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Senior Design Teams “The Flash” and “Three Phase”

Authored by: William Parker and Jacob Nelson

[ABB UNITROL-1020 EXCITER: START UP GUIDE]

A guide to summarize how to start the exciter (and generator) and use the exciter to power up the generator’s field. This guide will include a brief introduction to the commissioning software and lab procedures for using the system.

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Introduction

This manual covers how to start the BEL Power Lab generator using the VFD and black start system. Instructions to install and operate the UNITROL-1020 AVR interface software, CMT1000 are included, however the generator can be excited using just the lack start hardware . For a complete guide on the UNITROL-1020 and CMT1000 software please refer to the ABB User’s Manual for the UNITROL-1020. For a complete guide on the VFD please refer to the VFD’s user manual.

Section 1: CMT-1000 Software

CMT1000 is an open license software that is provided by ABB to commission, operate, and monitor the UNITROL-1020 exciter. This section will cover how to download CMT1000.

CMT1000 has also been pre-installed on the model power system computer. This computer requires a University of Idaho login and has an Ethernet connection available for use with the exciter.

1.1 Downloading

For an in-depth guide on installing CMT1000 please view the ABB User Manual section 6.4.3.

With internet access CMT1000 can be installed from the following link:

<http://domino.de.abb.com/unitrol1000>

Once the webpage has loaded it will ask for a username and password. The username for our access is “1000_USER” and the password is “UN1k”. The password IS capitol sensitive.

After logging in select:

By Products > UN1010/1020 > SW Releases > Release 6 > CMT1000 > CMT 1000 Software V 6.201

Figure 1 shows the page after following the first 5 steps from above with the described link highlighted.

Note: Other useful manuals and software for the Unitrol-1020 exciter can be found under UN1010/1020 from figure 1.

Under UN1010/1020 > Tools, there is a digital copy of the physical CD (named UN1010/20 E-Learning CD) that can be found in the lab. There is also a PID tuning tool.

Under UN1010/1020 > Manuals > Release 6 > UN1020, there can be found a copy of the ABB User’s Manual for the Unitrol-1020.

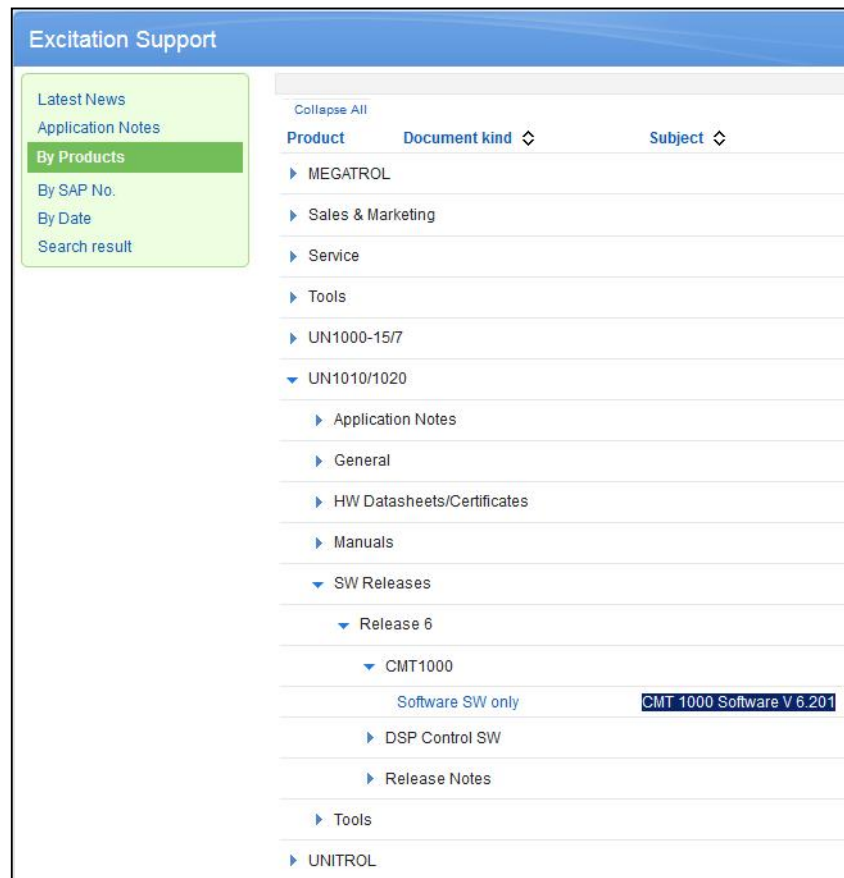


Figure 1: ABB Web Archives

1.2 Running CMT1000

There are two primary methods that CMT1000 uses to communicate with the exciter, either by USB or Ethernet. Both methods of communication are the same with the exception that USB can provide power to the EEPROM. This allows the operator to change set points or perform firmware updates without having to power on the exciter.

