



ABB EXCITATION SYSTEMS

UNITROL® 1005

Quick installation guide



Safety instructions

Read and obey the safety instructions in the *User Manual*.

- WARNING!**
- Obey the safety instructions to prevent physical injury or death, or damage to the equipment.
 - Read and make sure that you understand the operating and safety instructions before you operate the unit.
 - If you are not a qualified electrician, do not do electrical installation or maintenance work.
 - Use personal protective equipment, such as, safety shoes and gloves.

Obey these safety precautions before you do work on the system:

- Clearly identify the work location and equipment.
- Disconnect all possible voltage sources. Make sure that connection is not possible. Lock out and tag out.
 - Open the main disconnecting device of the AVR.
 - Disconnect any external power sources from the control circuits before you do work on the control cables.
 - If you have a permanent magnet generator connected to the AVR, disconnect it from the AVR with a safety switch or by other means.
 - After you disconnect the AVR, wait for 5 minutes to let the intermediate circuit capacitors discharge before you continue.
- Protect any other energized parts in the work location against contact.
- Take special precautions when you are near bare conductors.
- Measure that the installation is de-energized.
 - Use a multimeter with an impedance of at least 1 Mohm.
 - Make sure that the voltage between the AVR input power terminals (PWR L1, PWR L2, PWR L3 and PWR L4) and the grounding terminal (PE) is near 0 V.
 - Make sure that the voltage between the AVR output terminals (IE+ and IE-) and the grounding (PE) is near 0 V.
- Install temporary grounding as required by the local regulations.
- Ask for a permit to work from the person in control of the electrical installation work.

Residual danger areas

When the AVR operates,

- The voltage in the power section can be up to 300 V AC and the short-circuit current is very high.
- The voltage in the control cabinet is more than 50 V.

When the AVR is disconnected from power supplies, the large capacitors in the AVR hold a charge for some time. Wait for at least 5 minutes for the capacitors to discharge before you do work on the AVR.

Warning labels are attached to all of the cubicle doors to warn personnel against opening the doors during operation.

If the device is built into a larger system, additional warning labels are attached to the inside of the cubicle doors and to the covers of the power converter modules.

Consider the residual danger areas when you do work on the excitation system:

- Danger from live equipment inside the excitation system, if the protective covers are removed.
- Hazardous voltages from the rotor field winding and the secondary side of the excitation transformer.
- Danger from charged capacitors if a cabinet door is open immediately after the system stops.
- Danger from main and auxiliary voltages when the cabinet doors are open.

Introduction

This document is a quick installation guide for the UNITROL 1005 automatic voltage regulator. Make sure that you read and understand this document before you install or use the product. This document is meant only as a brief guide to the product. For detailed information on the product, refer to the *User Manual*.

Device description

UNITROL 1005 is an automatic voltage regulator (AVR) for synchronous machines up to 80 MVA. The AVR can be used for the excitation of indirectly excited synchronous machines and motors. The AVR can also operate as a reactive power regulator, power factor regulator or field current regulator.

Product package

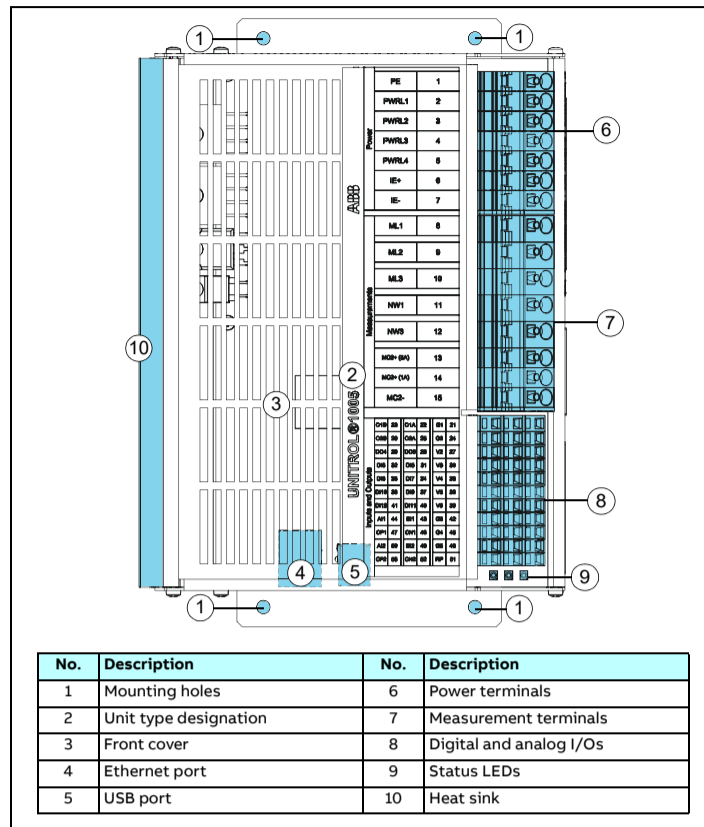
Contents of the product package:

- UNITROL 1005 AVR
- Special red USB cable that is used to power and to connect with the AVR. Keep this USB cable in a safe place.
- Quick installation guide and test certificate

Make sure that all of the listed items are in the product package and that there is no damage to the items.

