Klaus Honscheid
Shane Smith
Ohio State University

HV Enable and Controls Box

(http://www-physics.mps.ohio-state.edu/~klaus/LST/HV/hvenable.pdf)

A total of 21 HV power supplies will be used for the BaBar LST detector once it is complete in 2005. Three HV Enable and Controls boxes – one per rack – provide the interface between the HV supplies and the BaBar detector control system. Only one HV Enable and Controls box is needed for Run V.

Overview

A photograph of the HV Enable and Controls box is shown in Figure 1.

The following five signals are used by the unit

- Ext Enable
  Each HV power supply has an Ext. Enable input that has to be set before the supply can be turned on.
- Goto V0
  Each HV power supply has an input that can be used by the (internal) firmware to ramp the output voltages to a preset value (V_0).
- At V0
  Each HV power supply has an output that is set when all four output voltages are at or below the preset V_0 voltages.
- Ramping
  Each HV power supply has an output that is set when at least one of the HV segments is ramping. This signal is controlled by the firmware and can - if so desired – be converted to an “At V1” signal.
- Trip
  Each HV power supply has an output that is set when a trip (sometimes called a spike trip) is detected by the controller FPGA (this is not set when a (software) channel trip is detected).

For each signal the box provides a daisy chain input, inputs or outputs to control the local HV supplies and a daisy chain output. LEDs are used to indicate the

status of each signal. With one HV Enable and Controls box per rack the daisy-chain logic can be used to connect signals from all 21 HV power supplies.

Input and Output Standards

The signals for daisy-chaining are all opto-isolated.
The daisy-chain inputs of the HV Enable and Controls box uses +5 V (with a 330 Ω resistor in series) connected to the central contact of the front-panel LEMO receptacles with the outer shell providing the ground/return connection. An input signal is set when the input terminals are shorted or at low resistance (when driven by a photo transistor in an opto-coupler device). An input can be set with a 50 Ω LEMO-terminator.

The daisy-chain outputs are directly connected to the photo transistor with the collector going to the central contact. An inactive output is marked by high resistance. The resistance drops to ~200 Ω when the output is set. As is typical for opto-isolated signals the outputs do not source any current.

The local “Ext Enable” and “Goto V0” outputs are configured to provide +5V and sufficient current to drive the inputs of up to 7 HV supplies. The local inputs are matched to the standards used by the HV power supplies.

Operations

The “Ext. Enable” signal is required before any HV power supply can be turned on. The “Ext. Enable” inputs of the power supplies in a rack are connected to the “Local Ext. Enable Output” of the HV Enable and Controls box using a BNC cable and BNC T-connectors. The state of this signal can be controlled locally with a front-panel switch or remotely with a signal from the BaBar detector control system connected to the daisy chain input. The daisy-chain output for the “Ext. Enable” signal is connected directly to the input and is not affected by the state of the local Ext. Enable on/off switch. Reminder: the daisy-chain input can also be set with a 50 Ω LEMO terminator plugged into the input connector.

The “Goto V0” signal can be used by the BaBar detector control system to request a change in output voltage. This can be useful to quickly ramp to a safe voltage during injection. The “Goto V0” inputs of the power supplies in a rack are connected to the “Local Goto V0 Output” of the HV Enable and Controls box using a BNC cable and BNC T-connectors. The state of this signal can be controlled locally with a front-panel switch or remotely with a signal from the BaBar detector control system connected to the daisy chain input. The daisy-chain output for the “Goto V0” signal is connected directly to the input and is not affected by the state of the local Goto V0 on/off switch. Reminder: the daisy-chain input can also be set with a 50 Ω LEMO terminator plugged into the input connector.

The “At V0” signal can be used to inform the BaBar detector control system that the system is in a safe state and that injection can proceed. The (daisy-chain) “At V0” output is set when ALL of the 7 local inputs and the daisy-chain input are set. If less than 7 HV power supplies are used in a rack this channel can be disabled with a front-panel switch. The LED indicator will be on when the input channel is set or when the channel is disabled. For the first HV Enable and Controls box in the chain the daisy-chain input needs to be set with a 50 Ω terminator.

