The Advancement of Simulator Models in the Age of "Technology"

HOW MICRO TECHNOLOGY HAS MADE POWERPOINT PRESENTATIONS UNINTERESTING WITHOUT "FLARE"

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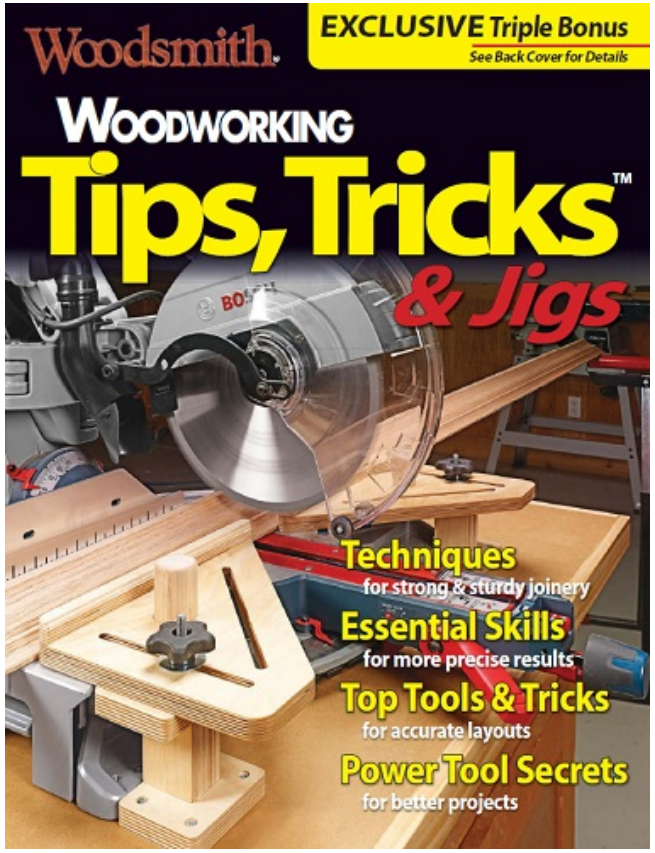
Tips & Tricks



- It's always easier to learn from somebody else's mistakes and successes than it is to learn from our own; the lesson just doesn't last as long.
- The internet is a fickle friend and every harvest does not yield the same fruit.
- In many cases the journey actually isn't as interesting as the destination.

Video Recording in the Simulator

Installed new video cameras and camera control console in simulator booth in 2013

Setup used DVR to DVD burner for recording simulator training and playing back in classroom

Did not work well

- Inconsistent
- Lost footage
- Unclear if footage deleted off DVR (union issue)