Hardware overview

Primary parts of the AVR. Refer to the *User Manual* for more information.



Status indicators

Color	Description
Green	Operating status ON: Device controllers are active Flashes: Device software is active
Yellow	Excitation status ON: Excitation is active Flashes: A limiter is active
Red	Alarm status ON: An alarm or a trip is active Flashes: • Startup failure • Parameter download failure • Excitation output is blocked

Mechanical installation

For detailed information on mechanical installation, refer to the *User Manual*.

Install the AVR in an indoor area that is dry and dust-free, and that does not contain volatile gases, acid fumes or similar hazards.

Examine the installation area and refer to technical data to make sure that:

- The maximum ambient temperature is in the permitted range.
- The vibration is limited and within the permitted class.
- The ingress protection and pollution degree are suitable.
- The EMC environment is suitable.

Installation requirements:

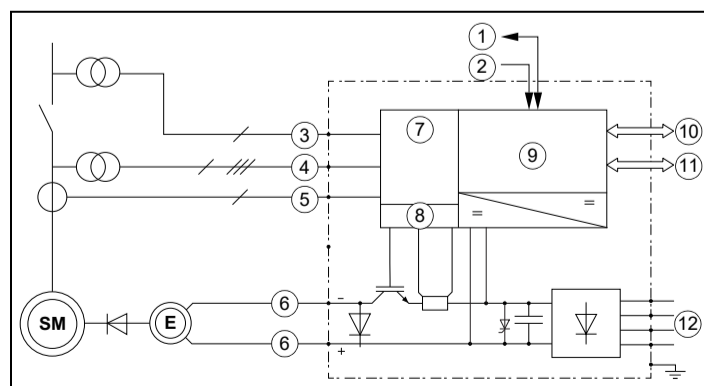
- Free space requirements:
 - 10 mm on the terminal side of the AVR
 - 30 mm on the other sides of the AVR
- Make sure that there is sufficient cooling air flow around the AVR.
- Make sure that other devices do not blow hot air on to the AVR.
- The AVR is designed to be installed with suitable hardware to an installation plate.
- Make sure that the frame of the AVR is electrically grounded (PE) to the installation plate with a grounding wire ($\geq 4 \text{ mm}^2$) through a mounting hole. Use toothed washers to get a good electrical ground contact.

Installation procedure:

- Refer to Dimensions for the mounting hole dimensions.
- Make the appropriate holes in the installation plate.
- Attach the AVR to the installation plate with suitable hardware, for example, M6 screws to a torque of 10 Nm. The mounting holes have a diameter of 6.5 mm.
- Make sure that there is a good electrical ground connection between the installation plate and the AVR. The installation plate must be electrically grounded (PE).

Electrical installation

For detailed information on electrical installation, refer to the *User Manual*.



No.	Description	No.	Description
1	Digital inputs and outputs Max. cable length 30 m	7	Measurement and control unit (DSP)
2	Analog inputs Max. cable length 30 m	8	Power electronic control (PWM)
3	Network voltage measurement U_{NET}	9	Communication MCU
4	Machine voltage measurement U_M	10	USB connection Max. cable length 3 m
5	Machine current measurement I_{M2}	11	Ethernet connection Max. cable length 100 m
6	Excitation output I_e & U_e	12	Excitation Power Supply input PWR L1-L4

CAUTION! Separate control (I/O) cables from the excitation (power and measurement) cables to avoid electromagnetic interference.

Cable dimension requirements:

Connection type	Cross-section area requirement	
Excitation cables Terminals 1 to 15	0.2 to 4 mm ²	AWG 24 to AWG 10
Control cables (I/O) Terminals 21 to 53	0.2 to 2.5 mm ²	AWG 24 to AWG 12

Grounding

Connect the AVR to the protective earth at terminal 1 with a 4 mm² grounding wire.

Make an additional grounding connection through the mounting holes to the installation plate (if it is connected to the protective earth) or with a 4 mm² cable to the protective earth.

Make sure that the grounding connections are as short as possible.