Before CMT1000 will communicate with the exciter, the connection type must be specified by the user. This is done by opening CMT1000, the communication tab, and then selecting “Port Configuration” (as shown in figure 2).

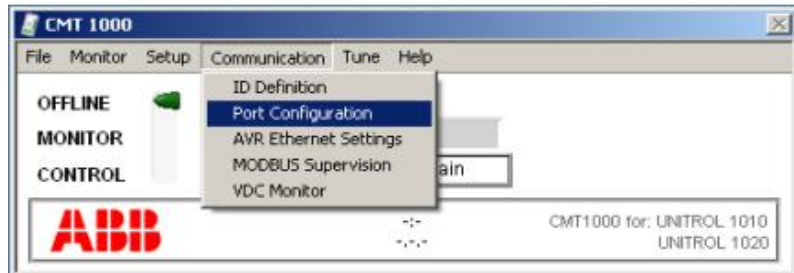


Figure 2: CMT1000 Menu Window

For further information, detailed Steps, or in the event of an error, please refer to sections 6.4.4.1 and 6.4.4.2 of the ABB User’s Manual.

1.2.1 Exciter Modes

The CMT1000 software functionality is affected by the mode selected. Each mode allows varying levels of interaction with the exciter.

Offline: CMT1000 is unused, no information is being sent to the exciter and only connection information is being retrieved. The exciter can only be configured from local control mode.

Monitor: CMT1000 will retrieve system measurements from the Unitrol-1020. In this mode an operator can view all system measurements and utilize CMT1000’s built in oscilloscope and other features. CMT1000, however, can only observe and not change the Unitrol-1020.

Control: CMT1000 has full access. Information is being sent and retrieved from the exciter on a regular basis. This is the only mode in which CMT1000 can change the Unitrol-1020.

1.2.2 USB

Before connecting to the exciter using the USB the USBDriverInstall (can be downloaded from the same place as CMT1000) should be run to properly configure the USB ports of the computer.

After the USB ports have been configured open the serial tab in the port configuration window (discussed in section 1.2) and select COM4. Press ok and the exciter should be connected to the CMT1000 software.

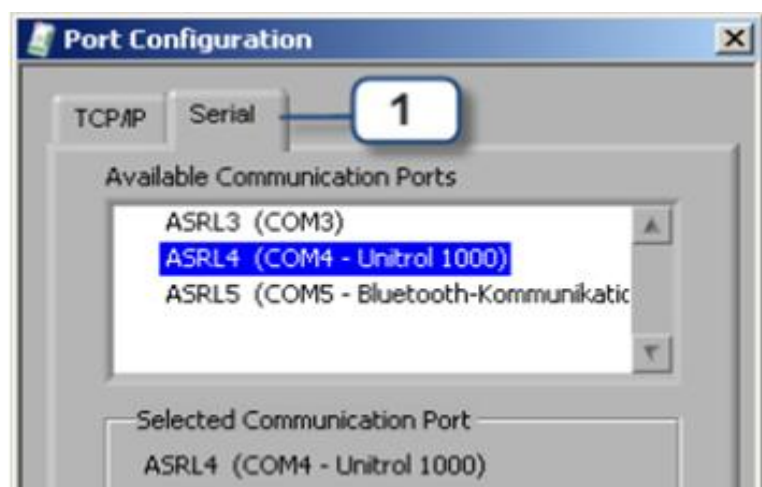


Figure 3: Connecting via USB

1.2.3 Ethernet

To connect to the exciter via Ethernet open the TCP/IP tab in the port configuration window (discussed in section 2.2) and select the desired connected AVR's. For use of the MODBUS insert the remote IP address and press enter (more detailed instructions can be found in the second part of section 6.4.4.1 of the ABB user manual).

1.2.4 Control modes

The exciter has two operation modes, Local and Remote. Remote mode will take control of the unit after 1 minute of inactivity in local mode. The operator can cycle between the two modes by pressing the REM/LOC button on the exciter. The current mode is shown in the upper left of the HMI display.

