

Re: 4017 Counter skips under load

Source: <http://sci.tech-archive.net/Archive/sci.electronics.design/2007-07/msg00467.html>

- *From:* "David L. Jones" <altzone@xxxxxxxx>
 - *Date:* Wed, 04 Jul 2007 17:11:19 -0700
-

On Jul 5, 2:00 am, jcargile2...@xxxxxxxx wrote:

On Jul 4, 12:56 am, "David L. Jones" <altz...@xxxxxxxx> wrote:

On Jul 4, 5:12 pm, jcargile2...@xxxxxxxx wrote:

On Jul 3, 4:58 pm, "David L. Jones" <altz...@xxxxxxxx>
wrote:

On Jul 4, 8:54 am, jcargile2...@xxxxxxxx
wrote:

On Jul 3, 3:14 pm, "David
L. Jones"
<altz...@xxxxxxxx>
wrote:

On Jul 4,
6:50 am,
jcargile2...@xxxxxxxx
wrote:

On
Jul
3,
1:24

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pm,
Joerg
<notthisjoerg...@xxxxxxxxxxxxxxxxxxxxxxxx>
wrote:

jcargile2...@xxxxxxxx
wrote:

On
Jul
2,
3:24
pm,
"David
L.
Jones"
<alt...@xxxxxxxx>
wrote:

On
Jul
3,
7:11
am,
jcargile2...@xxxxxxxx
wrote:

I
have
a
fairly
simple
circuit
that
consists
of
a
4017
decade
counter
and
nine
relay/LED
combinations.
The

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relays
are
very
small
and
the
circuit
operates
just
fine
with
no
load,
or
when
I
connect
an
LED
to
the
relay
output.
But
when
I
try
to
operate
the
circuit
under
load
(it
is
being
used
to
fire
nichrome
ignitors),
then
the
counter
simply
skips
the
loaded
relay
and
moves

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right
to
the
next
output.
So
if
I
send
the
counter
a
series
of
5
clock
pulses,
and
put
a
load
on
the
relay
attached
to
output
3,
then
the
count
goes
1,2,4,5,6.
The
final
count
ends
up
being
one
off,
so
it's
almost
like
the
output
in
question
doesn't
exist.

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What
I
don't
understand
is
why
this
is
happening,
since
the
relay
is
what
bears
the
load,
not
the
4017.
Shouldn't
the
output
requirement
on
the
counter
be
the
same
regardless
of
what
the
relay
is
switching?

Yes,
it
should
be,
but
only
if
you
have
used
proper

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circuit
physical
circuit
layout
techniques
to
ensure
that
there
is
no
ground
or
power
bounce.
Think
"star
grounding"
and
power
decoupling.
Very
common
trap
for
young
players.

Dave.

I
installed
the
final
power
setup
(on
the
tests
I
just
had
the
board
jumpered
onto
the

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power
supply)
and
now
it
will
fire
the
ignitors.
The
problem
is
that
the
counter
is
now
behaving
irrationally.
It
will
skip
several
counts
when
receiving
a
clock
pulse
and
will
jump
around
with
the
slightest
change
in
ground
(even
connecting
a
single
lead
from
the
multimeter
to
any
point
on

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ground
advances
the
count).
I've
tried
several
different
caps
(.01–10
uF)
connected
directly
to
the
power
leads
of
the
4017
with
no
luck.
All
of
the
info
I
can
find
on
decoupling
keeps
talking
about
selecting
the
capacitor
based
on
frequency.
But
I'm
only
sending
a
single
pulse
of
about
25

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ns
every
10–20
seconds.
Does
this
mean
I
can
use
a
larger
cap?
I'm
seriously
freaking
out
at
this
point
cause
I
only
have
24
hours
to
get
this
working.
Thanks
for
the
help!

How
on
earth
do
you
get
a
25nsec
pulse
out
of
a
CD4017?
That's

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like
clocking
a
moped
at
100mph.

Anyhow,
since
things
seem
to
become
desperate
over
there
I
can
only
suggest
to
build
it
up
again
on
an
experimental
board
that
has
a
ground
plane.
And
no,
you
do
not
have
to
select
decoupling
caps
based
on
frequency.
A
0.1uF

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plus
a
nice
10uF
electrolytic
should
do,
more
if
your
power
supply
is
wimpy.

Can
you
post
schematic
plus
photo?

--
Regards,
Joerg

<http://www.analogconsultants.com>–Hidequotedtext–

–
Show
quoted
text
–

Sorry,
I
mistyped.
The
clock
pulse
coming

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into
the
4017
from
the
PC
parallel
port
is
25
ms
in
length.

