Instruction Guide

Basic Guide to Commissioning the ACS550

Contents

Scope

The ACS550 product line includes hardware that ranges from small wall mount drives (1 Hp) through large floor mounted units (550 Hp). NEMA 1, NEMA 12, and NEMA 3R enclosure types are available. Both scalar and sensorless vector motor control are supported. The drive can run either as a speed regulator or as a torque regulator. The drive comes standard with 8 selectable macros.

The drive includes standard hardware support for Modbus RTU communication. In addition, support for 6 other standard fieldbuses is optionally available.

This document details two basic startup configurations. The first covers the ABB Standard macro with scalar motor control. The second covers the PID Control macro with sensorless speed vector control.

Implementation of communication is optional. This document provides setup information for both hardwired control and fieldbus control. Only generic communication setup information is provided. Details concerning specific protocols are beyond the scope of this guide.

Configuration features in real world installations will likely differ from the defaults assumed here. It is the responsibility of the commissioning agent to review the appropriate full product documentation to determine what additional or different commissioning steps are required. When uncertain of how to proceed, ABB Technical Support should be contacted at 800-435-7365 (800 HELP 365).

General information

Reference documents

This document is intended as an adjunct to and not as a replacement for ACS550 User's Manuals. In particular reference the following whenever seeking further detail:

User's Manual, ACS550-01/U1 (1…200 hp) (3AFE64804588)
User's Manual, ACS550-02/U2 (250…550 hp) (3AFE64804626)
User's Manual, ACS550-CC Packaged Drive with Bypass (3AUA0000014758)
User's Manual, ACS550-PC/PD Packaged Drive with Disconnect (3AUA0000012131)
Instruction Guide, Basic Guide to Installing an AC Drive (LVD-PNTG02U-EN)

Always insure that the latest available revision is utilized.

Safety warnings


WARNING! Even when the motor is stopped, dangerous voltage is present at the Power Circuit terminals U1, V1, W1 and U2, V2, W2 and, depending on the frame size, UDC+ and UDC-, or BRK+ and BRK-.


WARNING! Dangerous voltage is present when input power is connected. Even after disconnecting the supply, wait at least 5 minutes (to let the intermediate circuit capacitors discharge) before working on equipment.


WARNING! Even when power is removed from the power input terminals of the ACS550, there may be dangerous voltage (from external sources) on the relay output terminals or on control input terminals (OHDI option).


WARNING! Always follow safe lock-out / tag-out practices.

WARNING! Always measure AC input voltage and DC bus voltage to insure that dangerous voltages aren't present before working on equipment.


WARNING! Do not make any voltage tolerance tests (Hi Pot or Megger) on any part of a drive. Disconnect motor wires from the drive before taking any measurements of the motor or motor wires.


WARNING! When working on powered equipment always work with a partner.


WARNING! Before working on, or taking measurements on, powered equipment first remove ESD protective gear (ESD wrist straps and / or ESD protective clothing).


WARNING! Before working near rotating equipment always remove loose-fitting clothing, jewelry, and other metal items.


WARNING! Before working on any equipment always determine where and how mechanical motion can be quickly stopped and where and how electrical power can be quickly removed.

ESD comments

When removing or replacing internal components, wiring, or assemblies, it is recommended that a grounded ESD wrist strap be worn. If this is not available, as a minimum, insure that any body charge present has been safely discharged by touching chassis ground before touching the hardware to be replaced.

Before working on, or taking measurements on, powered equipment remove ESD protective gear (ESD wrist straps and / or ESD protective clothing).

Physical checks

Equipment mounting
All equipment should be mounted vertically. Contact the factory if some other mounting configuration is encountered.

Insure that equipment is securely mounted using the hardware called out in the Installation section of the applicable User's Manual. Appropriate hardware vs. frame size is listed here for reference.

ACS550-U1/U2 frame	Hardware
R1 - R4	#10
R5	1/4
R6	5/16
R7 - R8	7/16

Flat washers and lock washers should be installed to distribute loading and insure continuing reliable performance in the presence of vibration.

Equipment space / clearance

Insure that equipment space / clearance is provided as called out in the Technical Data, Cooling section (R1 – R6) or Installation section (R7, R8) of the applicable User's Manual. Note that back spacing is not required on any equipment. Appropriate space / clearance vs. frame size is also listed here for reference. Values given are in inches. Note that listed clearances should be doubled if the spacing involved is to another significant heat source (e.g. another drive). Doubling of distance isn't required for the R7 and R8 Front clearance entries (these are installation / maintenance requirements).

	Side	Top	Bottom	Front
ACS550-U1 R1 – R6	0	8	8	0
ACS550-U2 R7	0	8	0	20
ACS550-U2 R8	0	12	0	24

Ambient temperature

ACS550 products maintain their full output rating up to 40ºC (104ºF). The site conditions should be reviewed to confirm that this level is not likely to be exceeded during normal operation of the equipment. If temperatures above 40ºC and up to 50ºC (122ºF) are anticipated, then confirm that the drive is sized to compensate for the output current derating required (1% per ºC above 40ºC). If temperatures above 50ºC are expected contact Technical Support.

ACS550 products are designed to operate down to -15ºC (5ºF). The site conditions should be reviewed to confirm that temperatures below this level are not likely to be experienced. If temperatures below -15ºC are expected then space heaters or some other heating provision should be present.

Altitude

ACS550 products maintain their full output rating up to an altitude of 1000 meters (3300 feet). Above this altitude drive current output must be derated 1% for each 100 meters (330 feet) that the 1000 meter level is exceeded. At 2000 meters (6600 feet) the drive output must be derated 10%. Operation of ACS550 drives above 2000 meters is not permitted.

