ACS880 IGBT based SPRS control program (option +N5850)

Supplement

— List of related manuals

Drive firmware manuals and guides	Code (English)
ACS880 primary control program firmware manual	3AUA0000085967
ACS880 drives with primary control program, quick start-up guide	3AUA0000098062
ACS880 diode supply control program	3AUA0000103295
ACS880 IGBT supply control program firmware manual	3AUA0000131562
ACS880 SPRS control program (option +N5850) firmware manual	3AXD50000192854

Option manuals and guides	
ACX-AP-x assistant control panels user's manual	3AUA0000085685
Drive composer Start-up and maintenance PC tool User's manual	3AUA0000094606
Manuals and quick guides for I/O extension modules, fieldbus adapter, etc.	

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.

Firmware manual

ACS880 IGBT based SPRS control program (option +N5850)

Table of contents
2. Quick start-up guide

Table of contents

1. Introduction to the manual

2. Quick start-up guide

3. Default control connections

4. Program features

5. Parameters

6. Fault tracing

Further information

1

Introduction to the manual

Contents of this chapter

The chapter describes the contents of this manual. It also contains information on the compatibility, safety and intended audience.

Purpose of this guide

This supplement manual describes the parameter settings and program features required to control and program the ACS880 IGBT based Slip Power Recovery System (SPRS) control program.

Use this supplement manual along with the *ACS880 primary control program firmware manual* [3AUA0000085967 (English)] for general instructions on installation and maintenance.

Compatibility

This supplement applies to the ACS880 IGBT based SPRS control program used as a part of ACS880 primary control program. See version details below.

Control program	Version
ACS880 primary control program	3.10.0.0
ACS880 IGBT based SPRS control program	1.10.0.0

Safety

Follow all safety instructions delivered with the drive.

- Read the **complete safety instructions** before you install, commission, or use the drive. The complete safety instructions are given at the beginning of the hardware manual for the single drives, or in the *Safety instructions [3AUA0000102301 (English)]* for the multidrives and multidrives modules.
- Read the **software function specific warnings and notes** before changing the default settings of the function. For each function, the warnings and notes are given in this manual in the section describing the related user-adjustable parameters.

Licensing

The IGBT based SPRS control program (+N5850), version TBD comes with a license key on the ZMU-02 memory unit. The program activates only after recognizing the key and correspondingly registers itself with the crane software.

Device	License key
ZMU-02 memory unit license key	N8035
SPRS software (loading package)	N8036

You can see the license information in the Drive Composer PC tool or in the ACS-AP-x control panel from **System info → Licenses**.
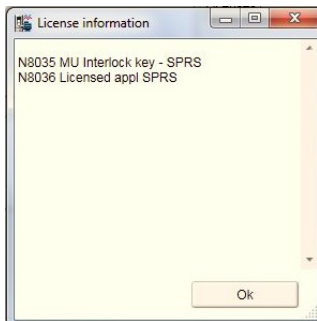
After the program is downloaded to the memory unit with the license key, the program remains there unless you remove it. This makes it possible for you to upgrade the SPRS control program later on a separate SPRS loading package.

If the program was loaded to the memory unit without the license key, then the drive indicates a fault *64A5 Licensing fault*. See the auxiliary fault code in the Event logger to know the plus code of the missing license, in this case N8035. For further assistance, contact your local ABB representative.

Target audience

This supplement is intended for personnel who install, commission, operate and service slip ring induction motors. The reader of this manual is expected to know the standard electrical wiring practices, electronic components, and electrical schematic symbols.

Contents

This manual consists of following chapters:

Introduction to the manual contains information on compatibility, safety and intended audience. It also includes a list of terms and abbreviations used in this manual.

Quick start-up guide provides the basic start-up procedure of the ACS880 IGBT based slip power recovery system.

Default control connections provides default control connections of the SPRS.

Program features contains descriptions of features specific to the SPRS such as low line harmonics and dedicated synchronization unit (RSYC) for bump less transfer.

Parameters describes the parameters used for SPRS control program.

Fault tracing lists the SPRS program specific faults and warning messages with possible cause and remedy.

.

Cybersecurity disclaimer

This product is designed to be connected to and to communicate information and data via a network interface. It is Customer's sole responsibility to provide and continuously ensure a secure connection between the product and Customer network or any other network (as the case may be). Customer shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Related documents

See the *List of related manuals* on the inside of the front cover.

Terms and abbreviations

Term/abbreviation	Definition
ACS880	A product family of ABB drives
ACS-AP-I	Types of control panel used with ACS880 drives
ACS-AP-W	
BCU	Type of control unit used in ACS880 drives.
CCR	Central control room.
DDCS	Distributed drives communication system; a protocol used in communication between ABB drive equipment
FCB	Function Chart Builder; Programming language to program RMIO board.
GRR	Grid rotor resistance; Connected to rotor and used for controlling the speed of slip ring induction motor.
ID run	Motor identification run. During the identification run, the drive will identify the characteristics of the motor for optimum motor control.
IGBT	Insulated gate bipolar transistor; a voltage-controlled semiconductor type widely used in inverters and IGBT supply units due to their easy controllability and high switching frequency
ISU	An IGBT supply unit; type of supply unit implemented using IGBT switching components, used in regenerative and low-harmonic drives.
LCL	Line filter. Inductor-capacitor-inductor filter for attenuating high order harmonics in IGBT supply units.
LRS	Resistance Starter. It is connected to the rotor for controlling the speed of slip ring induction motor. The resistance is achieved through movement of contacts kept in an electrolyte.
MSW	Main status word; Indicates the status of converter/inverter.
RSYNC	Synchronization unit for bump less transfer. The RSYNC ensures smooth and automated changeover from GRR to SPRS.
RMIO	Motor control and I/O board. Drive control unit.
RDCO-0x	DDCS communication module.
SPRS	Slip power recovery system; An external system connected to the rotor circuit, which provides excellent torque and speed control. Also recovers the power from rotor and feeds back to the power system avoiding wastage of energy.
ZCU	Type of control unit used in ACS880 drives. The control unit may be fitted onto the power module, or installed separately.

2

Quick start-up guide

Contents of this chapter

This chapter contains the basic start-up procedure of the ACS880 IGBT based SPRS control program.

Before you start

Make sure the drive is mechanically and electrically installed as described in the appropriate *Quick installation guide* and/or *Hardware manual*.

Safety

⚠ **WARNING!** All electrical installation and maintenance work on the drive must be carried out by qualified electricians only.

Never work on the drive, the brake chopper circuit, the motor cable or the motor when power is applied to the drive. Always make sure by measuring that no voltage is actually present.

⚠ **WARNING!** Make sure that the machinery into which the drive with the Override control program is integrated fulfills the personnel safety regulations. Note that the frequency converter (a Complete Drive Module or a Basic Drive Module, as defined in IEC 61800-2 with the Override control program), is not considered as a safety device mentioned in the European Machinery Directive and related harmonized standards. Thus, the personnel safety of the complete machinery must not be based on a specific frequency converter feature (such as the Override control program), but it has to be implemented as defined in the application specific regulations.

Start-up procedure

You can operate the drive locally from Drive composer or from the ACS880 control panel.

The following steps describe the actions that is necessary when powering up the drive for the first time in a new installation (for example, entering the motor data). After the start-up, the drive can be powered up without using these start-up functions. You can repeat the start-up procedure when you change the data.

In there is a fault, refer to chapter *Fault tracing* on page *47*.

Safety
☐   ⚠ **WARNING!** Obey all safety instructions for the drive. Only qualified electricians are allowed to start up the drive.
Settings
☐   Switch on the HT isolator and the charge feedback transformer. See *SPRS connection diagram* on page *19*.
☐   Check the voltage at the incoming panel. The voltage should be equal to the secondary voltage of feedback transformer.
☐   Switch on the ISU and check the DC bar voltage in ISU CDP. The DC bus voltage should be 1.1 · sqrt(2) · Vac (secondary voltage).
☐   Check the DI status of the inverter and SPRS RMIO as per the configuration. See *SPRS connection diagram* on page *19*.
☐   Check the rotor speed. The rotor speed should be within the specified limit. See parameters *78.01 SPRS max speed %* and *78.02 SPRS min speed %*.
☐   Release the emergency stop button on the panel and check if inverter and SPRS are ready for operation. Using selector, switch from GRR to SPRS mode. After SPRS RMIO receives synchronization acknowledgment from RSYNC card the changeover takes place from GRR/LRS to SPRS. See *SPRS connection diagram* on page *19*.
☐   Make sure the SPRS is aligned with the connection diagram. See *SPRS connection diagram* on page *19*.

3

Default control connections

Contents of this chapter

This chapter describes the default control connections of ACS880 IGBT based SPRS control program for ZCU control unit used with ACS880 drive.

