

AutomA / SmartmA Theory

AutomA is an automatic exposure control system that employs Z axis tube current modulation and is available on all GE LightSpeed scanners. A noise index parameter allows you to select the amount of x-ray noise that will be present in the reconstructed images.

Using a single patient scout exposure, the last scout taken, the CT system computes the required mA to be used based on the selected noise index setting. The noise index value will approximately equal the standard deviation in the central region of the image when a uniform phantom (with the patient's attenuation characteristics) is scanned and reconstructed using the standard reconstruction algorithm.

AutomA will use the last scout taken to compute the required mA. The lowest dose will be computed from an AP scout. You may use PA or Lateral, but they will raise the computed dose.

AutomA Off

The screenshot shows the 'mA Control' window with the following elements:

- Auto mA**: A yellow button that is currently selected.
- Reference Noise Index**: A field containing '2.80' and a 'Reset' button.
- Dose Steps**: A field containing '+5.71' with up/down arrow controls.
- Noise Index**: A field containing '2.00'.
- Smart mA**: A yellow button.
- mA Range**: Fields for 'Min' (10) and 'Max' (560).
- Manual mA**: A blue button that is highlighted with a yellow box.
- mA Value**: A field containing '180', also highlighted with a yellow box.
- OK** and **Cancel**: Buttons at the bottom.

Annotations with arrows point to the 'Manual mA' button and the '180' value field, with the text: 'Select [Manual mA] to set a fixed mA value for the scan' and 'Enter the fixed mA value'.

Manual mA will use the same mA for the entire image group

Make sure the Manual mA value in every protocol is set to a reasonable value even if the protocol will use AutomA or SmartmA, just in case AutomA gets turned off.

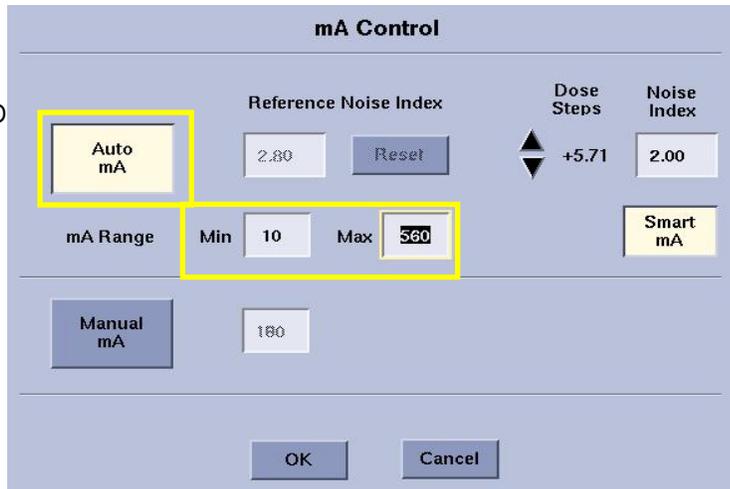
AutomA and SmartmA will be disabled if the patient orientation does not match the orientation of the scout. Once the orientation for the series matches the scout, AutomA and SmartmA can be selected.

AutomA On

AutomA adjust in the Z axis.

Select [Auto mA] to turn it ON

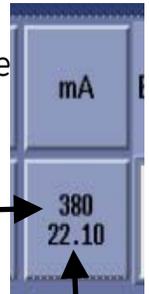
Set the Min and Max values over which AutomA is allowed to modulate.