Solution

AverMedia Video Game Recorder - ~$100

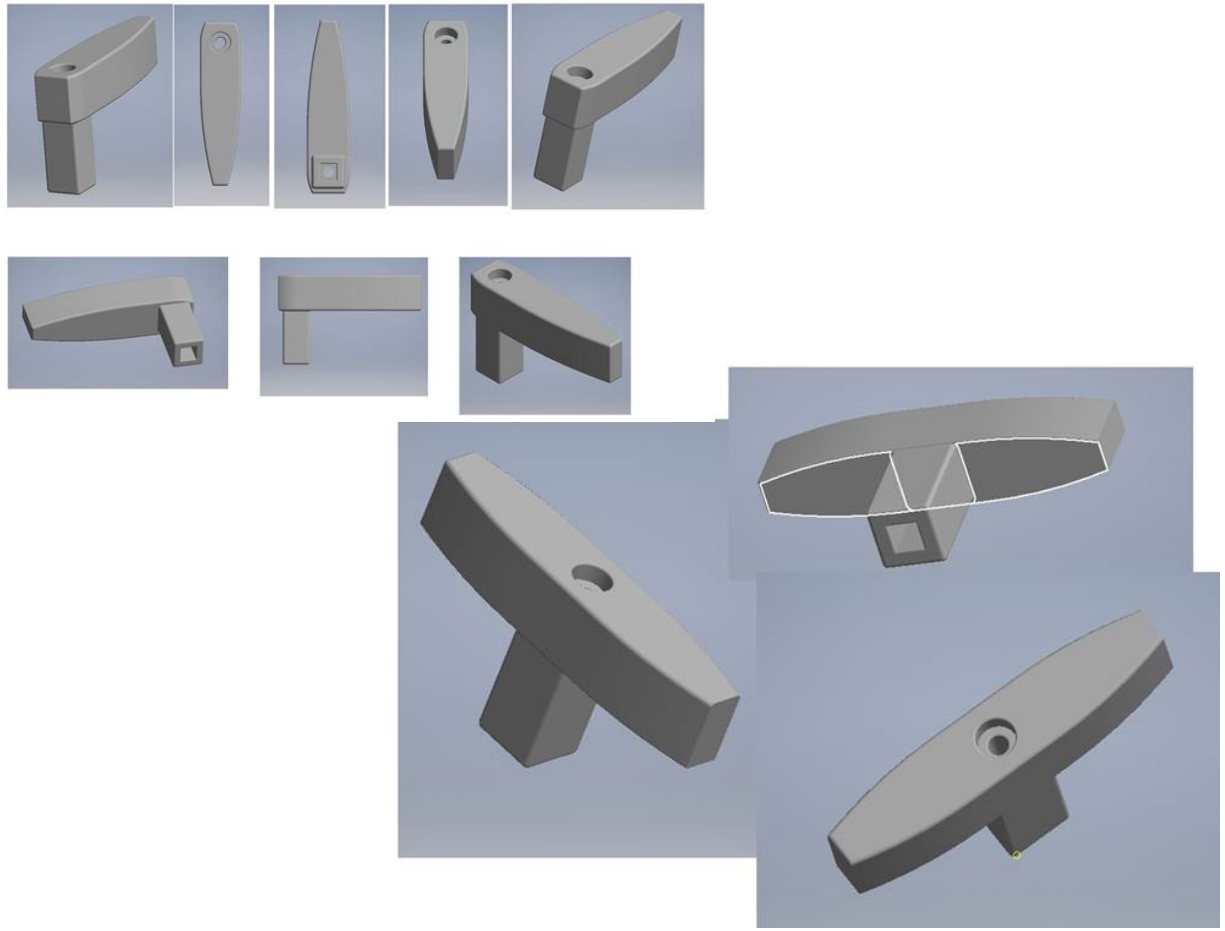
- In-line video recording hardware that records directly to USB. (HDMI in/HDMI out)
- Able to monitor exactly what is being recorded and playback/delete files easily
- Simple interface
- Easily transfer files
- Verify power off for NRC exam security

Safety Related Switch Handles

- Original Equipment safety related switch handles have been breaking for 20 years.
- Traditional solution was to purchase OEM qualified switch handles for $1000 each.
- Resulted in a first-aid case. Blood on the control panel is not good.
- Contingency was…

Safety Related Switch Handles

- New methods and technology allowed for fast prototyping (3D printing) of new design.
- T-Handle modification took 5 minutes to create by using copy-paste feature.
- Subtle modifications to ergonomics, length, texture and size significantly improved design.
- Could not use original material because nobody knew what it was. Some sort of Nylon.