Determine the site altitude. If the altitude is greater than 1000 meters then insure that the drive has been appropriately sized to compensate for the required current derating.

Clean, clear airflow

ACS550 UL type 1 products require access to clean air in order to maintain reliable operation. Although UL type 12 and some UL type 3R designs incorporate filters to keep out common dust and dirt, these designs are also limited in terms of how much air contamination can be tolerated. The site conditions should be reviewed to verify that air conditions are reasonable for the type of enclosure design present. Essentially this is a judgment call that needs to be made by the commissioning agent. If it is judged that air quality is not acceptable contact Technical Support.

Airflow is equal in importance to air quality. Individual ACS550 products require heatsink airflows ranging from 25 CFM to 1200 CFM. A drive will not be properly cooled if airflow in or out of the drive's cooling path is restricted. Multiple requirements apply:

- Spacing requirements as documented in the section “Equipment space / clearance” must be met
- The room / enclosure in which equipment is located must provide sufficient air exchange to limit ambient temperature rise to an acceptable level
- Internal enclosure air circulation design must insure that “dead zones” or “hot spots” don’t exist
- Heat generating components or assemblies should not be mounted in a manner that “preheats” air required for drive cooling
- Air baffles may be required to insure acceptable airflow

Again good practical judgment needs to be applied by the commissioning agent. If questionable conditions exist, temperature measurements should be made under normal full load operating conditions to confirm whether adequate cooling conditions are present. Since this testing requires normal full load operation of the equipment, the measurements need to be made after all other commissioning steps are complete. Contact Technical Support if additional assistance is needed.

Foreign objects

Before applying power to equipment always insure that no foreign objects (tools, wiring scraps, loose mounting hardware, etc.) are present internal to the electrical equipment. Also insure that no foreign objects (tools, temporary supports, etc.) are near any mechanical equipment that will rotate when the motor operates.

Mechanical preparation and adjustment

Insure that all required mechanical preparation and adjustments (motor mounting, motor alignment, belt tensioning, greasing, coupling connections, etc.) are complete and that no physical limitations concerning full speed motor operation exist. In some applications, it may be desirable to check the motor’s rotation before permanently coupling it to the load.

Wiring checks

Equipment grounding

Proper grounding of both the drive and its connected motor are important for both safety and operational reasons. From a safety standpoint, proper grounding insures that personnel can't be hurt by simply touching the frame of either a drive or a motor. From an operational standpoint, grounding using a motor cable of the type described in the section "Motor output" below insures that high frequency electrical noise and high frequency bearing currents will be minimized.

For more information and details on this subject see the section "Electrical Installation, Grounding issues" in the document Instruction Guide, Basic Guide to Installing an AC Drive.

Power input

Check that the equipment is protected by properly sized branch short circuit and ground fault protection (NEC section 430.52 compliance). It is strongly recommended that ACS550 drives be protected with fuses (not circuit breakers) of the type and size listed in the Technical Data section of the ACS550 User's Manuals. The external protection must also provide proper overload protection for the branch circuit feeder conductors (NEC Article 430, section III compliance).

In general there aren't any restrictions on the type of cable utilized to provide input power. A ground conductor should accompany the power phases. Best practice is to keep input power cables separate from motor output power cables. Input power cables should always be kept separate from control cables.

For further information see the section "Cable and wiring – Power, Drive power input" in the document Instruction Guide, Basic Guide to Installing an AC Drive.

Check that power input terminations are tight, that no frayed wires exist, and that no wire insulation has been inadvertently compressed into any connections. Recommended terminal torque is listed in the "Technical Data, Drive's Power Connection Terminals" section of the ACS550-01/

U1 User's Manual and the "Technical Data, Cable Entries" section of the ACS550-02/U2 User's Manual.

When an application utilizes parallel phase conductors installed in conduit, insure that each conduit contains all three phases and that each of the contained phase sets have the same number of conductors.

Motor output

ACS550 drives provide overload protection for a single connected motor and its cables. Applications that have multiple motors parallel connected to the drive output require additional external overload protection equipment. For further information see the section "Multiple motors on a single drive" in the document Instruction Guide, Basic Guide to Installing an AC Drive.

Motor cable construction

The high frequency nature of an AC drive's output waveform necessitates that special wiring techniques be applied to the wiring between the drive output and its associated motor. The "Technical Data, Motor Connections" section of the ACS550-01/U1 User's Manual and the "Planning the electrical installation, Selecting the power cables" section of the ACS550-02/U2 User's Manual identify three acceptable approaches:

- Steel Conduit
- Armored Cable
- Shielded Cable

Check that one of these three methods has been applied. Other general wiring methods (tray cable or individual conductors in a tray, plastic conduit, etc.) are not advised. When applying armored or shielded cable construction, the cables should be terminated on both ends using metal-clad cable fittings of a type recommended by the cable vendor.

When applying any of the three acceptable approaches it is important to also verify that the steel conduit, armor, or shield is fully bonded along the entire path of the wiring between the drive output and motor. A visual check of the output wiring should be made to insure that all wiring transitions maintain proper bonding of the conduit, armor, or shield. In particular if a

flexible conduit connection is utilized to provide the final connection to the motor, confirm that the flexible conduit provides a proper continuation of the conduit, armor, or shield grounding.

For more information and details see the section “Cable and wiring – Power, Drive power output / motor” in the document Instruction Guide, Basic Guide to Installing an AC Drive.

Check that the motor output terminations are tight, that no frayed wires exist, and that no wire insulation has been inadvertently compressed into any connections. Recommended terminal torque is listed in the “Technical Data, Drive’s Power Connection Terminals” section of the ACS550-01/U1 User’s Manual and the “Technical Data, Cable Entries” section of the ACS550-02/U2 User’s Manual.