Default control connections of SPRS control program (ZCU)

Terminal X21		ZCU/BCU board	
1	+24VI	24 V DC, 2 A	
2	GND		
XAI		Reference voltage and analog inputs	
1	+VREF	10 V DC, R_l 1…10 kohm	
2	-VREF	-10 V DC, R_l 1…10 kohm	
3	AGND	Ground	
4	AI1+	**Speed reference**	
5	AI1-	0(2)…10 V, R_{in} > 200 kohm	
6	AI2+	By default not in use.	
7	AI2-	0(4)…20 mA, R_{in} > 100 ohm	
XAO		Analog outputs	
1	AO1	**Motor speed rpm**	
2	AGND	0…20 mA, R_L < 500 ohm	
3	AO2	**Motor current**	
4	AGND	0…20 mA, R_L < 500 ohm	
XD2D		Drive-to-drive link	
1	B		
2	A	Drive-to-drive link	
3	BGND		
XRO1, XRO2, XRO3		Relay outputs	
1	NC		
2	COM	**SPRS contactor ON**	
3	NO		
1	NC		
2	COM	**GRR contactor OFF**	
3	NO		
1	NC		
2	COM	**Sync contactor ON**	
3	NO		
XD24		Digital interlock	
1	DIIL	Emergency stop select.	
2	+24VD	+24 V DC 200 mA	
3	DICOM	Digital input ground	
4	+24VD	+24 V DC 200 mA	
5	DIOGND	Digital input/output ground	
XDIO		Digital input/outputs	
1	DIO1	Input: Deactivate override control (0-->1 = Off)	
2	DIO2	Output: Running	
XDI		Digital inputs	
1	DI1	ACK SPRS contactor on	
2	DI2	ACK GRR contactor on	
3	DI3	ACK Sync contactor on	
4	DI4	HT isolator on feedback	
5	DI5	Sync input select	
6	DI6	SPRS GRR select	
XSTO		Safe torque off circuits must be closed for the drive to start. See *Hardware manual* of drive.	
X12		Safety options connection	
X13		Control panel connection	
X205		Memory unit connection	

Fault

4

Program features

Contents of this chapter

This chapter describes the additional features of IGBT based SPRS control program used with the ACS880 primary control program.

Overview of IGBT based SPRS control program

Slip Power Recovery System (SPRS) is an external system connected to the rotor circuit for controlling speed and torque. The system also recovers power from the rotor and feeds it back to the power system, avoiding wastage of energy.

This system is suitable for any new installation as well as retrofits. It offers optimum solution for speed adjustable applications with limited speed range. The power range is 500 to 5000 kW. See the *SPRS connection diagram* on page *19* to understand the operating principle of the complete system.

The IGBT based SPRS application is designed by programming the motor and I/O control (ZCU) board of ACS880 drive using an application software. The software is customized using the CODESYS tool for:

• integrating I/O control extension
• configuring application parameters and signals
• establishing communication between the control boards.

Other SPRS specific parameters can be programmed at the time of commissioning using the Drive composer PC tool or the ACS-AP-I control panel. You can easily program the SPRS parameters using the logical groups of ACS880 drive parameters. See section *Parameters* on page *35*.

The parameter group *99 START-UP DATA* includes all the basic settings required for matching the ACS880 drive with the motor and to set the control panel display language. You can set these parameters at the time of start-up. ABB recommends not to change these settings at any time. See *ACS880 primary control program firmware manual* [3AUA0000085967 (English)].

SPRS operation

The SPRS system synchronizes with the motor during the motor start-up and is available for process control. You can start the motor using either grid rotor resistor or liquid rotor resistor, based on the requirements of the user and the load torque.

The system integrates start-up functions and speed control functions into one drive system. You can retrofit the system to an existing motor and retain the existing start-up functions. The system determines how SPRS coordinates with the motor startup functions.

The ACS880 Multidrive converter with dedicated control board and customized SPRS control program facilitates optimum performance of the connected slip ring induction motor. If there is no tachometer feedback, the control program provides system performance by using special transducers for voltage reference.

■ SPRS connection diagram
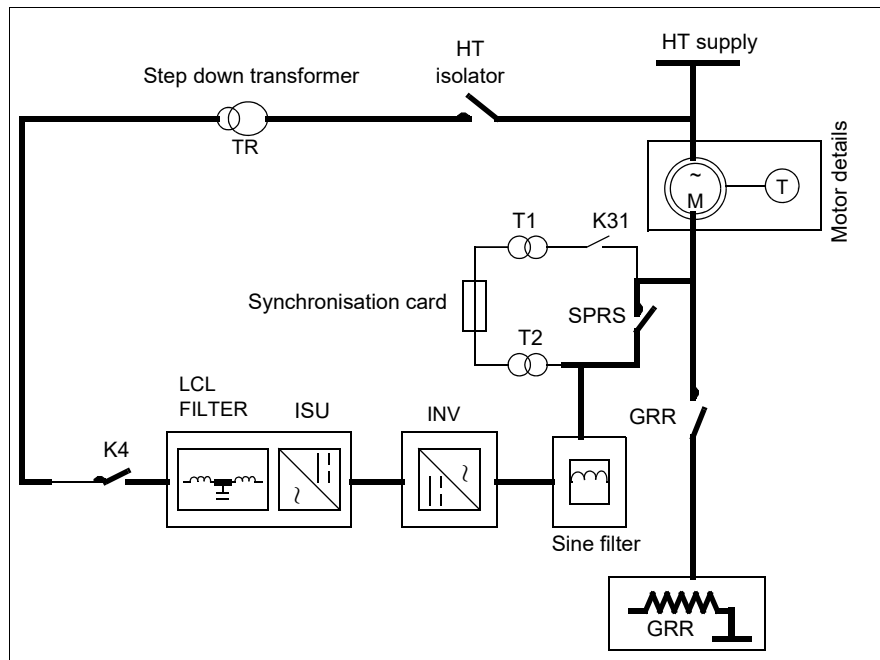
Component	Function
Inverter (INV)	Connected to rotor winding. Modulates the amount of power fed back into the power system and controls motor speed.
Converter (ISU)	Connected to power system.
Transformer	Matches system voltages.
Synchronization unit	Uses zero crossing transformer for bumpless transfer to *SPRS* and *GRR*. Q-control offers reactive power compensation by changing the flux length for system power factor correction, which eliminates the requirement of capacitor bank.

.

■   **Benefits of using SPRS system**

The IGBT based SPRS system offers following benefits in the power system compared to the previous methods:

- unity power factor
- low harmonics
- saves energy that is wasted as heat loss.

Liquid Resistance Starter (LRS) operation

The LRS is used to control the starting torque of a slip ring induction motor. With LRS, the resistance of the motor is controlled by adjusting the distance between the electrodes (one fixed and one movable electrode) which are kept in a liquid electrolyte (see in below connection diagram).The resistance is achieved by moving the movable electrode as necessary. The resistance is zero when the electrodes are in contact.

The LRS tracking function tracks the movement of the movable electrode inside the liquid electrolyte. The function can be activated with parameter *79.01 LRS tracking enable*. Parameter *79.02 LRS speed deviation percentage* defines the percentage of speed deviation to enable the LRS.

A motor running in the Direct Online (DOL) mode is used for the movement of electrode. When the forward contactor activates, DOL motor runs in forward direction and electrode moves towards the fixed electrode. When the reverse contactor is activated, DOL motor moves in reverse direction and the electrode moves in away from the fixed electrode.

The LRS activates the forward and reverse contractors automatically based on the difference in speed references from parameters *79.03 CCR speed reference* and *79.04 Actual speed feedback*. Parameter *79.07 LRS contactor command status* shows the status of forward/reverse movement of the contactors. This status can be used for the smooth transition between SPRS mode and LRS mode.

■ **LRS connection diagram**
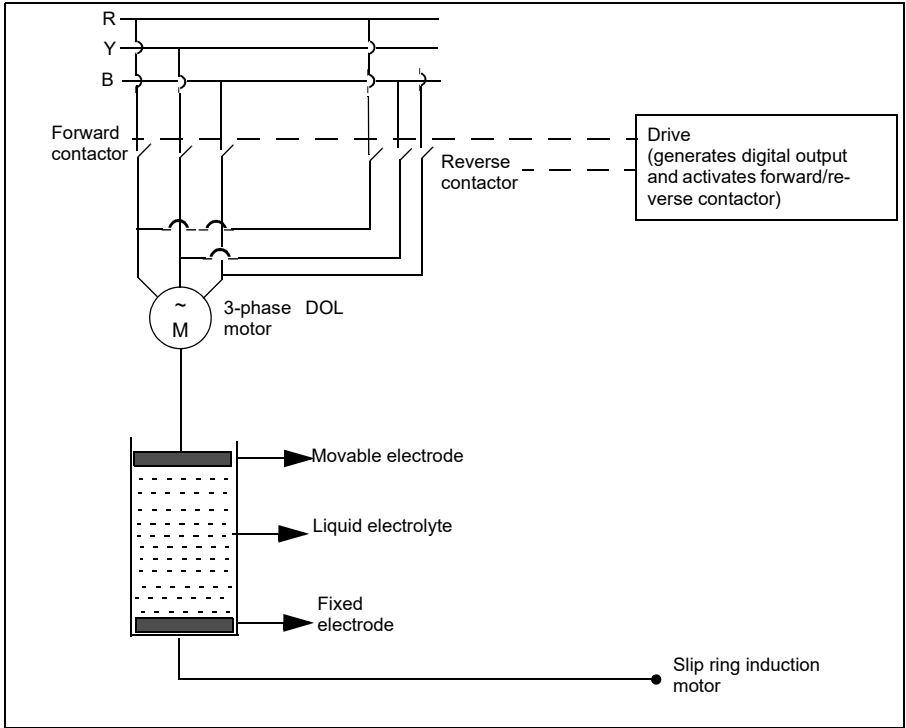
Settings

Parameter group *79 LRS tracking* (page *46*)

Programmable analog inputs

The drive has two programmable analog inputs: one voltage input (0/2 to 10 V or
-10 to 10 V) and one current input (0/4 to 20 mA). Three extra analog inputs are
available to scale the input values of the SPRS RMIO in counts.

