

ABB machinery drives

User's manual ACS355 drives



Power and productivity
for a better world™



List of related manuals

Drive manuals and guides	Code (English)
<i>ACS355 user's manual</i>	3AUA0000066143
<i>ACS355 drives with IP66/67 / UL Type 4x enclosure supplement</i>	3AUA0000066066
<i>ACS355 quick installation guide</i>	3AUA0000092940
<i>ACS355 common DC application guide</i>	3AUA0000070130
Option manuals and guides	
<i>FCAN-01 CANopen adapter module user's manual</i>	3AFE68615500
<i>FDNA-01 DeviceNet adapter module user's manual</i>	3AFE68573360
<i>FECA-01 EtherCAT® adapter module user's manual</i>	3AUA0000068940
<i>FENA-01/-11 Ethernet adapter module user's manual</i>	3AUA0000093568
<i>FLON-01 LONWORKS® adapter module user's manual</i>	3AUA0000041017
<i>FMBA-01 Modbus adapter module user's manual</i>	3AFE68586704
<i>FPBA-01 PROFIBUS DP adapter module user's manual</i>	3AFE68573271
<i>FRSA-00 RS-485 adapter board user's manual</i>	3AFE68640300
<i>MFDT-01 FlashDrop user's manual</i>	3AFE68591074
<i>MPOT-01 potentiometer module instructions for installation and use</i>	3AFE68591082
<i>MREL-01 output relay module user's manual</i>	3AUA0000035974
<i>MTAC-01 pulse encoder interface module user's manual</i>	3AFE68591091
<i>MUL1-R1 installation instructions for ACS150, ACS310, ACS320, ACS350 and ACS355</i>	3AFE68642868
<i>MUL1-R3 installation instructions for ACS310, ACS320, ACS350 and ACS355</i>	3AFE68643147
<i>MUL1-R4 installation instructions for ACS310, ACS320, ACS350 and ACS355</i>	3AUA0000025916
<i>SREA-01 Ethernet adapter module quick start-up guide</i>	3AUA0000042902
<i>SREA-01 Ethernet adapter module user's manual</i>	3AUA0000042896
<i>ACS355 and AC500-eCo application guide</i>	2CDC125152M0201
<i>AC500-eCo PLC and ACS355 quick installation guide</i>	2CDC125145M0201
Maintenance manuals and guides	
<i>Guide for capacitor reforming in ACS50, ACS55, ACS150, ACS310, ACS350, ACS355, ACS550, ACH550 and R1-R4 OINT/SINT boards</i>	3AFE68735190

You can find manuals and other product documents in PDF format on the Internet. See section [Document library on the Internet](#) on the inside of the back cover. For manuals not available in the Document library, contact your local ABB representative.

User's manual

ACS355

Table of contents



1. Safety



4. Mechanical installation



6. Electrical installation



8. Start-up, control with I/O
and ID run



Table of contents

List of related manuals	2
-------------------------------	---

1. Safety

What this chapter contains	17
Use of warnings	17
Safety in installation and maintenance	18
Electrical safety	18
General safety	19
Safe start-up and operation	20
Electrical safety	20
General safety	20

2. Introduction to the manual

What this chapter contains	21
Applicability	21
Target audience	21
Purpose of the manual	21
Contents of this manual	22
Related documents	23
Categorization by frame size	23
Quick installation and commissioning flowchart	24
Terms and abbreviations	25



3. Operation principle and hardware description

What this chapter contains	27
Operation principle	27
Product overview	28
Layout	28
Overview of power and control connections	29
Type designation label	30
Type designation key	31

4. Mechanical installation

What this chapter contains	33
Checking the installation site	33
Requirements for the installation site	33
Required tools	34
Unpacking	35
Checking the delivery	35
Installing	36
Install the drive	36
Fasten clamping plates	38
Attach the optional fieldbus module	38

5. *Planning the electrical installation*

What this chapter contains	39
Implementing the AC power line connection	39
Using an input choke	39
Selecting the supply disconnecting device (disconnecting means)	40
European union	40
Other regions	40
Checking the compatibility of the motor and drive	40
Checking the compatibility of the drive when multiple motors are connected to the drive ...	40
Selecting the power cables	41
General rules	41
Alternative power cable types	42
Motor cable shield	42
Additional US requirements	43
Selecting the control cables	43
General rules	43
Relay cable	44
Control panel cable	44
Routing the cables	44
Control cable ducts	45
Protecting the drive, input power cable, motor and motor cable in short-circuit situations and against thermal overload	46
Protecting the drive and input power cable in short-circuit situations	46
Protecting the motor and motor cable in short-circuit situations	46
Protecting the drive, motor cable and input power cable against thermal overload	46
Protecting the motor against thermal overload	46
Implementing the Safe torque off (STO) function	47
Using residual current devices (RCD) with the drive	47
Using a safety switch between the drive and the motor	47
Implementing a bypass connection	47
Protecting the contacts of relay outputs	47

6. *Electrical installation*

What this chapter contains	49
Checking the insulation of the assembly	49
Drive	49
Input power cable	49
Motor and motor cable	50
Checking the compatibility with IT (ungrounded) and corner-grounded TN systems	50
Connecting the power cables	51
Connection diagram	51
Connection procedure	52
Connecting the control cables	53
I/O terminals	53
Default I/O connection diagram	56
Connection procedure	58



7. Installation checklist

What this chapter contains	59
Checking the installation	59

8. Start-up, control with I/O and ID run

What this chapter contains	61
Starting up the drive	61
Starting up the drive without a control panel	62
Performing a manual start-up	63
Performing a guided start-up	68
Controlling the drive through the I/O interface	70
Performing the ID run	71
ID run procedure	71

9. Control panels

What this chapter contains	75
About control panels	75
Applicability	75
Basic control panel	77
Features	77
Overview	78
Operation	79
Output mode	82
Reference mode	83
Parameter mode	84
Copy mode	87
Basic control panel alarm codes	88
Assistant control panel	89
Features	89
Overview	90
Operation	91
Output mode	95
Parameters mode	97
Assistants mode	100
Changed parameters mode	102
Fault logger mode	103
Time and date mode	104
Parameter backup mode	106
I/O settings mode	109



10. Application macros

What this chapter contains	111
Overview of macros	111
Summary of the I/O connections of the application macros	113
ABB standard macro	114
Default I/O connections	114
3-wire macro	115
Default I/O connections	115

Alternate macro	116
Default I/O connections	116
Motor potentiometer macro	117
Default I/O connections	117
Hand/Auto macro	118
Default I/O connections	118
PID control macro	119
Default I/O connections	119
Torque control macro	120
Default I/O connections	120
AC500 Modbus macro	121
User macros	123

11. Program features

What this chapter contains	125
Start-up assistant	125
Introduction	125
Default order of the tasks	126
List of the tasks and the relevant drive parameters	127
Contents of the assistant displays	128
Local control vs. external control	130
Local control	130
External control	131
Settings	131
Diagnostics	131
Block diagram: Start, stop, direction source for <i>EXT1</i>	132
Block diagram: Reference source for <i>EXT1</i>	132
Reference types and processing	133
Settings	133
Diagnostics	133
Reference trimming	134
Settings	134
Example	135
Programmable analog inputs	135
Settings	135
Diagnostics	136
Programmable analog output	136
Settings	136
Diagnostics	136
Programmable digital inputs	137
Settings	137
Diagnostics	137
Programmable relay output	138
Settings	138
Diagnostics	138
Frequency input	138
Settings	138
Diagnostics	138
Transistor output	139
Settings	139



Diagnostics	139
Actual signals	139
Settings	139
Diagnostics	140
Motor identification	140
Settings	140
Power loss ride-through	141
Settings	141
DC magnetizing	141
Settings	141
Maintenance trigger	142
Settings	142
DC hold	142
Settings	142
Speed compensated stop	142
Settings	142
Flux braking	143
Settings	144
Flux optimization	144
Settings	144
Acceleration and deceleration ramps	144
Settings	144
Critical speeds	145
Settings	145
Constant speeds	145
Settings	145
Custom U/f ratio	146
Settings	146
Diagnostics	146
Speed controller tuning	147
Settings	147
Diagnostics	148
Speed control performance figures	148
Torque control performance figures	148
Scalar control	149
Settings	149
IR compensation for a scalar controlled drive	149
Settings	149
Programmable protection functions	149
AI<Min	149
Panel loss	150
External fault	150
Stall protection	150
Motor thermal protection	150
Underload protection	151
Earth fault protection	151
Incorrect wiring	151
Input phase loss	152
Pre-programmed faults	152
Overcurrent	152
DC overvoltage	152



DC undervoltage	152
Drive temperature	152
Short-circuit	152
Internal fault	152
Operation limits	152
Settings	152
Power limit	153
Automatic resets	153
Settings	153
Diagnostics	153
Supervisions	153
Settings	153
Diagnostics	153
Parameter lock	154
Settings	154
PID control	154
Process controller PID1	154
External/Trim controller PID2	154
Block diagrams	155
Settings	157
Diagnostics	157
Sleep function for the process PID (PID1) control	158
Example	159
Settings	159
Diagnostics	159
Motor temperature measurement through the standard I/O	160
Settings	161
Diagnostics	161
Control of a mechanical brake	162
Example	162
Operation time scheme	163
State shifts	164
Settings	165
Jogging	166
Settings	167
Diagnostics	167
Real-time clock and timed functions	168
Real-time clock	168
Timed functions	168
Example	170
Settings	171
Timer	171
Settings	171
Diagnostics	171
Counter	171
Settings	171
Diagnostics	172
Sequence programming	172
Settings	173
Diagnostics	173
State shifts	174



Example 1	175
Example 2	176
Safe torque off (STO) function	180

12. Actual signals and parameters

What this chapter contains	181
Terms and abbreviations	181
Fieldbus addresses	181
Fieldbus equivalent	182
Storing the parameters	182
Default values with different macros	182
Differences between the default values in E and U type drives	184
Actual signals	185
01 OPERATING DATA	185
03 FB ACTUAL SIGNALS	188
04 FAULT HISTORY	191
Parameters	192
10 START/STOP/DIR	192
11 REFERENCE SELECT	195
12 CONSTANT SPEEDS	199
13 ANALOG INPUTS	204
14 RELAY OUTPUTS	206
15 ANALOG OUTPUTS	209
16 SYSTEM CONTROLS	210
18 FREQ IN & TRAN OUT	216
19 TIMER & COUNTER	217
20 LIMITS	222
21 START/STOP	226
22 ACCEL/DECEL	231
23 SPEED CONTROL	235
24 TORQUE CONTROL	238
25 CRITICAL SPEEDS	239
26 MOTOR CONTROL	240
29 MAINTENANCE TRIG	245
30 FAULT FUNCTIONS	247
31 AUTOMATIC RESET	256
32 SUPERVISION	258
33 INFORMATION	260
34 PANEL DISPLAY	261
35 MOTOR TEMP MEAS	266
36 TIMED FUNCTIONS	268
40 PROCESS PID SET 1	272
41 PROCESS PID SET 2	281
42 EXT / TRIM PID	282
43 MECH BRK CONTROL	284
50 ENCODER	285
51 EXT COMM MODULE	286
52 PANEL COMM	288
53 EFB PROTOCOL	289
54 FBA DATA IN	291



55 FBA DATA OUT	291
84 SEQUENCE PROG	292
98 OPTIONS	305
99 START-UP DATA	305

13. Fieldbus control with embedded fieldbus

What this chapter contains	311
System overview	311
Setting up communication through the embedded Modbus	313
Drive control parameters	314
Fieldbus control interface	317
Control word and Status word	317
References	317
Actual values	317
Fieldbus references	318
Reference selection and correction	318
Fieldbus reference scaling	320
Reference handling	321
Actual value scaling	322
Modbus mapping	322
Register mapping	323
Function codes	324
Exception codes	325
Communication profiles	326
ABB drives communication profile	326
DCU communication profile	331



14. Fieldbus control with fieldbus adapter

What this chapter contains	337
System overview	337
Setting up communication through a fieldbus adapter module	339
Drive control parameters	340
Fieldbus control interface	342
Control word and Status word	342
References	343
Actual values	343
Communication profile	343
Fieldbus references	344
Reference selection and correction	344
Fieldbus reference scaling	346
Reference handling	346
Actual value scaling	346

15. Fault tracing

What this chapter contains	347
Safety	347
Alarm and fault indications	347
How to reset	347

Fault history	348
Alarm messages generated by the drive	349
Alarms generated by the basic control panel	352
Fault messages generated by the drive	355
Embedded fieldbus faults	365
No master device	365
Same device address	365
Incorrect wiring	365

16. Maintenance and hardware diagnostics

What this chapter contains	367
Maintenance intervals	367
Cooling fan	368
Replacing the cooling fan (frame sizes R1...R4)	368
Capacitors	369
Reforming the capacitors	369
Power connections	369
Control panel	370
Cleaning the control panel	370
Changing the battery in the assistant control panel	370
LEDs	370



17. Technical data

What this chapter contains	371
Ratings	372
Definitions	373
Sizing	373
Derating	373
Power cable sizes and fuses	375
Dimensions, weights and free space requirements	377
Dimensions and weights	377
Free space requirements	377
Losses, cooling data and noise	378
Losses and cooling data	378
Noise	379
Terminal and lead-through data for the power cables	380
Terminal and lead-through data for the control cables	380
Electric power network specification	381
Motor connection data	381
Control connection data	383
Clearance and creepage distance	384
Brake resistor connection	384
Common DC connection	384
Efficiency	384
Degrees of protection	384
Ambient conditions	385
Materials	386
Applicable standards	386
CE marking	387

Compliance with the European EMC Directive	387
Compliance with EN 61800-3:2004	387
Definitions	387
Category C1	388
Category C2	388
Category C3	388
UL marking	389
UL checklist	389
C-Tick marking	390
TÜV NORD Safety Approved mark	390
RoHS marking	390
Compliance with the Machinery Directive	390

18. Dimension drawings

What this chapter contains	391
Frame sizes R0 and R1, IP20 (cabinet installation) / UL open	392
Frame sizes R0 and R1, IP20 / NEMA 1	393
Frame size R2, IP20 (cabinet installation) / UL open	394
Frame size R2, IP20 / NEMA 1	395
Frame size R3, IP20 (cabinet installation) / UL open	396
Frame size R3, IP20 / NEMA 1	397
Frame size R4, IP20 (cabinet installation) / UL open	398
Frame size R4, IP20 / NEMA 1	399

19. Appendix: Resistor braking

What this chapter contains	401
Planning the braking system	401
Selecting the brake resistor	401
Selecting the brake resistor cables	403
Placing the brake resistor	404
Protecting the system in brake circuit fault situations	404
Electrical installation	404
Start-up	404

20. Appendix: Extension modules

What this chapter contains	405
Extension modules	405
Description	405
Installation	406
Technical data	408
MTAC-01 pulse encoder interface module	408
MREL-01 output relay module	408
MPOW-01 auxiliary power extension module	409
Description	409
Electrical installation	409
Technical data	410

21. Appendix: Safe torque off (STO)

What this appendix contains	411
Basics	411
Program features, settings and diagnostics	412
Operation of the STO function and its diagnostics function	412
STO status indications	413
STO function activation and indication delays	414
Installation	414
Start-up and commissioning	415
Technical data	415
STO components	415
Data related to safety standards	416
Abbreviations	416
Maintenance	416

22. Appendix: Permanent magnet synchronous motors (PMSMs)

What this chapter contains	417
Setting the parameters	417
Start mode	419
Smooth start	419
Speed controller tuning	419



Further information

Product and service inquiries	421
Product training	421
Providing feedback on ABB Drives manuals	421
Document library on the Internet	421



1

Safety

What this chapter contains

The chapter contains safety instructions which you must follow when installing, operating and servicing the drive. If ignored, physical injury or death may follow, or damage may occur to the drive, motor or driven equipment. Read the safety instructions before you work on the drive.



Use of warnings

Warnings caution you about conditions which can result in serious injury or death and/or damage to the equipment, and advise on how to avoid the danger. The following warning symbols are used in this manual:



Electricity warning warns of hazards from electricity which can cause physical injury and/or damage to the equipment.



General warning warns about conditions, other than those caused by electricity, which can result in physical injury and/or damage to the equipment.

Safety in installation and maintenance

These warnings are intended for all who work on the drive, motor cable or motor.

■ Electrical safety



WARNING! Ignoring the following instructions can cause physical injury or death, or damage to the equipment.

Only qualified electricians are allowed to install and maintain the drive!

- Never work on the drive, motor cable or motor when input power is applied. After disconnecting the input power, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you start working on the drive, motor or motor cable.

Always ensure by measuring with a multimeter (impedance at least 1 Mohm) that

1. there is no voltage between the drive input phases U1, V1 and W1 and the ground
2. there is no voltage between terminals BRK+ and BRK- and the ground.

- Do not work on the control cables when power is applied to the drive or to the external control circuits. Externally supplied control circuits may carry dangerous voltage even when the input power of the drive is switched off.



- Do not make any insulation or voltage withstand tests on the drive.
- Disconnect the internal EMC filter when installing the drive on an IT system (an ungrounded power system or a high-resistance-grounded [over 30 ohms] power system), otherwise the system will be connected to ground potential through the EMC filter capacitors. This may cause danger or damage the drive. See page 50. **Note:** When the internal EMC filter is disconnected, the drive is not EMC compatible without an external filter.

- Disconnect the internal EMC filter when installing the drive on a corner-grounded TN system, otherwise the drive will be damaged. See page 50. **Note:** When the internal EMC filter is disconnected, the drive is not EMC compatible without an external filter.

- All ELV (extra low voltage) circuits connected to the drive must be used within a zone of equipotential bonding, ie within a zone where all simultaneously accessible conductive parts are electrically connected to prevent hazardous voltages appearing between them. This is accomplished by a proper factory grounding.

Note:

- Even when the motor is stopped, dangerous voltage is present at the power circuit terminals U1, V1, W1 and U2, V2, W2 and BRK+ and BRK-.

Permanent magnet synchronous motor drives

These are additional warnings concerning permanent magnet synchronous motor drives. Ignoring the instructions can cause physical injury or death, or damage to the equipment.



WARNING! Do not work on the drive when the permanent magnet synchronous motor is rotating. Also, when the supply power is switched off and the inverter is stopped, a rotating permanent magnet synchronous motor feeds power to the intermediate circuit of the drive and the supply connections become live.

Before installation and maintenance work on the drive:

- Stop the motor.
- Ensure that there is no voltage on the drive power terminals according to step 1 or 2, or if possible, according to the both steps.
 1. Disconnect the motor from the drive with a safety switch or by other means. Measure that there is no voltage present on the drive input or output terminals (U1, V1, W1, U2, V2, W2, BRK+, BRK-).
 2. Ensure that the motor cannot rotate during work. Make sure that no other system, like hydraulic crawling drives, is able to rotate the motor directly or through any mechanical connection like felt, nip, rope, etc. Measure that there is no voltage present on the drive input or output terminals (U1, V1, W1, U2, V2, W2, BRK+, BRK-). Ground the drive output terminals temporarily by connecting them together as well as to the PE.



■ General safety



WARNING! Ignoring the following instructions can cause physical injury or death, or damage to the equipment.

- The drive is not field repairable. Never attempt to repair a malfunctioning drive; contact your local ABB representative or Authorized Service Center for replacement.
 - Make sure that dust from drilling does not enter the drive during the installation. Electrically conductive dust inside the drive may cause damage or lead to malfunction.
 - Ensure sufficient cooling.
-

Safe start-up and operation

These warnings are intended for all who plan the operation, start up or operate the drive.