When an application utilizes parallel phase conductors installed in conduit, insure that each conduit contains all three phases and that each of the contained phase sets have the same number of conductors.

Motor cable length

There are three basic issues concerning why motor cable length must be limited:

Issue 1 (Drive Operation / Drive Protection)

Motor cable length should always be verified to be less than or equal to the maximum cable length specified in the “Motor Connection Specifications” table which is contained in the “Technical Data, Motor Connections” section of the applicable ACS550 User’s Manual. Figure 1, Figure 2, and Figure 3 reproduce these tables for easy reference. The maximum cable length permitted is a function of voltage, frame size, and switching frequency. Larger frame size drives can reliably and safely handle longer length motor cables. Likewise, drives operating at a lower switching frequency can reliably and safely handle longer length motor cables.

Maximum cable length for up to 480V drives																		
Frame size	EMC limits												Operational limits					
	Second environment (category C3[1])						First environment (category C2[1])						Basic unit				With du/dt filters	
	1 kHz		4 kHz		8 kHz		1 kHz		4 kHz		8 kHz		1/4 kHz		8/12 kHz			
	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft
R1	300	980	300	980	300	980	300	980	300	980	300	980	100	330	100	330	150	490
R2	300	980	300	980	300	980	300	980	100	330	30	98	200	660	100	330	250	820
R3	300	980	300	980	300	980	300	980	75	245	75	245	200	660	100	330	250	820
R4	300	980	300	980	300	980	300	980	75	245	75	245	200	660	100	330	300	980
R5	100	330	100	330	100	330	100	330	100	330	100	330	300	980	150[2]	490[2]	300	980
R6	100	330	100	330	[3]	[3]	100	330	100	330	[3]	[3]	300	980	150[2]	490[2]	300	980

[1] See the new terms in section *IEC/EN 61800-3 (2004) Definitions* in manual.

[2] 12 kHz switching frequency is not available.

[3] Not tested.

Sine filters further extend the cable lengths.

Figure 1

Maximum cable length for 600 V drives				
Frame size	Operational limits			
	1/4 kHz		8/12 kHz	
	m	ft	m	ft
R2	100	330	100	330
R3...R4	200	660	100	330
R6	300	980	150[2]	490[2]

[2] 12 kHz switching frequency is not available.

Figure 2

Frame size	EMC limits				Operational limits			
	IEC/EN 61800-3 Second environment (category C3[1])		IEC/EN 61800-3 First environment (category C2[1])		Basic limits		With du/dt filters	
	m	ft	m	ft	m	ft	m	ft
R7	100	330	100	330	300	980	300	980
R8	100	330	-	-	300	980	300	980

[1] See the new terms in section *IEC/EN 61800-3 (2004) Definitions* in manual.

Sine filters further extend the cable lengths.

Figure 3

Using the appropriate table, voltage, frame size, and switching frequency, determine the maximum motor cable length allowed using the columns headed “Operational limits.” Compare this length to the installed motor cable length. If the installed motor cable length is less than the table value, no further action is required. If, on the other hand, the installed length exceeds the table value then hardware additions or changes are likely needed. Possible workarounds include installing common mode output chokes, an output reactor, a du/dt filter, or a sine filter. Application of a larger drive represents another possibility. Contact Technical Support for further assistance.

Issue 2 (EMC Level Compliance)

If compliance with EMC emission levels is a requirement (usually only true for European installations), then motor cable lengths must be limited to the lengths specified in the “Maximum Cable Length for EN 61800-3” tables (Restricted or Unrestricted) contained in the “Technical Data, Motor Connections” section of the ACS550 User’s Manual. In these cases fully bonded steel conduit, armored cable, or shielded cable is recommended for both power input cables and motor cables.

Using the previously referenced tables, voltage, frame size, and switching frequency, determine the maximum motor cable length allowed using the columns headed “EMC limits.” Compare this length to the installed motor cable length. If the installed motor cable length is less than the table value, no further action is required. If, on the other hand, the installed length exceeds the table value then additional hardware is likely needed. A possible workaround includes installing an additional input EMC filter. Contact Technical Support for further assistance.

Issue 3 (Motor Winding Protection)

The ACS550-01/U1 User’s Manual only addresses motor insulation under “Installation, Preparing for Installation, Motor Compatibility.” It states, “500…600V drives: Either the motor complies with NEMA MG1 Part 31, or a du/dt filter is used between the motor and drive.” NEMA MG1 Part 31 defines what is required for a motor to be considered “inverter duty motor.” The ACS550-02/U2 User’s Manual includes a more detailed table; however, it also summarily concludes that a du/dt filter is required when the motor doesn’t comply with NEMA MG1 Part 31.

These statements ignore motor lead length as a contributing factor. In actual practice if the motor cable length is between 5 feet and 30 feet an inverter duty motor is rarely required. At distances below 5 feet motor terminal voltage du/dt may be too high for a standard motor to handle. At distances in excess of 30 feet, peak motor terminal voltage may be too high for a standard motor to handle. Higher power motors (30 HP and above) can sometimes safely handle longer cable lengths (up to 150 feet) because their surge impedance more closely matches the motor cable impedance; however, larger motor size seldom reduces peak voltage by more than 150 V and therefore this factor usually isn't considered. When motor insulation capability is in doubt, either an inverter duty motor should be applied, or a load reactor or du/dt filter should be inserted between the drive and the standard duty motor.

Power factor compensation

Insure that power factor compensation (also known as power factor correction) capacitors are not wired in parallel with the motor driven by the drive. Capacitors wired in this manner can potentially destroy a drive.

It is also recommended that simple power factor correction banks are not connected on the same network as AC drives. When drives and power factor correction banks are on the same network the potential exists that either series or parallel harmonic resonance may occur. This can lead to over heating of the capacitor bank, tripping of the capacitor bank current protection, or excessive harmonic voltages on the network.