Click mA to open the mA Control

Max mA value for AutomA

Noise Index value for AutomA



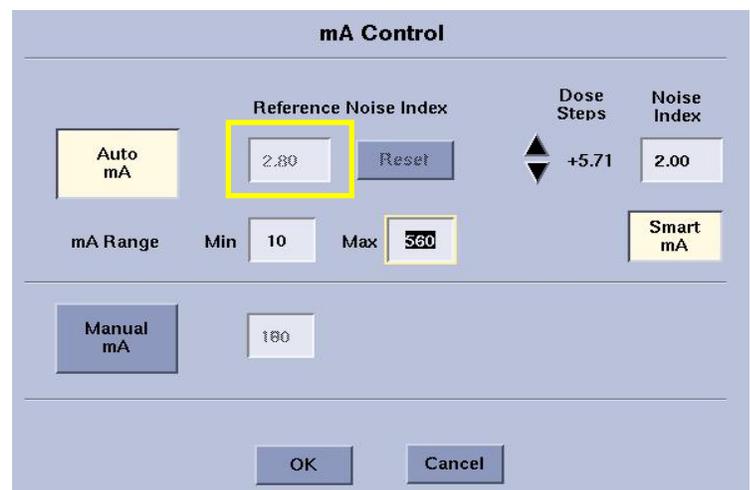
Min/Max mA

The Max mA value sets the clipping mA value. This mA value can also determine the focal spot size. You need to enter the proper mA value for the focal spot size you wish to use.

kV	Performix			Performix Pro		
	Small Focal Spot		Large Focal Spot	Small Focal Spot		Large Focal Spot
	Min mA	Max mA	> mA	Min mA	Max mA	> mA
80	10	300	300	10	300	300
100	10	240	240	10	310	310
120	10	200	200	10	335	335
140	10	170	170	10	335	335

Reference Noise Index

Default or baseline Noise Index for the given protocol. Any changes to Dose Steps, Slice Thickness or Noise index are referenced to this value. This value can only be prescribed while in protocol management.

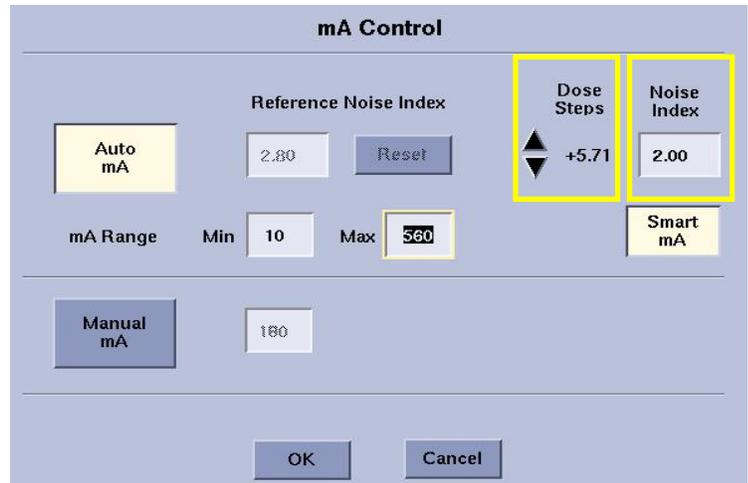


Noise Index (NI)

Default or baseline Noise Index for the given protocol. Any changes to Dose Steps, Slice Thickness or Noise Index are referenced to this value.

Dose Steps

Adjusts NI by steps of 5%. Dose steps can be increased or decreased. Plus values decrease image noise thus increasing required mA. Minus values increase image NI, thus decreasing required mA. A Dose Step value of 0 indicates that the prescribed NI is equal to the Reference NI for the protocol.



The Dose Step arrows increase or decrease the relative dose by 1 relative dose unit

1 relative dose unit is:

- 5% noise index change
- 10% mA change

Example #1

- Dose step decreased by 1
- mA decreased by 10%
- Noise index increased by 5%

Example #2

- Dose step increased by 2
- mA increased by 20%
- Noise index decreased by 10%

Certain patient images may be noisier than your experience suggests. For example, your experience tells you to expect significantly lower noise in thin patients than in obese patients. Since AutomA makes the image noise approximately the same for all patients, you may have to re-learn what to expect. What is most important, is to find the highest noise index that allows you to make a confident diagnosis for the clinical problem since this results in the lowest patient dose.

Reset

Resets the Reference Noise Index to the GE Target Noise Index Default for the anatomical area and slice thickness chosen in the protocol.

