The logic box mounts in a rack in USA15 and is connected by twisted pair “ethernet” style cables to 64 comparator boards which are at the PP2 locations inside the ATLAS detector. There are 32 comparator boards on the “A” side of the detector and 32 on the “C” side of the detector.

Front panel controls and indicators:

For each compare board:

The front panel has 2 rows of LEDs and switches corresponding to the “A” and “C” side comparator boards. Each of the 32 detector sectors has an endcap section indicated by an “E” and a barrel section indicated by a “B”. Just above the “E” or “B” is a recessed slide switch which can be moved by a small screwdriver or similar tool, but not by fingers or accidentally.

In the switch down position, the corresponding input from the comparator board is disabled. In the switch up position the corresponding input is enabled.
Each compare board section has 3 LEDs above the switch. The top, red LED indicates a potential alarm condition. This can be caused by either the compare board not being plugged in, the compare board not being powered, or more than some number of thermistors being above the temperature threshold set on the comparator board. As shipped from IU 2 thermistors above the temperature threshold will contribute an alarm condition from a compare board section. This number of thermistors above temperature threshold is set by a socketed resistor.

The middle, yellow LED indicates the position of the slide switch. If the switch is in the down, disable position the yellow LED will be on. If the switch is in the up, enable position, the yellow LED will be off.

The bottom, green LED indicates whether the associated comparator board section is contributing to an alarm condition. If the green LED is on, the section is not contributing to an alarm condition. If the yellow LED is on, the green LED will also be on regardless of the state of the red LED.

Note that it is possible for all 3 LEDs to be on. For example, if the switch is down (disable), and no compare board is plugged in, the red LED indicates a potential alarm condition, the yellow LED indicates a disabled section, and the green LED indicates the section is not contributing to an alarm condition (since it is disabled).

If the switch is up, the yellow LED is always off, and either the red or green LED will be on, but not both.

If the yellow and green LEDs are on, but the red LED is off, it is safe to enable that section by moving the switch up.

Common to entire box:

There are 2 sets of 4 auxiliary inputs. Each set of auxiliary inputs (“A” and “B”) has an enable/disable switch and 3 LEDs which function in the same manner as the compare board switches and LEDs.

The endcap (“EC”) and barrel (“BR”) alarm conditions can be enabled or disabled by slide switches and the status is shown on 3 LEDs.

A flashing red LED indicates an ALARM condition. This is the OR of the 4 possible alarm conditions above.

If the logic box is not DISABLEd, an ALARM condition will cause a KILL after a delay. This delay time is set by a resistor; as shipped from IU this delay time is 1 minute. A flashing red LED indicates the KILL condition.

If it is not desired for an ALARM condition to cause a KILL, the logic box can be disabled. Pushing the button causes a temporary disable. The time is set by a resistor; as shipped from IU this time is 5 minutes. This delay is retriggerable; pushing the button
again before the time is finished extends the time for another 5 minutes. If a much longer time is desired, or an “permanent” disable, the slide switch can be set to the down position. In either case, a flashing red LED indicates the DISABLE condition.

When recovering from a KILL, or when first bringing the logic box into service, or after a power outage it will be necessary to DISABLE the logic box and reset the RELAY in order for the Maratons and High Voltage for the TRT to be turned on.

A KILL condition causes the RELAY to latch. Three sets of relay contacts are available on the back panel. The RELAY remains latched regardless of the state of the KILL. Once the KILL condition is turned off, either by removing the source of the ALARM or by going to DISABLE, the latched RELAY can be reset by pushing the button. A flashing red LED indicates the state of the RELAY.

There are two buttons associated with the internal ELMBs which provide information about the logic box internal signals to the Detector Control System software. MR asserts the ELMB Master Reset input signal when pushed. PWR interrupts the power supplies for the ELMBs when pushed.

**Back panel connectors:**

There are two rows of RJ45 style connectors for the cabling from the comparator boards. These are labeled as “A” and “C” corresponding to the two sides of the ATLAS detector and from 1 to 32 corresponding to the detector sectors. The labels correspond to the labels on the front panel switches and LEDs.

The two sets of four AUXiliary inputs come in on LEMO connectors. These connectors are not grounded to the logic box chassis in order to eliminate a possible source of ground loop. These inputs require a “HIGH” TTL level in order to be OFF. A “LOW” TTL level or a disconnected input will contribute to a possible ALARM condition.

The ELMBs CAN bus is accessed through a standard DB9P connector. This CAN bus segment is terminated by a 120 ohm socketed resistor on the bottom most receiver board.

Three sets of relay contacts are available on 3 pin terminal blocks. Common, Normally Closed, and Normally open terminals are available.

+12 volts, +5 volts, and Ground are available on a 3 pin terminal block. A TTL compatible control signal could be generated by passing the +5 volts through a set of relay contacts (for example).

A rack mounted LED stack and audible alarm can be connected to the 8 pin terminal block.

A power entry block will accept either 120 or 220 volt AC mains. There is a power switch and a fuse. This fuse is 1 amp as shipped from IU.
**Internal switches and resistors:**

All user changeable switches and resistors are on the top board and can be accessed by removing the box cover.

Towards the top left are 2 sets of quad DIP switches. Moving the switch to the “ON” position (towards the front panel) enables the corresponding AUX input and allows it to contribute to an ALARM condition. A red LED indicates a contribution to the ALARM condition.

There are 3 INPUT THRESHOLD setting resistors. The UNPLUG threshold resistor is 1000 ohms as shipped from IU and should not be changed. This threshold detects if no comparator board is connected to the logic box inputs.
The EC and BR MULT threshold resistors are 1000 ohms (corresponding to 2 thermistors over temperature threshold) as shipped from IU. Useful values are:

<table>
<thead>
<tr>
<th># of thermistors over temperature</th>
<th>Mult threshold resistor value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>698 ohms</td>
</tr>
<tr>
<td>2</td>
<td>1.00 K ohms</td>
</tr>
<tr>
<td>3</td>
<td>1.24 K ohms</td>
</tr>
<tr>
<td>4</td>
<td>1.43 K ohms</td>
</tr>
</tbody>
</table>

There are 4 MULTIPLICITY THRESHOLD resistors. The AUX A and AUX B resistors set the number of AUX inputs indicating a fault required to initiate an ALARM condition. As shipped from IU these resistors are 1.69 K (corresponding to one AUX input). The EC_BRDS and BR_BRDS resistors are 1.00 K as shipped from IU (corresponding to 2 comparator boards with a multiplicity of EC or BR thermistors over temperature). Useful values are:

<table>
<thead>
<tr>
<th>Multiplicity Threshold</th>
<th>Mult threshold resistor value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.69 K ohms</td>
</tr>
<tr>
<td>2</td>
<td>1.00 K ohms</td>
</tr>
<tr>
<td>3</td>
<td>698 ohms</td>
</tr>
<tr>
<td>4</td>
<td>549 ohms</td>
</tr>
</tbody>
</table>

On the far right side of the board are two delay setting resistors. The KILL delay is set at IU to ~1 minute; the resistor value varies slightly between logic boxes, but is approximately 620K. The delay is approximately proportional to the resistor value, but should be experimentally determined if a different delay time is desired. The PB DISABLE delay is set at IU to ~5 minutes; the resistor value is 1 MegOhm. The delay is approximately proportional to the resistor value, but should be experimentally determined if a different delay time is desired.