Settings

Parameter	Additional information
Group 12 Standard AI	Standard outputs for selecting and processing analog output values.
Group *77 Speed and Feedback SEL*	AI as a reference source

Communication tools

◼ Drive composer

Drive composer PC tool is a 32-bit Windows application for commissioning and maintaining ABB common architecture drives.

The full version is called Drive composer pro and the limited version is called Drive composer entry. Both versions include a demo that allows testing user interface functionality, edit parameter files offline (pro) or open and analyze saved monitored files without connecting to a physical drive.

◼ Control panel

The ACS880 drive uses ACS-AP-I control panel for programming and locally controlling the drive. For more details, see chapter Control Panel in the *ACS880 primary control program firmware manual* [3AUA0000085967 (English)].

Setting up communication to SPRS

The control program uses DDCS protocol to exchange data between the RDCO boards. The SPRS RDCO fetches data from INV RDCO and ISU RDCO at intervals of 10 ms.

An example connection with either a ZCU-based or BCU-based IGBT supply unit using fiber optic cables is shown below.

IGBT supply units with a *ZCU* control unit require an additional FDCO DDCS communication module; IGBT supply units with a BCU control unit require RDCO or FDCO module. The *BCU* has a dedicated slot for the RDCO – FDCO module can also be used with a BCU control unit but it will reserve one of the three universal option module slots. Ring and star configurations are also possible much in the same way as with the master/follower link; the notable difference is that the external

controller connects to channel CH0 on the RDCO module instead of CH2. The channel on the FDCO communication module can be freely selected.
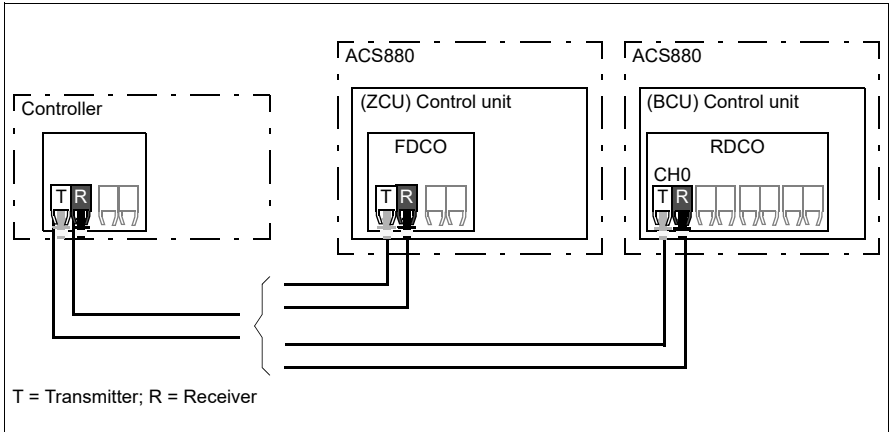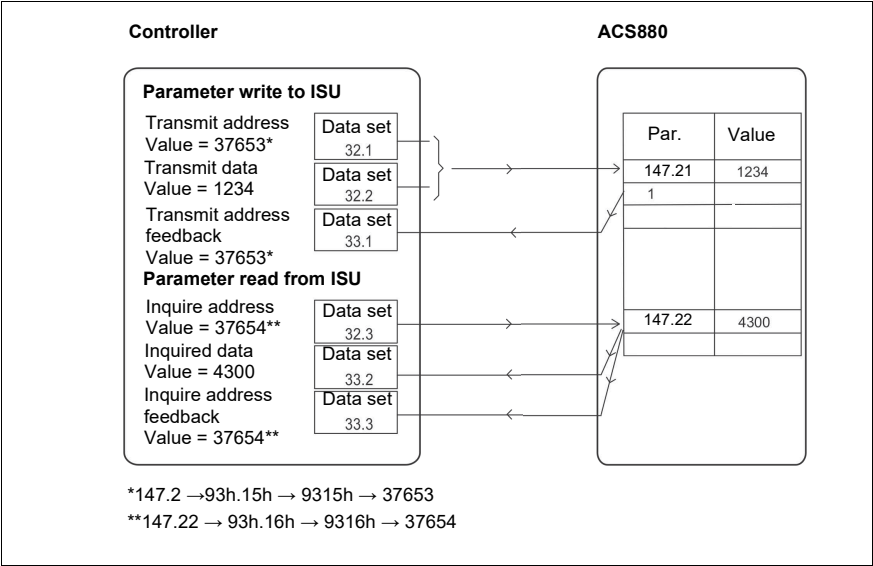

Communication

The communication between the controller and the IGBT supply unit consists of data sets of three 16-bit words each. The controller sends a data set to the IGBT supply unit, which returns the next data set to the controller.

The communication uses data sets 10…33. The contents of the data sets are freely configurable, but data set 10 typically contains the control word, while data set 11 returns the status word and selected actual values.

By default, data sets 32 and 33 are dedicated for the mailbox service, which enables the setting or inquiry of parameter values as follows:

Controller		ACS880

Parameter write to ISU

Transmit address
Value = 37653* — Data set 32.1

Transmit data
Value = 1234 — Data set 32.2

Par.	Value
147.21	1234
1	

Transmit address feedback
Value = 37653* — Data set 33.1

Parameter read from ISU

Inquire address
Value = 37654** — Data set 32.3

147.22	4300

Inquired data
Value = 4300 — Data set 33.2

Inquire address feedback
Value = 37654** — Data set 33.3

*147.2 →93h.15h → 9315h → 37653
**147.22 → 93h.16h → 9316h → 37654

■ Connecting to a drive with an Assistant control panel for the first time

To establish a connection between Drive composer and drive, connect a USB type A (PC) type mini B (panel) cable to the USB port of the computer and the USB port of the Assistant control panel (ACS-AP-x panel). The maximum length of the USB cable should be three meters.

Note: If the drive is used without an Assistant control panel or with a Basic control panel, use separate USB/485 adapter to establish connection between Drive composer and drive.

1. Connect your PC to the Assistant control panel with a USB cable.
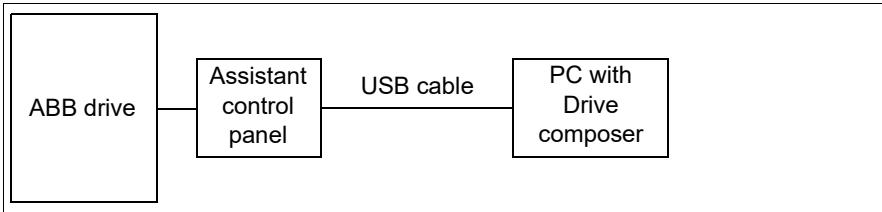
The "USB connected" message appears on the control panel screen.
Note: You cannot use the Assistant control panel when it is connected to the PC.

2. Double click **Drive composer entry/pro.exe** to launch Drive composer.

3. Click **Connect** if you want to connect to the drive or click **Demo** if you want to choose the Offline mode.

Drive composer loads the parameters and displays the following window.
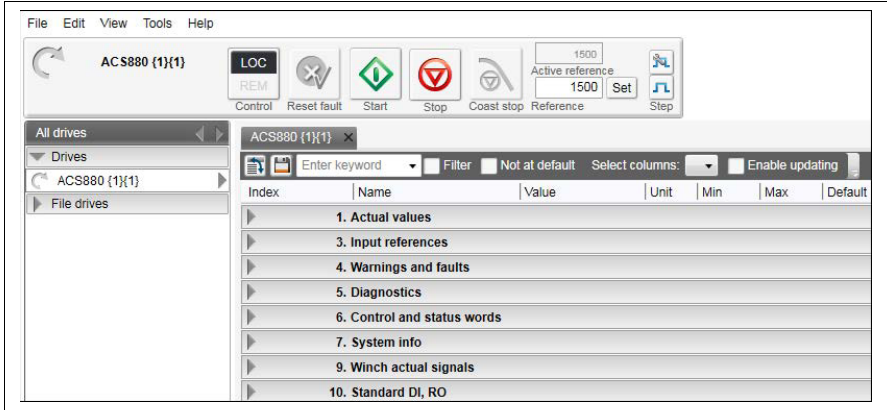
You can also select the dedicated connections to the drive:

Connection	Result
DDCS (ACS800 only)	Connects to the drive through DDCS (fiber optic) communication.
USB/COM	Connects to the drive through USB connection. Use this option only when you want to connect to the drive through serial connection, example, USB cable to ACS-AP-x panel.
Ethernet	Connects to the drive through Ethernet network
Virtual drive	Connects to the Virtual drive smart component. This option is applicable only when you have Automation Builder installed in the PC.
Comm settings	Opens another dialog box where you can configure the connections in more detail other than the above three options.

