Maximum motor cable lengths with input filter ACS100-FLT-C o ACS140-FLT-C and switching frequency 4 kHz or 8 kHz.

Converter Type	ACS100-FLT-C	
	4 kHz	8 kHz *
ACS141-K75-1	100 m	100 m
ACS141-1K1-1	100 m	100 m
ACS141-1K6-1	100 m	100 m
ACS141-2K-1	100 m	100 m
ACS141-2K7-1	100 m	100 m
ACS141-4K1-1	100 m	100 m
Converter Type	ACS140-FLT-C	
ACS143-xKx-1**	100 m	100 m
ACS143-xKx-3	100 m	100 m

* Effective motor cable screen is required, according to .
**ACS143-4K1-1: maximum continuous load 70 % of nominal.
For ACS141-4K1-1 and ACS143-4K1-1, a cable shown in Figure 21 is required.

If input filter ACS100-FLT-C or ACS140-FLT-C is used with 200 V units always use output choke ACS-CHK-B when motor cable length exceed m. Also with 200 V units use output choke ACS-CHK-A with filters ACS FLT-C and ACS140-FLT-C.

If input filterACS140-FLT-C is used with 400 V units, always use output choke ACS-CHK-B when motor cable length is 30...50 m and three out chokes SACL22 if motor cable length exceeds 50 m.

Table 10 Maximum motor cable lengths with input filter ACS100-FLT-D, or ACS140-FLT-D and switching frequency 4 kHz.

Converter type	ACS100-FLT-D	ACS100-FI
	4 kHz	4 kHz
ACS141-K75-1	5 m	-
ACS141-1K1-1	5 m	-
ACS141-1K6-1	5 m	-
ACS141-2K1-1	-	5 m
ACS141-2K7-1	-	5 m
ACS141-4K1-1	-	5 m

Converter type	ACS140-FI
	4 kHz
ACS143-xKx-3	5 m

For 1-phase converters ACS141-xKx-1 two chokes ACS-CHK-A or ACS CHK-C are supplied in the filter package. The motor cable including the shield must be fed through the hole in the choke. Also all control cables ar the control panel cable, if present, must be fed through another choke. Fo phase converters ACS143-xKx-3 one choke ACS-CHK-A is supplied in filter package and the motor cable including the shield must be fed thro the hole in the choke. The cable lengths between the converter and the chokes must be at maximum 50 cm.

For types ACS141-2K1-1, ACS141-2K7-1 and ACS141-4K1-1 the co panel, if present, must be mounted on the converter front cover.

Additional Instructions to Comply with EN6180
Second Environment

Always use optional RFI filter as specified in Table 11 and follow the instructions in the filter package for all cable screen connections.

The motor cable lengths have to be limited as specified in Table 11. At the motor end, the cable screen must be earthed 360 degrees with an EM cable gland (e.g. Zemrex SCG screened cable glands).

Table 11 Maximum motor cable lengths with input filter ACS100/140-IF -IFCD-1, or ACS140-IFAB-3, -IFCD-3 and switching frequency 4 kHz, 8 or 16 kHz.

Converter type	ACS100/140-IFAB-1		
	4 kHz	8 kHz	1
ACS141-K18-1, -H18-1	50 m	50 m	
ACS141-K25-1, -H25-1	50 m	50 m	
ACS141-K37-1, -H37-1	50 m	50 m	
ACS141-K75-1, -H75-1	75 m	75 m	
ACS141-1K1-1, -1H1-1	75 m	75 m	
ACS141-1K6-1, -1H6-1	75 m	75 m	
Converter type	ACS100/140-IFCD-1		
ACS141-2K1-1	75 m	75 m	
ACS141-2K7-1	75 m	75 m	
ACS141-4K1-1	75 m	75 m	
Converter type	ACS140-IFAB-3		

Line Current Harmonics

The product standard EN 61800-3 refers to EN 61000-3-2 which specif
limits for harmonic current emissions for equipment connected to low v
public supply network.