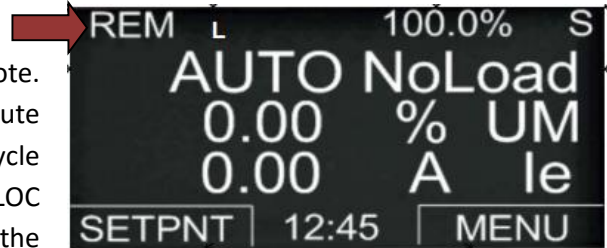


Figure 4: Front Panel HMI Display

Remote (REM): Front panel of the physical exciter has no write access rights, only indications.

Local (LOC): Front panel of the physical exciter has full write access, blocks CMT and field bus remote access.

Section 2: Startup Procedures

2.1 Connections

The following diagram demonstrates the connection of the exciter to the VFD and Generator.

- Utility is provided from the ship to shore plug that will be discussed in section 3.2 of this manual
- PWR L1, L2, and L3 respectively connects to A, B, and C phases of the generator interface panel
- AUX 1 and AUX 2 are connected
- IE+ and IE- respectively connects to F1 and F2 on the generator interface panel
- MC2+ and MC2- is a current transformer (polar end facing the load) measuring generator output

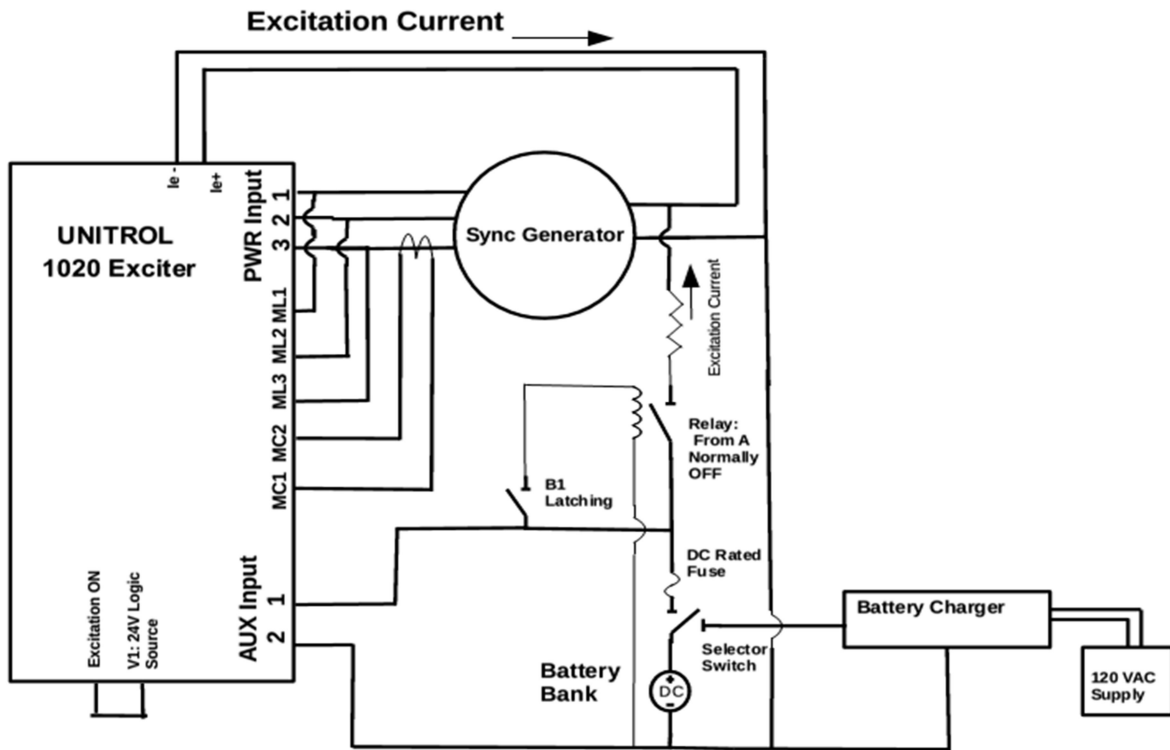


Figure 5 System Connection Diagram

1.3 Power on System

- ❖ **ALWAYS CHECK CONNECTIONS AND CONFIRM ROTOR IS FREE OF OBSTRUCTIONS BEFORE ENERGIZING THE SYSTEM.**

To power up the VFD and exciter, the panels must be energized in the following order.

- Turn on main power supply, box 0 (figure 6)
- Rout power to ship to shore plug, box 1 (figure 6)
- Turn on Ship to shore plug (figure 7)

Note: The main power supply switch is locked with a padlock. Please see lab supervisor for the key. The switch should **always** be locked when not in use.