Noise Index Increase/Decrease

- As the NI increases the mA decreases. You are allowing increased noise in the image, therefore it will require less mA.
- As the NI decreases the mA increases. You are asking for decreased noise in the image, therefore it will require more mA.

mA Table

The mA Table reports what the mA will be for each scan rotation, based on the factors you have set on the AutomA Control.

These factors are applied to the patient data gathered for the last scout taken (typically AP).

Use the same kV for scanning as used on this Scout

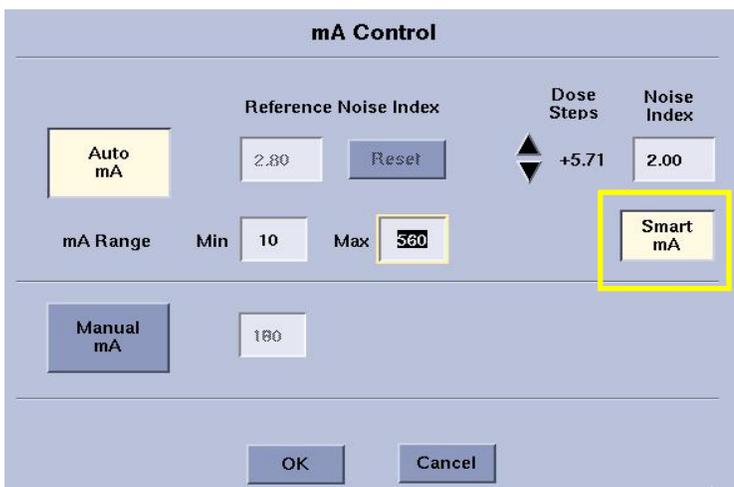
Always check the mA Table before proceeding on to Confirm the Rx.

mA Table Information	
Scan #	mA
1	90
2	102
3	103
4	100
5	80
6	78
7	83
8	118
9	141
10	141
11	122
12	185
13	210
14	214

Ok

AutomA adjust in the Z axis only.

SmartmA On



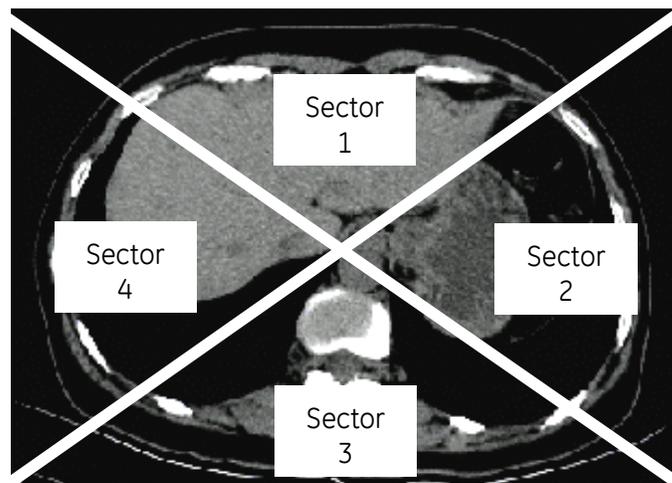
AutomA must be selected first, then SmartmA is available.

Select [SmartmA] to turn it ON



mA Modulation

- Modulates 4 times per rotation
- Modulation ramp is 100 ms



Dose with AutomA

Dose Information			
Images	CTDIvol mGy	DLP mGy·cm	Dose Efficiency %
1-73	5.94	234.94	97.40

Dose with SmartmA

Dose Information			
Images	CTDIvol mGy	DLP mGy·cm	Dose Efficiency %
1-73	5.03	198.60	97.40

AutomA Annotation

```

kV 80
mA 281
Noise Index: 5.0
Small
5.000mm/11.25 0.75:1
Tilt: 0.0
1.0s /HE 17:30:09/18.22
W:100 L:35
    
```