■ Electrical safety

Permanent magnet synchronous motor drives

These warnings concern permanent magnet synchronous motor drives. Ignoring the instructions can cause physical injury or death, or damage to the equipment.





WARNING! It is not recommended to run the permanent magnet synchronous motor over 1.2 times the rated speed. Motor overspeed may lead to overvoltage which may permanently damage the drive.



■ General safety



WARNING! Ignoring the following instructions can cause physical injury or death, or damage to the equipment.

- Before adjusting the drive and putting it into service, make sure that the motor and all driven equipment are suitable for operation throughout the speed range provided by the drive. The drive can be adjusted to operate the motor at speeds above and below the speed provided by connecting the motor directly to the power line.
- Do not activate automatic fault reset functions if dangerous situations can occur. When activated, these functions will reset the drive and resume operation after a fault.
- Do not control the motor with an AC contactor or disconnecting device (disconnecting means); use instead the control panel start and stop keys  and  or external commands (I/O or fieldbus). The maximum allowed number of charging cycles of the DC capacitors (ie power-ups by applying power) is two per minute and the maximum total number of chargings is 15 000.

Note:

- If an external source for start command is selected and it is ON, the drive will start immediately after an input voltage break or fault reset unless the drive is configured for 3-wire (a pulse) start/stop.
 - When the control location is not set to local (LOC not shown on the display), the stop key on the control panel will not stop the drive. To stop the drive using the control panel, first press the LOC/REM key  and then the stop key .
-



Introduction to the manual

What this chapter contains

The chapter describes applicability, target audience and purpose of this manual. It describes the contents of this manual and refers to a list of related manuals for more information. The chapter also contains a flowchart of steps for checking the delivery, installing and commissioning the drive. The flowchart refers to chapters/sections in this manual.

Applicability

The manual is applicable to the ACS355 drive firmware version 5.060 or later. See parameter [3301 FIRMWARE](#) on page [260](#).

Target audience

The reader is expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.

The manual is written for readers worldwide. Both SI and imperial units are shown. Special US instructions for installations in the United States are given.

Purpose of the manual

This manual provides information needed for planning the installation, installing, commissioning, using and servicing the drive.

Contents of this manual

The manual consists of the following chapters:

- [Safety](#) (page 17) gives safety instructions you must follow when installing, commissioning, operating and servicing the drive.
 - [Introduction to the manual](#) (this chapter, page 21) describes applicability, target audience, purpose and contents of this manual. It also contains a quick installation and commissioning flowchart.
 - [Operation principle and hardware description](#) (page 27) describes the operation principle, layout, power connections and control interfaces, type designation label and type designation information in short.
 - [Mechanical installation](#) (page 33) tells how to check the installation site, unpack, check the delivery and install the drive mechanically.
 - [Planning the electrical installation](#) (page 39) tells how to check the compatibility of the motor and the drive and select cables, protections and cable routing.
 - [Electrical installation](#) (page 49) tells how to check the insulation of the assembly and the compatibility with IT (ungrounded) and corner-grounded TN systems as well as connect power cables and control cables.
 - [Installation checklist](#) (page 59) contains a checklist for checking the mechanical and electrical installation of the drive.
 - [Start-up, control with I/O and ID run](#) (page 61) tells how to start up the drive as well as how to start, stop, change the direction of the motor rotation and adjust the motor speed through the I/O interface.
 - [Control panels](#) (page 75) describes the control panel keys, LED indicators and display fields and tells how to use the panel for control, monitoring and changing the settings.
 - [Application macros](#) (page 111) gives a brief description of each application macro together with a wiring diagram showing the default control connections. It also explains how to save a user macro and how to recall it.
 - [Program features](#) (page 125) describes program features with lists of related user settings, actual signals, and fault and alarm messages.
 - [Actual signals and parameters](#) (page 181) describes actual signals and parameters. It also lists the default values for the different macros.
 - [Fieldbus control with embedded fieldbus](#) (page 311) tells how the drive can be controlled by external devices over a communication network using embedded fieldbus.
 - [Fieldbus control with fieldbus adapter](#) (page 337) tells how the drive can be controlled by external devices over a communication network using a fieldbus adapter.
 - [Fault tracing](#) (page 347) tells how to reset faults and view fault history. It lists all alarm and fault messages including the possible cause and corrective actions.
 - [Maintenance and hardware diagnostics](#) (page 367) contains preventive
-

maintenance instructions and LED indicator descriptions.

- [Technical data](#) (page 371) contains technical specifications of the drive, eg ratings, sizes and technical requirements as well as provisions for fulfilling the requirements for CE and other marks.
- [Dimension drawings](#) (page 391) shows dimension drawings of the drive.
- [Appendix: Resistor braking](#) (page 401) tells how to select the brake resistor.
- [Appendix: Extension modules](#) (page 405) describes common features and mechanical installation of the optional extension modules: MPOW-01 auxiliary power extension module, MTAC-01 pulse encoder interface module and MREL-01 output relay module. Specific features and electrical installation for the MPOW-01 are also described; for information on the MTAC-01 and MREL-01, refer to the corresponding user's manual.
- [Appendix: Safe torque off \(STO\)](#) (page 411) describes STO features, installation and technical data.
- [Appendix: Permanent magnet synchronous motors \(PMSMs\)](#) (page 417) describes the parameter settings needed for permanent magnet synchronous motors.
- [Further information](#) (inside of the back cover, page 421) tells how to make product and service inquiries, get information on product training, provide feedback on ABB Drives manuals and how to find documents on the Internet.

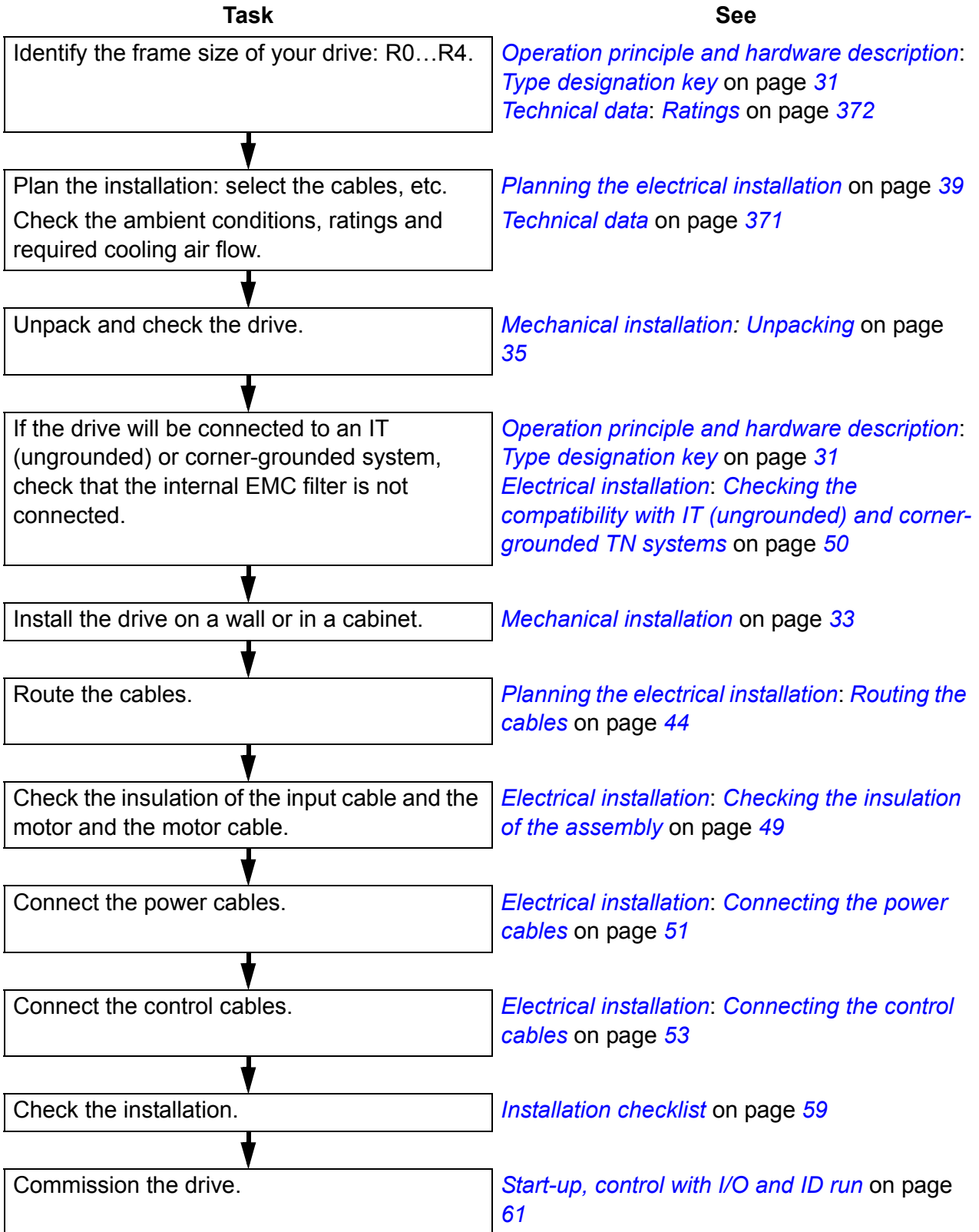
Related documents

See [List of related manuals](#) on page 2 (inside of the front cover).

Categorization by frame size

The ACS355 is manufactured in frame sizes R0...R4. Some instructions and other information which only concern certain frame sizes are marked with the symbol of the frame size (R0...R4). To identify the frame size of your drive, see the table in section [Ratings](#) on page 372.

Quick installation and commissioning flowchart



Terms and abbreviations

Term/abbreviation	Explanation
ACS-CP-A	Assistant control panel, advanced operator keypad for communication with the drive
ACS-CP-C	Basic control panel, basic operator keypad for communication with the drive
ACS-CP-D	Assistant control panel for Asian languages, advanced operator keypad for communication with the drive
Brake chopper	Conducts the surplus energy from the intermediate circuit of the drive to the brake resistor when necessary. The chopper operates when the DC link voltage exceeds a certain maximum limit. The voltage rise is typically caused by deceleration (braking) of a high inertia motor.
Brake resistor	Dissipates the drive surplus braking energy conducted by the brake chopper to heat. Essential part of the brake circuit. See Brake chopper .
Capacitor bank	See DC link capacitors .
Control board	Circuit board in which the control program runs.
CRC	Cyclic redundancy check
DC link	DC circuit between rectifier and inverter
DC link capacitors	Energy storage which stabilizes the intermediate circuit DC voltage.
DCU	Drive control unit
Drive	Frequency converter for controlling AC motors
EMC	Electromagnetic compatibility
EFB	Embedded fieldbus
FBA	Fieldbus adapter
FCAN	Optional CANopen adapter module
FDNA	Optional DeviceNet adapter module
FECA	Optional EtherCAT adapter module
FENA	Optional Ethernet adapter module for EtherNet/IP, Modbus TCP and PROFINET IO protocols
FLON	Optional LONWORKS® adapter module
FMBA	Optional Modbus RTU adapter module
FPBA	Optional PROFIBUS DP adapter module
Frame (size)	Refers to drive physical size, for example R1 and R2. To determine the frame size of a drive, refer to the rating table in chapter Technical data on page 371 .
FRSA	RSA-485 adapter board
I/O	Input/Output
ID run	Identification run
IGBT	Insulated gate bipolar transistor
Intermediate circuit	See DC link .
Inverter	Converts direct current and voltage to alternating current and voltage.

Term/abbreviation	Explanation
IT system	Type of supply system that has no (low-impedance) connection to ground/earth.
LRFI	Series of optional EMC filters
LSW	Least significant word
Macro	Pre-defined default values of parameters in drive control program. Each macro is intended for a specific application. See Parameter .
MFDT-01	FlashDrop, a tool for configuring an unpowered drive
MPOT	Potentiometer module
MPOW	Auxiliary power extension module
MREL	Relay output module
MSW	Most significant word
MTAC	Pulse encoder interface module
MUL1-R1	Option kit for R1 frame sizes for compliance with NEMA 1
MUL1-R3	Option kit for R3 frame sizes for compliance with NEMA 1
MUL1-R4	Option kit for R4 frame sizes for compliance with NEMA 1
Parameter	User-adjustable operation instruction to the drive, or signal measured or calculated by the drive
PLC	Programmable logic controller
PMSM	Permanent magnet synchronous motor
PROFIBUS, PROFIBUS DP, PROFINET IO	Registered trademarks of PI - PROFIBUS & PROFINET International
R1, R2, ...	Frame (size)
RCD	Residual current device
Rectifier	Converts alternating current and voltage to direct current and voltage.
RFI	Radio-frequency interference
RTU	Remote terminal unit
SIL	Safety integrity level. See Appendix: Safe torque off (STO) on page 411.
SREA-01	Ethernet adapter module
STO	Safe torque off. See Appendix: Safe torque off (STO) on page 411.
TN system	Type of supply system that provides a direct connection to ground/earth.

3

Operation principle and hardware description

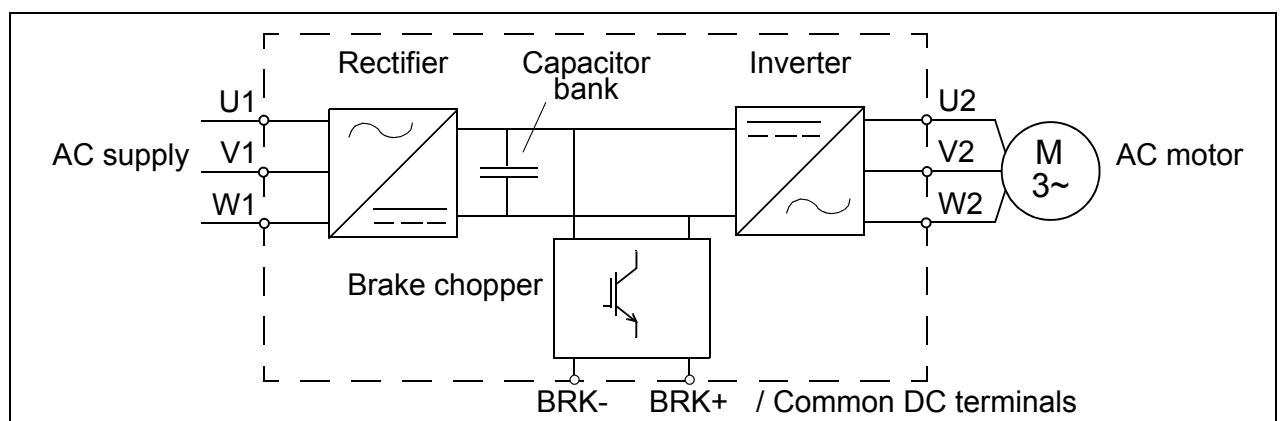
What this chapter contains

The chapter briefly describes the operation principle, layout, type designation label and type designation information. It also shows a general diagram of power connections and control interfaces.

Operation principle

The ACS355 is a wall or cabinet mountable drive for controlling asynchronous AC induction motors and permanent magnet synchronous motors.

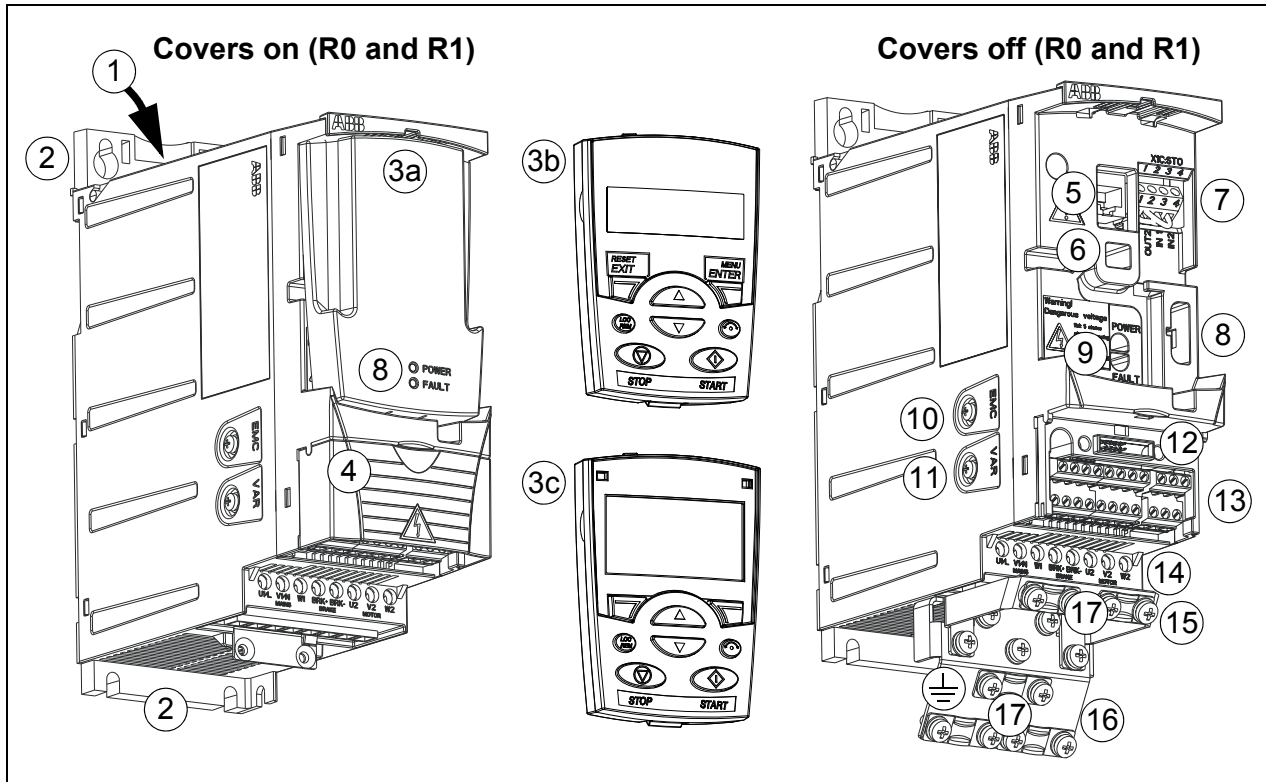
The figure below shows the simplified main circuit diagram of the drive. The rectifier converts three-phase AC voltage to DC voltage. The capacitor bank of the intermediate circuit stabilizes the DC voltage. The inverter converts the DC voltage back to AC voltage for the AC motor. The brake chopper connects the external brake resistor to the intermediate DC circuit when the voltage in the circuit exceeds its maximum limit.



Product overview

Layout

The layout of the drive is presented below. The construction of the different frame sizes R0...R4 varies to some extent.