The “Ramping” signal can be used to inform the BaBar detector control system that the system is changing output voltage(s). The (daisy-chain) “Ramping” output is set when at least one of the 7 local inputs and or the daisy-chain input is set. The local on/off switches are not useful in this mode of operation. The mode of operation of this part of the HV Enable and Controls box can be modified by changing the position of a jumper inside the box (see appendix). The default position of the jumper configures the “OR” logic as described above. If the jumper is moved to the other position the logic if configured as an “AND” as described for the “At V0” signal. This could be used to implement an “At V1” signal should this become useful. In the “AND” mode and if less than 7 HV power supplies are used in a rack a channel can be disabled with a front-panel switch. The LED indicator will be on when the input channel is set or when the channel is disabled. For the first HV Enable and Controls box in the chain the daisy-chain input needs to be set with a 50 Ω terminator.

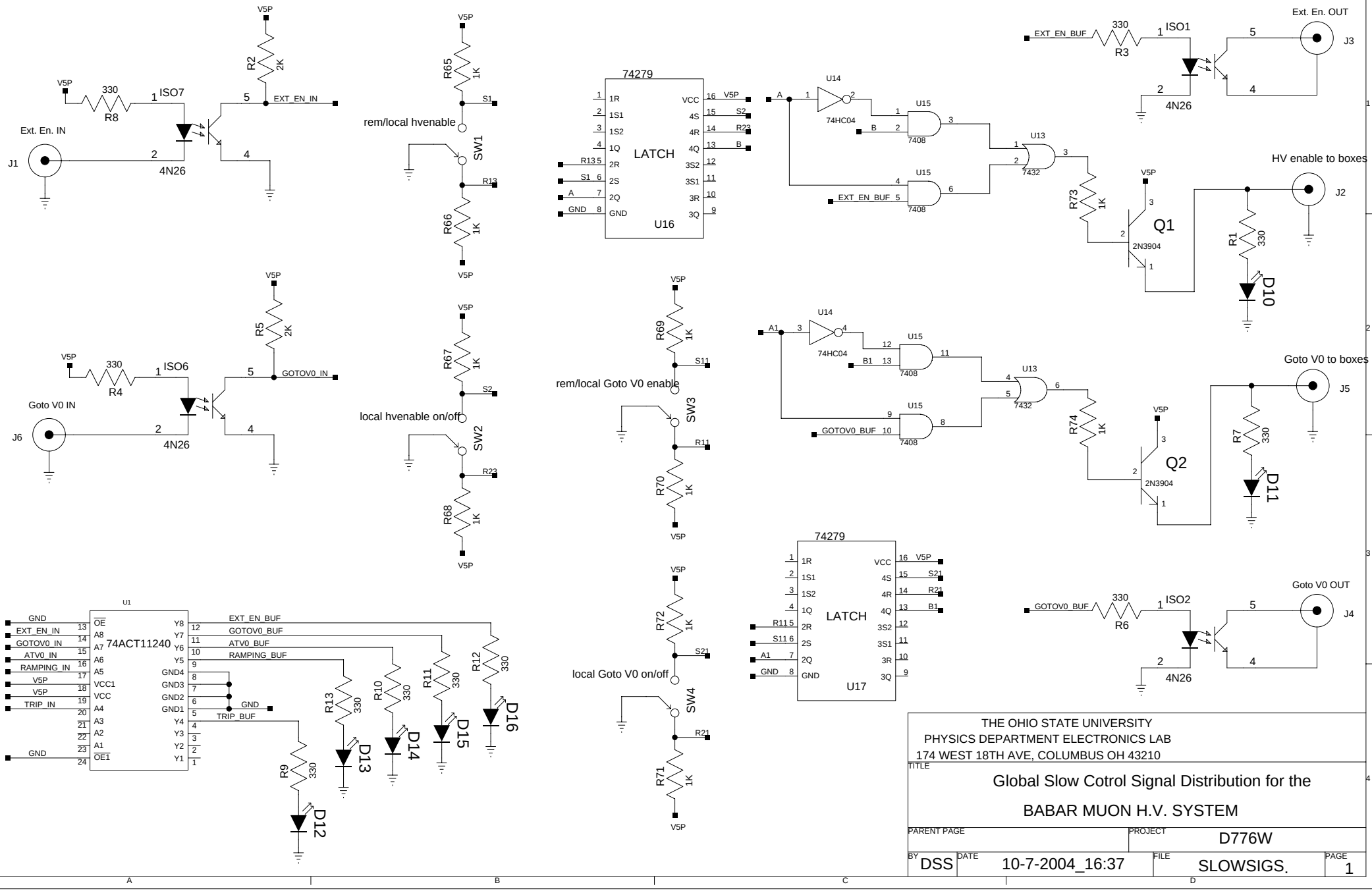
The “Trip” signal can be used to inform the BaBar detector control system that the HV system has tripped. As mentioned above this covers only trips detected by the (power supply) hardware and this excludes so called brick trips and software channel trips. The “Trip” output is set when at least one of the 7 local inputs and or the daisy-chain input is set. The front panel switches are included for a future extension.