The EN 61000-3-2 applies to low-voltage networks interfacing with the
supply at the low-voltage level. It does not apply to private low voltage
networks interfacing with the public supply only at the medium- or high-
voltage level.

Public Low Voltage Network

The limits and requirements of the EN 1000-3-2 apply for equipment w
rated current ≤16 A. The ACS140 is a professional equipment to be used i
trades, professions, or industries and is not intended for sale to the ger
public.

The ACS140 with a total rated power greater than 1 kW conforms to EN
61000-3-2. Below 1 kW, use combinations of input chokes and ACS140
specified in Table 12 or ask the supply authority for permission to conn

*Table 12 Combinations of input chokes and ACS140 which comply with
class A limits of EN 61800-3-2.*

Converter type	Input choke (IP21)	Input choke (IP0
ACS141-K18-1	ACS-CHK-A3 *	SACL21
ACS141-K25-1	ACS-CHK-A3 **	SACL21+SACL
ACS141-K37-1	ACS-CHK-A3 **	SACL21+SACL
ACS141-K75-1	ACS-CHK-A3 **	-
ACS143-K75-3	ACS-CHK-A3	-

APPENDIX

Local Control vs. Remote Control

The ACS140 can be controlled from two remote control locations or from t
control panel. Figure 23 below shows the ACS140 control locations.

The selection between local control (LOC) and remote control (REM) can
done by pushing the MENU and ENTER buttons simultaneously.

Figure 23 Control locations.

Local Control

The control commands are given explicitly from the control panel when the
ACS140 is in local control. This is indicated by LOC on the control panel
display.

Remote Control

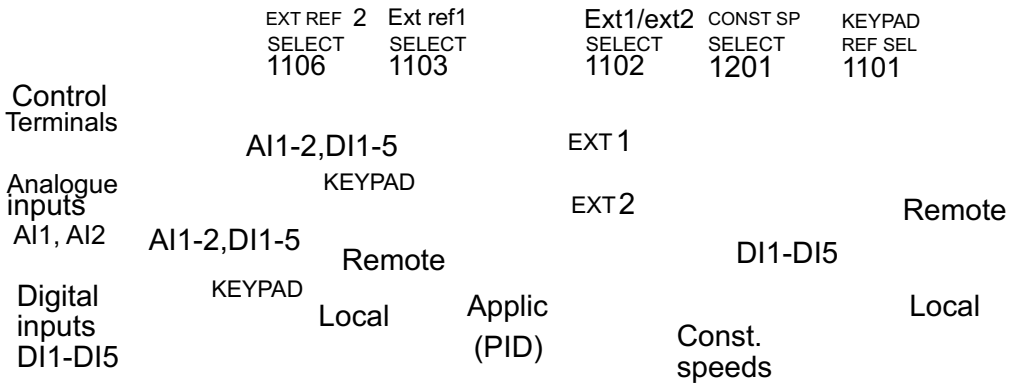
When the ACS140 is in remote control (REM), the commands are given primarily through digital and analogue inputs, although commands can also be given also through the control panel or serial communication.

Parameter 1102 EXT1/EXT2 SELECT selects between the two external locations EXT1 and EXT2.

For EXT1, the source of the Start/Stop/Direction commands is defined by parameter 1001 EXT1 COMMANDS, and the reference source is defined by parameter 1103 EXT REF 1 SELECT. External reference 1 is always a frequency reference.

For EXT2, the source of the Start/Stop/Direction commands is defined by parameter 1002 EXT2 COMMANDS, and the reference source is defined by parameter 1106 EXT REF 2 SELECT. External reference 2 can be a frequency reference, or a process reference, depending on the application macro selected.

In remote control, constant speed operation can be programmed by parameter 1201 CONST SPEED SEL. Digital inputs can be used to select between the external frequency reference and seven configurable constant speeds (1202 CONST SPEED 1... 1208 CONST SPEED 7).