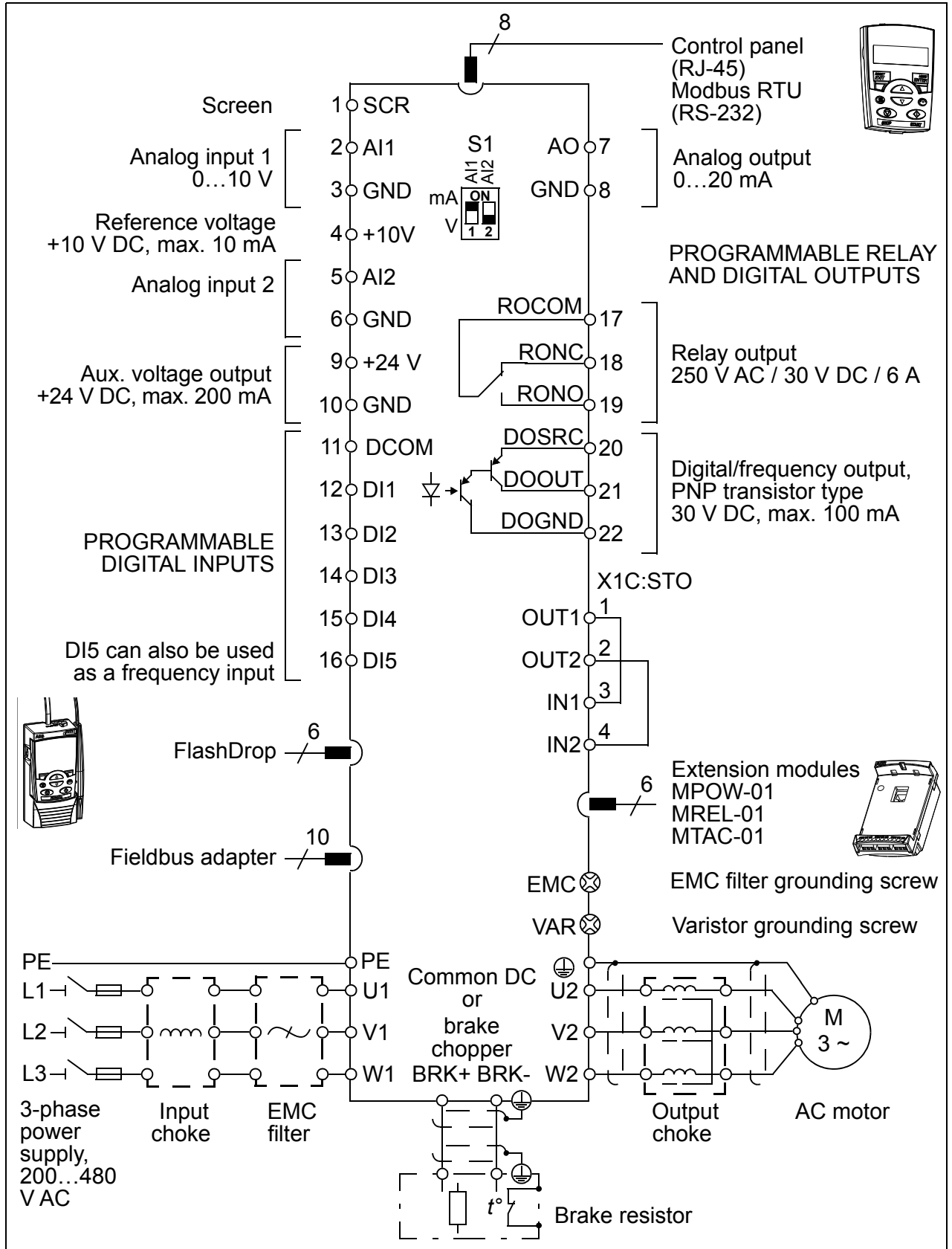


1	Cooling outlet through top cover
2	Mounting holes
3	Panel cover (a) / basic control panel (b) / assistant control panel (c)
4	Terminal cover (or optional potentiometer unit MPOT-01)
5	Panel connection
6	Option connection
7	STO (Safe torque off) connection
8	FlashDrop connection
9	Power OK and Fault LEDs. See section LEDs on page 370.

10	EMC filter grounding screw (EMC). Note: The screw is on the front in frame size R4.
11	Varistor grounding screw (VAR)
12	Fieldbus adapter (serial communication) connection
13	I/O connections
14	Input power connection (U1, V1, W1), brake resistor connection (BRK+, BRK-) and motor connection (U2, V2, W2).
15	I/O clamping plate
16	Clamping plate
17	Clamps

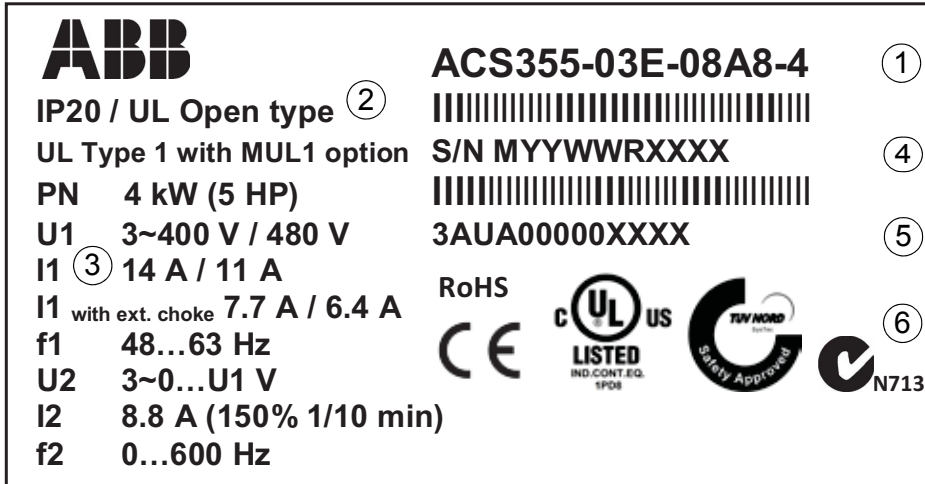
Overview of power and control connections

The diagram gives an overview of connections. I/O connections are parameterable. See chapter [Application macros](#) on page 111 for I/O connections for the different macros and chapter [Electrical installation](#) on page 49 for installation in general.



Type designation label

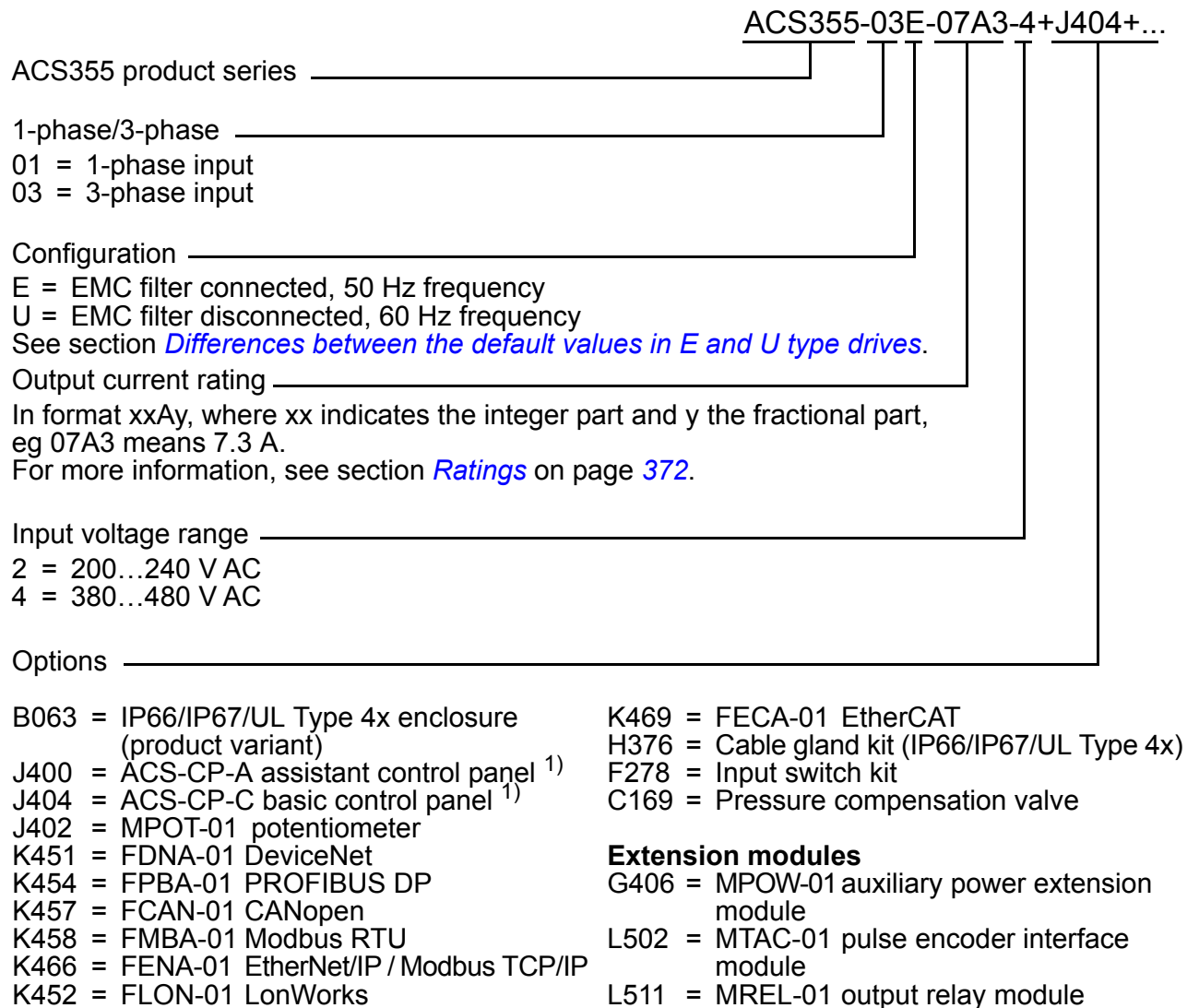
The type designation label is attached to the left side of the drive. An example label and explanation of the label contents are shown below.



1	Type designation, see section Type designation key on page 31
2	Degree of protection by enclosure (IP and UL/NEMA)
3	Nominal ratings, see section Ratings on page 372.
4	Serial number of format MYYWWRXXXX, where M: Manufacturer YY: 10, 11, 12, ... for 2010, 2011, 2012, ... WW: 01, 02, 03, ... for week 1, week 2, week 3, ... R: A, B, C, ... for product revision number XXXX: Integer starting every week from 0001
5	ABB MRP code of the drive
6	CE marking and C-Tick, C-UL US, RoHS and TÜV NORD marks (the label of your drive shows the valid markings)

Type designation key

The type designation contains information on the specifications and configuration of the drive. You find the type designation on the type designation label attached to the drive. The first digits from the left express the basic configuration, for example ACS355-03E-07A3-4. The optional selections are given after that, separated by + signs, for example +J404. The explanations of the type designation selections are described below.



1) The ACS355 is compatible with panels that have the following panel revisions and panel firmware versions. To find out the revision and firmware version of your panel, see page 76.

Panel type	Type code	Panel revision	Panel firmware version
Basic control panel	ACS-CP-C	M or later	1.13 or later
Assistant control panel	ACS-CP-A	F or later	2.04 or later
Assistant control panel (Asia)	ACS-CP-D	Q or later	2.04 or later

Note that unlike the other panels, the ACS-CP-D is ordered with a separate material code.

4

Mechanical installation

What this chapter contains

The chapter tells how to check the installation site, unpack, check the delivery and install the drive mechanically.

Checking the installation site

The drive may be installed on the wall or in a cabinet. Check the enclosure requirements for the need to use the NEMA 1 option in wall installations (see chapter [Technical data](#) on page 371).

The drive can be installed in three different ways, depending on the frame size:

- a) back mounting (all frame sizes)
- b) side mounting (frame sizes R0...R2)
- c) DIN rail mounting (all frame sizes).

The drive must be installed in an upright position.

Check the installation site according to the requirements below. Refer to chapter [Dimension drawings](#) on page 391 for frame details.

■ Requirements for the installation site

Operation conditions

See chapter [Technical data](#) on page 371 for the allowed operation conditions of the drive.

Wall

The wall should be as close to vertical and even as possible, of non-flammable material and strong enough to carry the weight of the drive.



Floor

The floor/material below the installation should be non-flammable.

Free space around the drive

The required free space for cooling above and below the drive is 75 mm (3 in). No free space is required on the sides of the drive, so drives can be mounted immediately next to each other.

Required tools

To install the drive, you need the following tools:

- screwdrivers (as appropriate for the mounting hardware used)
- wire stripper
- tape measure
- drill (if the drive will be installed with screws/bolts)
- mounting hardware: screws or bolts (if the drive will be installed with screws/bolts). For the number of screws/bolts, see [With screws](#) on page 36.



Unpacking

The drive (1) is delivered in a package that also contains the following items (frame size R1 shown in the figure):

- plastic bag (2) including clamping plate (also used for I/O cables in frame sizes R3 and R4), I/O clamping plate (for frame sizes R0...R2), fieldbus option ground plate, clamps and screws
- panel cover (3)
- mounting template, integrated into the package (4)
- user's manual (5)
- possible options (fieldbus, potentiometer, extension module, all with instructions, basic control panel or assistant control panel).



Checking the delivery

Check that there are no signs of damage. Notify the shipper immediately if damaged components are found.

Before attempting installation and operation, check the information on the type designation label of the drive to verify that the drive is of the correct type. See section [Type designation label](#) on page 30.

Installing

The instructions in this manual cover drives with the IP20 degree of protection. To comply with NEMA 1, use the MUL1-R1, MUL1-R3 or MUL1-R4 option kit, which is delivered with multilingual installation instructions (3AFE68642868, 3AFE68643147 or 3AUA0000025916, respectively).

To obtain a higher degree of protection, the drive must be installed inside a cabinet. If there are sand, dust or other impurities in the operating environment, a typical minimum requirement for the installation cabinet is IP54 degree of protection.

■ Install the drive

Install the drive with screws or on a DIN rail as appropriate.

Note: Make sure that dust from drilling does not enter the drive during the installation.

With screws

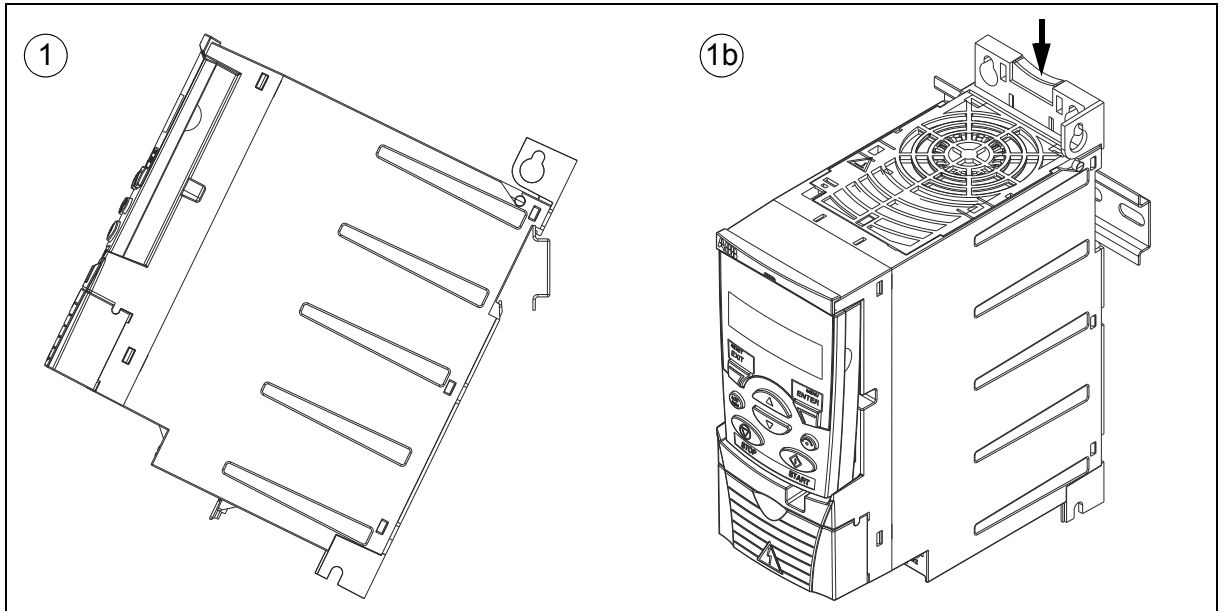
1. Mark the hole locations using for example the mounting template cut out from the package. The locations of the holes are also shown in the drawings in chapter [Dimension drawings](#) on page 391. The number and location of the holes used depend on how the drive is installed:
 - a) back mounting (frame sizes R0...R4): four holes
 - b) side mounting (frame sizes R0...R2): three holes; one of the bottom holes is located in the clamping plate.
2. Fix the screws or bolts to the marked locations.
3. Position the drive onto the screws on the wall.
4. Tighten the screws in the wall securely.



On DIN rail

1. Click the drive to the rail.

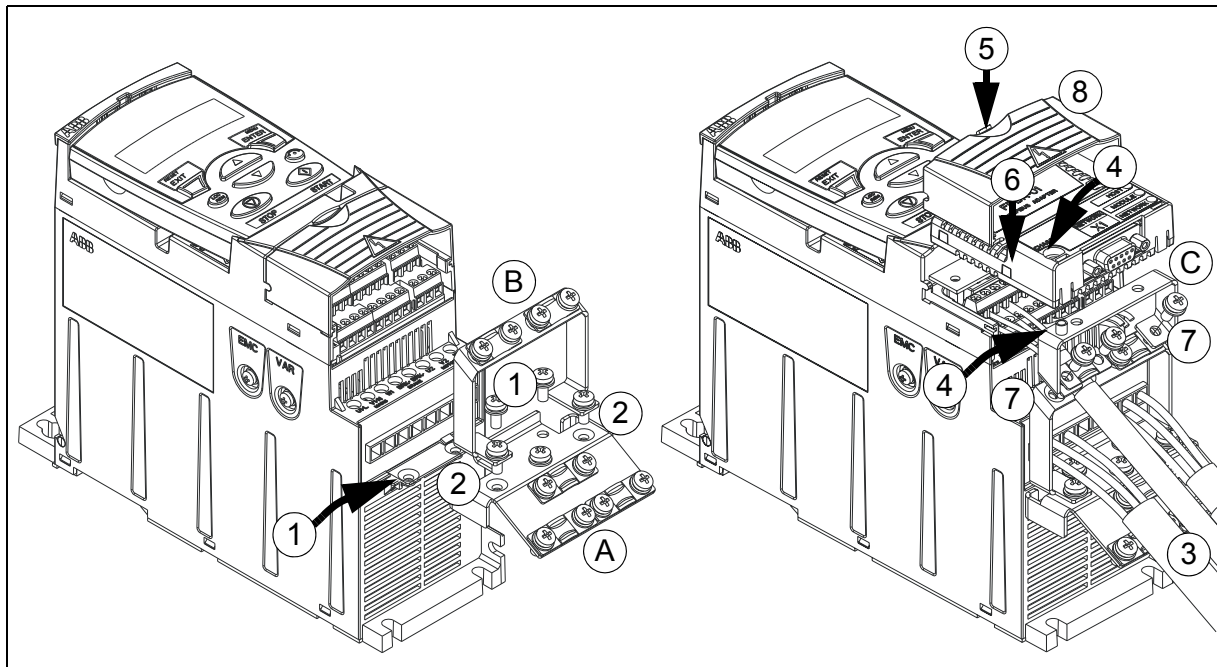
To detach the drive, press the release lever on top of the drive (1b).



■ Fasten clamping plates

Note: Make sure that you do not throw the clamping plates away as they are required for proper grounding of the power and control cables as well as the fieldbus option.

1. Fasten the clamping plate (A) to the plate at the bottom of the drive with the provided screws.
2. For frame sizes R0...R2, fasten the I/O clamping plate (B) to the clamping plate with the provided screws.



■ Attach the optional fieldbus module

1. Connect the power and control cables as instructed in chapter [Electrical installation](#) on page 49.
2. Place the fieldbus module on the option ground plate (C) and tighten the grounding screw on the left corner of the fieldbus module. This fastens the module to the option ground plate (C).
3. If the terminal cover is not already removed, push the recess in the cover and simultaneously slide the cover off the frame.
4. Snap the fieldbus module attached to the option ground plate (C) in position so that the module is plugged to the connection on the drive front and the screw holes in the option ground plate (C) and the I/O clamping plate (B) are aligned.
5. Fasten the option ground plate (C) to the I/O clamping plate (B) with the provided screws.
6. Slide the terminal cover back in place.