If a check reveals that power factor compensation is present, the user should be advised of the potential risk of malfunction or equipment failure. In such cases it is recommended that either the power factor correction equipment be removed, that the drive be connected to a different network, or that detuning reactors as recommended by the power factor correction equipment vendor be added in series with the correction bank capacitors to insure that resonance doesn't occur.

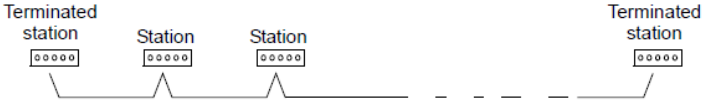
Control connections

The control connections present vary greatly with application design. Review the installation drawings to determine what signals are expected and then confirm that those connections are present. Digital inputs usually utilize the drive's internal 24 VDC supply as a power source. In these cases insure that DCOM (X1:12) is jumpered to either GND (X1:11 (sinking input)) or 24V (X1:10 (sourcing input)). The most common signals to be expected are speed or process references, process feedbacks, a start command, safety and / or process interlocks, and Run Enable interlocks. Verify the integrity of all signal inputs.

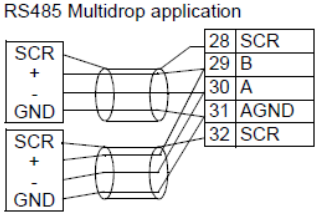
Depending on the signal type and voltage level involved, different types of cabling are recommended. For further information and details see the section "Electrical Installation, Cable and wiring – Control" in the document Instruction Guide, Basic Guide to Installing an AC Drive.

Check that all connections are tight, that no frayed wires exist, and that no wire insulation has been inadvertently compressed into any connections. Recommended terminal torque is 0.3 lb-ft. Control cable shields should only be grounded at the drive end. This helps to insure that high frequency voltages that are often conducted into the process ground plane don't induce noise into the drive control inputs.

If the drive utilizes the standard embedded Modbus fieldbus (usage is optional), it should be implemented as shown in Figure 4. Cabling and connections to optional fieldbus adapter modules vary. Consult the manual specific to the fieldbus utilized for specific wiring instructions.



X1	Identification	Hardware description
28	Screen	RS485 Multidrop application
29	B (Positive +)	
30	A (Negative -)	
31	AGND	
32	Screen	



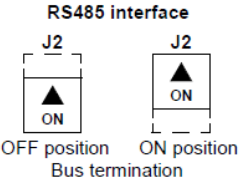


Figure 4

Motor disconnection interlocking

Normally motors should be wired either directly to the drive that supplies them power or, if a series load reactor or du/dt filter is installed, to the load side of that series equipment. Some applications include disconnection equipment (disconnect switch or contactor) between the drive and motor. In these cases it is recommended that the disconnection device be interlocked with a Run Enable input. This interlock will insure that the drive doesn't attempt to "power through" the disconnection device when it is opened. Typically an late make, early break auxiliary contact is installed on the disconnect equipment. This is then wired to a Run Enable input on the drive.

Cable routing

In general power input wiring and motor output wiring should utilize separate wireways. Likewise, when practical, motor output wiring should be kept separate from other motor output wiring. If multiple drive / motor outputs do share a wireway, insure that the power levels involved are close in magnitude. Power levels should never differ by more than a factor of 10. For example never allow a 10 Hp motor to be routed in the same wireway with a 150 Hp motor (ratio factor of 15). Also, even when a low ratio factor is present, inform the user that routing multiple drive outputs in the same wireway may necessitate disabling of drive wiring fault protection (parameter 3023) and earth fault protection (parameter 3017). Also inform them that, because voltage can be induced between cables contained in

a common conduit, all drives sharing a conduit should be turned off and locked out before performing any motor maintenance.

Always insure that all control cables are routed separate from power cables and spaced at least 8 inches away. In cases where the 8 inch spacing can't be met, insure that control cables and power cables cross perpendicular to each other.

Temporary wiring

Before applying power to equipment a final check should be made to insure that any temporary wiring and jumpers installed to facilitate preliminary checkout has been removed. In particular verify that any temporary grounding jumpers are removed.

Electrical checks

Line voltage

Before applying power to the equipment always measure the voltage present to insure that it agrees with the voltage rating as listed on the equipment nameplate.

⚠ Applying a voltage that exceeds the equipment voltage rating will likely cause equipment damage and may lead to personal injury or death. Use caution.

Line voltage should be balanced within +/-3%.

EM1, EM3, F1, F2 screw removal / insertion

To determine recommended EM1, EM2, F1, and F2 screw removal / insertion the system ground type must first be established. This can be done by referencing appropriate site documentation, by visual inspection of the feeder transformer secondary wiring, or by measuring line voltages to ground. When the latter method is applied, Table 1 should be utilized to determine the type of system grounding present.

Four measurements are required to use Table 1 : (1) input voltage line to line, (2) input voltage line1 to ground, (3) input voltage line2 to ground, and (4) input voltage line3 to ground. Readings (2), (3), and (4) are then divided by reading (1) to establish ratios. The resulting ratios are then compared to the table values to determine which grounding type is present. In the “ungrounded / floating” instance the determining factor is not the ratios present but rather the variability and randomness of readings (2), (3), and (4).

For case C1 screws EM1 and EM3 (drive frames R1 through R4), F1 and F2 (drive frames R5 and R6), and screws / cable as visually identified below (R7 and R8) may be installed. Drives are shipped from the factory with the EM3 screw removed. Not installing EM3 will not harm the drive, however, the internal EMI filter will not be fully active.

For cases C2, C3, and C4, screws EM1 and EM3 (drive frames R1 through R4), and F1 and F2 (drive frames R5 and R6) should be removed.