Appendix

1. Jumper settings
   The HV Enable and Controls box includes one jumper to change the behavior of the “RAMPING” inputs. In it’s default configuration which is shown in the layout picture, all inputs are or’ed meaning that the output is active if at least one of the inputs (including the daisy chain input) is set. If the jumper is moved to the over position, the inputs are and’ed meaning that the output is set only if all inputs including the daisy chain input are set.

2. Schematics

3. Layout

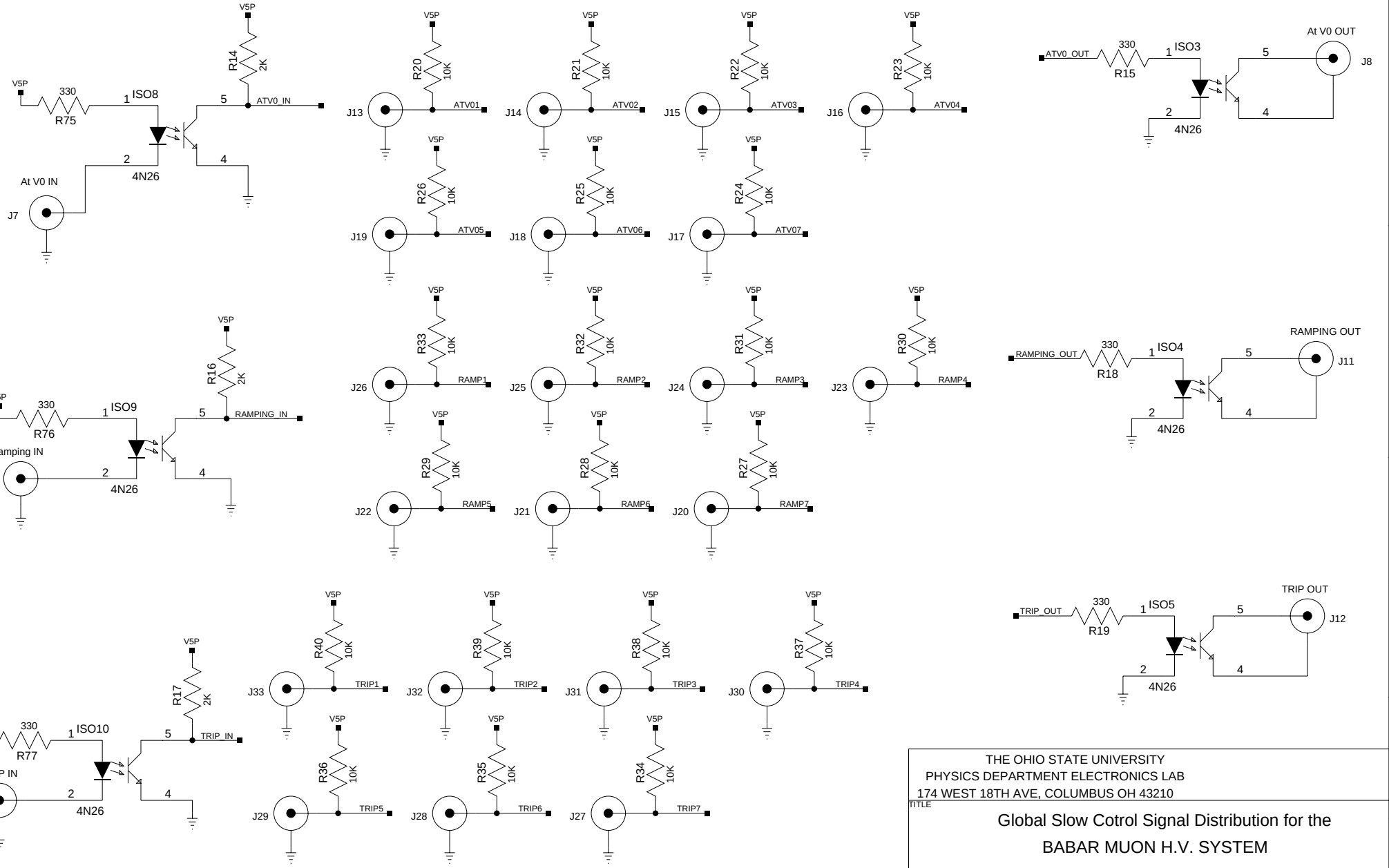


THE OHIO STATE UNIVERSITY
PHYSICS DEPARTMENT ELECTRONICS LAB