Internal Signal Connections for the Macros

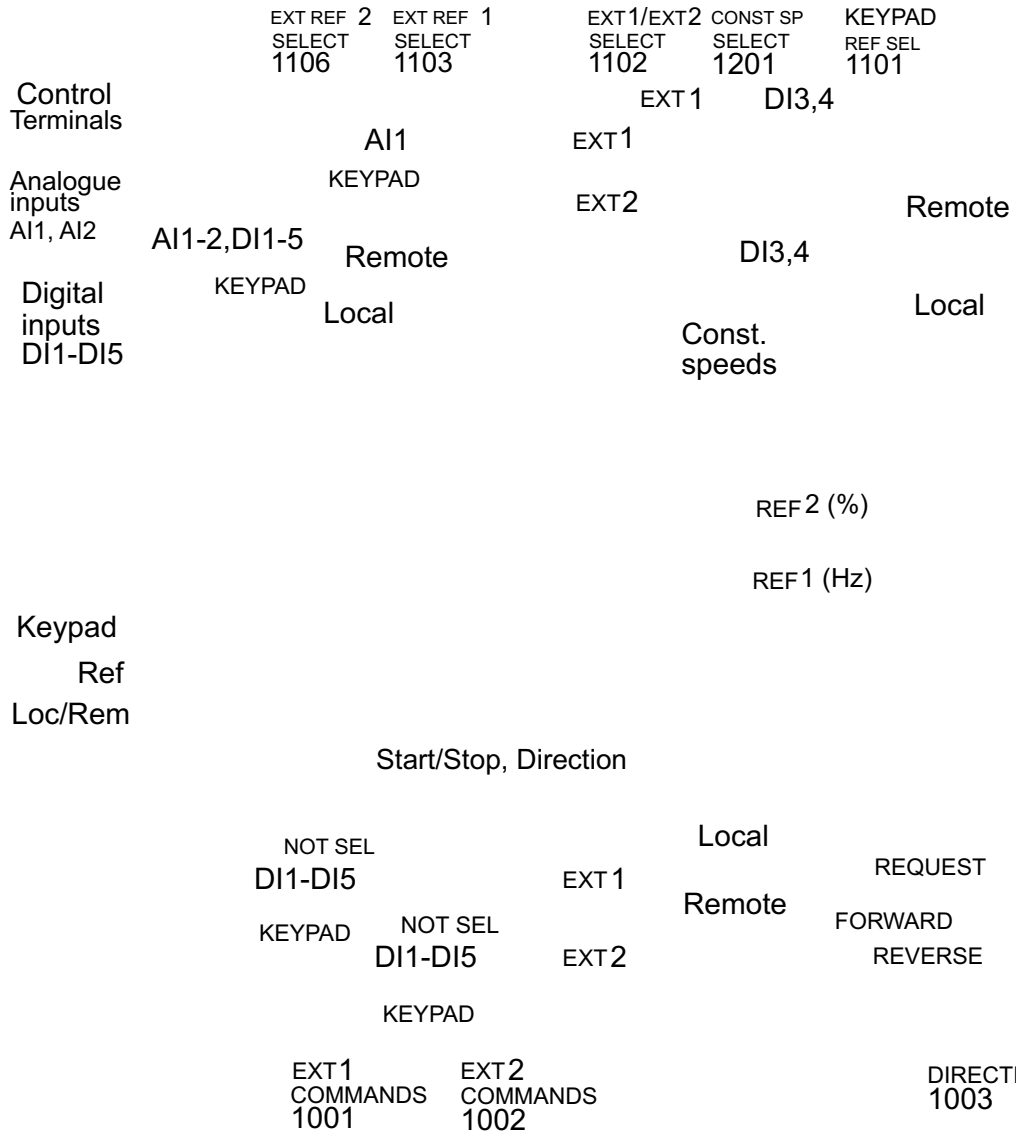


Figure 25 The control signal connections of the ABB Standard, Alternate a
Premagnetise macros.