5

Planning the electrical installation

What this chapter contains

The chapter contains the instructions that you must follow when checking the compatibility of the motor and drive, and selecting cables, protections, cable routing and way of operation for the drive.

Note: The installation must always be designed and made according to applicable local laws and regulations. ABB does not assume any liability whatsoever for any installation which breaches the local laws and/or other regulations. Furthermore, if the recommendations given by ABB are not followed, the drive may experience problems that the warranty does not cover.

Implementing the AC power line connection

See the requirements in section [Electric power network specification](#) on page 381. Use a fixed connection to the AC power line.



WARNING! As the leakage current of the device typically exceeds 3.5 mA, a fixed installation is required according to IEC 61800-5-1.

■ Using an input choke

An input choke is required in case of unstable supply networks. An input choke can also be used for decreasing the input current.

Selecting the supply disconnecting device (disconnecting means)

Install a hand-operated supply disconnecting device (disconnecting means) between the AC power source and the drive. The disconnecting device must be of a type that can be locked to the open position for installation and maintenance work.

■ European union

To meet the European Union Directives, according to standard EN 60204-1, Safety of Machinery, the disconnecting device must be one of the following types:

- a switch-disconnector of utilization category AC-23B (EN 60947-3)
- a disconnector having an auxiliary contact that in all cases causes switching devices to break the load circuit before the opening of the main contacts of the disconnector (EN 60947-3)
- a circuit breaker suitable for isolation in accordance with EN 60947-2.

■ Other regions

The disconnecting device must conform to the applicable safety regulations.

Checking the compatibility of the motor and drive

Check that the 3-phase AC induction motor and the drive are compatible according to the rating table in section [Ratings](#) on page [372](#). The table lists the typical motor power for each drive type.

Only one permanent magnet synchronous motor can be connected to the inverter output.

Checking the compatibility of the drive when multiple motors are connected to the drive

The drive is selected based on the sum of the connected motor powers. Typically, overdimensioning of the drive and the use of external output chokes is recommended.

When one drive controls several motors, only scalar control is possible. Motor parameters (P_N , I_{2N}) are given as the sum of the nominal values of the motors. Nominal speed is given as an average of the motors. It is recommended to limit the maximum current according to the actual need and it should not exceed $1.1 \cdot I_{2N}$ (parameter [2003 MAX CURRENT](#)).

When multiple motors are connected, the sum of the output cable lengths must not exceed the maximum allowed cable length (see [Maximum recommended motor cable length](#) on page [382](#)). If motor contactors are used, switching the contactors during run is not recommended.

When more than 4 motors need to be controlled by one drive, contact your local ABB representative.

Selecting the power cables

■ General rules

Dimension the input power and motor cables **according to local regulations**.

- The input power and the motor cables must be able to carry the corresponding load currents. See section [Ratings](#) on page [372](#) for the rated currents.
- The cable must be rated for at least 70 °C (158 °F) maximum permissible temperature of the conductor in continuous use. For US, see section [Additional US requirements](#) on page [43](#).
- The conductivity of the PE conductor must be equal to that of the phase conductor (same cross-sectional area).
- 600 V AC cable is accepted for up to 500 V AC.
- Refer to chapter [Technical data](#) on page [371](#) for the EMC requirements.

A symmetrical shielded motor cable (see the figure below) must be used to meet the EMC requirements of the CE and C-Tick marks.

A four-conductor system is allowed for input cabling, but a shielded symmetrical cable is recommended.

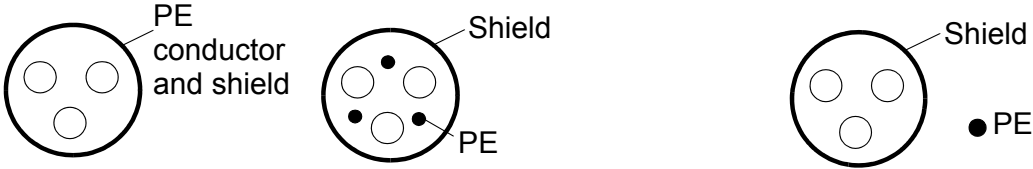
Compared to a four-conductor system, the use of a symmetrical shielded cable reduces electromagnetic emission of the whole drive system as well as motor bearing currents and wear.

Alternative power cable types

Power cable types that can be used with the drive are presented below.

Motor cables
(recommended for input cables also)

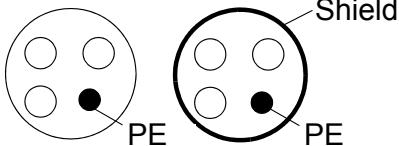
Symmetrical shielded cable: three phase conductors, a concentric or otherwise symmetrically constructed PE conductor and a shield



Note: A separate PE conductor is required if the conductivity of the cable shield is not sufficient for the purpose.

Allowed as input cables

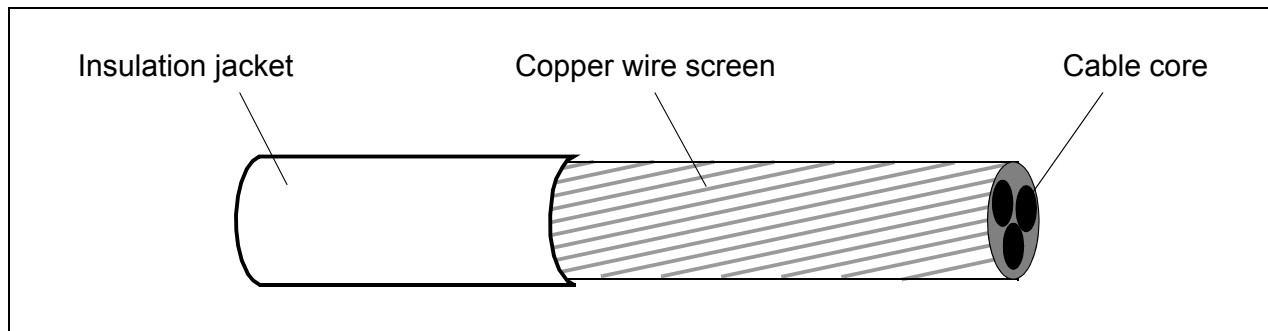
A four-conductor system: three phase conductors and a protective conductor



Motor cable shield

To function as a protective conductor, the shield must have the same cross-sectional area as the phase conductors when they are made of the same metal.

To effectively suppress radiated and conducted radio-frequency emissions, the shield conductivity must be at least 1/10 of the phase conductor conductivity. The requirements are easily met with a copper or aluminum shield. The minimum requirement of the motor cable shield of the drive is shown below. It consists of a concentric layer of copper wires. The better and tighter the shield, the lower the emission level and bearing currents.



■ Additional US requirements

Type MC continuous corrugated aluminum armor cable with symmetrical grounds or shielded power cable is recommended for the motor cables if metallic conduit is not used.

The power cables must be rated for 75 °C (167 °F).

Conduit

Where conduits must be coupled together, bridge the joint with a ground conductor bonded to the conduit on each side of the joint. Bond the conduits also to the drive enclosure. Use separate conduits for input power, motor, brake resistors and control wiring. Do not run motor wiring from more than one drive in the same conduit.

Armored cable / shielded power cable

Six-conductor (three phases and three ground) type MC continuous corrugated aluminum armor cable with symmetrical grounds is available from the following suppliers (trade names in parentheses):

- Anixter Wire & Cable (Philsheath)
- BICC General Corp (Philsheath)
- Rockbestos Co. (Gardex)
- Oaknite (CLX).

Shielded power cable is available from the following suppliers:

- Belden
- LAPPKABEL (ÖLFLEX)
- Pirelli.

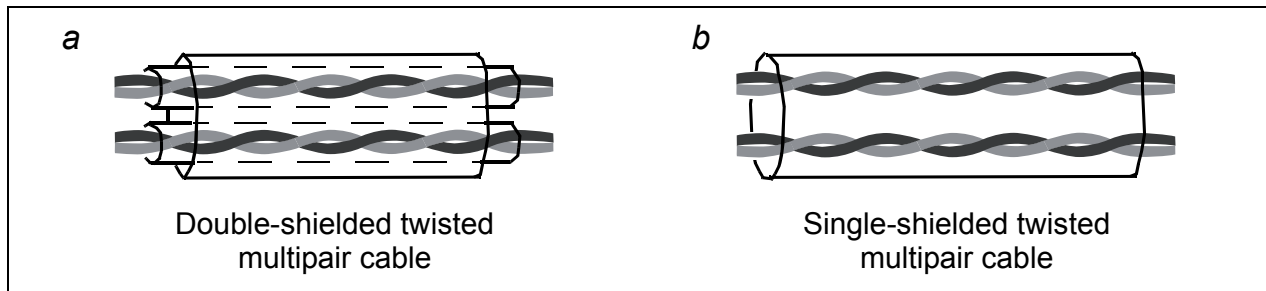
Selecting the control cables

■ General rules

All analog control cables and the cable used for the frequency input must be shielded.

Use a double-shielded twisted pair cable (Figure a, for example JAMAK by Draka NK Cables) for analog signals. Employ one individually shielded pair for each signal. Do not use common return for different analog signals.

A double-shielded cable is the best alternative for low-voltage digital signals, but a single-shielded or unshielded twisted multipair cable (Figure b) is also usable. However, for frequency input, always use a shielded cable.



Run analog and digital signals in separate cables.

Relay-controlled signals, providing their voltage does not exceed 48 V, can be run in the same cables as digital input signals. It is recommended that the relay-controlled signals are run as twisted pairs.

Never mix 24 V DC and 115/230 V AC signals in the same cable.

■ **Relay cable**

The cable type with braided metallic screen (for example ÖLFLEX by LAPPKABEL) has been tested and approved by ABB.

■ **Control panel cable**

In remote use, the cable connecting the control panel to the drive must not exceed 3 m (10 ft). The cable type tested and approved by ABB is used in control panel option kits.

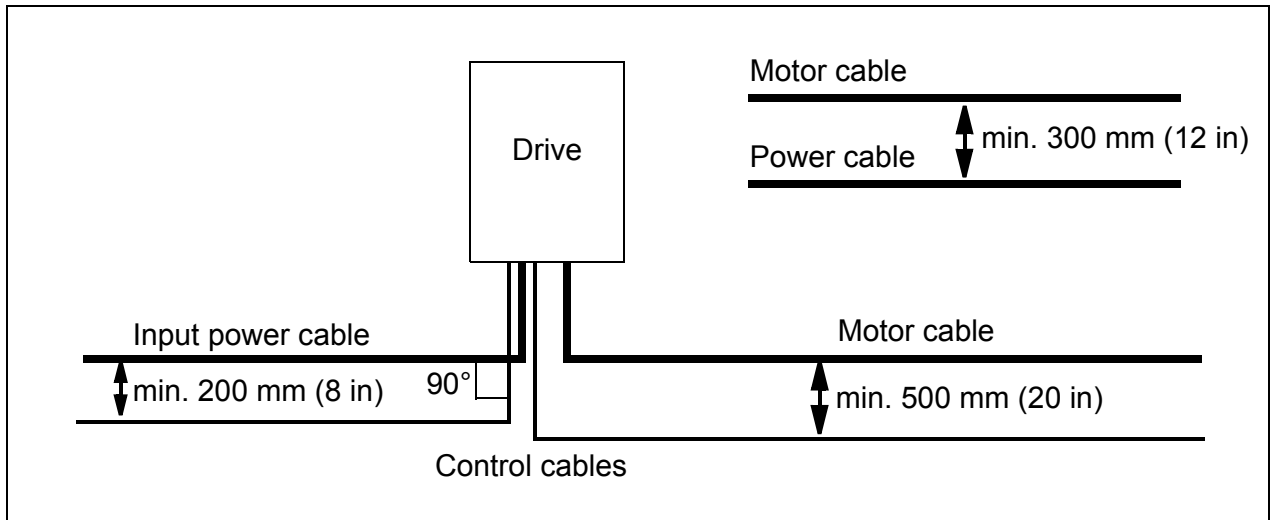
Routing the cables

Route the motor cable away from other cable routes. Motor cables of several drives can be run in parallel installed next to each other. It is recommended that the motor cable, input power cable and control cables are installed on separate trays. Avoid long parallel runs of motor cables with other cables to decrease electromagnetic interference caused by the rapid changes in the drive output voltage.

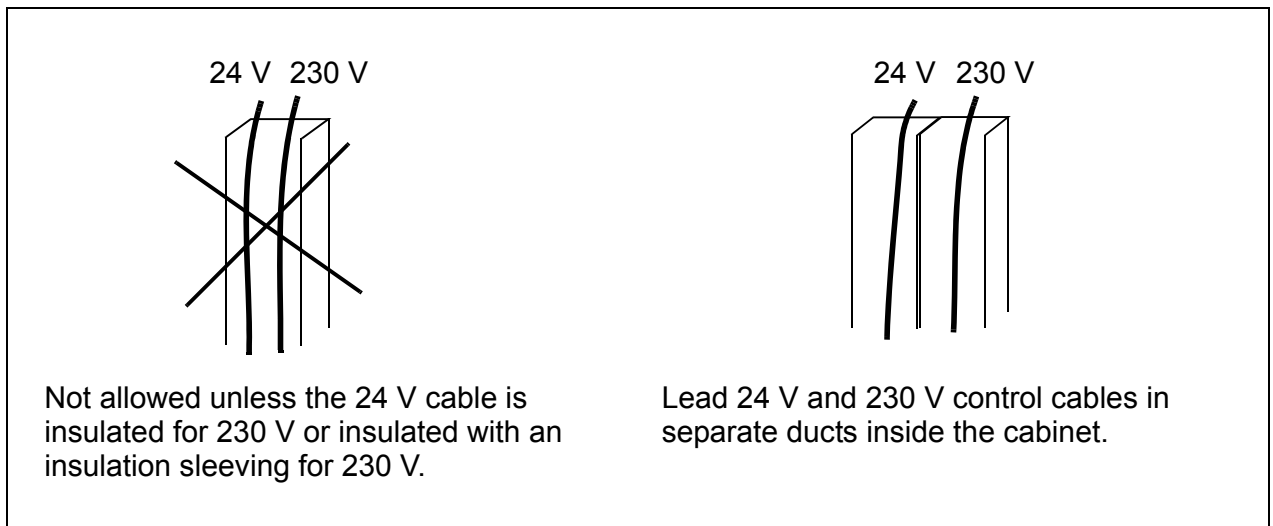
Where control cables must cross power cables make sure that they are arranged at an angle as near to 90 degrees as possible.

The cable trays must have good electrical bonding to each other and to the grounding electrodes. Aluminum tray systems can be used to improve local equalizing of potential.

A diagram of the cable routing is shown below.



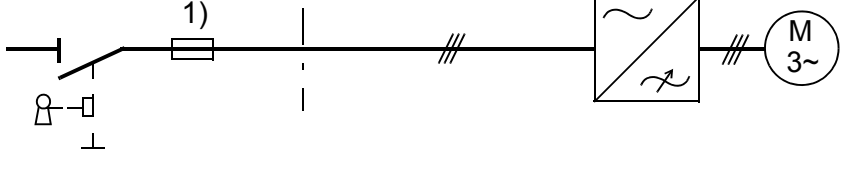
Control cable ducts



Protecting the drive, input power cable, motor and motor cable in short-circuit situations and against thermal overload

■ Protecting the drive and input power cable in short-circuit situations

Arrange the protection according to the following guidelines.

Circuit diagram			Short-circuit protection
Distribution board	Input cable	Drive	Protect the drive and input cable with fuses. See footnote 1).
			

1) Size the fuses according to instructions given in chapter [Technical data](#) on page 371. The fuses will protect the input cable in short-circuit situations, restrict drive damage and prevent damage to adjoining equipment in case of a short-circuit inside the drive.

■ Protecting the motor and motor cable in short-circuit situations

The drive protects the motor and motor cable in a short-circuit situation when the motor cable is dimensioned according to the nominal current of the drive. No additional protection devices are needed.

■ Protecting the drive, motor cable and input power cable against thermal overload

The drive protects itself and the input and motor cables against thermal overload when the cables are dimensioned according to the nominal current of the drive. No additional thermal protection devices are needed.



WARNING! If the drive is connected to multiple motors, a separate thermal overload switch must be used for protecting each cable and motor. These devices may require a separate fuse to cut off the short-circuit current.

■ Protecting the motor against thermal overload

According to regulations, the motor must be protected against thermal overload and the current must be switched off when overload is detected. The drive includes a motor thermal protection function that protects the motor and switches off the current when necessary. It is also possible to connect a motor temperature measurement to the drive. The user can tune both the thermal model and the temperature measurement function further by parameters.

The most common temperature sensors are:

- motor sizes IEC 180...225: thermal switch (for example Klixon)
- motor sizes IEC 200...250 and larger: PTC or Pt100.

For more information on the thermal model, see section [Motor thermal protection](#) on page 150. For more information on the temperature measurement function, see section [Motor temperature measurement through the standard I/O](#) on page 160.

Implementing the Safe torque off (STO) function

See [Appendix: Safe torque off \(STO\)](#) on page 411.

Using residual current devices (RCD) with the drive

ACS355-01x drives are suitable to be used with residual current devices of Type A, ACS355-03x drives with residual current devices of Type B. For ACS355-03x drives, other measures for protection in case of direct or indirect contact, such as separation from the environment by double or reinforced insulation or isolation from the supply system by a transformer, can also be applied.

Using a safety switch between the drive and the motor

It is recommended to install a safety switch between the permanent magnet synchronous motor and the drive output. This is needed to isolate the motor from the drive during maintenance work on the drive.

Implementing a bypass connection



WARNING! Never connect the supply power to the drive output terminals U2, V2 and W2. Power line voltage applied to the output can result in permanent damage to the drive.

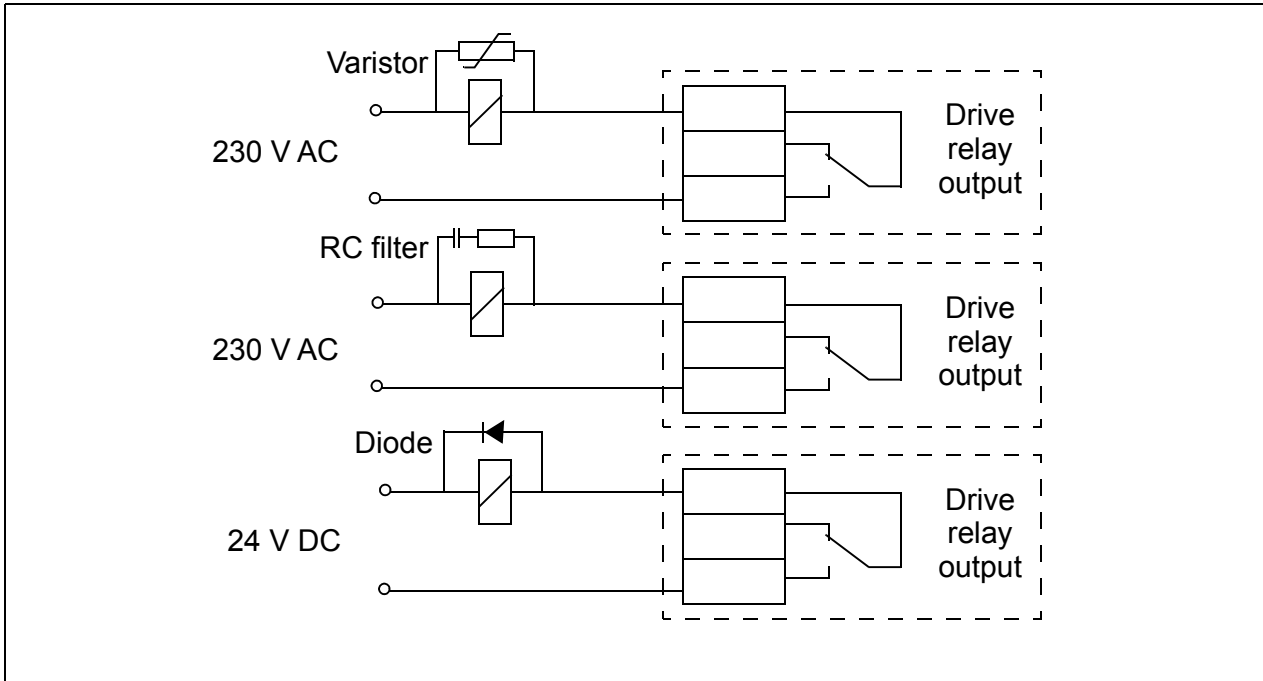
If frequent bypassing is required, employ mechanically connected switches or contactors to ensure that the motor terminals are not connected to the AC power line and drive output terminals simultaneously.