Safety Related Switch Handles

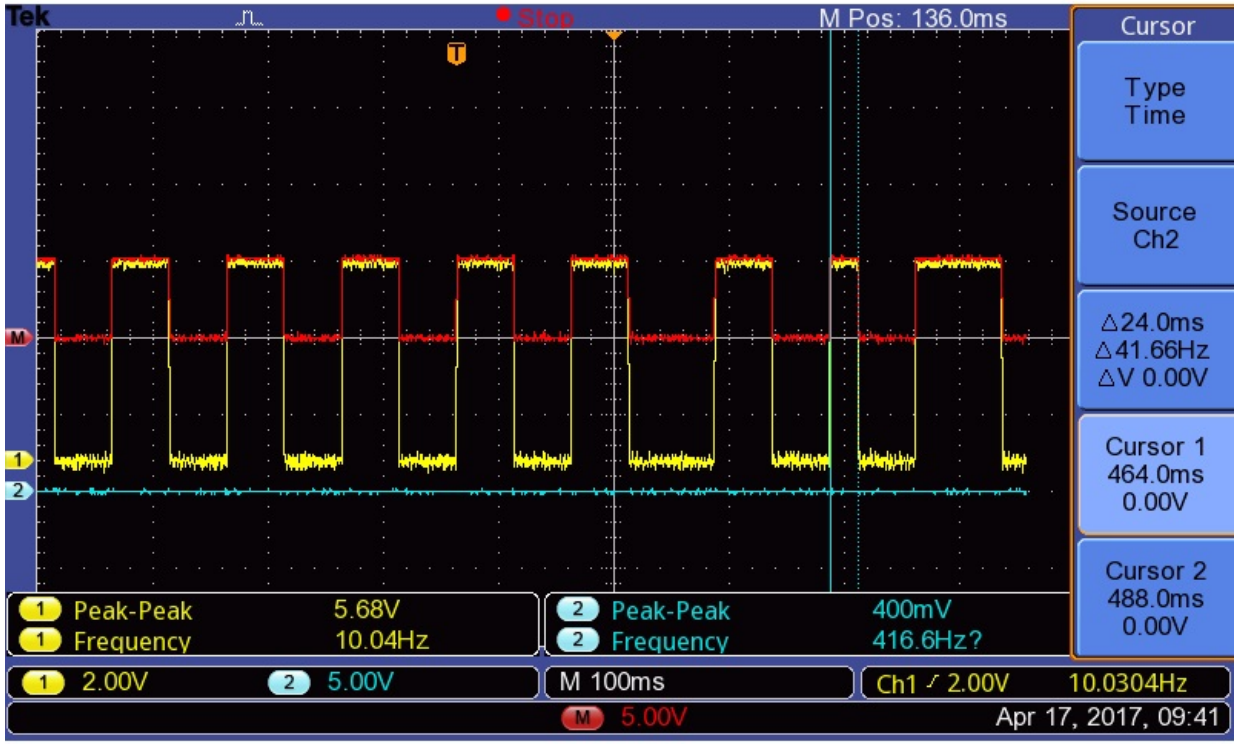
- New design is created and shipped within days from the vendor.
- Material specifications are detailed, tested and significantly better than OEM.
- New failure mechanism; the shaft is the weakest link.
- Per unit cost…$12.
- A savings of $988/unit for approximately 100 units in the control room; delivering the nuclear promise.

PWR Step Counter Issue

- During manual insertion of rods, occasionally, in a somewhat repeatable fashion, the step counters would incorrectly display the rod position.
- Step counters use a pulsed signal to toggle the rod position.
- Standard 100 mSec pulse, 50 mSec high and 50 mSec low.
- Strobe signals less than 75 mSec are ignored. Strobe signals greater than 150 mSec could be counted twice.