⚠ Failure to remove these screws can lead to drive damage under ground fault or other line transient conditions.

Case	VL-L	VL1-G	VL2-G	VL3-G	Grounding Type
C1	X	0.58X	0.58X	0.58X	grounded neutral point, symmetrical
C2	X	1.0X	1.0X	0	grounded corner point, nonsymmetrical
C3	X	0.5X	0.5X	0.87X	grounded delta midpoint, nonsymmetrical
C4	X	Varying level vs. time	Varying level vs. time	Varying level vs. time	ungrounded / floating, nonsymmetrical

Table 1

Figure 5 shows the location of the EM1 and EM3 screws on frames R1 through R4. Figure 6 shows the location of the F1 and F2 screws on frames R5 and R6.

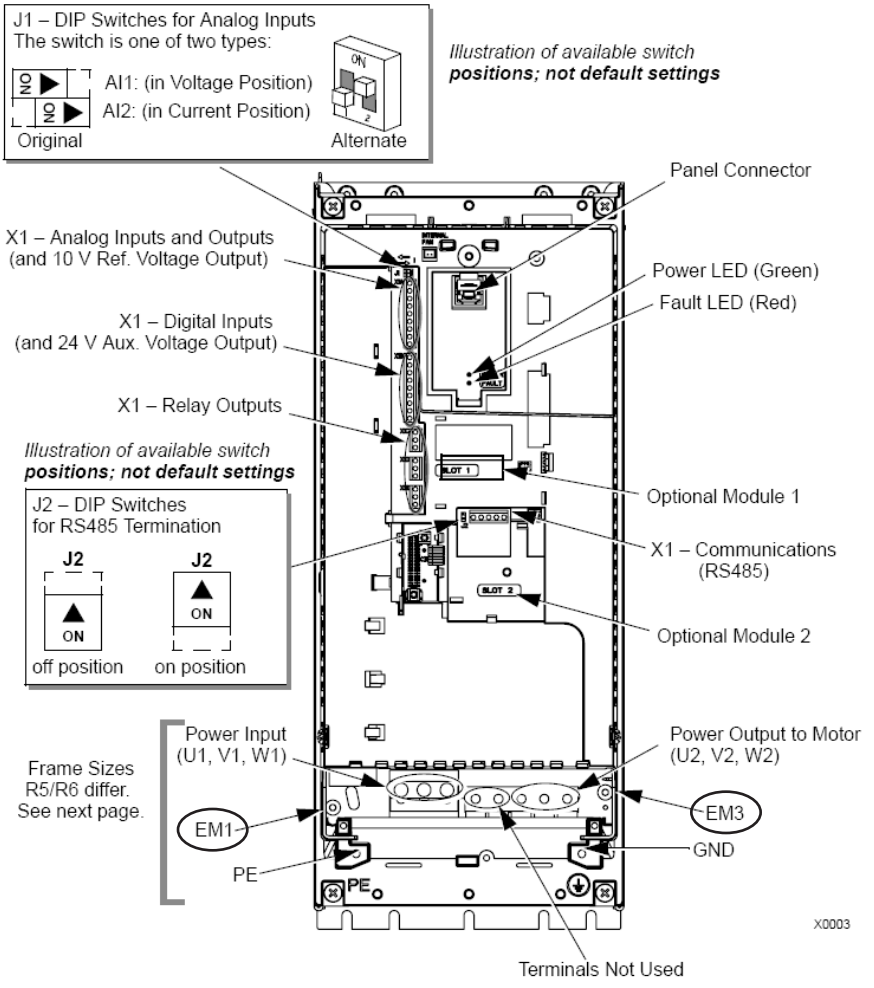


Figure 5

J1 dip switches

The drive's J1 dip switches determine whether its analog inputs are set for a voltage input or a current input. There is a separate dip switch for AI1 and for AI2. In each case if a voltage input is being utilized verify that the switch in the OFF position (left or down). Likewise, if a current input is being utilized verify that the switch in the ON position (right or up). The J1 dip switches are shown in Figure 5.