174 WEST 18TH AVE, COLUMBUS OH 43210

TITLE

Global Slow Cotrol Signal Distribution for the BABAR MUON H.V. SYSTEM

PARENT PAGE		PROJECT	D776W	
BY DSS	DATE 10-7-2004_16:37	FILE SLOWSIGS.		PAGE 1



THE OHIO STATE UNIVERSITY
PHYSICS DEPARTMENT ELECTRONICS LAB
174 WEST 18TH AVE, COLUMBUS OH 43210

TITLE

Global Slow Cotrol Signal Distribution for the BABAR MUON H.V. SYSTEM

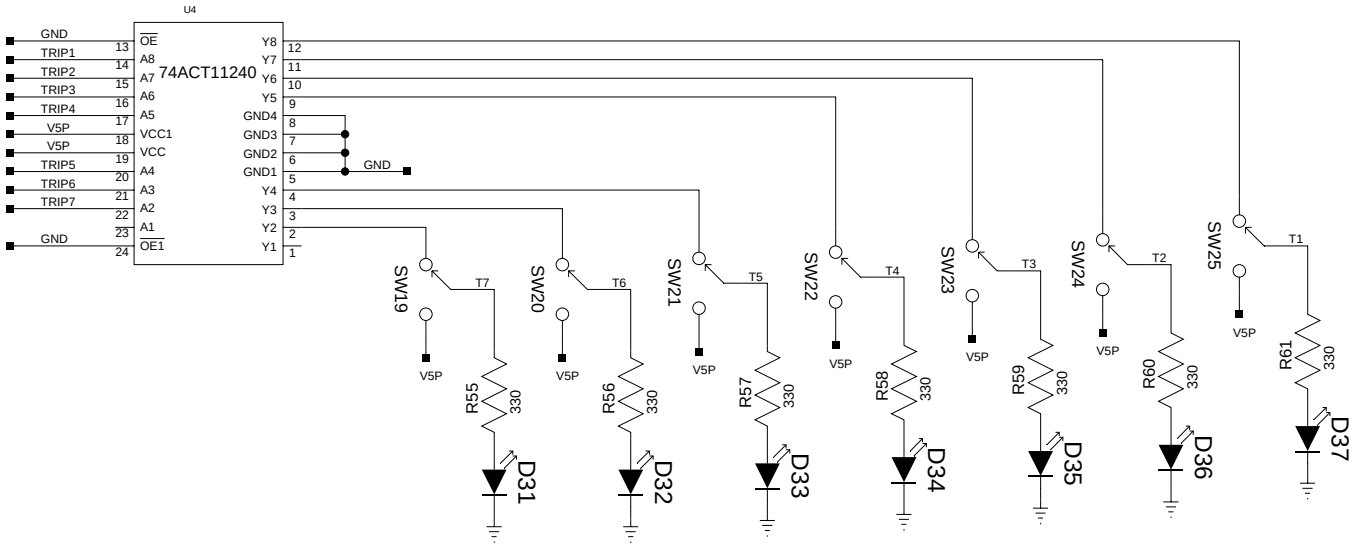
PARENT PAGE		PROJECT	D776W	
BY DSS	DATE 10-7-2004_15:01	FILE SLOWSIGS.		PAGE 2

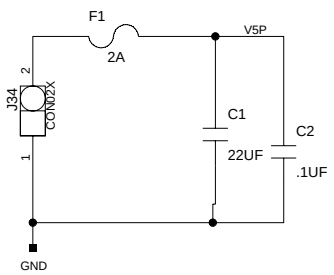
THE OHIO STATE UNIVERSITY
PHYSICS DEPARTMENT ELECTRONICS LAB
174 WEST 18TH AVE, COLUMBUS OH 43210