Additional signal ground terminals are provided for the control cables.

Inrush current limitation

The large internal DC capacitor of the AVR can cause a high inrush current especially with a strong voltage source.

WARNING! To prevent damage to the AVR, make sure that the inrush current is not more than 100 A for 10 ms.

To prevent damage to the AVR from a high inrush current:

Method	Description
Shunt supply	The excitation power is taken from the generator output over a shunt transformer. Use an excitation supply transformer with a maximum power of 3 kVA.
PMG supply	The excitation power is taken from a permanent magnet generator (PMG). The maximum permitted output power of the PMG is 3 kVA.
Auxiliary windings	The excitation power is taken from an additional stator winding of the generator.
DC battery	The excitation power is taken from a battery. Limit the inrush current with a resistor.

To calculate the inrush current, you can use a capacitor voltage of 0 V at startup. The external resistor for a 200 V AC input is typically 1.5 Ω .

Power and measurement terminals

Terminals	Type	Ref.	Label	Description
PE 1	Power terminals	1	PE	Protective earth
PWR L1 2		2	PWR L1	Input power L1
PWR L2 3		3	PWR L2	Input power L2
PWR L3 4		4	PWR L3	Input power L3
PWR L4 5		5	PWR L4	Input power L4
IE+ 6		6	IE +	Excitation current +
IE- 7		7	IE -	Excitation current -
ML1 8	Measurement terminals	8	ML1	Machine voltage L1
ML2 9		9	ML2	Machine voltage L2
ML3 10		10	ML3	Machine voltage L3
NW1 11		11	NW1	Network voltage L1
NW3 12		12	NW3	Network voltage L3
MC2+ (5A) 13		13	MC2+ (5A)	Machine current 5A+
MC2+ (1A) 14		14	MC2+ (1A)	Machine current 1A+
MC2- 15		15	MC2-	Machine current -

Commissioning

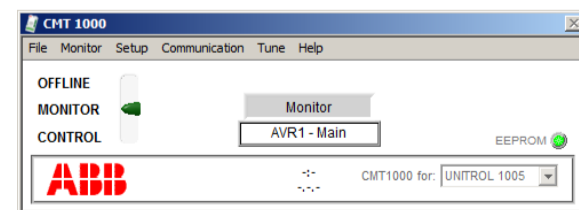
For detailed instructions on commissioning, refer to the *User Manual*.

Commissioning procedure overview:

- Make sure that all of the connections are correct and safe.
- Download the configuration file to the AVR. Make sure that the parameters are correct.
- Examine the digital and analog I/Os in standstill.
- Do tests with the machine:
 - Standstill
 - Measure resistance of exciter stator winding.
 - No load condition
 - Increase the speed of the machine to nominal.
 - Start excitation in Manual mode and increase the manual setpoint until machine voltage is 50%.
 - Use CMT 1000 to verify the AVR measurements and compare them with other equipment used, such as protection devices.
 - Increase the setpoint until the machine voltage is 100% and tune the AVR with the AVR tuning assistant.
 - Do step response tests to examine performance in Manual mode and Auto mode.
 - Machine connected to grid
 - Select AUTO (voltage regulator).
 - Increase the AUTO setpoint to verify the polarity of the of I_M measurement. Q must increase.
 - Do step response tests to examine performance in Auto mode and direct VAR regulator modes.
- Finalizing commissioning
 - Save the parameters on the AVR and verify the status with CMT 1000.
 - Save backup files for project documentation.

WARNING! To prevent unstable regulation and damage to the machine, do tests for all used regulator modes and limiters.

CMT 1000 commissioning and maintenance tool



You can set the parameters of the AVR with the CMT 1000 commissioning and maintenance tool PC application for Microsoft Windows. CMT 1000 connects to the AVR through the USB port or Ethernet port. An Ethernet connection permits access to the AVR from remote locations. For more information on CMT 1000, refer to the *User Manual*.

Operation

The AVR is controlled by analog and digital I/Os. You can also use control signals by remote access over MODBUS.