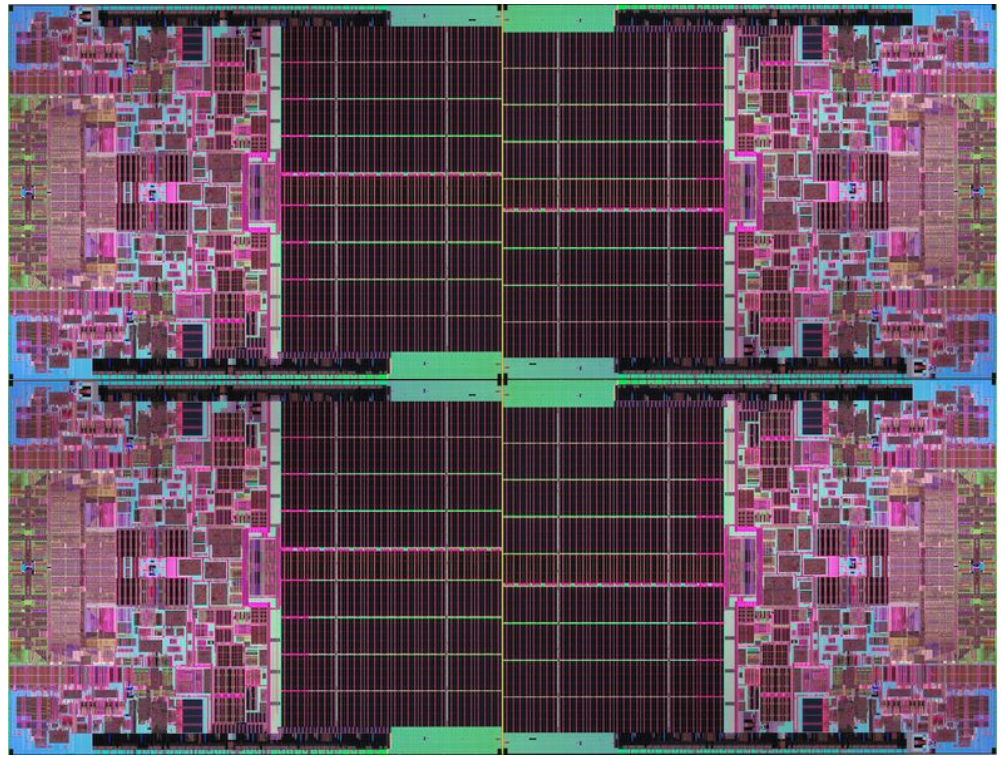
PWR Step Counter Issue

- Tektronix 1052B 50 MHz, 2 Channel, Digital Oscilloscope, 1 GS/s Sampling. $544 on Amazon.
- Recently purchased because there is significant risk for out-of-service time associated with troubleshooting. All problems are not obvious to understand.
- Had to read the manual.
- Identified one 75 mSec pulse followed shortly by a 23 mSec pulse.
- Truly, this was just discovering the real problem with no understanding of why.



PWR Step Counter Issue

- We separated the I/O and I/O critical tasks from the THOR model so they each ran in their own thread with their own dedicated CPU.
- The simulation is run on a quad dual-core processor (eight physical CPUs).
- The 75 mSec pulse occurred when the original I/O thread was moved from the dedicated CPU to another CPU.
- In the Windows operating system CPU dedication is really more of a suggestion and cannot be guaranteed.
- After a 75 mSec frame the Executive runs a fast frame ~23 mSec to catch up to real time.



Automatic Voltage Regulator Issue

- Facility recently upgraded the main generator and installed a MEC 700 AVR Module.
- Module was simulated in the simulator.
- An Issue was identified in the plant that did not have impact in the simulator but is a thought provoking situation anyway.

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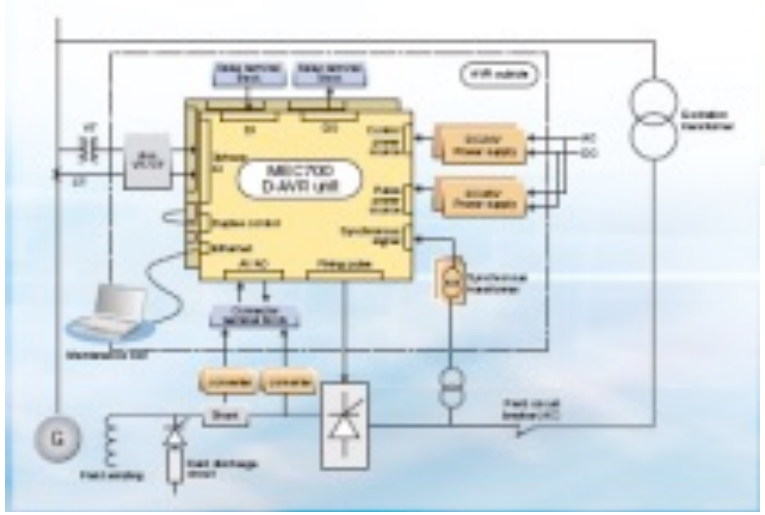
Changes for the Better