Protecting the contacts of relay outputs

Inductive loads (relays, contactors, motors) cause voltage transients when switched off.

Equip inductive loads with noise attenuating circuits (varistors, RC filters [AC] or diodes [DC]) in order to minimize the EMC emission at switch-off. If not suppressed, the disturbances may connect capacitively or inductively to other conductors in the control cable and form a risk of malfunction in other parts of the system.

Install the protective component as close to the inductive load as possible. Do not install protective components at the I/O terminal block.



6

Electrical installation

What this chapter contains

The chapter tells how to check the insulation of the assembly and the compatibility with IT (ungrounded) and corner-grounded TN systems as well as connect power cables and control cables.



WARNING! The work described in this chapter may only be carried out by a qualified electrician. Follow the instructions in chapter [Safety](#) on page 17. Ignoring the safety instructions can cause injury or death.

Make sure that the drive is disconnected from the input power during installation. If the drive is already connected to the input power, wait for 5 minutes after disconnecting the input power.

Checking the insulation of the assembly

■ Drive

Do not make any voltage tolerance or insulation resistance tests (for example hi-pot or megger) on any part of the drive as testing can damage the drive. Every drive has been tested for insulation between the main circuit and the chassis at the factory. Also, there are voltage-limiting circuits inside the drive which cut down the testing voltage automatically.

■ Input power cable

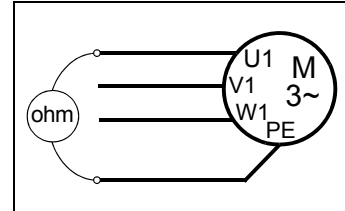
Check the insulation of the input power cable according to local regulations before connecting to the drive.



Motor and motor cable

Check the insulation of the motor and motor cable as follows:

1. Check that the motor cable is connected to the motor and disconnected from the drive output terminals U2, V2 and W2.
2. Measure the insulation resistance between each phase conductor and the Protective Earth conductor using a measuring voltage of 500 V DC. The insulation resistance of an ABB motor must exceed 100 Mohm (reference value at 25 °C or 77 °F). For the insulation resistance of other motors, please consult the manufacturer's instructions.



Note: Moisture inside the motor casing will reduce the insulation resistance. If moisture is suspected, dry the motor and repeat the measurement.

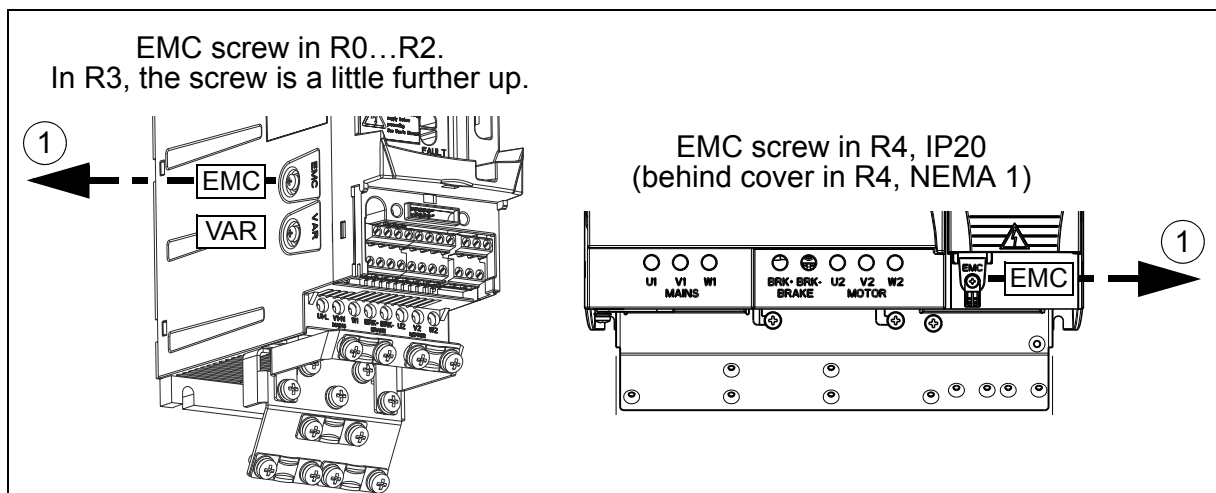
Checking the compatibility with IT (ungrounded) and corner-grounded TN systems

WARNING! Disconnect the internal EMC filter when installing the drive on an IT system (an ungrounded power system or a high-resistance-grounded [over 30 ohms] power system), otherwise the system will be connected to ground potential through the EMC filter capacitors. This may cause danger or damage the drive.

Disconnect the internal EMC filter when installing the drive on a corner-grounded TN system, otherwise the drive will be damaged

Note: When the internal EMC filter is disconnected, the drive is not EMC compatible without an external filter.

1. If you have an IT (ungrounded) or corner-grounded TN system, disconnect the internal EMC filter by removing the EMC screw. For 3-phase U-type drives (with type designation ACS355-03U-), the EMC screw is already removed at the factory and replaced by a plastic one.



Connecting the power cables

■ Connection diagram

For alternatives, see section [Selecting the supply disconnecting device \(disconnecting means\)](#) on page 40.

- 1) Ground the other end of the PE conductor at the distribution board.
- 2) Use a separate grounding cable if the conductivity of the cable shield is insufficient (smaller than the conductivity of the phase conductor) and there is no symmetrically constructed grounding conductor in the cable. See section [Selecting the power cables](#) on page 41.
- 3) For more information on Common DC, see *ACS355 Common DC application guide* (3AUA0000070130 [EN]).
- 4) In one-phase installations, connect the neutral cable here.

Note:

Do not use an asymmetrically constructed motor cable.

If there is a symmetrically constructed grounding conductor in the motor cable in addition to the conductive shield, connect the grounding conductor to the grounding terminal at the drive and motor ends.

Route the motor cable, input power cable and control cables separately. For more information, see section [Routing the cables](#) on page 44.

Grounding of the motor cable shield at the motor end

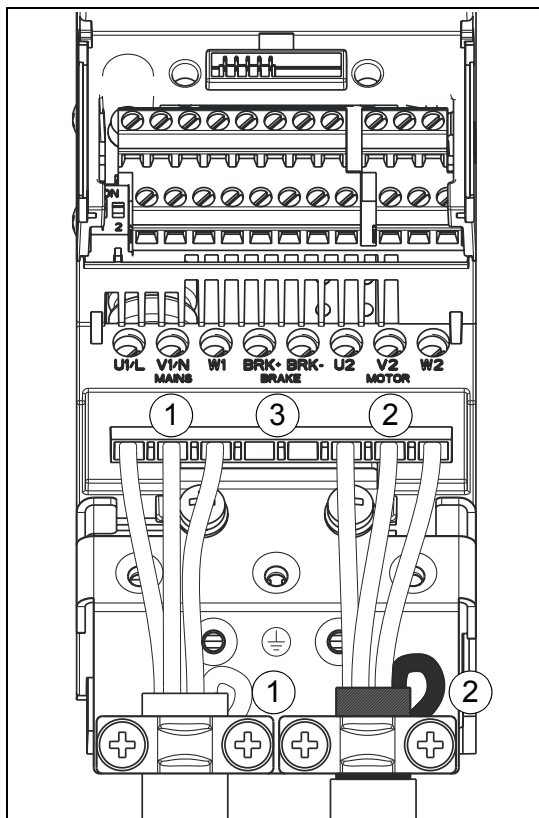
For minimum radio frequency interference:

- ground the cable by twisting the shield as follows: flattened width $\geq 1/5 \cdot \text{length}$
- or ground the cable shield 360 degrees at the lead-through of the motor terminal box.



■ Connection procedure

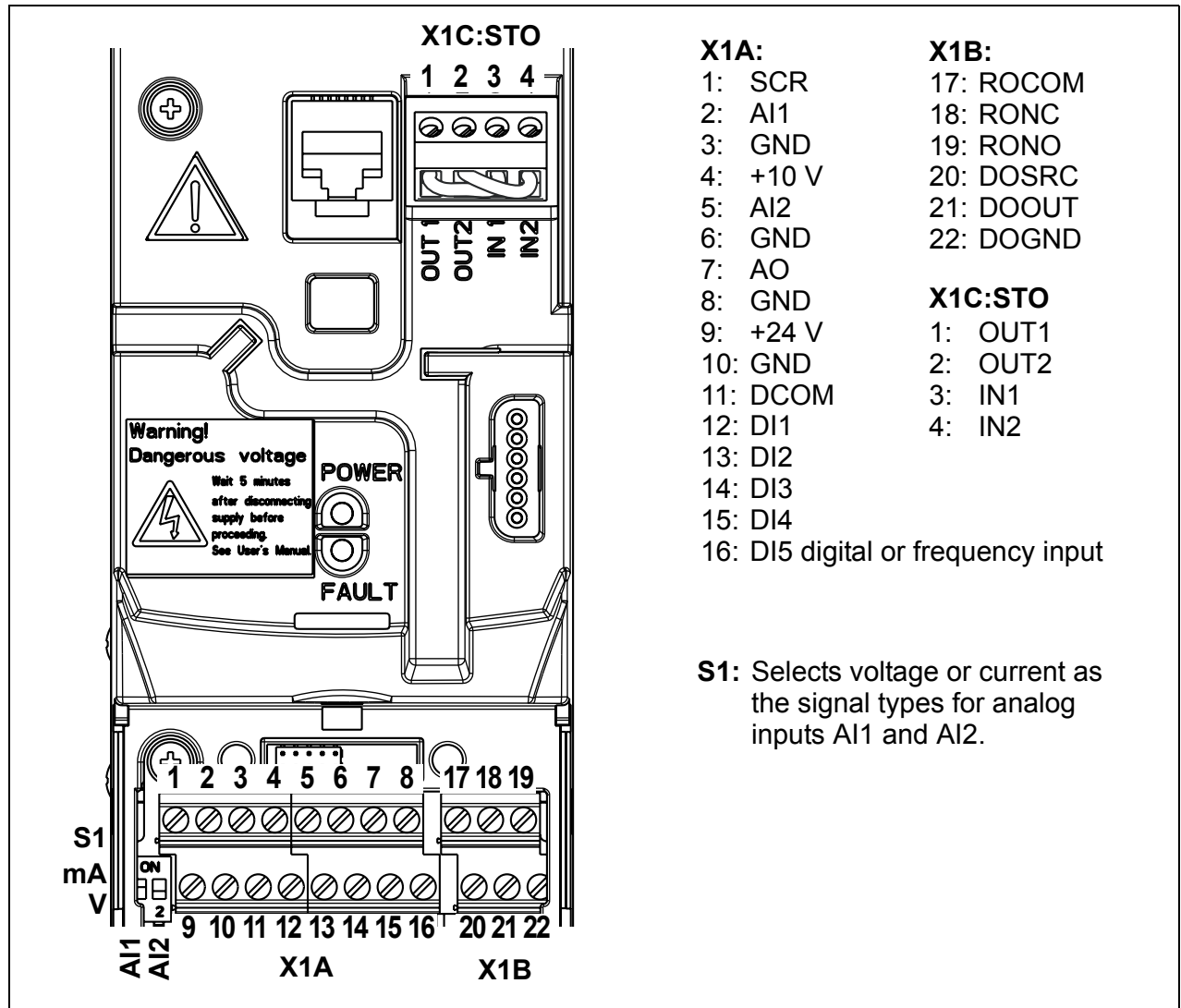
1. Strip the input power cable. Ground the bare shield of the cable (if any) 360 degrees under the grounding clamp. Fasten the grounding conductor (PE) of the input power cable under the grounding clamp. Connect the phase conductors to the U1, V1 and W1 terminals. Use a tightening torque of 0.8 N·m (7 lbf·in) for frame sizes R0...R2, 1.7 N·m (15 lbf·in) for R3 and 2.5 N·m (22 lbf·in) for R4.
3. Strip the input power cable. Ground the bare shield of the cable (if any) 360 degrees under the grounding clamp. Twist the shield to form as short a pigtail as possible. Fasten the twisted shield under the grounding clamp. Connect the phase conductors to the U2, V2 and W2 terminals. Use a tightening torque of 0.8 N·m (7 lbf·in) for frame sizes R0...R2, 1.7 N·m (15 lbf·in) for R3 and 2.5 N·m (22 lbf·in) for R4.
2. Connect the optional brake resistor to the BRK+ and BRK- terminals with a shielded cable using the same procedure as for the motor cable in the previous step.
3. Secure the cables outside the drive mechanically.



Connecting the control cables

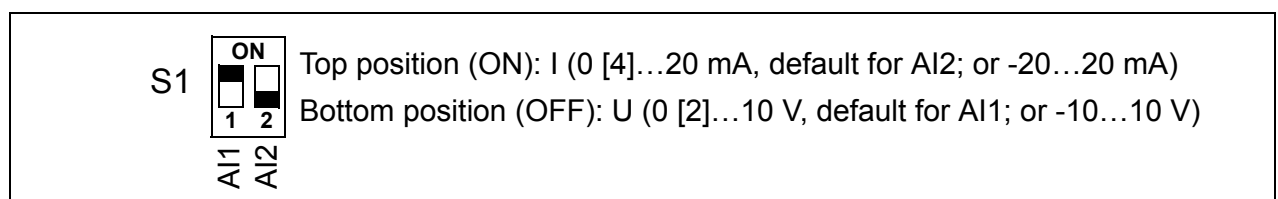
I/O terminals

The figure below shows the I/O terminals. Tightening torque is 0.4 N·m / 3.5 lbf·in.



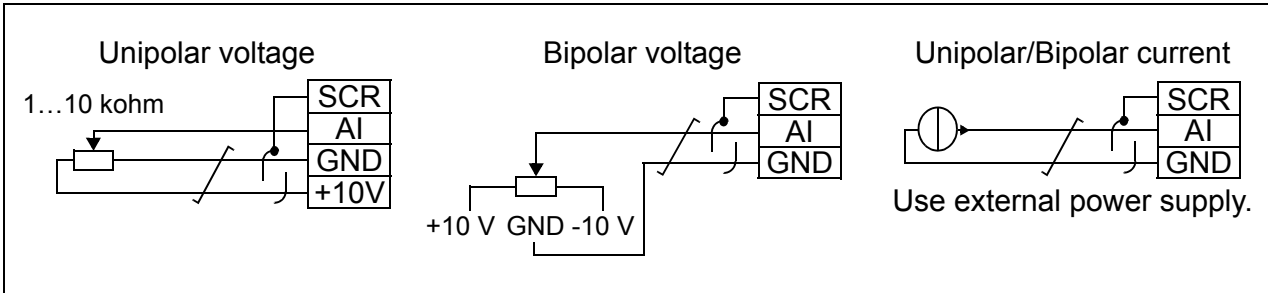
Voltage and current selection for analog inputs

Switch S1 selects voltage (0 [2]...10 V / -10...10 V) or current (0 [4]...20 mA / -20...20 mA) as the signal types for analog inputs AI1 and AI2. The factory settings are unipolar voltage for AI1 (0 [2]...10 V) and unipolar current for AI2 (0 [4]...20 mA), which correspond to the default usage in the application macros. The switch is located to the left of I/O terminal 9 (see the I/O terminal figure above).



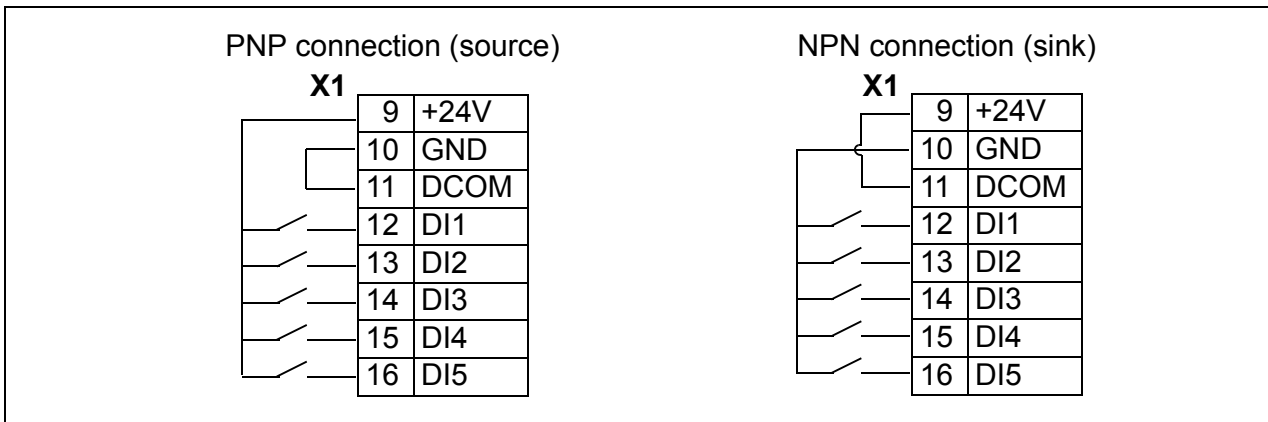
Voltage and current connection for analog inputs

Bipolar voltage (-10...10 V) and current (-20...20 mA) are also possible. If a bipolar connection is used instead of a unipolar one, see section [Programmable analog inputs](#) on page 135 for how to set parameters accordingly.



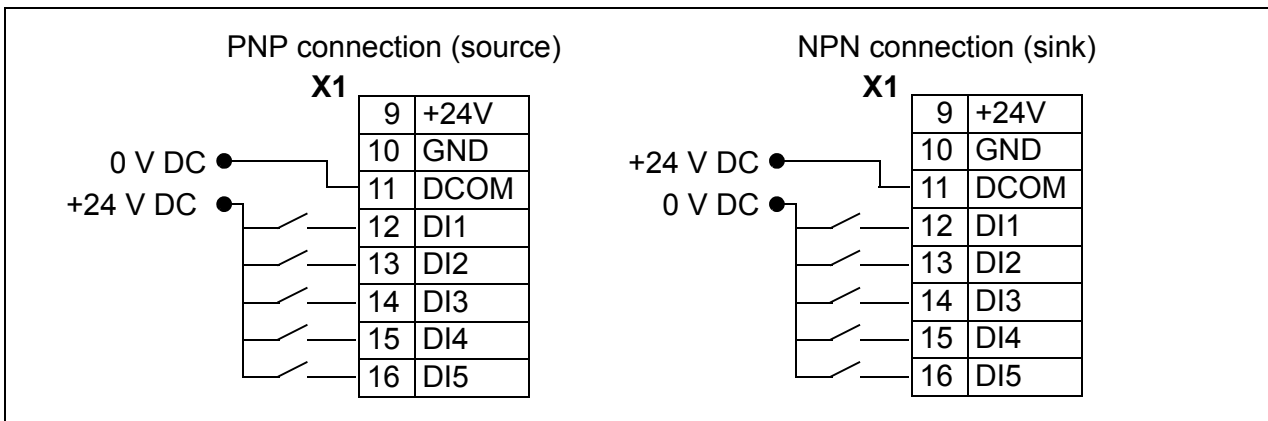
PNP and NPN configuration for digital inputs

You can wire the digital input terminals in either a PNP or NPN configuration.