Observe the following actions in the Assistant control panel:

- Status LED start flickering, to indicate that data is transferring between the drive and PC.
- Status LED keeps blinking, as long as the Drive composer PC tool is connected to the drive.
- The welcome dialog box displays on the screen to indicate that the application is initialized.
- On first time connection, parameter texts are loaded from the drive and this might take few minutes depending on the drive type.

4. If the drive composer fails to connect online with the drive, go to **View ® Settings** to check the COM settings and click **View ® Refresh** (Ctrl + R) to reconnect Drive composer to the drive.

■ Ethernet network connection

The figure below shows the Drive composer PC tool communication set up through Ethernet cables.
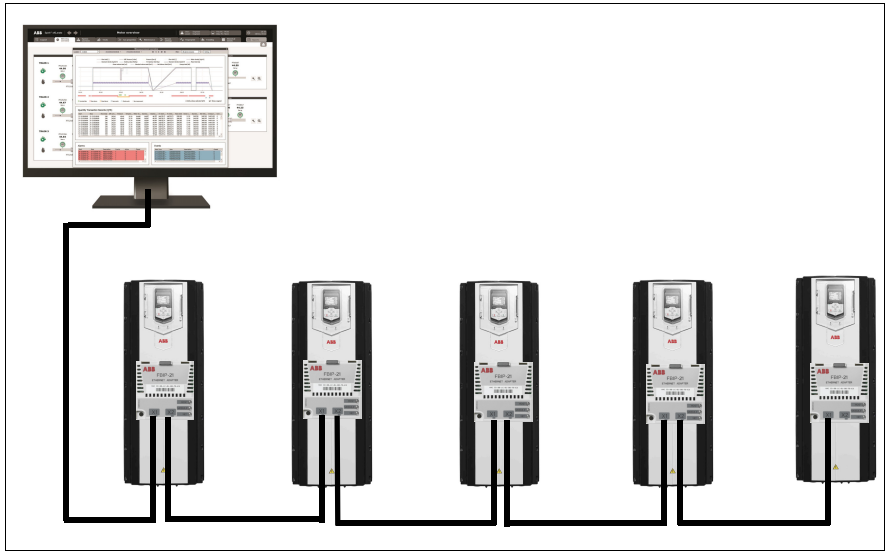
Connection through Ethernet fieldbus

The below figure shows the Drive composer PC tool communication set up through the Ethernet fieldbus.
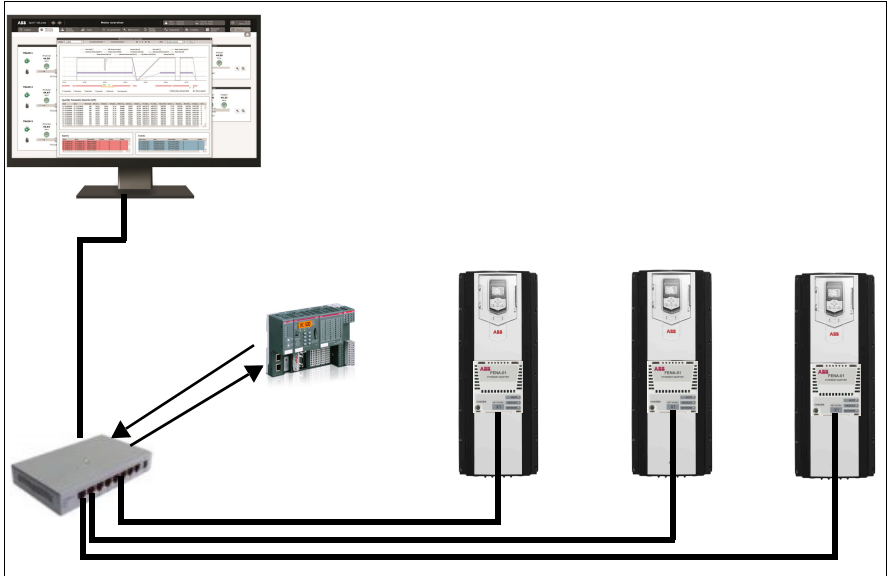
For more information on Ethernet network connection, refer *Drive composer Start-up and maintenance PC tool user's manual* [3AUA0000094606 (English)].

Communication profile

■ State diagram (ABB Drives profile)

The block diagram below illustrates AC drive communication profile with different control and states.

MAINS OFF

Power ON

SWITCH-ON INHIBITED — SW b6=1

CW b0=0

from any state

Fault

FAULT — SW b3=1

CW b7=1

A B C D

CW b3=0

NOT READY TO SWITCH ON — SW b0=0

CW=xxxx x**1**xx xxxx x**110**

OPERATION INHIBITED — SW b2=0

operation inhibited

READY TO SWITCH ON — SW b0=1

from any state

Emergency stop **OFF2** (CW b1=0)

CW=xxxx x**1**xx xxxx x**111**

OFF2 ACTIVE — SW b4=0

from any state

OFF1 (CW b0=0)

OFF1 ACTIVE — SW b1=0

n(f) = 0 / I = 0

READY TO OPERATE — SW b1=1

CW=xxxx x**1**xx xxxx **1111**

from any state

Emergency stop **OFF3** (CW b2=0)

OFF3 ACTIVE — SW b5=0

n(f) = 0 / I = 0

B C D

CW b4=0

OPERATION ENABLED — SW b2=1

C D

CW b5=0

A

CW=xxxx x**1**xx xxx**1 1111**

STATE

condition

rising edge of bit

RFG: OUTPUT ENABLED

D

CW b6=0

B

CW=xxxx x**1**xx xx**11 1111**

CW   = Control word
SW   = Status word
bx   = bit x
n   = Speed
I   = Input Current
RFG = Ramp Function
          Generator
f   = Frequency

RFG: ACCELERATOR ENABLED

C

CW=xxxx x**1**xx x**111 1111**

OPERATION — SW b8=1

D

Programmable analog outputs

Two programmable current outputs (0/4 to 20 mA) are available as standard. The analog output signals can be proportional to motor speed, process speed (scaled motor speed), output frequency, output current, motor torque, motor power, etc.

You can write a value to an analog output through a serial communication link.

Settings

Parameter	Additional information
Group 13 Standard AO	Standard outputs for selecting and processing analog output values.

Programmable digital inputs

The drive consists of six programmable digital inputs as a standard. Six extra inputs are available if optional digital I/O extension modules are used.

■ Update cycles in the Standard Control Program

Input	Cycle
DI/standard	6 ms
DI/extension	12 ms

Settings

Group/Parameter	Additional information
Group *74 SPRS DI*	DI as start, stop, direction

Run enable

The drive run can be prevented using the run enable function. If the run enable signal is switched off, the drive will not start. If already running, the drive will stop according to the setting of parameter *20.11 Run enable stop mode*.

Programmable relay outputs

The drive consists of three programmable relay outputs as a standard. Six outputs can be added by using optional digital I/O extension modules. You can set the parameter in the relay outputs to indicate the following information: ready, running, fault, warning, motor stall and so on.

You can write a value to a relay output through a serial communication link.

■ Update cycles in the Standard Control Program

Input	Cycle
RO/standard	100 ms
RO/extension	100 ms

Settings

Group/Parameter	Additional information
Group *76 SPRS relay outputs*	RO value selections and operation times

SPRS actual signals

Several SPRS actual signals are available:

- Sync correction
- CCR speed ref
- Actual speed
- SPRS and INV DI Status
- AI and AO Values
- SPRS Status word 1, 2, 3, 5
- Fault word 1
- Warning word 1
- Drive reference percentage
- Actual speed feedback
- Motor potentiometer reference

Settings

Parameter	Additional information
Group *09 SPRS actual signals*	Lists signals for monitoring SPRS operation.

Data storage parameters

Data storage relates to parameters used for receiving information from or sending to an external control system. For data storage parameters, see *ACS880 primary control program firmware manual* [3AUA0000085967 (English)].

Settings

Parameter	Additional information
Group *47 Data storage*	This group defines parameters used for receiving information from or sending to an external control system.