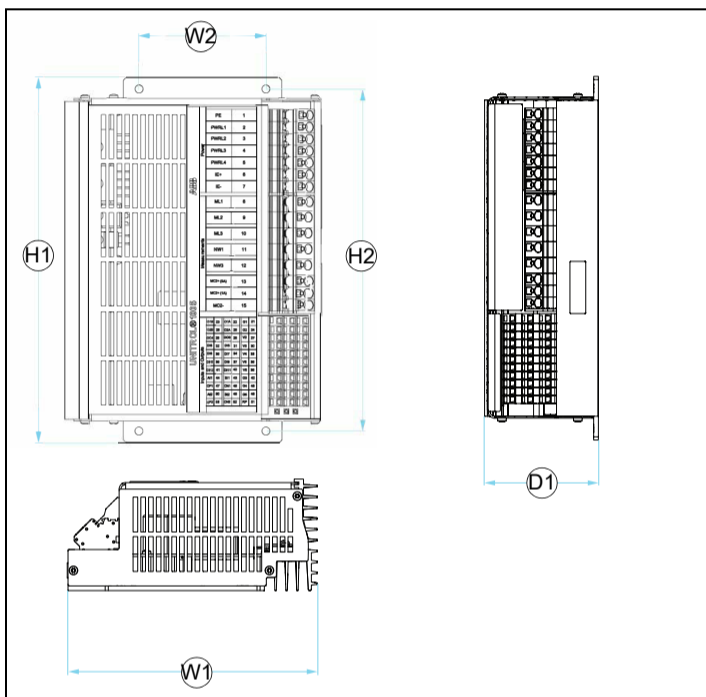
Use CMT 1000 only to set parameters and operation and not as an operator interface.

For detailed information on operation, refer to the *User Manual*.

Technical data

UNITROL 1005	
Ingress protection	IP20
Power electronic output	
AC nominal input voltage	16 to 250 V AC
Frequency	25 to 600 Hz
DC nominal input voltage	18 to 300 V DC
Maximum peak input voltage (non-sinusoidal)	420 V _p
Minimum required start voltage	6 V AC / 16 V DC
Auxiliary supply for controller only	
DC nominal input voltage	18 to 30 V DC
Excitation output	
Continuous current at 55 °C	8 A DC
Overload current for 10 seconds at 55 °C	16 A DC
Exciter current measurements	
Full range	0 to 25 A
Accuracy / Resolution	< 1% / < 20 mA
Machine and net measurements	
Machine voltage, 1-, 2-, or 3-phase	Up to 500 V AC
Machine current, 1-phase	1 to 5 A AC
Network voltage, 1-phase	Up to 500 V AC
Frequency range	10 to 150 Hz
Accuracy (-40 °C to 70 °C / at 25 °C)	±1% / 0.1%
Voltage regulation	
AVR response time (3-phase / 1-phase measurement)	< 20 ms / < 50 ms
PWM limitation	0.5 to 99%
Digital inputs and outputs	
Number of digital inputs and outputs input only / in or out / output only	8 / 0 / 4
Digital I/O voltage	24 V
Analog inputs and outputs	
Number of analog inputs / outputs	2 / 0
Analog I/O range	±10 V / 0...20 mA
Communication interfaces	
Ethernet (cable length < 100 m)	10 / 100 MBit/s
USB version (use the supplied red USB cable only)	1.0, 1.1, 2.0
CAN (cable length < 3 m)	Not supported

Dimensions



Dimensions and weights

D1		W1		W2		H1		H2		Weight	
mm	in	mm	in	mm	in	mm	in	mm	in	kg	lb
72	2.8	161	6.3	80	3.1	230	9.0	215	8.5	1.5	3.3

Device connections

Terminal	Signal	Circuit
1 = PE	Protective earth	
2 = PWR L1 3 = PWR L2 4 = PWR L3 5 = PWR L4	Power electronics and control supply U _{PWR} • Main L1 • Main L2 • Main L3 • Main L4 Note: To get a 6 V AC start level, use L1 and L2.	Absolute max. values 16...300 V AC 16...300 V AC 16...300 V DC
6 = IE+ 7 = IE-	Excitation current output I _e • Exciter current + • Exciter current -	External 0 to 300 V DC 5 A
8 = ML1 9 = ML2 10 = ML3	Machine voltage three-phase U _M • Machine L1 • Machine L2 • Machine L3	External max. 500 V / 0.2 VA
13, 14 = MC2+ 15 = MC2-	Machine current single-phase I _{M2} • Machine current + • Machine current -	External max. 500 V / 0.2 VA
8 = ML1 10 = ML3	Machine voltage single-phase U _M • Main L1 • Main L3	External max. 500 V / 0.2 VA
8 = ML1 9 = ML2 10 = ML3	Machine voltage three-phase with ground U _M • Machine L1 • Machine L2 • Machine L3 1) You must ground PT & CTs.	External max. 500 V / 0.2 VA
11 = NW1 12 = NW3	Line voltage measurement single-phase U _{NET} • Network L1 • Network L3 1) You must ground PT & CTs.	External max. 500 V / 0.2 VA
22 = OA1 23 = OB1 25 = OA2 26 = OB2	Digital output, potential free • Digital output 1, collector • Digital output 1, emitter • Digital output 2, collector • Digital output 2, emitter	External max. 50 mA
27, 30, 33, 36, 39 = Vn	24 V supply for external contacts • 24 V DC output (max. 50 mA) • Alternatively supply for internal controller	24V 20...28 V DC max. 50 mA
21, 24, 42, 45, 48 = Gn	Digital ground, connected to PE	
28 = DO3 29 = DO4	Digital output • Digital output 3 • Digital output 4	External Ext Pwr supply 24 V DC max. 200 mA
21 = G1 24 = G2	Digital ground, connected to PE • Digital ground, connected to PE	
31 = DI5 32 = DI6 34 = DI7 35 = DI8 37 = DI9 38 = DI10 40 = DI11 41 = DI12	Digital input • Digital input 5 • Digital input 6 • Digital input 7 • Digital input 8 • Digital input 9 • Digital input 10 • Digital input 11 • Digital input 12	External 20...28 V DC 24V ADC
30 = V3 33 = V4 36 = V5 39 = V6	• 24 V power • 24 V power • 24 V power • 24 V power Note: The 24 V terminals can be used to power the AVR controller.	