External power supply for digital inputs

For using an external +24 V supply for the digital inputs, see the figure below.



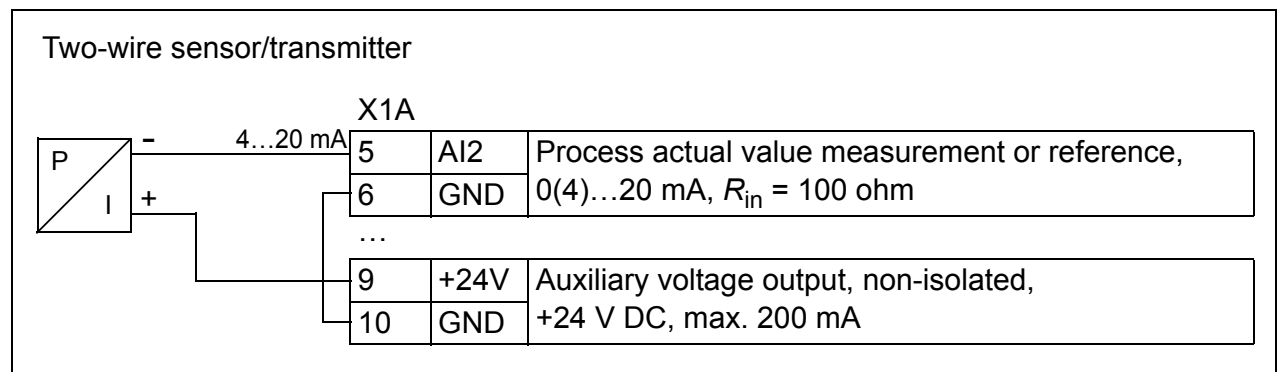
Frequency input

If DI5 is used as a frequency input, see section [Frequency input](#) on page 138 for how to set parameters accordingly.

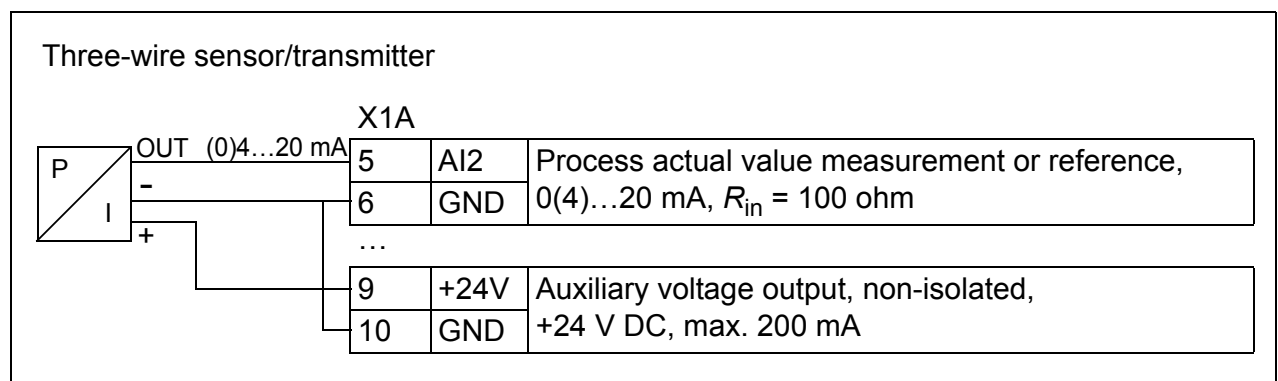
Connection examples of two-wire and three-wire sensors

Hand/Auto, PID control, and Torque control macros (see section [Application macros](#), pages 118, 119 and 120, respectively) use analog input 2 (AI2). The macro wiring diagrams on these pages use an externally powered sensor (connections not shown). The figures below give examples of connections using a two-wire or three-wire sensor/transmitter supplied by the drive auxiliary voltage output.

Note: Maximum capability of the auxiliary 24 V (200 mA) output must not be exceeded.



Note: The sensor is supplied through its current output and the drive feeds the supply voltage (+24 V). Thus the output signal must be 4...20 mA, not 0...20 mA.

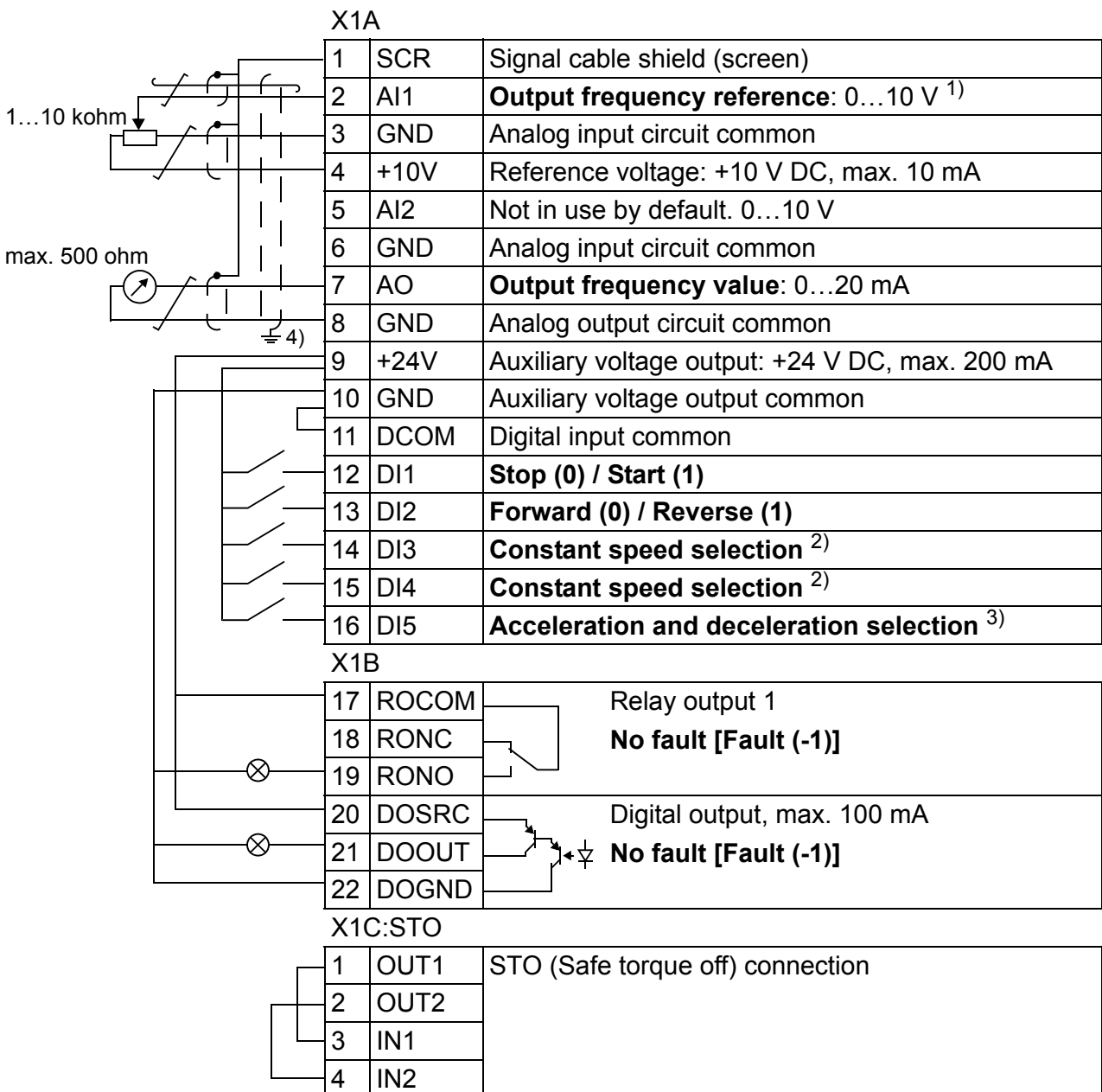


■ Default I/O connection diagram

The default connection of the control signals depends on the application macro in use, which is selected with parameter [9902 APPLIC MACRO](#).

The default macro is the ABB standard macro. It provides a general purpose I/O configuration with three constant speeds. Parameter values are the default values given in section [Default values with different macros](#) on page 182. For information on other macros, see chapter [Application macros](#) on page 111.

The default I/O connections for the ABB standard macro are given in the figure below.



- 1) AI1 is used as a speed reference if vector mode is selected.
- 2) See parameter group **12 CONSTANT SPEEDS**:

DI3	DI4	Operation (parameter)
0	0	Set speed through AI1
1	0	Speed 1 (1202)
0	1	Speed 2 (1203)
1	1	Speed 3 (1204)

- 3) 0 = ramp times according to parameters [2202](#) and [2203](#).
1 = ramp times according to parameters [2205](#) and [2206](#).

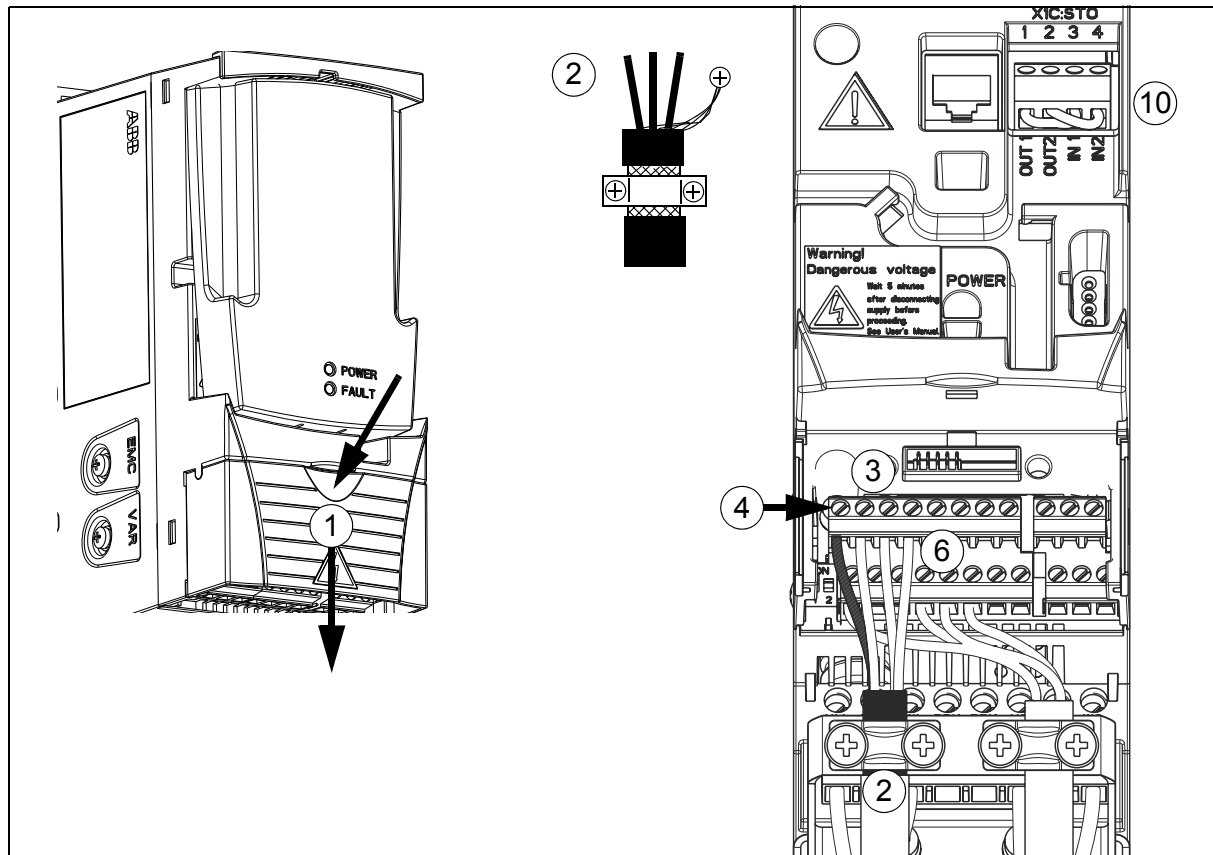
- 4) 360 degree grounding under a clamp.

Tightening torque: 0.4 N·m / 3.5 lbf·in.



■ Connection procedure

1. Remove the terminal cover by simultaneously pushing the recess and sliding the cover off the frame.
2. *Analog signals:* Strip the outer insulation of the analog signal cable 360 degrees and ground the bare shield under the clamp.
3. Connect the conductors to the appropriate terminals. Use a tightening torque of 0.4 N·m (3.5 lbf·in).
4. Twist the grounding conductors of each pair in the analog signal cable together and connect the bundle to the SCR terminal (terminal 1).
5. *Digital signals:* Strip the outer insulation of the digital signal cable 360 degrees and ground the bare shield under the clamp.
6. Connect the conductors of the cable to the appropriate terminals. Use a tightening torque of 0.4 N·m (3.5 lbf·in).
7. For double-shielded cables, twist also the grounding conductors of each pair in the cable together and connect the bundle to the SCR terminal (terminal 1).
8. Secure all cables outside the drive mechanically.
9. Unless you need to install the optional fieldbus module (see section [Attach the optional fieldbus module](#) on page 38), slide the terminal cover back in place.
10. Connect STO conductors to the appropriate terminals. Use a tightening torque of 0.4 N·m (3.5 lbf·in).



7

Installation checklist

What this chapter contains

This chapter contains a list for checking the mechanical and electrical installation of the drive.


Checking the installation

Check the mechanical and electrical installation of the drive before start-up. Go through the checklist below together with another person. Read chapter [Safety](#) on page [17](#) of this manual before you work on the drive.

Check
<p>MECHANICAL INSTALLATION</p> <ul style="list-style-type: none"> <input type="checkbox"/> The ambient operating conditions are within allowed limits. (See Mechanical installation: Checking the installation site on page 33 as well as Technical data: Losses, cooling data and noise on page 378 and Ambient conditions on page 385.) <input type="checkbox"/> The drive is fixed properly on an even vertical non-flammable wall. (See Mechanical installation on page 33.) <input type="checkbox"/> The cooling air will flow freely. (See Mechanical installation: Free space around the drive on page 34.) <input type="checkbox"/> The motor and the driven equipment are ready for start. (See Planning the electrical installation: Checking the compatibility of the motor and drive on page 40 as well as Technical data: Motor connection data on page 381.)
<p>ELECTRICAL INSTALLATION (See Planning the electrical installation on page 39 and Electrical installation on page 49.)</p> <ul style="list-style-type: none"> <input type="checkbox"/> For ungrounded and corner-grounded systems: The internal EMC filter is disconnected (EMC screw removed). <input type="checkbox"/> The capacitors are reformed if the drive has been stored over a year.

Check

- The drive is grounded properly.
 - The input power voltage matches the drive nominal input voltage.
 - The input power connections at U1/L, V1/N and W1 are OK and tightened with the correct torque.
 - Appropriate input power fuses and disconnectors are installed.
 - The motor connections at U2, V2 and W2 are OK and tightened with the correct torque.
 - The motor cable, input power cable and control cables are routed separately.
 - The external control (I/O) connections are OK.
 - Safe torque off (STO) connections, operation and reaction are OK.
 - The input power voltage cannot be applied to the output of the drive (with a bypass connection).
 - Terminal cover and, for NEMA 1, hood and connection box, are in place.
-



Start-up, control with I/O and ID run

What this chapter contains

The chapter tells how to:

- perform the start-up
- start, stop, change the direction of the motor rotation and adjust the speed of the motor through the I/O interface
- perform an Identification run for the drive.

Using the control panel to do these tasks is explained briefly in this chapter. For details on how to use the control panel, refer to chapter [Control panels](#) on page 75.

Starting up the drive



WARNING! The start-up may only be carried out by a qualified electrician.

The safety instructions given in chapter [Safety](#) on page 17 must be followed during the start-up procedure.

The drive will start up automatically at power-up if the external run command is on and the drive is in the remote control mode.



Check that the starting of the motor does not cause any danger. **De-couple the driven machine** if:

- there is a risk of damage in case of incorrect direction of rotation, or
- an ID run needs to be performed during the drive start-up. ID run is essential only in applications that require the ultimate in motor control accuracy.

-
- Check the installation. See the checklist in chapter [Installation checklist](#) on page 59.

How you start up the drive depends on the control panel you have, if any.

- **If you have no control panel**, follow the instructions given in section [Starting up the drive without a control panel](#) on page 62.
- **If you have a basic control panel** (ACS-CP-C), follow the instructions given in section [Performing a manual start-up](#) on page 63.
- **If you have an assistant control panel** (ACS-CP-A, ACS-CP-D), you can either run the Start-up assistant (see section [Performing a guided start-up](#) on page 68) or perform a manual start-up (see section [Performing a manual start-up](#) on page 63).

The Start-up assistant, which is included in the assistant control panel only, guides you through all essential settings to be done. In the manual start-up, the drive gives no guidance; you go through the very basic settings by following the instructions given in section [Performing a manual start-up](#) on page 63.

■ Starting up the drive without a control panel

POWER-UP

- Apply input power and wait for a moment.
- Check that the red LED is not lit and the green LED is lit but not blinking.










The drive is now ready for use.









■ Performing a manual start-up

For the manual start-up, you can use the basic control panel or the assistant control panel. The instructions below are valid for both control panels, but the displays shown are the basic control panel displays, unless the instruction applies to the assistant control panel only.

Before you start, ensure that you have the motor nameplate data on hand.





POWER-UP	
<p><input type="checkbox"/> Apply input power.</p> <p>The basic control panel powers up into the Output mode.</p> <p>The assistant control panel asks if you want to run the Start-up assistant. If you press , the Start-up assistant is not run, and you can continue with manual start-up in a similar manner as described below for the basic control panel.</p>	<div style="border: 1px solid black; padding: 5px;"> <p>REM 0.0 Hz</p> <p>OUTPUT FWD</p> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> <p>REM ↻ CHOICE _____</p> <p>Do you want to use the start-up assistant?</p> <p>Yes</p> <p>NO</p> <p>EXIT 00:00 OK</p> </div>
MANUAL ENTRY OF START-UP DATA (parameter group 99)	
<p><input type="checkbox"/> If you have an assistant control panel, select the language (the basic control panel does not support languages). See parameter 9901 for the values of the available language alternatives.</p> <p>For instructions on how to set parameters with the assistant control panel, see section Assistant control panel on page 89.</p> <p><input type="checkbox"/> Select the motor type (9903).</p> <ul style="list-style-type: none"> • 1 (AM): Asynchronous motor • 2 (PMSM): Permanent magnet synchronous motor. <p>Setting of parameter 9903 is shown below as an example of parameter setting with the basic control panel. You find more detailed instructions in section Basic control panel on page 77.</p> <ol style="list-style-type: none"> 1. To go to the Main menu, press  if the bottom line shows OUTPUT; otherwise press  repeatedly until you see MENU at the bottom. 2. Press keys   until you see “PAR”, and press . 3. Find the appropriate parameter group with keys   and press . 	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p>REM ↻ PAR EDIT _____</p> <p>9901 LANGUAGE</p> <p>ENGLISH</p> <p>[0]</p> <p>CANCEL 00:00 SAVE</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p>REM 9903</p> <p>PAR FWD</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p>REM rEF</p> <p>MENU FWD</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p>REM -01-</p> <p>PAR FWD</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p>REM 9901</p> <p>PAR FWD</p> </div>



4. Find the appropriate parameter in the group with keys  .
5. Press and hold  for about two seconds until the parameter value is shown with **SET** under the value.
6. Change the value with keys  . The value changes faster while you keep the key pressed down.
7. Save the parameter value by pressing .