5

Parameters

Contents of this chapter

This chapter lists the actual signals and parameters of the ACS880 IGBT based SPRS application and also gives the fieldbus equivalent values for each signal/parameter. Refer these parameters in addition to the actual signals and parameters described in the *ACS880 primary control program firmware manual* [*3AUA0000085967* (English)].

Terms and abbreviations

Term	Definition
Actual signal	Type of *Parameter* that is the result of a measurement or calculation by the drive, or contains status information. Most actual signals are read-only, but some (especially counter-type actual signals) can be reset.
Def	(In the following table, shown on the same row as the parameter name) The default value of a *Parameter*. **Note:** Certain drive hardware or optional equipment may require different default values.
FbEq16	(In the following table, shown on the same row as the parameter range, or for each selection) 16-bit fieldbus equivalent: The scaling between the value shown on the panel and the integer used in communication when a 16-bit value is selected for transmission to an external system. A dash (-) indicates that the parameter is not accessible in 16-bit format.
Other	The value is taken from another parameter. Choosing "Other" displays a parameter list in which the user can specify the source parameter.
Other [bit]	The value is taken from a specific bit in another parameter. Choosing "Other" displays a parameter list in which the user can specify the source parameter and bit.
Parameter	Either a user-adjustable operating instruction for the drive, or an *Actual signal*.
p.u.	Per unit

Summary of parameter groups

Group	Contents	Page
09 SPRS actual signals	Signals for monitoring SPRS operation.	*37*
14 I/O extension module 1	Configuration of I/O extension module 1 for SPRS.	*40*
15 I/O extension module 2	Configuration of I/O extension module 2 for SPRS.	*40*
74 SPRS DI	Defines SPRS digital inputs.	*40*
75 SPRS User values	User values for SPRS.	*42*
76 SPRS relay outputs	Status information indicated through the relay outputs and the relay operating delays for SPRS.	*43*
77 Speed and Feedback SEL	Analog inputs for SPRS.	*44*
78 SPRS Limits	Speed limits for SPRS.	*46*
79 LRS tracking	Tracking of electrode movement in Liquid Resistance Starter (LRS).	*46*
99 Motor data	Motor configuration settings.	*47*

Parameter listing

No.	Name/Value	Description	Def/ FbEq16/32
09 SPRS actual signals		Signals for monitoring SPRS operation. These parameters are read-only.	
09.01	Sync correction	Shows the value of the speed correction done by Rsync card during Sync operation, for changeover from GRR to SPRS mode. This value is provided by parameter 40.05 Process PID trim output Actual.	-
	0...3000rpm	Correction factor.	1 = 1rpm
09.02	Modified Sync reference [%]	Shows modified synchronization reference of the drive.	-
	0...3000%	Value in percent.	1 = 1%
09.03	Speed actual [%]	Shows output of the speed measurement block.	-
	0...1000%	Value in percent.	1 = 1%
09.04	CCR speed reference [%]	Shows speed reference from Central Control Room (CCR).	-
	0...100%	Value in percent.	1 = 1%
09.05	Inverter Speed reference [%]	Shows the internally calculated and modified speed reference from CCR.	-
	0...100%	Value in percent.	1 = 1%
09.06	SPRS Status word 1	Shows 15-bit data word for monitoring the output of speed measurement block. This parameter is read-only.	-

Bit	Name	Description
0	Ack for SPRS contactor ON	1 = DI of SPRS contactor received / acknowledged.
1	Ack for synchronized input	1 = DI of synchronized input received / acknowledged.
2	Ack for GRR contactor ON	1 = DI of GRR contactor received / acknowledged.
3	Ack for synchronized contactor	1 = DI of synchronized contactor received / acknowledged.
4	Ack for HT isolator ON	1 = DI of HT isolator received / acknowledged.
5	Ack for LT isolator ON	1 = DI of LT isolator received / acknowledged.
6	Ack for HT breaker ON	1 = DI of HT breaker received / acknowledged.
7	Transformer healthy feedback signal	1 = DI of transformer healthy feedback received / acknowledged.
8...15	Reserved	

No.	Name/Value	Description	Def/FbEq16/32
09.07	SPRS Status word 2	Shows 15-bit data word for monitoring the output of speed measurement block. This parameter is read-only.	-

Bit	Name	Description
0	Reset	1 = Reset command active.
1	SPRS selected	1 = SPRS selected.
2	Low synchronized feedback	1 = Output low command of the synchronized feedback signal active.
3	High synchronized feedback	1 = Output high command of the synchronized feedback signal active.
4...15	Reserved	

No.	Name/Value	Description	Def/FbEq16/32
09.08	SPRS Status word 3	Shows the 15-bit data word for monitoring the output of speed measurement block. This parameter is read-only.	-

Bit	Name	Description
0	Inverter ready	1 = Inverter ready for operation.
1	SPRS ready to CCR	1 = SPRS is ready to take reference from central control room.
2	SPRS running	1 = SPRS running with normal operation.
3	SPRS tripped	1 = SPRS tripped.
4	SPRS contactor ON cmd	1 = SPRS contactor close command active from relay output.
5	Rotor contactor ON cmd	1 = Rotor contactor close command active from relay output.
6	Sync process running ack	1 = Sync process running acknowledgment active.
7	Synchronized delay	1 = Synchronized delay active.
8...15	Reserved	

No.	Name/Value	Description	Def/FbEq16/32
09.10	SPRS Status word 5	Shows the 15-bit data word for monitoring the output of speed measurement block. This parameter is read-only.	-

Bit	Name	Description
0	GRR selected	1 = GRR Selected.
1	Reserved	
2	Speed more than min limit	1 = Operation speed is greater than the minimum limit.
3	Max speed operation	1 = Operation speed greater than the maximum limit.
4	Ready for SPRS	1 = Ready for SPRS operation.
5	Synchronized process running	1 = Synchronization process running to make the output of inverter match with the rotor voltage.
6	Reserved	
7	Emergency stop	1 = Emergency stop active.
8...15	Reserved	

No.	Name/Value	Description		Def/ FbEq16/32
09.14	Fault word 1	Defines SPRS fault word 1. This parameter is read-only.		-

Bit	Name	Description
0	Emergency stop	1 = Emergency stop fault active.
1	Max speed operation	1 = Max speed operation fault active.
2	Min speed operation	1 = Min speed operation fault active.
3	Rotor over voltage	1 = Rotor over voltage fault active.
4	Over current	1 = Over current fault active.
5	HT isolator trip	1 = HT isolator trip fault active due to non availability of feedback.
6	Rotor circuit isolator trip	1 = Rotor circuit isolator trip fault active due to non availability of feedback.
7	Trafo fault	1 = Trafo fault active due to non availability of feedback.
8	App External fault 1	1 = App External fault 1 active due to non availability of feedback.
9	App External fault 2	1 = App External fault 2 active due to non availability of feedback.
10	Earth fault	1 = Earth fault active.
11	HT Breaker Fault	1 = HT Breaker Fault active due to non availability of feedback.
12...15	Reserved	

No.	Name/Value	Description		Def/ FbEq16/32
09.15	Warning word 1	Defines SPRS warning word 1. This parameter is read-only.		-

Bit	Name	Description
0	GRR contactor not open	1 = GRR contactor not open warning command active due to non availability of feedback.
1	SPRS contactor not close	1 = SPRS contactor not closed warning command active due to non availability of feedback.
2	Tacho feedback fail	1 = No tacho feedback warning command active due to non availability of feedback.
3	SPRS ready	1 = SPRS ready for operation warning command active.
4...15	Reserved	

No.	Name/Value	Description	Def/ FbEq16/32
09.28	Drive reference percentage [%]	Shows inverter reference before converting to equivalent frequency.	0.0
	0.0...300.0%	Inverter reference.	1 = 1%
09.32	Actual speed feedback	Shows actual speed measured by tachometer in counts. During tachometer failure, the drive calculates actual speed feedback by converting measured rotor voltage feedback (*77.03*) into corresponding rpm.	0.0
	0.0...10000.0 rpm	Counter value.	1 = 1rpm
09.33	Speed calculated from rotor voltage	Shows the actual speed based on the corresponding rotor voltage feedback received.	-
	0...10000 rpm	Actual speed calculated using rotor voltage	1 = 1 rpm

No.	Name/Value	Description	Def/ FbEq16/32
09.42	Mot pot reference value	Shows speed reference value given as increase/decrease push button for SPRS.	0
	0...30000%	Counts	1 = 1%
09.43	CCR speed reference for GRR correction	Shows the speed reference to the drive based on parameter *75.12 GRR reference error correction*. When you enable parameter *75.12 GRR reference error correction*, the actual feedback value in % is used as the GRR speed reference.	-
	0...100%	GRR speed reference correction.	1 = 1%

14 I/O extension module 1	Configuration of I/O extension module 1 for SPRS. For the SPRS application, Slot 2 must be used for the module type FIO-01. See parameters 14.01 and 14.02. All the other configurations are similar to the ACS880 primary control program.	