TITLE: Global Slow Cotrol Signal Distribution for the BABAR MUON H.V. SYSTEM

PARENT PAGE	PROJECT	
	D776W	

BY	DATE	FILE	PAGE
DSS	10-6-2004_9:39	SLOWSIGS.	3



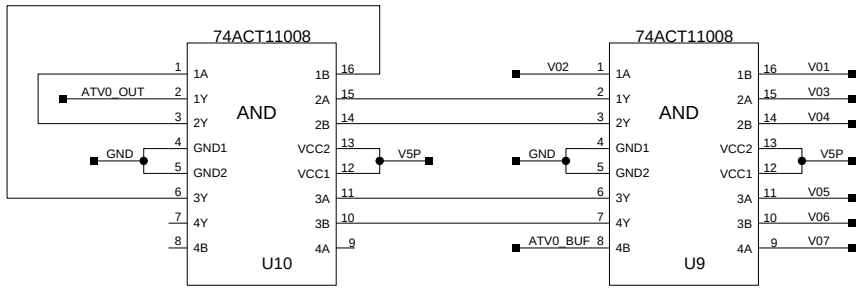


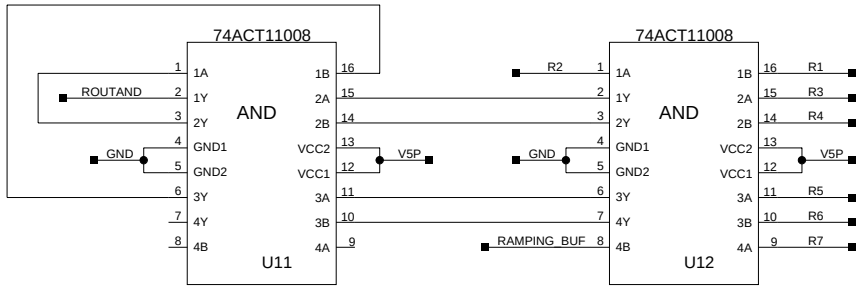
THE OHIO STATE UNIVERSITY
PHYSICS DEPARTMENT ELECTRONICS LAB
174 WEST 18TH AVE, COLUMBUS OH 43210

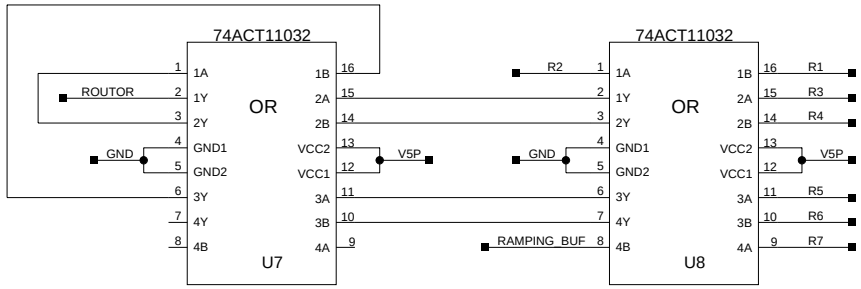
TITLE: Global Slow Cotrol Signal Distribution for the BABAR MUON H.V. SYSTEM

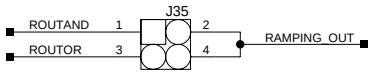
PARENT PAGE	PROJECT	
	D776W	

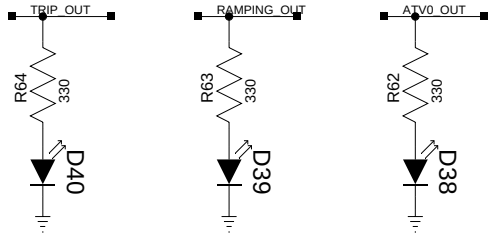
BY	DATE	FILE	PAGE
DSS	10-6-2004_9:39	SLOWSIGS.	4