Note: The internal 24 V supply (V1 to V6) can be loaded with a maximum of 50 mA by all used digital inputs and outputs. If the load is higher, use an external power supply.

Terminal	Signal	Circuit
44 = AI1 43 = BI1 50 = AI2 49 = BI2	Analog inputs ±10 V DC AIx/BIx Signal bandwidth 100 Hz	External max. ±10 V
51 = RP	+10 V pos Ref	
42, 45, 48 = Gx	GND Positive Reference R = 10 kOhm Input range 0 V to 9.1 V	External 10 V DC
44 = AI1, 43 = BI1 50 = AI2, 49 = BI2	Analog inputs 20 mA AIx/BIx; CPn/CNn Signal bandwidth 100 Hz	External Max. 20 mA
47 = CP1, 46 = CN1 53 = CP2, 52 = CN1	Add bridge between CPx and CNx to enable 20 mA input.	
44 = AI1, 43 = BI1 50 = AI2, 49 = BI2 51 = RP	Analog inputs digitally assigned AIx/BIx Refer to the <i>User Manual</i> Note: If both switches are activated at the same time, none of the digital inputs are activated.	External 10 V DC

Certifications

The applicable certifications are shown on the type label of the device.



CE marking



UKCA marking



DNV.COM/AF



SQS

Related documents

Document	Code
UNITROL® 1005 User Manual (English)	3BHS581681 E81
UNITROL® 1000 Control SW manual (English)	3BHS399489 E02
UNITROL® 1000 Commissioning instructions (English)	3BHS399489 E01
UN1000 Modbus Reference table (English)	3BHS358281 E81
UN1000 Modbus Address Manual (English)	3BHS358281 E80
UN1000 Railway Type Test Summary (English)	3BHS258571 E44
UN1000 Type Test Summary (English)	3BHS258571 E41
Release Notes HW/SW (English)	3BHS355555 E02

Support information

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Internet: <http://www.abb.com/unitrol>

24 h hotline for urgent service inquiries: +41 844 845 845

E-mail contact for questions and support:

unitrol1000.supportline@ch.abb.com

Documentation, software and tools

You can get access to the latest documentation, software and tools for the AVR on the myABB business portal.

To get access:

- Go to <https://myportal.abb.com> in your web browser.
- Select Log In.
 - If you have an ABB account, you can sign in with your email and password.
 - If you do not have an ABB account, refer to How to register to the myABB business portal.
- After you log in, the myABB dashboard opens.
- On the myABB dashboard, find the myExcitation widget. For information on how to register to the myExcitation widget, refer to How to register to the myExcitation widget.
- In the myExcitation widget in the myABB business portal, select GO TO ABB LIBRARY.
- ABB Library opens.
- In the left-hand menu, select Category > ABB products > Power Electronics > UNITROL Excitation Systems > UNITROL 1000 > UNITROL 1005.
- Select your documentation. You can search for documents by categories and by document kind.
- You can also download the documents to your computer.

How to register to the myABB business portal:

- Select Sign up below the LOGIN button.
- Fill in the registration form.
- Select Sign up.
- ABB sends you an email for activation of your ABB account.
- In the email, select ACTIVATE ACCOUNT.
- You now have an access to the myABB business portal.

How to register to the myExcitation widget:

- In the myExcitation widget in the myABB business portal, select GET ACCESS.
- Fill in the registration form.
- After registration, you can get access to UNITROL 1000 series documents and tools on the ABB Library.