15 I/O extension module 2	Configuration of I/O extension module 2 for SPRS. For the SPRS application, slot 3 must be used for the module type FIO-11. See parameters 15.01 and 15.02. All the other configurations are similar to the ACS880 primary control program.	

74 SPRS DI	Defines SPRS digital inputs.	
74.01	ACK SPRS contactor on	Defines the source from which DI SPRS contactor is acknowledged.	*DI1*
	Not selected	0	0
	Selected	1	1
	DI1	Digital input DI1.	2
	DI2	Digital input DI2.	3
	DI3	Digital input DI3.	4
	DI4	Digital input DI4.	5
	DI5	Digital input DI5.	6
	DI6	Digital input DI6.	7
	DI7	Digital input DI7. Used with FDIO-01.	8
	DI8	Digital input DI8. Used with FDIO-01.	9
	DI9	Digital input DI9. Used with FDIO-01.	10
	DIO1	Digital input/output DIO1.	11
	DIO2	Digital input/output DIO2.	12
	DIIL	Digital inputs DIIL.	13
	Other	Source selection (see *Terms and abbreviations* on page *36*).	-
74.02	ACK G/LRR contactor on	Defines the source from which DI ROTOR contactor is acknowledged. For the available selections, see parameter *74.01 ACK SPRS contactor on*.	*DI2*
74.03	ACK Sync contactor on	Defines the source from which DI SYNC contactor is acknowledged. For the available selections, see parameter *74.01 ACK SPRS contactor on*.	*DI3*

No.	Name/Value	Description	Def/ FbEq16/32
74.04	Sync input select	Defines the source from which DI synchronized input is acknowledged. For the available selections, see parameter *74.01 ACK SPRS contactor on*.	*DI5*
74.05	SPRS/G(L) RR select	Defines the source from which DI SPRS/GRR SEL done. For the available selections, see parameter *74.01 ACK SPRS contactor on*.	*DI6*
74.06	HT isolator on feedback	Defines the source from which DI HT Isolator on is acknowledged. For the available selections, see parameter *74.01 ACK SPRS contactor on*.	*DI4*
74.07	LT isolator on feedback	Defines the source from which DI LT Isolator on is acknowledged. For the available selections, see parameter *74.01 ACK SPRS contactor on*.	*DI9*
74.08	Emergency stop select	Defines the source from which DI emergency stop is selected. For the available selections, see parameter *74.01 ACK SPRS contactor on*.	*DIIL*
74.09	Transformer healthy select	Defines the source from which DI feed back transformer healthy is selected. For the available selections, see parameter *74.01 ACK SPRS contactor on*.	*Not selected*
74.11	Fault reset	Defines the source from which DI reset for SPRS is selected. For the available selections, see parameter *74.01 ACK SPRS contactor on*.	*Not selected*
74.12	ACK HT breaker select	Defines the source from which DI HT breaker on is acknowledged. For the available selections, see parameter *74.01 ACK SPRS contactor on*.	*Not selected*
74.13	Over current relay	Defines the source from which DI over current relay input is selected. For the available selections, see parameter *74.01 ACK SPRS contactor on*.	*Not selected*
74.14	Speed increase	Defines the source from which DI speed increase for SPRS is selected. For the available selections, see parameter *74.01 ACK SPRS contactor on*.	*Not selected*
74.15	Speed decrease	Defines the source from which DI speed decrease for SPRS is selected. For the available selections, see parameter *74.01 ACK SPRS contactor on*.	*Not selected*
74.16	Rotor over voltage select	Defines the source from which DI rotor over voltage for SPRS is selected. For the available selections, see parameter *74.01 ACK SPRS contactor on*.	*Not selected*
74.17	Earth fault select	Defines the source from which DI earth fault for SPRS is selected. For the available selections, see parameter *74.01 ACK SPRS contactor on*.	*Not selected*

No.	Name/Value	Description	Def/ FbEq16/32
74.18	Control zone select	Defines the source from which the DI control zone for SPRS is selected. If DI control zone = 1, the synchronization between inverter output and rotor terminal voltage is enabled. For the available selections, see parameter *74.01 ACK SPRS contactor on*.	*Not selected*
74.19	Application external fault 1	Defines the source from which DI External Fault 1 for SPRS is selected. For the available selections, see parameter *74.01 ACK SPRS contactor on*.	*Selected*
74.20	Application external fault 2	Defines the source from which DI External Fault 2 for SPRS is selected. For the available selections, see parameter *74.01 ACK SPRS contactor on*.	*Selected*
75 SPRS User values		User values for SPRS.	
75.01	Sync delay [sec]	Defines the delay time desired after synchronization to open and close the respective contactors.	0.50
	0.00...100.00s	Delay time.	100 = 1s
75.02	CCR reference add value	Defines the weightage factor added to the CCR reference.	0.0
	-10.0...10.0%	Weightage factor.	10 = 1%
75.11	Rotor overvoltage fault	Enables/disables the Rotor overvoltage fault.	*Disable*
	Disable	Rotor overvoltage fault is disabled.	0
	Enable	Rotor overvoltage fault is enabled.	1
75.12	GRR reference error correction	Enables/disables the GRR reference error correction feature. This should be enabled only when the speed reference from CCR is not matching with the actual feedback due to the non-functional GRR internal contactor logic.	*Disable*
	Disable	GRR reference error correction is disabled.	0
	Enable	GRR reference error correction is enabled.	1
75.14	CCR speed reference after GRR error correction	Shows the difference between CCR speed reference given to the drive and the actual feedback read from either from Tachometer or rotor voltage. This value is added to CCR Speed Reference (*79.03 CCR speed reference*).	0.00
	0.00...100.00%	Difference between CCR speed reference and actual feedback.	1 = 1%
75.25	GRR off delay	Defines delay time for switching off the GRR contactor. The rotor contactor is switched off immediately after the drive takes over from GRR mode to SPRS mode after the delay time is elapsed.	1.00
	0.00...3.00s	Delay time.	100 = 1s
75.26	Tacho fail limit	Defines the limit for AI feedback value, below which the Tacho is considered as failed.	50
	0...100%	Tacho fail limit.	1 = 1%
75.27	Speed ready delay	Defines the delay before the drive is reset and after the drive trips on Speed Less Limit fault, provided speed actual is greater than the value mentioned in parameter *78.02 SPRS min speed %*.	60

No.	Name/Value	Description	Def/ FbEq16/32
	0...1000s	Time delay.	1 = 1s
75.28	MOT POT slope time	Defines the slope time of the motor potentiometer.	100
	0...10000s	Slope time.	1 = 1s
76 SPRS relay outputs		Status information indicated through the relay outputs and the relay operating delays for SPRS.	
76.01	Relay output 1	Selects the drive status indicated through Relay output 1 selection for SPRS. The relay energizes when the status meets the setting.	*SPRS contactor ON*
	Not used	Not used.	0
	SPRS contactor ON	SPRS contactor is ON.	1
	GRR contactor OFF	GRR contactor is OFF.	2
	Sync contactor ON	Synchronizing contactor ON command.	3
	SPRS Ready	SPRS ready to function: Run enable signal is on, no fault.	4
	SPRS Run	SPRS running: Start signal on, Run Enable signal is on, no active fault.	5
	SPRS Trip	SPRS tripped.	6
	HT Iso Trip	Feedback transformer HT isolator trip command.	7
76.02	Relay output 2	Selects the drive status indicated through Relay output 2 selection for SPRS. The relay energizes when the status meets the setting. For the available selections, see parameter *76.01 Relay output 1*.	*GRR contactor OFF*
76.03	Relay output 3	Selects the drive status indicated through Relay output 3 selection for SPRS. The relay energizes when the status meets the setting. For the available selections, see parameter *76.01 Relay output 1*.	*Sync contactor ON*
76.04	Relay output 4	Selects the drive status indicated through Relay output 4 selection for SPRS. The relay energizes when the status meets the setting. For the available selections, see parameter *76.01 Relay output 1*.	*SPRS Ready*
76.05	Relay output 5	Selects the drive status indicated through Relay output 5 selection for SPRS. The relay energizes when the status meets the setting. For the available selections, see parameter *76.01 Relay output 1*.	*SPRS Run*
76.06	DIO output 1	Selects the drive status indicated through Digital output 1 selection for SPRS.	*Not used*
	Not used	Not used	0
	SPRS Ready	SPRS ready to function: Run enable signal is on, no fault.	1
	SPRS Run	SPRS running: Start signal on, Run Enable signal is on, no active fault.	2
	SPRS Trip	SPRS tripped.	3
	Inverter trip	Fault from Inverter control program except SPRS fault.	4