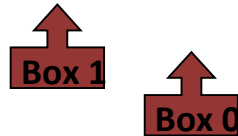


Figure 5: Main power and routing switches

Once the switch on the ship to shore plug has been switched to the "ON" position, the VFD and Unitrol-1020 will both be energized and ready to operate.

1.3.1 VFD Startup

The VFD has been pre-configured and will ramp the generator up to rated speed as soon as the operator presses the green "start" button on its front panel. To stop (ramp down) the VFD the red "stop" button can be pressed.

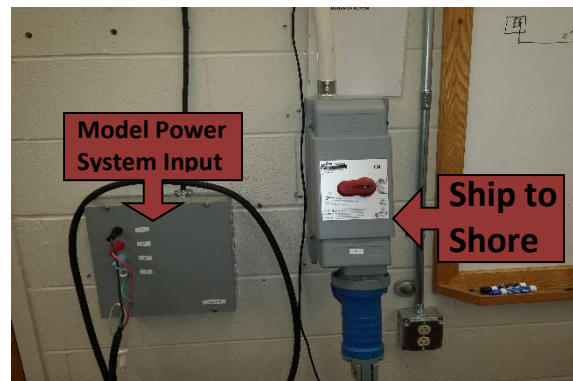


Figure 6: Ship to Shore Plug

1.3.2 Exciter Startup

The UNITROL-1020 and black start system are used to excite the synchronous generator. Once the VFD is turned on and the rotor is spinning at synchronous speed, proceed with the generator excitation procedure:

1. Turn selector switch to "System On" position - *Connects the battery to AUX power supply on AVR control system*
2. Press "Flash Field" button - *Turns on relay connecting batteries to field windings of the generator*
3. Wait for UNITROL 1020 AVR to ramp up field current using machine output power – UNITROL 1020 excitation on DIO bit is tied to logic 1, so excitation starts automatically.
4. Release flash "Flash Field" - *Disconnects Batteries from generator field windings*
5. AVR controls excitation in steady state operation

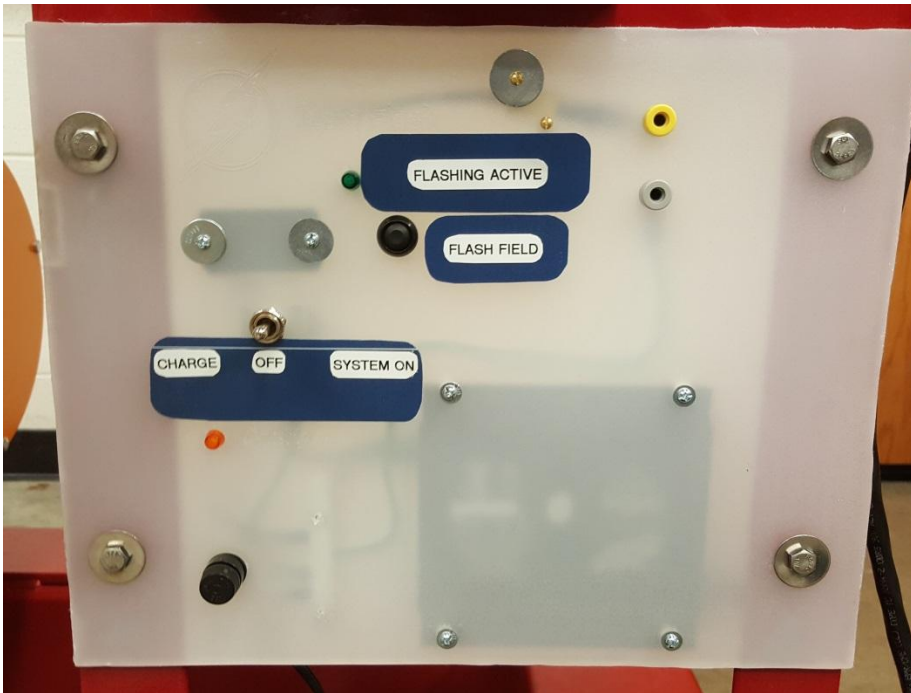


Figure 7 Black Start System Interface

Note: The UNITROL 1020 soft start has been configured so that the exciter will only begin to operate after the generator has reached rated speed even if digital I/O is enabled.

Section 3: Shutdown

To power off the system first bring any load applied to the generator to a minimum. Next press the stop button on the VFD. Once the generator has stopped spinning, turn the selector switch back to the “charge” position to maintain battery charge. Turn off the power and routing boxes in the reverse order of turning them on, lock the main power switch once it has been shut off.