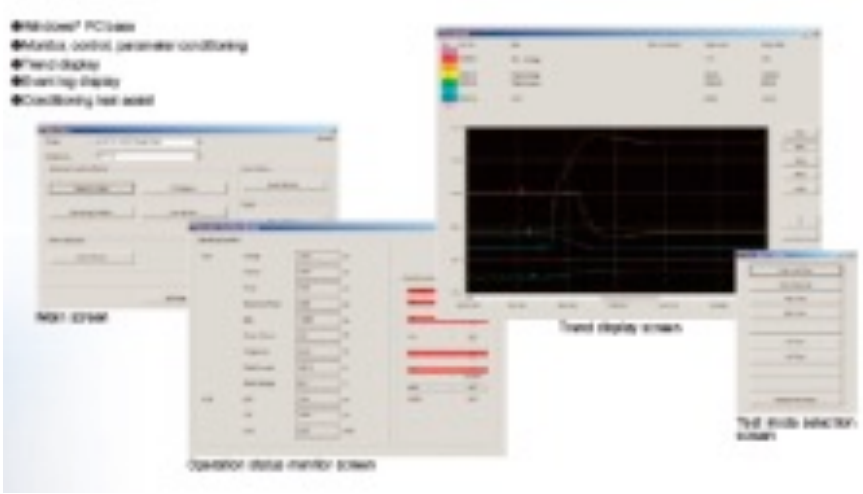
Automatic Voltage Regulator Issue

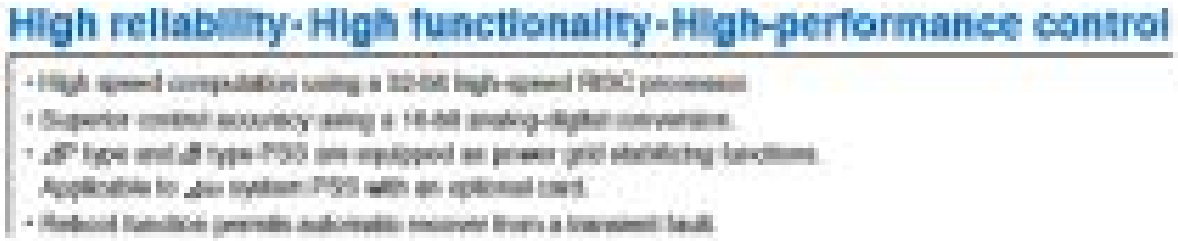
- Notified of a software update that could be “critical”.
- The module has an internal counter that overflows at 994 days (~2.7 years) from last power-on condition.
- Who would ever run an electronic module for 2.7 years? We would!
- What are the consequences…the overflow causes a loss of Main Generator field control and results in a unit trip.
- This will happen on August 25, 2018 if nothing is done.



Automatic Voltage Regulator Issue

- The vendor has a patch that corrects the counter issue and a manual reset method that resets the counter.
- These COULD be done “at power” but preferably “off-line”.
- There are no scheduled outages before the drop dead date.
- The plant wanted to know if we had discovered this in the simulator and why not?





THEWORLDISDIFFICULTTOUNDERSTAND WITHOUTUSINGSPACES

- CTI [Not Dave's Fault]
- For malfunctions associated with Plant Process Computer points the T-Rex Scheduler may not correctly insert the malfunction.
- If in the Lightning Database the Range field in the malfunction table contains an American Standard Code for Information Interchange 0100000, bad things happen.
- The fix was to replace the " " with a "_".
- Issue had been present for years, nobody noticed; 2,100 instances at one site, 1,000 at the other.

7-BIT ASCII CODE

Bits 7654321	Character	Bits 7654321	Character	Bits 7654321	Character	Bits 7654321	Character
0000000	NUL	0100000	SP	1000000	@	1100000	`
0000001	SOH	0100001	!	1000001	A	1100001	a
0000010	STX	0100010	"	1000010	B	1100010	b
0000011	ETX	0100011	#	1000011	C	1100011	c
0000100	EOT	0100100	$	1000100	D	1100100	d
0000101	ENQ	0100101	%	1000101	E	1100101	e
0000110	ACK	0100110	&	1000110	F	1100110	f
0000111	BEL	0100111	'	1000111	G	1100111	g
0001000	BS	0101000	(	1001000	H	1101000	h
0001001	HT	0101001	)	1001001	I	1101001	i
0001010	LF	0101010	*	1001010	J	1101010	j
0001011	VT	0101011	+	1001011	K	1101011	k
0001100	FF	0101100	,	1001100	L	1101100	l
0001101	CR	0101101	-	1001101	M	1101101	m
0001110	SO	0101110	.	1001110	N	1101110	n
0001111	SI	0101111	/	1001111	O	1101111	o
0010000	DLE	0110000	0	1010000	P	1110000	p
0010001	DC1	0110001	1	1010001	Q	1110001	q
0010010	DC2	0110010	2	1010010	R	1110010	r
0010011	DC3	0110011	3	1010011	S	1110011	s
0010100	DC4	0110100	4	1010100	T	1110100	t
0010101	NAK	0110101	5	1010101	U	1110101	u
0010110	SYN	0110110	6	1010110	V	1110110	v
0010111	ETB	0110111	7	1010111	W	1110111	w
0011000	CAN	0111000	8	1011000	X	1111000	x
0011001	EM	0111001	9	1011001	Y	1111001	y
0011010	SUB	0111010	:	1011010	Z	1111010	z
0011011	ESC	0111011	;	1011011	[	1111011	{
0011100	FS	0111100	<	1011100	\	1111100	|
0011101	GS	0111101	=	1011101	]	1111101	}
0011110	RS	0111110	>	1011110	^	1111110	~
0011111	US	0111111	?	1011111	_	1111111	DEL

Questions?

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