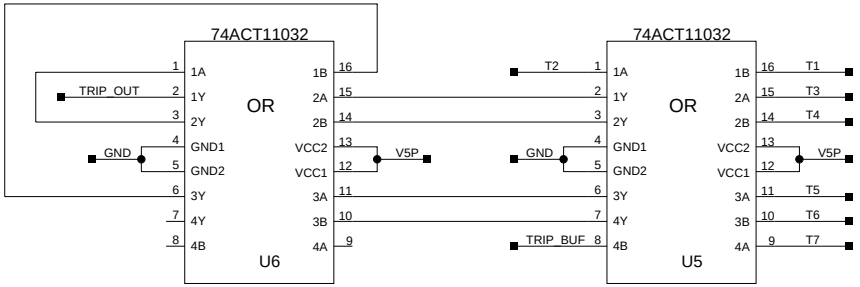










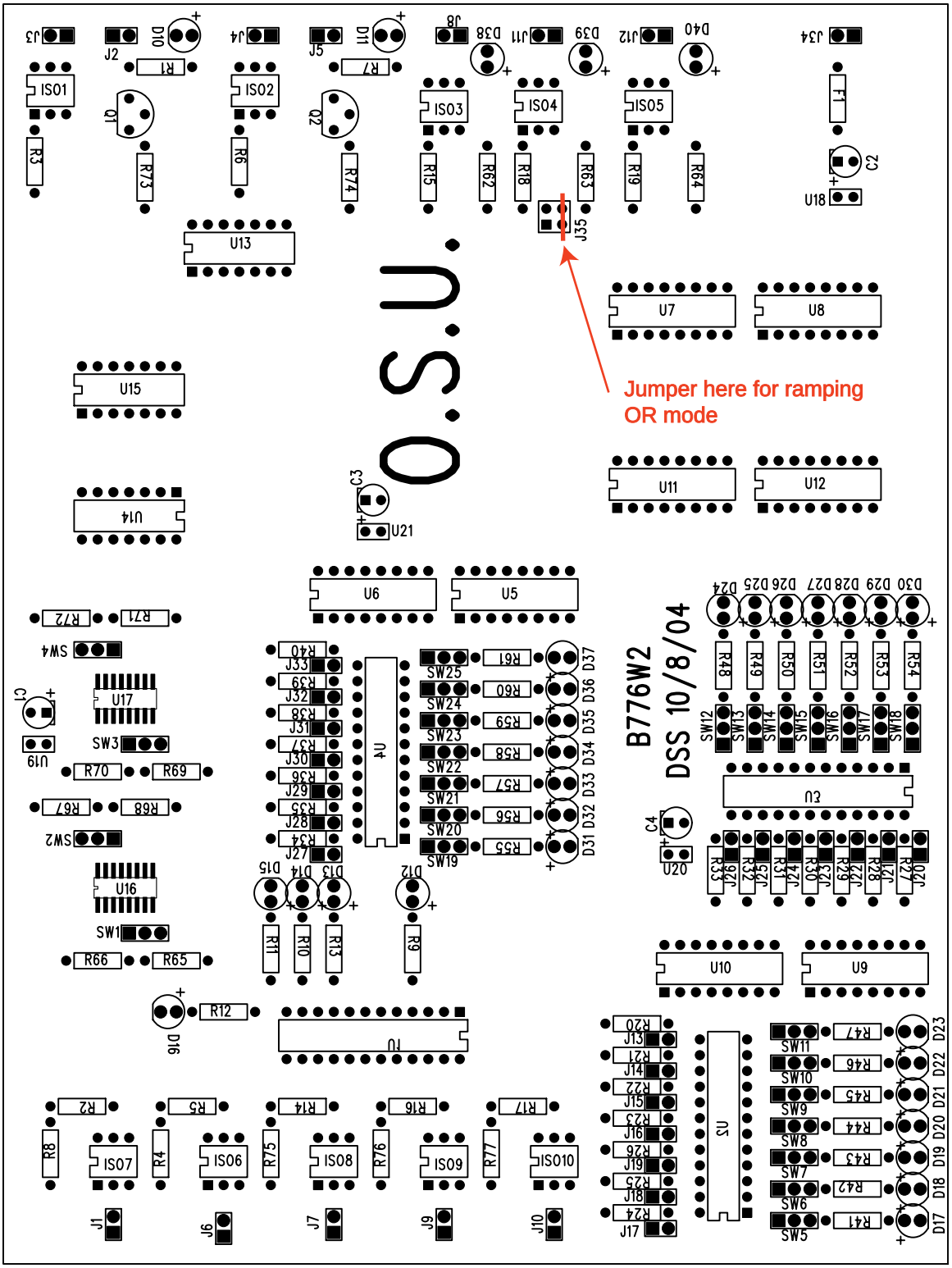


THE OHIO STATE UNIVERSITY
PHYSICS DEPARTMENT ELECTRONICS LAB
174 WEST 18TH AVE, COLUMBUS OH 43210

TITLE

Global Slow Cotrol Signal Distribution for the BABAR MUON H.V. SYSTEM

PARENT PAGE		PROJECT	D776W	
BY DSS	DATE 10-7-2004_17:51	FILE SLOWSIGS.		PAGE 5


O.S.U.
B776W2
DSS 10/8/04
Jumper here for ramping
OR mode