Ah, the
alarm bells
start ringing
right there,
no pun
intended.
You
probably
have
ringing on
your clock
line from
the PC.
Keep the
lead from
the parallel
port as short
as possible.
Are you
able to view
the signal
with an
oscilloscope?

Classic
problem
with PC
parallel port
driven
equipment.

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Dave.–
Hide quoted
text –

– Show
quoted text
–

Unfortunately I don't have access to a scope. This is the kit that I'm using. The board itself is plugged directly into the parallel port. I then have leads soldered on to the board at the resistors so that I get a clean 12 volt signal from the parallel port. From there, that signal is run via ethernet cable to the firing controllers. In my initial tests, this setup worked fine with just an LED as the load. Because of safety reasons, I can't have the laptop and thus myself any closer to the controllers themselves.

<img
src="http://kitsrus.com/jpg/k74v2_1.jpg>

Ah, a picture tells a thousand words.

The board should work just fine **if** you power your load from an entirely separate and **floating** power supply relative to the plugpack

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or power supply which powers the board.
You've said the board works
just fine with an LED load, so obviously
something is amiss with the
power supply wiring for the load.

Dave.– Hide quoted text –

– Show quoted text –

I tried that earlier, but couldn't get the firing boards (running 4017) to recognize the clock pulses from the parallel port interface unless the grounds were connected. Am I doing something wrong there?

I don't get the whole picture here, so let's see if I have this correct...
The 4017's are located on your own board at the end of a long ethernet cable connected connected to this relay interface board?

Please explain in detail what the relay interface board does, what your 4017 board does, how they are connected together, how they are powered, and what lengths of cable are used. Unless you do that we'll all be going around in circles.

Dave.– Hide quoted text –

– Show quoted text –

Hopefully these pics will show the full set up.

http://a548.ac-images.myspacecdn.com/images01/105/1_9f67b69cc9c5093d7...

This is the inside of the firing box. The barrier strip at the top brings the +12V and ground for the firing control boards (at bottom)

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as well as a separate ground for the igniters that is controlled by a safety switch. I added the cap to the barrier strip last night in an attempt to help stiffen the power supply to be boards, but have not yet tested it.

http://a340.ac-images.myspacecdn.com/images01/79/1_d358560b9c651a8da6...

The second pic is the top side of one firing control board. There are 5 of these in total. The IC at the top is the 4017. The black rectangular boxes at the bottom of the board are the SPST reed relays that activate the igniters.

http://a502.ac-images.myspacecdn.com/images01/82/1_86a86c8ec7313a72a4...

The underside of the firing board. The wide trace on the right side of the board is the +12V and the left side is ground. Are these too small?

http://a861.ac-images.myspacecdn.com/images01/82/1_5aafdf9e0837402f36...

This is the Kit74 parallel port interface as well as the power supply. I only have them sitting this close in order to fit them into one picture. I have wired leads onto the Kit74 that goes to an RJ45 jack. That ethernet cable then goes to an identical jack where each line is connected to the clock pin of one firing control board.

So in theory the operation goes like this:

The system is powered up and all counters and parallel port are reset. The ignitor ground is then connected via a remote switch.>From there the software on my laptop plays the soundtrack and at set

intervals activates a single channel output on the parallel port. That signal is then sent from the Kit74 interface via an ethernet cable to the firing boards in the display. The 4017 in the firing controller advances one count, activating the next relay in line. The wire connected to the relay receives +12v which passes through the nichrome igniter and returns to ground through the safety switch. The wire heats, igniting the fireworks. The igniter typically burns up in less than 1 second. The process repeats until all 9 cues have been used.

Problems:

- 1) You are driving the relays directly with a 4017, that's *bad*. A 4017 will not have enough output current to do that. You are using low power reed relays, but it's still too much for a 4017.
- 2) You can't use a relay driver board to provide clock pulses to a 4017, in fact this probably the worst possible way I can think of to do this. You'll get ridiculous amounts of contact bounces causing multiple pluses.

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3) You are feeding power to the remote boards via the long ethernet cable that is also the same ground line as the 4017. Power for the 4017 board should be local.

I'm surprised it even worked at all with no load.

At the very least, this might help until you can design the whole thing properly from scratch – add a single-shot circuit to the 4017 board clock input so you are guaranteed to only generate one clock pulse from how ever many erroneous input pulses.

Dave.

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