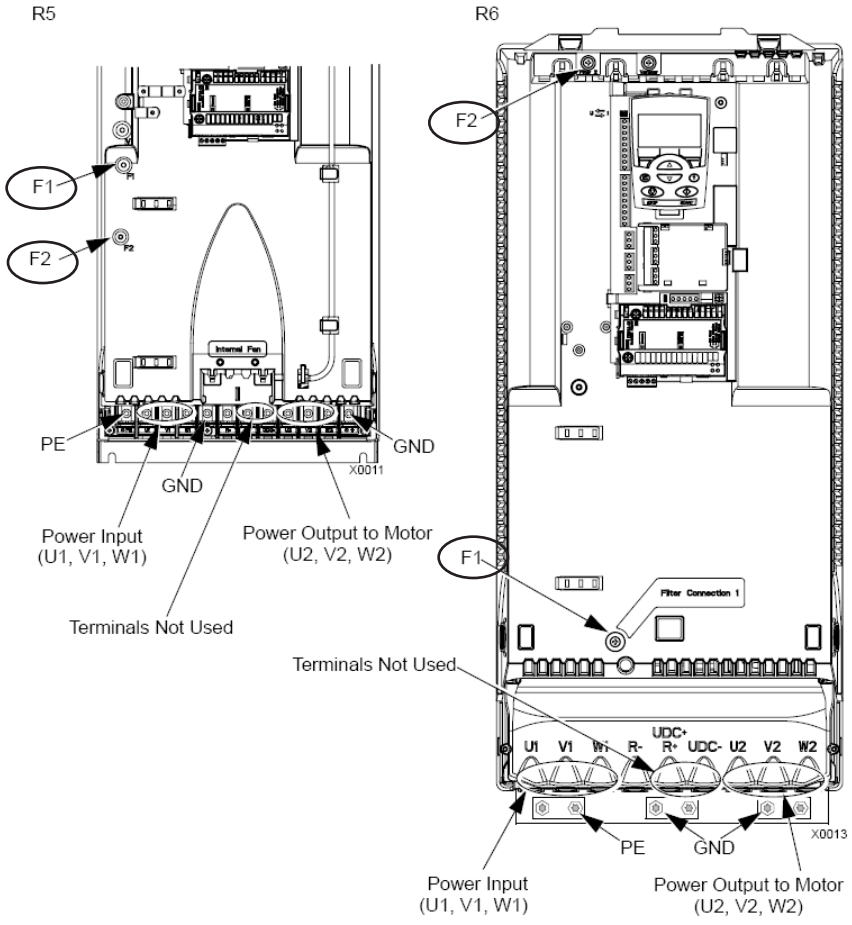


Figure 6

J2 dip switches (if RS485 is used)

When the RS485 communication port is in use the J2 dip switch should normally be set to the OFF (down, unterminated) position. If the RS485 communication port is the termination point of the communication bus, J2 can optionally be placed in the ON (up, terminated) position. However, be aware that this enables an active bus termination (not passive) which may cause complications on some networks. The J2 dip switch is shown in Figure 5.

Verify internal motor connections

Many motors can be connected for multiple input voltages. Always confirm that the motor connections match the voltage that will be applied. Motors that are connected improperly can lead to very confusing results during later commissioning steps. It is important to confirm correct motor connections at an early point so that commissioning time isn't wasted later.

ACS550 startup, ABB Standard Macro

The following start-up procedure assumes full knowledge of ACS550 Control Panel operation. Instructions to enter parameter values or to read signal levels don't include specific keystroke steps. If further information on Control Panel usage is needed see the "Control panels" section of the ACS550 User's Manual.

The procedure also assumes that all program changes are made using manual parameter entry. ASSISTANTS aren't used.

Initial power up and data entry

1. Apply power to the drive.
   - The drive Control Panel display should illuminate
   - A green light should be displayed on the upper left corner of the Control Panel

2. Enter the desired macro in group 99, Start-Up Data, parameter 9902, APPLIC MACRO. The procedure as documented herein assumes that the ABB Standard [1] macro is selected.

   Note: The ABB Standard macro sets 9904, MOTOR CTRL MODE to SCALAR:FREQ. A motor ID run is not required; motor ID run steps are not included in this procedure.

3. Enter all motor parameters in group 99, Start-Up Data. Enter motor data exactly as it appears on the motor nameplate.\
   - 9905 MOTOR NOM VOLT
   - 9906, MOTOR NOM CURR
   - 907, MOTOR NOM FREQ
   - 9908, MOTOR NOM SPEED
   - 9909, MOTOR NOM POWER

Verify motor rotation

4. If not already in Local mode press the LOC REM key to toggle the control mode to Local.
5. Set the Control Panel speed reference to approximately 3 Hz.

6. Press START on the Control Panel. Check that a clockwise rotating arrow is present on the first line of the display. If a counterclockwise rotating arrow appears, press the DIR soft key to toggle to a clockwise request. Verify that the motor rotates and that rotation is in the direction corresponding to forward.

   Note! If the Control Panel displays an OVERCURRENT or EARTH FAULT, disconnect and lock out power to the drive. Wait at least 5 minutes. Disconnect the motor leads from the drive output and Megger each motor lead to ground to determine if the motor is good. Check the power leads from the drive to the motor for damaged or improper wiring. Correct the problem and then repeat this step.

7. Press STOP on the Control Panel. If rotation direction was correct go to step 8. If rotation direction was incorrect then
   - Disconnect and lock out power to the drive
   - Wait 5 minutes for DC link to discharge
   - Switch any two motor leads at the drive output as shown in Figure 7
   - Reapply power to the drive
   - Repeat step 6
   -

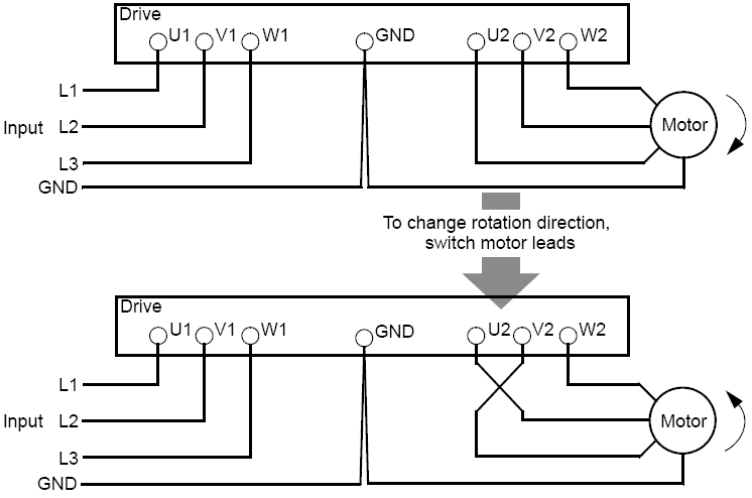


Figure 7

Check motor current

8. Insure that the Control Panel is displaying motor frequency and motor current. By default these are displayed as the first and second signals. If needed, use group 34 parameters to change the displayed signals.
9. Press START on the Control Panel. While monitoring the displayed motor current, increase the speed reference slowly until full speed is requested (60 Hz). Initially motor current should be between 20% and 50% of the motor's nameplate current value. As speed increases motor current will typically slowly increase. For most applications motor current will not exceed rated motor current even when full speed is reached.
10. Press STOP on the Control Panel. The motor will coast to a stop.
11. Press START on the Control Panel. The motor should accelerate linearly up to full speed in 5 seconds (default value of parameter 2202, ACCELER TIME 1). Motor current should smoothly increase as speed increases.
12. Press STOP on the Control Panel. The motor will coast to a stop.