No.	Name/Value	Description	Def/FbEq16/32
76.07	DIO output 2	Selects the drive status indicated through Digital output 2 selection for SPRS. For the available selections, see parameter *76.06 DIO output 1*.	*Not used*
76.08	DIO output 3	Selects the drive status indicated through Digital output 3 selection for SPRS. For the available selections, see parameter *76.06 DIO output 1*.	*SPRS Trip*
76.09	DIO output 4	Selects the drive status indicated through Digital output 4 selection for SPRS. For the available selections, see parameter *76.06 DIO output 1*.	*Not used*

77 Speed and Feedback SEL		Analog inputs for SPRS.	
77.01	Speed reference select	Defines the source from which the speed reference is given to the drive. It can be the voltage input AI1 or current input AI2 or AI3 or AI4.	*AI2 Scaled*
	AI1 Scaled	Analog input AI1 after scaling.	1
	AI2 Scaled	Analog input AI2 after scaling.	2
	AI3 Scaled	Analog input AI3 after scaling.	3
	AI4 Scaled	Analog input AI4 after scaling.	4
	Motor Pot	Activates and selects the mode of the motor potentiometer.	5
77.02	Tacho feedback selection	Defines the source from which the tacho feedback reference is given to the drive. It can be the voltage input AI1 or current input AI2 or AI3 or AI4. **Example:** If, 77.02 Tacho feedback selection = AI3 Scaled, *78.07 Motor nominal speed* = 992, and *09.04 CCR speed reference [%]* = 80%, set 15.35 AI1 scaled at AI1 minimum to 0.000, and 15.36 AI1 scaled at AI1 maximum to 992.000 (*78.07*). Then, the corresponding speed feedback value in 15.27 AI1 scaled value is displayed as 794 rpm [(1- 0.20)*992]. This is the corresponding value of the rotor speed at 80% CCR speed reference. Below table shows tacho feedback values in parameter 15.27 AI scaled value at difference CCR speed reference. {TABLE}	*AI3 Scaled*
	NULL	Tacho feedback selection is not selected.	0
	AI1 Scaled	Analog input AI1 after scaling.	1

Inner table (within 77.02 Description):

78.07 Motor nominal speed	*09.04 CCR speed reference [%]*	Tacho feedback in 15.27 AI scaled value
992 rpm	70%	694.4 rpm
992 rpm	75%	744 rpm
992 rpm	85%	843 rpm
992 rpm	90%	892.8 rpm

No.	Name/Value	Description	Def/ FbEq16/32
	AI2 Scaled	Analog input AI2 after scaling.	2
	AI3 Scaled	Analog input AI3 after scaling.	3
	AI4 Scaled	Analog input AI4 after scaling.	4
	AI5 Scaled	Analog input AI5 after scaling.	5
	Other	Source selection (see *Terms and abbreviations* on page *36*).	-
77.03	Rotor voltage feedback	Defines the source from which the rotor voltage reference is given to the drive. It can be the voltage input AI1 or current input AI2 or AI3 or AI4. **Example:** If, 77.03 Rotor Voltage Feedback = AI2 Scaled value, *78.04 Rotor max voltage* = 2150 V, *09.04 CCR speed reference [%]* = 80%, then adjust 12.29 AI2 scaled at AI2 minimum and 12.30 AI2 scaled at AI2 maximum such that, 12.22 AI2 scaled value is displayed as 430 V [(1-0.80)*2150]. This is in correspondence with the rotor voltage value at 80% CCR Speed Reference. Below table shows the rotor voltage feedback value in parameter 12.22 AI scaled value at different CCR speed reference values. | *78.04 Rotor max voltage*	*09.04 CCR speed reference [%]*	Rotor voltage feedback in 12.22 AI2 scaled value
---	---	---
2150 V	70%	645 V
2150 V	75%	537.5 V
2150 V	85%	322.5 V
2150 V	90	215 V		*AI4 Scaled*
	NULL	Rotor voltage feedback is not selected.	0
	AI1 Scaled	Analog input AI1 after scaling.	1
	AI2 Scaled	Analog input AI2 after scaling.	2
	AI3 Scaled	Analog input AI3 after scaling.	3
	AI4 Scaled	Analog input AI4 after scaling.	4
	AI5 Scaled	Analog input AI5 after scaling.	5
	Other	Source selection (see *Terms and abbreviations* on page *36*).	-
77.04	Sync reference	Defines the source from which the Synchronization reference is given to the drive. It can be the voltage input AI1 or current input AI2 or AI3 or AI4.	*AI1 Scaled*
	NULL	Synchronization reference is not selected.	0
	AI1 Scaled	Analog input AI1 after scaling.	1
	AI2 Scaled	Analog input AI2 after scaling.	2
	AI3 Scaled	Analog input AI3 after scaling.	3
	AI4 Scaled	Analog input AI4 after scaling.	4
	AI5 Scaled	Analog input AI5 after scaling.	5
	Other	Source selection (see *Terms and abbreviations* on page *36*).	-

No.	Name/Value	Description	Def/ FbEq16/32
78 SPRS Limits		Speed limits for SPRS.	
78.01	SPRS max speed %	Defines the maximum speed percentage for SPRS operation. SPRS trips if the speed is beyond this parameter value. The parameter *78.01 SPRS max speed %* along with parameter *78.05 SPRS Max Speed Hysteresis* gives the maximum speed% within which the SPRS system is operated based on the nominal motor speed.	95.0
	20.0...100.0%	SPRS maximum speed.	10 = 1%
78.02	SPRS min speed %	Defines the minimum speed percentage to operate the SPRS. SPRS trips if the speed is below this parameter value. The parameter *78.02 SPRS min speed %* along with parameter *78.06 SPRS Min Speed Hysteresis* gives the minimum speed% within which the SPRS system is operated based on the nominal motor speed.	65.0
	20.0...100.0%	SPRS minimum speed.	10 = 1%
78.03	Rotor over voltage limit	Defines the rotor overvoltage limit to operate the drive in SPRS Mode. This value is the maximum Rotor overvoltage limit at which the drive is operated.	710
	690...1000V	Rotor overvoltage limit.	1 = 1V
78.04	Rotor max voltage	Defines the Rotor maximum Voltage for operation of the drive. This voltage is the rotor maximum voltage at zero speed operation.	3000
	1000...3000V	Rotor maximum voltage.	1 = 1V
78.05	SPRS Max Speed Hysteresis	Defines the maximum Hysteresis value to SPRS Max Speed [%] speed set in parameter *78.01 SPRS max speed %*. This value with SPRS MAX SPEED [%] determines the maximum speed limit in SPRS Mode.	1.00
	0.00...1.00%	SPRS maximum speed hysteresis.	100 = 1%
78.06	SPRS Min Speed Hysteresis	Defines the minimum Hysteresis value to SPRS Min Speed [%] speed set in parameter *78.02 SPRS min speed %*. This value along with SPRS Min Speed [%] determines the minimum speed limit in SPRS Mode.	1.00
	0.00...1.00%	SPRS minimum speed hysteresis.	100 = 1%
78.07	Motor nominal speed	Defines the nominal motor speed. The setting must match the value on the rating plate of the motor. **Note**: This is the value of the Slip Ring Induction Motor at Zero Voltage.	0 rpm
	0...30000rpm	Nominal motor speed.	1 = 1rpm
79 LRS tracking		Tracking of electrode movement in Liquid Resistance Starter (LRS).	
79.01	LRS tracking enable	Enables/disables LRS tracking function.	*Disable*
	Disable	LRS tracking is disabled.	0
	Enable	LRS tracking is enabled.	1

No.	Name/Value	Description	Def/ FbEq16/32
79.02	LRS speed deviation percentage	Defines the minimum difference between *79.03 CCR speed reference* and *79.04 Actual speed feedback* value to activate the LRS tracking function.	4%
	0...100%	LRS activation criteria.	1 = 1%
79.03	CCR speed reference	Shows speed reference from Central Control Room (CCR).	0%
	0...100%	Value in percent.	1 = 1%
79.04	Actual speed feedback	Shows the actual feedback from tachometer or rotor voltage.	0%
	0...100%	Actual speed feedback in percent.	1=1%
79.07	LRS contactor command status	Shows the status of forward or reverse contactor. The contactor is activated automatically based on the difference between CCR Speed reference and actual speed feedback. **Note:** Additional digital output is required to activate forward/reverse contactor. Hence, to activate this function, a separate FIO-01 module needs to be configured in Group 16.	0b0000

Bit	Name	Description
0	Forward command	1 = Forward command is active.
1	Reverse command	1 = Reverse command is active.
2...15	Reserved	