SmartmA Annotation

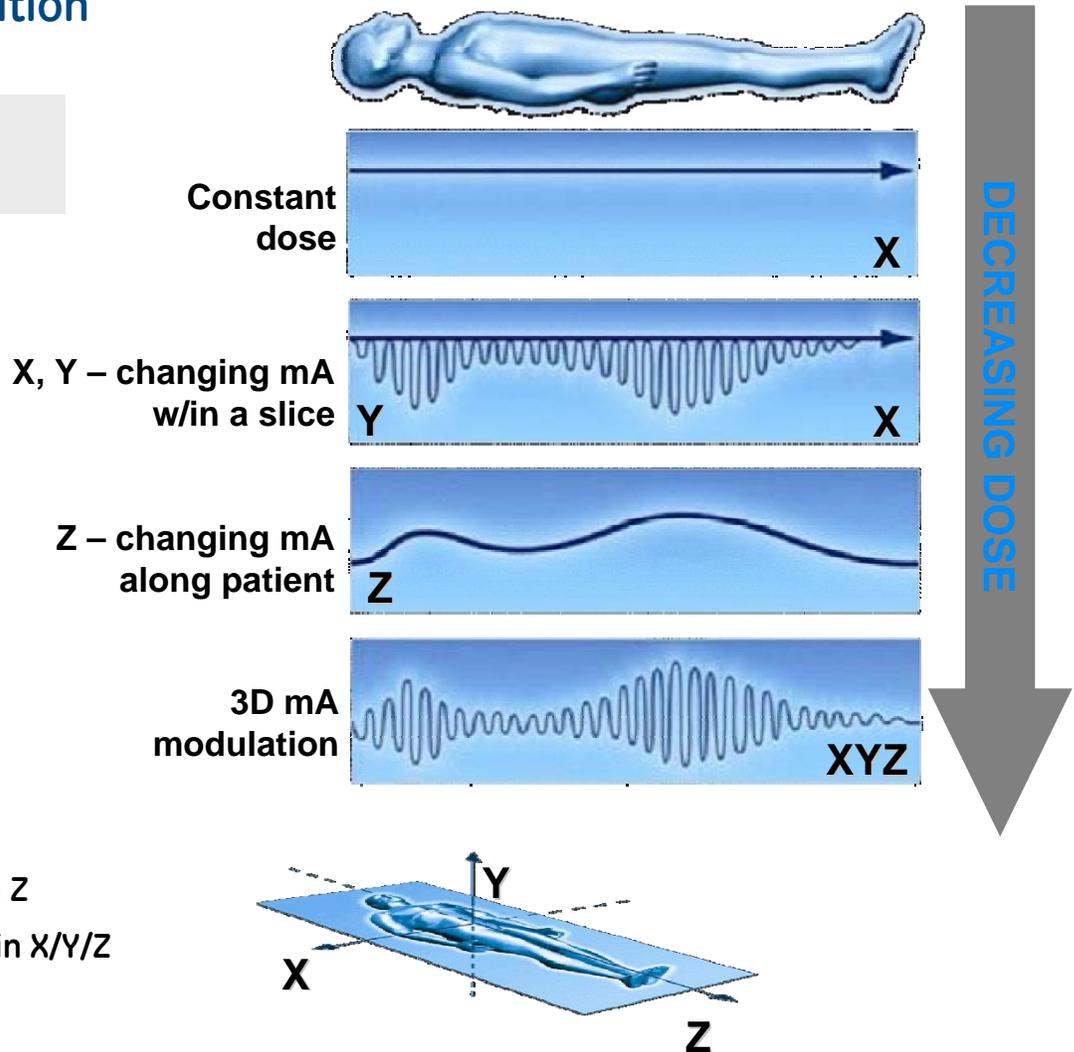
```

kV 80
mA 274
Noise Index: 5.0~
Small
5.000mm/11.25 0.75:1
Tilt: 0.0
1.0s /HE 17:30:43/18.22
W:100 L:35
    
```

A tilde ~ following the NI# indicates that SmartmA was also ON.

3D Dose Modulation

From a Single Scout View



- Auto mA varies mA in Z
- Smart mA varies mA in X/Y/Z

Note: Some radiographers choose not to use SmartmA on dedicated Liver studies due to the need for low contrast detectability in these studies.