Enable and Set Up Communication (if used)

13. If the application is designed to utilize serial communication then continue with step 14. Otherwise go to step 20.
14. Set parameter 9802, COMM PROT SEL, to the applicable protocol (STD MODBUS or EXT FBA).
15. If the speed reference is provided via serial communication then set parameter 1103 to COMM [8].
16. If motor start and stop is commanded via serial communication then set parameter 1001, EXT1 COMMANDS, to COMM [10].
17. If STD MODBUS was selected in step 14, then set the following parameters (application specific entries; appropriate values are determined by the design of the communication bus master):
    - 5302, EFB STATION ID. This must be a unique number
    - 5303, EFB BAUD RATE
    - 5304, EFB PARITY
    - 5305, EFB CTRL PROFILE
18. If EXT FBA was selected in step 14, then set the following parameters (application specific entries; values established by the communication bus master):
    - 5101, FBA TYPE

- 5102 through 5126, Refer to the communication module documentation that corresponds to the FBA TYPE entered in 5101

19. If STD MODBUS is the selected fieldbus, cycle power to the ACS550 drive. For other fieldbus options, set parameter 5127 - FBA Par Refresh to REFRESH. This will initiate a “save” of the communication settings to the fieldbus adapter’s flash memory.

Confirm Auto mode operation

20. Select REM mode on the Control Panel.
21. Start the drive. By default this requires that DI1 go high. If serial communication is implemented the start command may come over the fieldbus (parameter 1001 dependent).
22. Verify that the speed of the motor follows the speed reference. By default the speed reference is connected to AI1. If serial communication is implemented the speed reference may come over the fieldbus (drive parameter 1103 dependent).

Set other needed parameter values

23. Drive parameter values requiring change are application specific; however, the following drive parameters are typical of those that may need adjustment:
    - 2007, MINIMUM FREQ
    - 2008, MAXIMUM FREQ
    - 2102, STOP FUNCTION
    - 1202, CONST SPEED 1
    - 1203, CONST SPEED 2
    - 1204, CONST SPEED 3
    - 2202, ACCELER TIME 1
    - 2203, DECELER TIME 1
    - Group 34 to display different signal values

For descriptions of other macros and full parameter descriptions consult the ACS550 UH User’s Manual.

ACS550 Startup, PID Control Macro

The following start-up procedure assumes full knowledge of ACS550 Control Panel operation. Instructions to enter parameter values or to read signal levels don't include specific keystroke steps. If further information on Control Panel usage is needed see the "Control panels" section of the ACS550 User's Manual.

The procedure also assumes that all program changes are made using manual parameter entry. ASSISTANTS aren't used.

Initial power up and data entry

1. Apply power to the drive.
   - The drive Control Panel display should illuminate
   - A green light should be displayed on the upper left corner of the Control Panel
2. Enter the desired macro in group 99, Start-Up Data, parameter 9902, APPLIC MACRO. The procedure as documented here assumes that the PID Control [6] macro is selected.

   Note: The PID Control macro sets 9904, MOTOR CTRL MODE to VECTOR:SPEED. A full motor ID run is recommended. See the section Motor ID Run below.

3. Enter all motor parameters in group 99, Start-Up Data. Enter motor data exactly as it appears on the motor nameplate.
   - 9905, MOTOR NOM VOLT
   - 9906, MOTOR NOM CURR
   - 9907, MOTOR NOM FREQ
   - 9908, MOTOR NOM SPEED
   - 9909, MOTOR NOM POWER
   - 2002, MAXIMUM SPEED, typically this is the synchronous speed of the motor

Motor ID Run

The next steps assume that it is safe to automatically run the motor at full speed. Group 22 speed ramps are ignored during the ID run. For best results the ID should be run with the motor decoupled from its load.

4. The PID Control macro assumes that a Run Enable input is connected to DI5. Either insure that this connection is present or change 1601, RUN ENABLE to NOT SEL [0].
5. If not already in Local mode press the LOC REM key to toggle the control mode to Local.
6. Set 9910, ID RUN, to ON. The Control Panel will display the message “ALARM 2019, ID run.” Press START to start the motor ID run.

   Note! If the Control Panel displays an OVERCURRENT or EARTH FAULT, disconnect and lock out power to the drive. Wait at least 5 minutes. Disconnect the motor leads from the drive output and Megger each motor lead to ground to determine if the motor is good. Check the power leads from the drive to the motor for damaged or improper wiring. Correct the problem and then repeat this step.

7. When the motor ID run is complete the message “ALARM 2019, ID run” will no longer be displayed.
8. If the motor was decoupled from its load, reconnect the load.

Verify motor rotation

9. If not already in Local mode press the LOC REM key to toggle the control mode to Local.
10. Set the Control Panel speed reference to approximately 60 rpm.
11. Press START on the Control Panel. Check that a clockwise rotating arrow is present on the first line of the display. (This should occur automatically since the PID Control macro defaults to setting 1003, DIRECTION, to FORWARD.) Verify that the motor rotates in the normal direction required by the application.
12. Press STOP on the Control Panel. If rotation direction was correct go to step 13. If rotation direction was incorrect then
    - Disconnect and lock out power to the drive
    - Wait 5 minutes for DC link to discharge
    - Switch any two motor leads at the drive output as shown in Figure 7
    - Reapply power to the drive
    - Repeat step 11

Check motor current

13. Insure that the Control Panel is displaying motor speed and motor current. By default these are displayed as the first and second signals. If needed, use group 34 parameters to change the displayed signals.
14. Press START on the Control Panel. While monitoring the displayed motor current, increase the speed reference slowly until full speed is requested. Initially motor current should be between 20% and 50% of the motor's nameplate current value. As speed increases motor current will typically slowly increase. For most applications motor current will not exceed rated motor current even when full speed is reached.
15. Press STOP on the Control Panel. The motor will coast to a stop.
16. Press START on the Control Panel. The motor should accelerate linearly up to full speed in 5 seconds (default value of parameter 2202, ACCELER TIME 1). Motor current should smoothly increase as speed increases.
17. Press STOP on the Control Panel. The motor will coast to a stop.