No.	Name/Value	Description	Def/ FbEq16/32
99 Motor data		Motor configuration settings.	
99.03	Motor type	Selects the motor type. For SPRS operation, set the motor type to asynchronous motor.	Asynchronous motor
99.04	Motor control mode	Selects the motor control mode. For SPRS operation, set the parameter to Scalar mode.	DTC
99.06	Motor nominal current	Defines the nominal motor current of the rotor. This setting must match the value on the rating plate of the motor. **Notes:** This parameter cannot be changed while the drive is running.	0.0 A
	0.0...6400.0 A	Nominal motor current of the rotor. The allowable range is $1/6…2 × I_N$ (nominal current) of the drive ($0…2 × I_N$ with scalar control mode).	1 = 1 A
99.07	Motor nominal voltage	Defines the nominal motor voltage supplied to the motor at SPRS minimum operation speed% (*78.02*). This setting must match the value on the rating plate of the motor at SPRS minimum operation speed. Example: If rotor voltage is 2150 V and SPRS minimum operation speed% (*78.02*) is 68%, then set parameter *99.07 Motor nominal voltage* to 688 V [(1 - 0.68) * 2150]. **Note:** This parameter cannot be changed while the drive is running.	0.0 V
	0.0...800.0 V	Nominal voltage of the motor. The allowable range is $1/6…2 × U_N$ (nominal voltage) of the drive. U_N equals the upper bound of the supply voltage range selected by parameter 95.01 Supply voltage.	10 = 1 V

No.	Name/Value	Description	Def/FbEq16/32
99.08	Motor nominal frequency	Defines the nominal motor frequency supplied to the motor at SPRS minimum operation speed%(*78.02*). This setting must match the value on the rating plate of the motor at SPRS minimum operation speed. Example: If nominal frequency on the motor name plate is 50 Hz and SPRS minimum operation speed% is 68% (*78.02*), then set parameter *99.08 Motor nominal frequency* to 16 Hz [(1 - 0.68) * 50]. **Note:** This parameter cannot be changed while the drive is running.	50.00 Hz
	0.00...1000.00 Hz	Nominal motor frequency supplied to the motor at SPRS minimum operation speed%.	10 = 1 Hz
99.09	Motor nominal speed	Defines the nominal motor speed supplied to the motor at SPRS minimum operation speed%(*78.02*). Example: If nominal speed on the motor name plate is 990 rpm and SPRS minimum operation speed%(*78.02*) is 68%, then set parameter *99.09 Motor nominal speed* to 317 rpm [(1 - 0.68) * 990]. **Note:** This parameter cannot be changed while the drive is running.	0 rpm
	0...30000 rpm	Nominal motor speed supplied to the motor at SPRS minimum operation speed%.	1 = 1 rpm

Changed firmware default values for SPRS application

The following default parameter settings of the ACS880 primary control program are changed for SPRS application.

Note: The changed default values does not appear in the Default column and appears only in the Value field. For example, by default, the value of parameter 40.07 Set 1 operation mode is set as On when drive running. See below figure.

No.	Name/Value	Description	Def/ FbEq16/32
40 Process PID set 1		The default values of the following parameters are changed for the SPRS application program.	
40.07	Set 1 PID operation mode	Default value changed from Off to On when driving.	On when drive running
40.15	Set 1 output scaling	Default value changed from 1500.00 to 100.00.	100.00
40.21	Set 1 internal setpoint 1	Default value changed from 0.00 to 50.00.	50.00
40.31	Set 1 deviation inversion	Default value changed from Not Inverted (Fbk - Ref) to Inverted (Fbk - Ref).	Inverted (Fbk - Ref)
40.33	Set 1 integration time	Default value changed from 60.0 to 0.0.	0.0
40.36	Set 1 output min	Default value changed from 0.0 to -100.0.	-100.0
40.37	Set 1 output max	Default value changed from 1500.0 to 100.0.	100.0
40.51	Set 1 trim mode	Default value changed from Off to Direct.	Direct
40.52	Set 1 trim selection	Default value changed from Torque to Speed.	Speed
40.55	Set 1 trim adjust	Default value changed from 1.000 to 0.500.	0.500
40.56	Set 1 trim source	Default value changed from PID ref to PID output.	PID output

6

Fault tracing

Contents of this chapter

This chapter lists the warning and fault messages (including possible causes and corrective actions) which differ from ACS880 primary control program described in *ACS880 primary control program firmware manual* [*3AUA0000085967* (English)].

⚠ **WARNING!** Only qualified electricians are allowed to service the drive. Read the Safety instructions on the first pages of the hardware manual for the single drives, or in the *Safety instructions [3AUA0000102301 (English)]* for the multidrives and multidrives modules before working on the drive.

Indications

◾ Warnings and faults

A warning or fault message on the panel display indicates abnormal drive status. Most of the warnings and faults causes can be identified and corrected using this information. If not, contact your local ABB representative.

Warning messages

Code	Warning	Cause	What to do
D200	GRR contactor not open	GRR contactor failed to switch off.	• Monitor the parameter *74.02 ACK G/LRR contactor on*, the DI assigned to detect feedback from GRR contactor. • Check the circuit connected to the chosen DI for faults.
D202	Tacho feedback fail	Tachometer feedback failed.	• See parameters *77.02 Tacho feedback selection* and *77.04 Rotor voltage feedback*. • Check the connections for the chosen AI for both parameters.
D203	SPRS Ready	SPRS system indication while in GRR mode.	Can safely changeover from GRR to SPRS system without any problems.

Fault messages

Code	Fault	Cause	What to do
64A5	Licensing fault	Running the control program is prevented either because a restrictive license exists, or because a required license is missing.	Record the auxiliary codes of all active licensing faults and contact your product vendor for further instructions.
D100	Emergency stop	Emergency activated.	See parameter *74.08 Emergency stop select* to activate or deactivate the emergency stop with any particular DI.
D101	Max operation speed	Speed actual is beyond the value set in *78.01 SPRS max speed %*.	• Monitor the parameter *09.03 Speed actual [%]*. • Compare it to the Max Speed limit set in parameter *78.01 SPRS max speed %*. • Change the speed reference till the speed actual is below the limit and reset the drive.
D102	Rotor over voltage	Rotor voltage is greater than the value set in parameter *78.03 Rotor over voltage limit*.	• Monitor the parameter *74.16 Rotor over voltage select*, the DI assigned to detect rotor over-voltage fault. • Check the circuit connected to the chosen DI for faults. • Check if value ofparameter *77.03 Rotor voltage feedback* is greater than *78.03 Rotor over voltage limit*. During normal operation, rotor voltage feedback should be less than rotor over voltage limit.
D103	Earth fault	Earth fault relay sensed earth fault in the converter.	See parameter *74.17 Earth fault select*, the DI assigned to detect earth fault. Also check the circuit connected to the chosen DI.
D104	Over current fault	Output current is beyond the trip current limit.	See parameter *74.13 Over current relay*, the DI assigned to detect Over Current Relay pick condition. Also check the circuit connected to the chosen DI.

Code	Fault	Cause	What to do
D105	Min operation speed	Speed actual is below the value set in *78.02 SPRS min speed %*.	Monitor the parameter *09.03 Speed actual [%]*. Increase the speed limit to at least more than one value set in *78.02 SPRS min speed %*. Check if value of parameter *77.03 Rotor voltage feedback* is in correspondence with the CCR Speed Reference(*09.04 CCR speed reference [%]*).
D106	HT Isolator trip	There is no feedback from HT Isolator.	Monitor the parameter *74.06 HT isolator on feedback*. It has designated DI to detect fault in HT Isolator. Check the circuit connected to the chosen DI.
D107	Transformer fault	There is no feedback from Transformer.	Monitor the parameter *74.09 Transformer healthy select*. It is an active low designated DI to detect transformer faults. Check the circuit connected to the chosen DI.
D108	App External fault 1	Externally configured fault for a particular DI.	Monitor the parameter *74.19 Application external fault 1*. It has designated DI to detect fault assigned for this parameter. Check the circuit connected to the chosen DI.
D109	App External fault 2	Externally configured fault for a particular DI.	Monitor the parameter *74.20 Application external fault 2*. It has designated DI to detect fault assigned for this parameter. Check the circuit connected to the chosen DI.
D110	Rotor circuit isolator trip	There is no feedback from LT Isolator.	Monitor the parameter *74.07 LT isolator on feedback*. It has designated DI to detect fault in LT isolator. Check the circuit connected to the chosen DI.
E101	HT Breaker Tripped	There is no feedback from HT Breaker.	Monitor the parameter *74.12 ACK HT breaker select*. It has designated DI to detect fault in HT Breaker. Check the circuit connected to the chosen DI.
E200	SPRS Contactor not close	SPRS contactor failed to switch on.	• Monitor the parameter *74.01 ACK SPRS contactor on*, the DI assigned to detect feedback from SPRS contactor. • Check the circuit connected to the chosen DI for faults

—

Further information

Product and service inquiries

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

Product training

For information on ABB product training, navigate to new.abb.com/service/training.

Providing feedback on ABB Drives manuals

Your comments on our manuals are welcome. Navigate to new.abb.com/drives/manuals-feedback-form.

Document library on the Internet

You can find manuals and other product documents in PDF format on the Internet at abb.com/drives/documents.

ABB

abb.com/drives
abb.com/solar
abb.com/driveSspartners

3AXD50000192854D