- Select the application macro (parameter **9902**) according to how the control cables are connected.
The default value 1 (**ABB STANDARD**) is suitable in most cases.
- Select the motor control mode (parameter **9904**).
1 (**VECTOR: SPEED**) is suitable in most cases.
2 (**VECTOR: TORQ**) is suitable for torque control applications.
3 (**SCALAR: FREQ**) is recommended
 - for multimotor drives when the number of the motors connected to the drive is variable
 - when the nominal motor current is less than 20% of the nominal current of the drive
 - when the drive is used for test purposes with no motor connected.
- Enter the motor data from the motor nameplate.

Asynchronous motor nameplate example:

 ABB Motors 							
3 ~ motor		M2AA 200 MLA 4					
IEC 200 M/L 55							
No							
Ins.cl. F				IP 55			
V	Hz	kW	r/min	A	cos φ	IA/IN	tE/s
690 Y	50	30	1475	32.5	0.83		
400 D	50	30	1475	56	0.83		
660 Y	50	30	1470	34	0.83		
380 D	50	30	1470	59	0.83		
415 D	50	30	1475	54	0.83		
440 D	60	35	1770	59	0.83		
Cat. no 3GAA 202 001 - ADA							
6312/C3				6210/C3		180 kg	
IEC 34-1							

380 V
supply
voltage

REM **9903**
PAR FWD

REM **1**
PAR **SET** FWD

REM **2**
PAR **SET** FWD

REM **9903**
PAR FWD

REM **9902**
PAR FWD

REM **9904**
PAR FWD

Note: Set the motor data to exactly the same value as on the motor nameplate. For example, if the motor nominal speed is 1470 rpm on the nameplate, setting the value of parameter **9908 MOTOR NOM SPEED** to 1500 rpm results in the wrong operation of the drive.



Permanent magnet synchronous motor nameplate example:

ABB MS4836N4008E43C10
 I_o/I_n 9.1/9.5 A IP65
 I_p 27.8 A Insulation class F
 T_o/T_n 10.5/10.5 Nm
 T_p 31.5 Nm
 P_n 3.3 kW
 F_n 200 Hz
 N_n 3000 r/min
 B_{emf @ N_n} 208.7 V@ r/min
 Feedback RESOLVER
 Brake V_{dc} A Nm
 CE
 UL[®]
 C TS 4836
 S/N 6 8 8 4 7 1 8 4 A A 1 2 3 4 5
 01/2007 Made in Japan

- motor nominal voltage (parameter [9905](#)).
 For permanent magnet synchronous motors, enter the back emf voltage at nominal speed here. Otherwise use nominal voltage and perform ID run. If the voltage is given as voltage per rpm, eg 60 V per 1000 rpm, the voltage for 3000 rpm nominal speed is 3 · 60 V = 180 V.
- nominal motor current (parameter [9906](#))
 Allowed range: 0.2...2.0 · I_{2N} A
- motor nominal frequency (parameter [9907](#))
- motor nominal speed (parameter [9908](#))
- motor nominal power (parameter [9909](#))

REM	9905
	PAR FWD

REM	9906
	PAR FWD

REM	9907
	PAR FWD



REM	9908
	PAR FWD

REM	9909
	PAR FWD












- Select the motor identification method (parameter **9910**).
 The default value 0 (**OFF/IDMAGN**) using the identification magnetization is suitable for most applications. It is applied in this basic start-up procedure. Note however that this requires that parameter **9904** is set to 1 (**VECTOR: SPEED**) or 2 (**VECTOR: TORQ**).
 If your selection is 0 (**OFF/IDMAGN**), move to the next step.
 Value 1 (**ON**) should be selected if:
 - the operation point is near zero speed, and/or
 - operation at torque range above the motor nominal torque over a wide speed range and without any measured speed feedback is required.
 If you decide to perform the ID run (value 1 [**ON**]), continue by following the separate instructions given on page **71** in section **ID run procedure** and then return to step **DIRECTION OF THE MOTOR ROTATION** on page **66**.

IDENTIFICATION MAGNETIZATION WITH ID RUN SELECTION 0 (OFF/IDMAGN)

- Press key  to switch to local control (LOC shown on the left).
 Press  to start the drive. The motor model is now calculated by magnetizing the motor for 10 to 15 s at zero speed.

DIRECTION OF THE MOTOR ROTATION

- Check the direction of the motor rotation.
 - If the drive is in remote control (REM shown on the left), switch to local control by pressing .
 - To go to the Main menu, press  if the bottom line shows OUTPUT; otherwise press  repeatedly until you see MENU at the bottom.
 - Press keys   until you see “rEF” and press .
 - Increase the frequency reference from zero to a small value with key .
 - Press  to start the motor.
 - Check that the actual direction of the motor is the same as indicated on the display (FWD means forward and REV reverse).
 - Press  to stop the motor.

To change the direction of the motor rotation:



- Invert the phases by changing the value of parameter **9914** to the opposite, ie from 0 (*NO*) to 1 (*YES*), or vice versa.
- Verify your work by applying input power and repeating the check as described above.

LOC	9914	PAR	FWD
-----	-------------	-----	-----

SPEED LIMITS AND ACCELERATION/DECELERATION TIMES

- Set the minimum speed (parameter **2001**).
- Set the maximum speed (parameter **2002**).
- Set the acceleration time 1 (parameter **2202**).
Note: Set also acceleration time 2 (parameter **2205**) if two acceleration times will be used in the application.
- Set the deceleration time 1 (parameter **2203**).
Note: Set also deceleration time 2 (parameter **2206**) if two deceleration times will be used in the application.

LOC	2001	PAR	FWD
-----	-------------	-----	-----

LOC	2002	PAR	FWD
-----	-------------	-----	-----

LOC	2202	PAR	FWD
-----	-------------	-----	-----

LOC	2203	PAR	FWD
-----	-------------	-----	-----

SAVING A USER MACRO AND FINAL CHECK

- The start-up is now completed. However, it might be useful at this stage to set the parameters required by your application and save the settings as a user macro as instructed in section *User macros* on page **123**.
- Check that the drive state is OK.
Basic control panel: Check that there are no faults or alarms shown on the display.
If you want to check the LEDs on the front of the drive, switch first to remote control (otherwise a fault is generated) before removing the panel and verifying that the red LED is not lit and the green LED is lit but not blinking.
Assistant control panel: Check that there are no faults or alarms shown on the display and that the panel LED is green and does not blink.

LOC	9902	PAR	FWD
-----	-------------	-----	-----













The drive is now ready for use.


















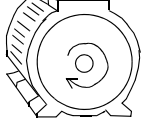
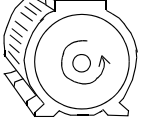

■ Performing a guided start-up

To be able to perform the guided start-up, you need the assistant control panel. Guided start-up is applicable to AC induction motors.

Before you start, ensure that you have the motor nameplate data on hand.

POWER-UP	
<p>□ Apply input power. The control panel first asks if you want to use the Start-up assistant.</p> <ul style="list-style-type: none"> • Press  (when Yes is highlighted) to run the Start-up assistant. • Press  if you do not want to run the Start-up assistant. • Press key  to highlight No and then press  if you want to make the panel ask (or not ask) the question about running the Start-up assistant again the next time you switch on the power to the drive. 	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>REM ↻ CHOICE</p> <p>Do you want to use the start-up assistant?</p> <p>Yes</p> <p>NO</p> <p>EXIT 00:00 OK</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p>REM ↻ CHOICE</p> <p>Show start-up assistant on next boot?</p> <p>Yes</p> <p>No</p> <p>EXIT 00:00 OK</p> </div>
SELECTING THE LANGUAGE	
<p>□ If you decided to run the Start-up assistant, the display then asks you to select the language. Scroll to the desired language with keys / and press  to accept.</p> <p>If you press , the Start-up assistant is stopped.</p>	<div style="border: 1px solid black; padding: 5px;"> <p>REM ↻ PAR EDIT</p> <p>9901 LANGUAGE</p> <p>ENGLISH</p> <p>[0]</p> <p>EXIT 00:00 SAVE</p> </div>
STARTING THE GUIDED SET-UP	
<p>□ The Start-up assistant now guides you through the set-up tasks, starting with the motor set-up. Set the motor data to exactly the same value as on the motor nameplate.</p> <p>Scroll to the desired parameter value with keys / and press  to accept and continue with the Start-up assistant.</p> <p>Note: At any time, if you press , the Start-up assistant is stopped and the display goes to the Output mode.</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>REM ↻ PAR EDIT</p> <p>9905 MOTOR NOM VOLT</p> <p>220 V</p> <p>EXIT 00:00 SAVE</p> </div>
<p>□ The basic start-up is now completed. However, it might be useful at this stage to set the parameters required by your application and continue with the application set-up as suggested by the Start-up assistant.</p>	<div style="border: 1px solid black; padding: 5px;"> <p>REM ↻ CHOICE</p> <p>Do you want to continue with application setup?</p> <p>Continue</p> <p>Skip</p> <p>EXIT 00:00 OK</p> </div>



<p><input type="checkbox"/> Select the application macro according to which the control cables are connected.</p> <p>Continue with the application set-up. After completing a set-up task, the Start-up assistant suggests the next one.</p> <ul style="list-style-type: none"> • Press  (when Continue is highlighted) to continue with the suggested task. • Press key  to highlight Skip and then press  to move to the following task without doing the suggested task. • Press  to stop the Start-up assistant. 	<div data-bbox="1067 203 1444 394"> <p>REM  PAR EDIT</p> <p>9902 APPLIC MACRO ABB STANDARD [1]</p> <p>EXIT 00:00 SAVE</p> </div> <div data-bbox="1067 416 1444 607"> <p>REM  CHOICE</p> <p>Do you want to continue with EXT1 reference setup?</p> <p>Continue Skip</p> <p>EXIT 00:00 OK</p> </div>
<p>DIRECTION OF THE MOTOR ROTATION</p>	
<p><input type="checkbox"/> Press  to switch to local control (LOC shown on the left).</p> <ul style="list-style-type: none"> • If the drive is in remote control (REM shown on the status line), switch to local control by pressing . • If you are not in the Output mode, press  repeatedly until you get there. • Increase the frequency reference from zero to a small value with key . • Press  to start the motor. • Check that the actual direction of the motor is the same as indicated on the display ( means forward and  reverse). • Press  to stop the motor. <p>To change the direction of the motor rotation:</p> <ul style="list-style-type: none"> • Invert the phases by changing the value of parameter 9914 to the opposite, ie from 0 (NO) to 1 (YES), or vice versa. • Verify your work by applying input power and repeating the check as described above. 	<div data-bbox="1067 976 1444 1167"> <p>LOC  xx.xHZ</p> <p>XX.X HZ X.X A XX.X %</p> <p>DIR 00:00 MENU</p> </div> <div data-bbox="1067 1321 1444 1523"> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>forward direction</p> </div> <div style="text-align: center;">  <p>reverse direction</p> </div> </div> </div> <div data-bbox="1067 1590 1444 1780"> <p>LOC  PAR EDIT</p> <p>9914 PHASE INVERSION YES [1]</p> <p>CANCEL 00:00 SAVE</p> </div>
<p>FINAL CHECK</p>	
<p><input type="checkbox"/> After the whole set-up is completed, check that there are no faults or alarms shown on the display and the panel LED is green and does not blink.</p>	
<p>The drive is now ready for use.</p>	




Controlling the drive through the I/O interface

The table below instructs how to operate the drive through the digital and analog inputs when:

- the motor start-up is performed, and
- the default (standard) parameter settings are valid.

Displays of the basic control panel are shown as an example.

PRELIMINARY SETTINGS	
<p>If you need to change the direction of rotation, check that parameter 1003 DIRECTION is set to 3 (REQUEST).</p> <p>Ensure that the control connections are wired according to the connection diagram given for the ABB standard macro.</p> <p>Ensure that the drive is in remote control. Press key  to switch between remote and local control.</p>	<p>See section Default I/O connection diagram on page 56.</p> <p>In remote control, the panel display shows text REM.</p>
STARTING AND CONTROLLING THE SPEED OF THE MOTOR	
<p>Start by switching digital input DI1 on.</p> <p><u>Basic control panel</u>: Text FWD starts flashing fast and stops after the setpoint is reached</p> <p><u>Assistant control panel</u>: The arrow starts rotating. It is dotted until the setpoint is reached.</p> <p>Regulate the drive output frequency (motor speed) by adjusting the voltage of analog input AI1.</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>REM 0.0 Hz</p> <p>OUTPUT FWD</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p>REM 50.0 Hz</p> <p>OUTPUT FWD</p> </div>
CHANGING THE DIRECTION OF THE MOTOR ROTATION	
<p>Reverse direction: Switch digital input DI2 on.</p> <p>Forward direction: Switch digital input DI2 off.</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>REM 50.0 Hz</p> <p>OUTPUT REV</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p>REM 50.0 Hz</p> <p>OUTPUT FWD</p> </div>
STOPPING THE MOTOR	
<p>Switch digital input DI1 off. The motor stops.</p> <p><u>Basic control panel</u>: Text FWD starts flashing slowly.</p> <p><u>Assistant control panel</u>: The arrow stops rotating.</p>	<div style="border: 1px solid black; padding: 5px;"> <p>REM 0.0 Hz</p> <p>OUTPUT FWD</p> </div>



Performing the ID run

The drive estimates motor characteristics automatically when the drive is started for the first time and after any motor parameter (group [99 START-UP DATA](#)) is changed. This is valid when parameter [9910 ID RUN](#) has value 0 ([OFF/IDMAGN](#)).

In most applications there is no need to perform a separate ID run. The ID run should be selected if:

- vector control mode is used (parameter [9904](#) = 1 [[VECTOR: SPEED](#)] or 2 [[VECTOR: TORQ](#)]), and
- operation point is near zero speed and/or
- operation at torque range above the motor nominal torque, over a wide speed range, and without any measured speed feedback (ie without a pulse encoder) is needed or
- permanent magnet synchronous motor is used and the back emf voltage is unknown.

Note: If motor parameters (group [99 START-UP DATA](#)) are changed after the ID run, it must be repeated.


■ ID run procedure

The general parameter setting procedure is not repeated here. For basic control panel, see page [77](#) and for assistant control panel, see page [89](#) in chapter [Control panels](#). The ID run cannot be performed without a control panel.

PRE-CHECK







WARNING! The motor will run at up to approximately 50...80% of the nominal speed during the ID run. The motor will rotate in the forward direction. **Ensure that it is safe to run the motor before performing the ID run!**

- De-couple the motor from the driven equipment.
- If parameter values (group [01 OPERATING DATA](#) to group [98 OPTIONS](#)) are changed before the ID run, check that the new settings meet the following conditions:
 - [2001 MINIMUM SPEED](#) < 0 rpm
 - [2002 MAXIMUM SPEED](#) > 80% of the motor rated speed
 - [2003 MAX CURRENT](#) > I_{2N}
 - [2017 MAX TORQUE 1](#) > 50% or [2018 MAX TORQUE 2](#) > 50%, depending on which limit is in use according to parameter [2014 MAX TORQUE SEL](#).
- Check that the Run enable signal is on (parameter [1601](#)).
- Ensure that the panel is in local control (LOC shown at the top). Press key  to switch between local and remote control.



ID RUN WITH THE BASIC CONTROL PANEL

- Change parameter **9910 ID RUN** to 1 (**ON**). Save the new setting by pressing .
- If you want to monitor actual values during the ID run, go to the Output mode by pressing  repeatedly until you get there.
- Press  to start the ID run. The panel keeps switching between the display that was shown when you started the run and the alarm display presented on the right.
In general, it is recommended not to press any control panel keys during the ID run. However, you can stop the ID run at any time by pressing .
- After the ID run is completed, the alarm display is not shown any more.
If the ID run fails, the fault display presented on the right is shown.

LOC **9910**
PAR FWD





LOC **1**
PAR **SET** FWD


LOC **0.0** HZ
OUTPUT FWD


LOC **A2019**
FWD


LOC **F0011**
FWD

ID RUN WITH THE ASSISTANT CONTROL PANEL

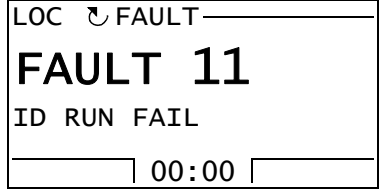
- Change parameter **9910 ID RUN** to 1 (**ON**). Save the new setting by pressing .
- If you want to monitor actual values during the ID run, go to the Output mode by pressing  repeatedly until you get there.
- Press  to start the ID run. The panel keeps switching between the display that was shown when you started the run Run and the alarm display presented on the right.
In general, it is recommended not to press any control panel keys during the ID run. However, you can stop the ID run at any time by pressing .

REM  PAR EDIT
9910 ID RUN
ON
[1]
CANCEL | 00:00 | SAVE

LOC  **50.0HZ**
0.0 HZ
0.0 A
0.0 %
DIR | 00:00 | MENU

LOC  ALARM
ALARM 2019
ID RUN
| 00:00 |



<input type="checkbox"/>	<p>After the ID run is completed, the alarm display is not shown any more. If the ID run fails, the fault display presented on the right is shown.</p>	 <p>LOC FAULT FAULT 11 ID RUN FAIL 00:00</p>
--------------------------	--	--





9

Control panels

What this chapter contains

The chapter describes the control panel keys, LED indicators and display fields. It also instructs in using the panel in control, monitoring and changing the settings.

About control panels

Use a control panel to control the ACS355, read status data, and adjust parameters. The drive works with either of two different control panel types:

- Basic control panel – This panel (described in section [Basic control panel](#) on page [77](#)) provides basic tools for manual entry of parameter values.
- Assistant control panel – This panel (described in section [Assistant control panel](#) on page [89](#)) includes pre-programmed assistants to automate the most common parameter setups. The panel provides language support. It is available with different language sets.

Applicability

The manual is applicable to panels with the panel revisions and the panel firmware versions given in the table below.

Panel type	Type code	Panel revision	Panel firmware version
Basic control panel	ACS-CP-C	M or later	1.13 or later
Assistant control panel	ACS-CP-A	F or later	2.04 or later
Assistant control panel (Asia)	ACS-CP-D	Q or later	2.04 or later

76 Control panels

To find out the panel revision, see the label on the back of the panel. An example label and explanation of the label contents are shown below.



1	Panel type code
2	Serial number of format MYYWWRXXXX, where M: Manufacturer YY: 09, 10, 11, ..., for 2009, 2010, 2011, ... WW: 01, 02, 03, ... for week 1, week 2, week 3, ... R: A, B, C, ... for panel revision XXXX: Integer starting every week from 0001
3	RoHS mark (the label of your drive shows the valid markings)

To find out the panel firmware version of your assistant control panel, see page [93](#).
For the basic control panel, see page [80](#).

See parameter [9901 LANGUAGE](#) to find out the languages supported by the different assistant control panels.