Enable and Set Up Communication (if used)

18. If the application is designed to utilize serial communication then continue with step 19. Otherwise go to step 29.
19. Set parameter 9802, COMM PROT SEL, to the applicable protocol (STD MODBUS or EXT FBA).
20. If EXT1 motor start and stop (speed control mode) is commanded via serial communication then set parameter 1001, EXT1 COMMANDS, to COMM [10].
21. If EXT2 motor start and stop (PID control mode) is commanded via serial communication then set parameter 1002, EXT2 COMMANDS, to COMM [10].
22. If EXT1/EXT2 selection is commanded via serial communication then set parameter 1102, EXT1/EXT2 SEL, to COMM [8].
23. If the EXT1 drive speed reference is provided via serial communication then set parameter 1103 to COMM [8].
24. If the Run Enable is provided via serial communication then set parameter 1601 to COMM [7].
25. If the process set point is provided via serial communication then set parameter 4010, SET POINT SEL, to COMM [8].

26. If STD MODBUS was selected in step 19, then set the following parameters (application specific entries; appropriate values are determined by the design of the communication bus master):
    - 5302, EFB STATION ID. This must be a unique number
    - 5303, EFB BAUD RATE
    - 5304, EFB PARITY
    - 5305, EFB CTRL PROFILE
27. If EXT FBA was selected in step 19, then set the following parameters (application specific entries; values established by the communication bus master):
    - 5101, FBA TYPE
    - 5102 through 5126, Refer to the communication module documentation that corresponds to the FBA TYPE entered in 5101
28. If STD MODBUS is the selected fieldbus, cycle power to the ACS550 drive. For other fieldbus options, set parameter 5127 - FBA Par Refresh to REFRESH. This will initiate a “save” of the communication settings to the fieldbus adapter’s flash memory.

Confirm ACS550 Remote mode operation

Remote mode control may be provided by direct hardwired inputs (switches and potentiometers), by indirect hardwired inputs (PLC or computer controlled), or by serial communication (fieldbus controlled). Mixes of these are also possible. The control scheme implemented must be analyzed to determine how to make selections and initiate commands in the following steps.

29. On the ACS550 Control Panel select REM mode.
30. Select the remote speed control mode (EXT1).
31. Start the drive.
32. Verify that the speed of the motor follows the speed reference.
33. Stop the drive.

    Note: When verifying proper PID operation it is useful to monitor the PID setpoint and feedback. Therefore it is recommended that 3408, SIGNAL2 PARAM, be set to PID 1 SETPNT [128], and that 3415, SIGNAL3 PARAM, be set to PID 1 FBK [130].

34. Select the remote PID control mode (EXT2).
35. Start the process.

36. Verify that the process follows the setpoint reference.

    Note: If the process feedback moves away from the process setpoint instead of towards the process setpoint this is an indication that parameter 4005, ERROR VALUE INV, needs to be set opposite to its present value.

    It is normal for 4001, GAIN, and 4002, INTEGRATION TIME, to require tuning; however, PID loop tuning is beyond the intent of this document.

Set other needed parameter values

37. Drive parameter values requiring change are application specific; however, the following drive parameters are typical of those that may need adjustment:
    - 2001, MINIMUM SPEED
    - 2102, STOP FUNCTION
    - 2202, ACCELER TIME 1 (maximum of ½ 4002 value recommended)
    - 2203, DECELER TIME 1 (maximum of ½ 4002 value recommended)
    - 2301, PROP GAIN (speed regulator)
    - 2302, INTEGRATION TIME (speed regulator)
    - 4022, SLEEP SELECTION
    - 4023, PID SLEEP LEVEL
    - Group 34 to display different signal values

For descriptions of other macros and full parameter descriptions consult the ACS550 User's Manual.

Summary checklist

x	Check
	Equipment is securely mounted using properly sized hardware.
	Mounting arrangement meets recommended minimum spacing requirements.
	Expected ambient temperature range is OK.
	Drive is sized correctly for site altitude.
	Cooling air is sufficiently clean and free from unacceptable chemical contaminants.
	Cooling airflow pattern is acceptable.
	All foreign objects have been removed from electrical and mechanical areas
	All rotating equipment is ready for operation
	All electrical equipment is properly grounded
	Short circuit, ground fault, and overload protective devices of the recommended size and type are present
	Motor cables of a recommended type and acceptable length are correctly installed
	No power factor correction devices are connected in parallel with drive motors
	Control cabling is properly routed and separated from all power cables
	DCOM jumper installed (sinking X1:11 to X1:12; sourcing X1:10 to X1:12)
	Any motor disconnection equipment present includes Run Enable interlocking
	All temporary wiring has been removed
	Line voltage has been confirmed correct for the connected equipment
	EM1, EM3, F1, and F2 grounding screws are correctly removed / installed
	All dip switches are correctly set
	Motor internal wiring connections checked and correct for voltage present
	Drive motor data entry completed and confirmed (Group 99)
	Drive motor rotation and direction confirmed
	Correct motor speed and current confirmed
	PID control adjustments complete and PID operation confirmed (if applicable)

Index

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