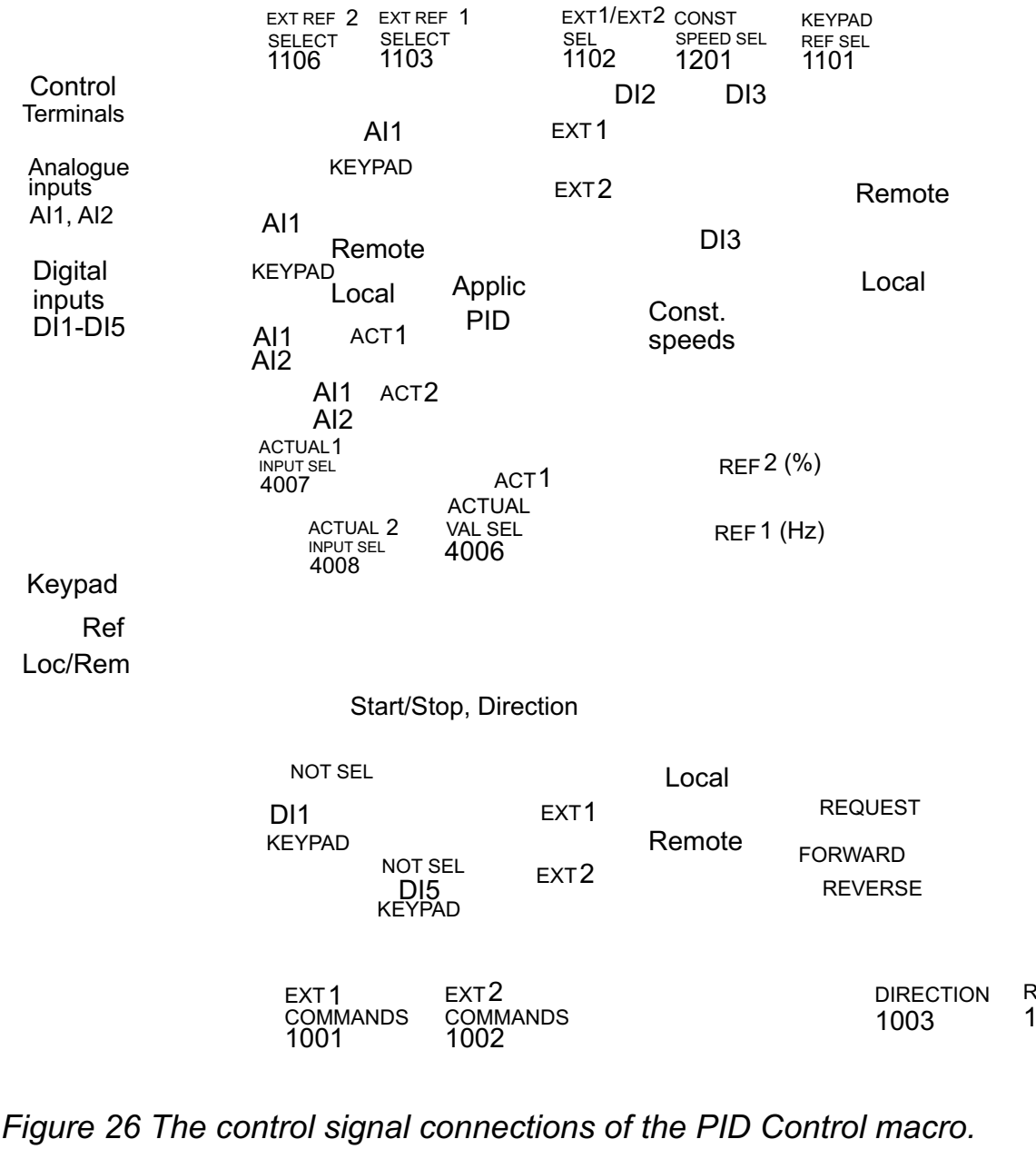


Figure 26 The control signal connections of the PID Control macro.