Basic control panel

■ Features

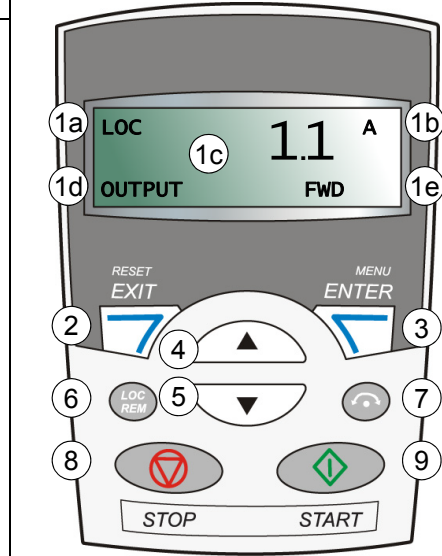
The basic control panel features:

- numeric control panel with an LCD display
 - copy function – parameters can be copied to the control panel memory for later transfer to other drives or for backup of a particular system.
-




Overview


The following table summarizes the key functions and displays on the basic control panel.

No.	Use
1	<p>LCD display – Divided into five areas:</p> <ol style="list-style-type: none"> Upper left – Control location: LOC: drive control is local, that is, from the control panel REM: drive control is remote, such as the drive I/O or fieldbus. Upper right – Unit of the displayed value. Center – Variable; in general, shows parameter and signal values, menus or lists. Shows also fault and alarm codes. Lower left and center – Panel operation state: OUTPUT: Output mode PAR: Parameter mode MENU: Main menu. FAULT: Fault mode. Lower right – Indicators: FWD (forward) / REV (reverse): direction of the motor rotation Flashing slowly: stopped Flashing rapidly: running, not at setpoint Steady: running, at setpoint SET: Displayed value can be modified (in the Parameter and Reference modes).
2	<p>RESET/EXIT – Exits to the next higher menu level without saving changed values. Resets faults in the Output and Fault modes.</p>
3	<p>MENU/ENTER – Enters deeper into menu level. In the Parameter mode, saves the displayed value as the new setting.</p>
4	<p>Up –</p> <ul style="list-style-type: none"> • Scrolls up through a menu or list. • Increases a value if a parameter is selected. • Increases the reference value in the Reference mode. • Holding the key down changes the value faster.
5	<p>Down –</p> <ul style="list-style-type: none"> • Scrolls down through a menu or list. • Decreases a value if a parameter is selected. • Decreases the reference value in the Reference mode. • Holding the key down changes the value faster.
6	<p>LOC/REM – Changes between local and remote control of the drive.</p>
7	<p>DIR – Changes the direction of the motor rotation.</p>
8	<p>STOP – Stops the drive in local control.</p>
9	<p>START – Starts the drive in local control.</p>



■ Operation

You operate the control panel with the help of menus and keys. You select an option, eg operation mode or parameter, by scrolling the  and  arrow keys until the option is visible in the display and then pressing the  key.

With the  key, you return to the previous operation level without saving the made changes.

The basic control panel has five panel modes: *Output mode*, *Reference mode*, *Parameter mode*, *Copy mode* and Fault mode. The operation in the first four modes is described in this chapter. When a fault or alarm occurs, the panel goes automatically to the Fault mode showing the fault or alarm code. You can reset the fault or alarm in the Output or Fault mode (see chapter *Fault tracing* on page 347).

After the power is switched on, the panel is in the Output mode, where you can start, stop, change the direction, switch between local and remote control and monitor up to three actual values (one at a time). To do other tasks, go first to the Main menu and select the appropriate mode.




REM	49.1	Hz
OUTPUT		FWD
REM	PAR	
	MENU	FWD

How to do common tasks

The table below lists common tasks, the mode in which you can perform them and the page number where the steps to do the task are described in detail.





Task	Mode	Page
How to find out the panel firmware version	At power up	80
How to switch between local and remote control	Any	80
How to start and stop the drive	Any	80
How to change the direction of the motor rotation	Any	81
How to browse the monitored signals	Output	82
How to set the speed, frequency or torque reference	Reference	83
How to change the value of a parameter	Parameter	84
How to select the monitored signals	Parameter	85
How to reset faults and alarms	Output, Fault	347
How to copy parameters from the drive to the control panel	Copy	88
How to restore parameters from the control panel to the drive	Copy	88

How to find out the panel firmware version

Step	Action	Display
1.	If the power is switched on, switch it off.	
2.	<p>Keep key  pressed down while you switch on the power and read the panel firmware version shown on the display.</p> <p>When you release the  key, the panel goes to the Output mode.</p>	


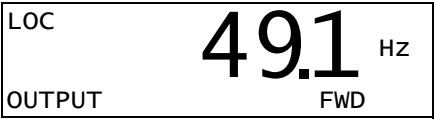

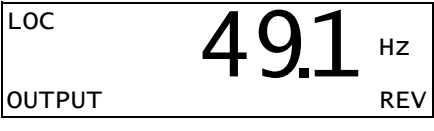
How to start, stop and switch between local and remote control

You can start, stop and switch between local and remote control in any mode. To be able to start or stop the drive, the drive must be in local control.

Step	Action	Display
1.	<ul style="list-style-type: none"> To switch between remote control (REM shown on the left) and local control (LOC shown on the left), press . <p>Note: Switching to local control can be disabled with parameter 1606 LOCAL LOCK.</p> <p>After pressing the key, the display briefly shows message “LoC” or “rE”, as appropriate, before returning to the previous display.</p> <p>The very first time the drive is powered up, it is in remote control (REM) and controlled through the drive I/O terminals. To switch to local control (LOC) and control the drive using the control panel, press . The result depends on how long you press the key:</p> <ul style="list-style-type: none"> If you release the key immediately (the display flashes “LoC”), the drive stops. Set the local control reference as instructed on page 83. If you press the key for about two seconds (release when the display changes from “LoC” to “LoC r”), the drive continues as before. The drive copies the current remote values for the run/stop status and the reference, and uses them as the initial local control settings. <ul style="list-style-type: none"> To stop the drive in local control, press . To start the drive in local control, press . 	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>LOC 49.1 Hz</p> <p>OUTPUT FWD</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p>LOC LoC</p> <p style="text-align: right;">FWD</p> </div> <p>Text FWD or REV on the bottom line starts flashing slowly.</p> <p>Text FWD or REV on the bottom line starts flashing rapidly. It stops flashing when the drive reaches the setpoint.</p>

How to change the direction of the motor rotation

You can change the direction of the motor rotation in any mode.

Step	Action	Display
1.	If the drive is in remote control (REM shown on the left), switch to local control by pressing  . The display briefly shows message "LoC" before returning to the previous display.	 <p>The display shows "LOC" at the top left, "49.1 Hz" in the center, and "OUTPUT" at the bottom left. "FWD" is shown at the bottom right.</p>
2.	To change the direction from forward (FWD shown at the bottom) to reverse (REV shown at the bottom), or vice versa, press  . Note: Parameter <i>1003 DIRECTION</i> must be set to 3 (<i>REQUEST</i>).	 <p>The display shows "LOC" at the top left, "49.1 Hz" in the center, and "OUTPUT" at the bottom left. "REV" is shown at the bottom right.</p>

■ Output mode

In the Output mode, you can:



- monitor actual values of up to three group **01 OPERATING DATA** signals, one signal at a time
- start, stop, change the direction and switch between local and remote control.

You get to the Output mode by pressing  until the display shows text OUTPUT at the bottom.

The display shows the value of one group **01 OPERATING DATA** signal. The unit is shown on the right. Page **85** tells how to select up to three signals to be monitored in the Output mode. The table below shows how to view them one at a time.

REM	49.1 Hz
OUTPUT	FWD

How to browse the monitored signals














Step	Action	Display												
1.	<p>If more than one signals have been selected to be monitored (see page 85), you can browse them in the Output mode.</p> <p>To browse the signals forward, press key  repeatedly. To browse them backward, press key  repeatedly.</p>	<table border="1"> <tr> <td>REM</td> <td>49.1 Hz</td> </tr> <tr> <td>OUTPUT</td> <td>FWD</td> </tr> </table> <table border="1"> <tr> <td>REM</td> <td>0.5 A</td> </tr> <tr> <td>OUTPUT</td> <td>FWD</td> </tr> </table> <table border="1"> <tr> <td>REM</td> <td>10.7 %</td> </tr> <tr> <td>OUTPUT</td> <td>FWD</td> </tr> </table>	REM	49.1 Hz	OUTPUT	FWD	REM	0.5 A	OUTPUT	FWD	REM	10.7 %	OUTPUT	FWD
REM	49.1 Hz													
OUTPUT	FWD													
REM	0.5 A													
OUTPUT	FWD													
REM	10.7 %													
OUTPUT	FWD													

■ Reference mode

In the Reference mode, you can:

- set the speed, frequency or torque reference
- start, stop, change the direction and switch between local and remote control.

How to set the speed, frequency or torque reference


















Step	Action	Display
1.	Go to the Main menu by pressing  if you are in the Output mode, otherwise by pressing  repeatedly until you see MENU at the bottom.	
2.	If the drive is in remote control (REM shown on the left), switch to local control by pressing  . The display briefly shows “LoC” before switching to local control. Note: With group 11 REFERENCE SELECT , you can allow the reference modification in remote control (REM).	
3.	If the panel is not in the Reference mode (“rEF” not visible), press key  or  until you see “rEF” and then press  . Now the display shows the current reference value with SET under the value.	 
4.	<ul style="list-style-type: none"> • To increase the reference value, press . • To decrease the reference value, press . The value changes immediately when you press the key. It is stored in the drive permanent memory and restored automatically after power switch-off.	

■ Parameter mode

In the Parameter mode, you can:

- view and change parameter values
- select and modify the signals shown in the Output mode
- start, stop, change the direction and switch between local and remote control.

How to select a parameter and change its value

Step	Action	Display
1.	Go to the Main menu by pressing  if you are in the Output mode, otherwise by pressing  repeatedly until you see MENU at the bottom.	<div style="border: 1px solid black; padding: 5px; text-align: center;"> LOC rEF MENU FWD </div>
2.	If the panel is not in the Parameter mode (“PAR” not visible), press key  or  until you see “PAR” and then press  . The display shows the number of one of the parameter groups.	<div style="border: 1px solid black; padding: 5px; text-align: center;"> LOC PAR MENU FWD </div>
		<div style="border: 1px solid black; padding: 5px; text-align: center;"> LOC -01- PAR FWD </div>
3.	Use keys  and  to find the desired parameter group.	<div style="border: 1px solid black; padding: 5px; text-align: center;"> LOC -11- PAR FWD </div>
4.	Press  . The display shows one of the parameters in the selected group.	<div style="border: 1px solid black; padding: 5px; text-align: center;"> LOC 1101 PAR FWD </div>
5.	Use keys  and  to find the desired parameter.	<div style="border: 1px solid black; padding: 5px; text-align: center;"> LOC 1103 PAR FWD </div>
6.	Press and hold  for about two seconds until the display shows the value of the parameter with SET underneath indicating that changing of the value is now possible. Note: When SET is visible, pressing keys  and  simultaneously changes the displayed value to the default value of the parameter.	<div style="border: 1px solid black; padding: 5px; text-align: center;"> LOC 1 PAR SET FWD </div>
		<div style="border: 1px solid black; padding: 5px; text-align: center;"> LOC 2 PAR SET FWD </div>
7.	Use keys  and  to select the parameter value. When you have changed the parameter value, SET starts flashing. <ul style="list-style-type: none"> • To save the displayed parameter value, press . • To cancel the new value and keep the original, press . 	<div style="border: 1px solid black; padding: 5px; text-align: center;"> LOC 1103 PAR FWD </div>
		<div style="border: 1px solid black; padding: 5px; text-align: center;"> LOC 1103 PAR FWD </div>

How to select the monitored signals

Step	Action	Display
1.	<p>You can select which signals are monitored in the Output mode and how they are displayed with group 34 PANEL DISPLAY parameters. See page 84 for detailed instructions on changing parameter values.</p> <p>By default, the display shows three signals.</p> <p>Signal 1: 0102 SPEED for macros 3-wire, Alternate, Motor potentiometer, Hand/Auto and PID control; 0103 OUTPUT FREQ for macros ABB standard and Torque control</p> <p>Signal 2: 0104 CURRENT</p> <p>Signal 3: 0105 TORQUE.</p> <p>To change the default signals, select up to three signals from group 01 OPERATING DATA to be shown.</p> <p>Signal 1: Change the value of parameter 3401 SIGNAL1 PARAM to the index of the signal parameter in group 01 OPERATING DATA (= number of the parameter without the leading zero), eg 105 means parameter 0105 TORQUE. Value 100 means that no signal is displayed.</p> <p>Repeat for signals 2 (3408 SIGNAL2 PARAM) and 3 (3415 SIGNAL3 PARAM). For example, if 3401 = 0 and 3415 = 0, browsing is disabled and only the signal specified by 3408 appears in the display. If all three parameters are set to 0, ie no signals are selected for monitoring, the panel displays text "n.A".</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> LOC 103 <small>PAR SET FWD</small> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> LOC 104 <small>PAR SET FWD</small> </div> <div style="border: 1px solid black; padding: 5px;"> LOC 105 <small>PAR SET FWD</small> </div>
2.	<p>Specify the decimal point location, or use the decimal point location and unit of the source signal (setting 9 [DIRECT]). Bar graphs are not available for basic control panel. For details, see parameter 3404.</p> <p>Signal 1: parameter 3404 OUTPUT1 DSP FORM Signal 2: parameter 3411 OUTPUT2 DSP FORM Signal 3: parameter 3418 OUTPUT3 DSP FORM.</p>	<div style="border: 1px solid black; padding: 5px;"> LOC 9 <small>PAR SET FWD</small> </div>
3.	<p>Select the units to be displayed for the signals. This has no effect if parameter 3404/3411/3418 is set to 9 (DIRECT). For details, see parameter 3405.</p> <p>Signal 1: parameter 3405 OUTPUT1 UNIT Signal 2: parameter 3412 OUTPUT2 UNIT Signal 3: parameter 3419 OUTPUT3 UNIT.</p>	<div style="border: 1px solid black; padding: 5px;"> LOC 3 <small>PAR SET FWD</small> </div>

Step	Action	Display
4.	<p>Select the scalings for the signals by specifying the minimum and maximum display values. This has no effect if parameter 3404/3411/3418 is set to 9 (<i>DIRECT</i>). For details, see parameters 3406 and 3407.</p> <p>Signal 1: parameters 3406 OUTPUT1 MIN and 3407 OUTPUT1 MAX Signal 2: parameters 3413 OUTPUT2 MIN and 3414 OUTPUT2 MAX Signal 3: parameters 3420 OUTPUT3 MIN and 3421 OUTPUT3 MAX.</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> LOC 0.0 Hz PAR SET FWD </div> <div style="border: 1px solid black; padding: 5px;"> LOC 500.0 Hz PAR SET FWD </div>

■ Copy mode

The basic control panel can store a full set of drive parameters and up to three user sets of drive parameters to the control panel. Uploading and downloading can be performed in local control. The control panel memory is non-volatile.

In the Copy mode, you can do the following:

- Copy all parameters from the drive to the control panel (uL – Upload). This includes all defined user sets of parameters and internal (not adjustable by the user) parameters such as those created by the ID run.
- Restore the full parameter set from the control panel to the drive (dL A – Download all). This writes all parameters, including the internal non-user-adjustable motor parameters, to the drive. It does not include the user sets of parameters.

Note: Only use this function to restore a drive, or to transfer parameters to systems that are identical to the original system.

- Copy a partial parameter set from the control panel to a drive (dL P – Download partial). The partial set does not include user sets, internal motor parameters, parameters [9905...9909](#), [1605](#), [1607](#), [5201](#), nor any group [51 EXT COMM MODULE](#) and [53 EFB PROTOCOL](#) parameters.

The source and target drives and their motor sizes do not need to be the same.













- Copy user set 1 parameters from the control panel to the drive (dL u1 – Download user set 1). A user set includes group [99 START-UP DATA](#) parameters and the internal motor parameters.

The function is only shown on the menu when user set 1 has been first saved using parameter [9902 APPLIC MACRO](#) (see section [user macros](#) on page [123](#)) and then uploaded to panel.

- Copy user set 2 parameters from the control panel to the drive (dL u2 – Download user set 2). As dL u1 – Download user set 1 above.
- Copy user set 3 parameters from the control panel to the drive (dL u3 – Download user set 2). As dL u1 – Download user set 1 above.
- Start, stop, change the direction and switch between local and remote control.

How to upload and download parameters

For the upload and download functions available, see above. Note that the drive has to be in local control for uploading and downloading.

Step	Action	Display
1.	Go to the Main menu by pressing  if you are in the Output mode, otherwise by pressing  repeatedly until you see MENU at the bottom. – If REM is shown on the left, press first  to switch to local control.	<div style="border: 1px solid black; padding: 5px; text-align: center;"> LOC PAr MENU FWD </div>
2.	<p>If the panel is not in the Copy mode (“CoPY” not visible), press key  or  until you see “CoPY”.</p> <p>Press .</p>	<div style="border: 1px solid black; padding: 5px; text-align: center;"> LOC CoPY MENU FWD </div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> LOC uL MENU FWD </div>
3.	<p>To upload all parameters (including user sets) from the drive to the control panel, step to “uL” with keys  and .</p> <p>Press . During the transfer, the display shows the transfer status as a percentage of completion.</p> <p>To perform downloads, step to the appropriate operation (here “dL A”, Download all, is used as an example) with keys  and .</p> <p>Press . During the transfer, the display shows the transfer status as a percentage of completion.</p>	<div style="border: 1px solid black; padding: 5px; text-align: center;"> LOC uL MENU FWD </div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> LOC uL 50 % FWD </div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> LOC dL A MENU FWD </div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> LOC dL 50 % FWD </div>

Basic control panel alarm codes

In addition to the faults and alarms generated by the drive (see chapter [Fault tracing](#) on page 347), the basic control panel indicates control panel alarms with a code of form A5xxx. See section [Alarms generated by the basic control panel](#) on page 352 for a list of the alarm codes and descriptions.

Assistant control panel

■ Features

The assistant control panel features:

- alphanumeric control panel with an LCD display
 - language selection for the display
 - Start-up assistant to ease drive commissioning
 - copy function – parameters can be copied to the control panel memory for later transfer to other drives or for backup of a particular system.
 - context-sensitive help
 - real time clock.
-

Overview

The following table summarizes the key functions and displays on the assistant control panel.

No.	Use
1	Status LED – Green for normal operation. If LED is flashing, or red, see section LEDs on page 370.
2	LCD display – Divided into three main areas: f. Status line – variable, depending on the mode of operation, see section Status line on page 91. g. Center – variable; in general, shows signal and parameter values, menus or lists. Shows also faults and alarms. h. Bottom line – shows current functions of the two soft keys and, if enabled, the clock display.
3	Soft key 1 – Function depends on the context. The text in the lower left corner of the LCD display indicates the function.
4	Soft key 2 – Function depends on the context. The text in the lower right corner of the LCD display indicates the function.
5	Up – • Scrolls up through a menu or list displayed in the center of the LCD display. • Increments a value if a parameter is selected. • Increments the reference value if the upper right corner is highlighted. Holding the key down changes the value faster.
6	Down – • Scrolls down through a menu or list displayed in the center of the LCD display. • Decrements a value if a parameter is selected. • Decrements the reference value if the upper right corner is highlighted. Holding the key down changes the value faster.
7	LOC/REM – Changes between local and remote control of the drive.
8	Help – Displays context-sensitive information when the key is pressed. The information displayed describes the item currently highlighted in the center of the display.
9	STOP – Stops the drive in local control.

