Dim/Bright vs. Micro-Dim/Micro-Bright Commands

For X-10 made switches and modules any PLC dim/bright command preceded by a gap (3 or more idle cycles) is interpreted as a micro-step and all dim/bright commands not preceded by a gap are interpreted as standard steps. The value of both a micro-step and standard step depend on the receiver. All X-10 manufactured dimmer modules and switches will respond to micro-dim and micro-bright commands but those designed and made by others may either not respond or may respond in a different manner. There is a dearth of software that can send single micro-step commands.

X-10's CM11A documentation indicates there are 210 possible dim levels. PCS has implemented support for micro-dim and micro-bright by redefining other X-10 PLC protocol commands (Hail Request, Hail Acknowledge) as micro-step commands. The PCS documentation indicates there are 204 possible levels but they may be referring to their own devices. ACT's Phil Kingery says there are 128 levels. My measurements using a Kill A Watt meter and LM465 show 146 levels. An LM14A has 154 levels but its minimum is about 5%. I do not know how X-10 switches respond to micro-steps. SmartHome's SwitchLinc/LampLinc do not support micro-dim/micro-bright but interpret a micro-step as a preset dim with a value of about 3%.

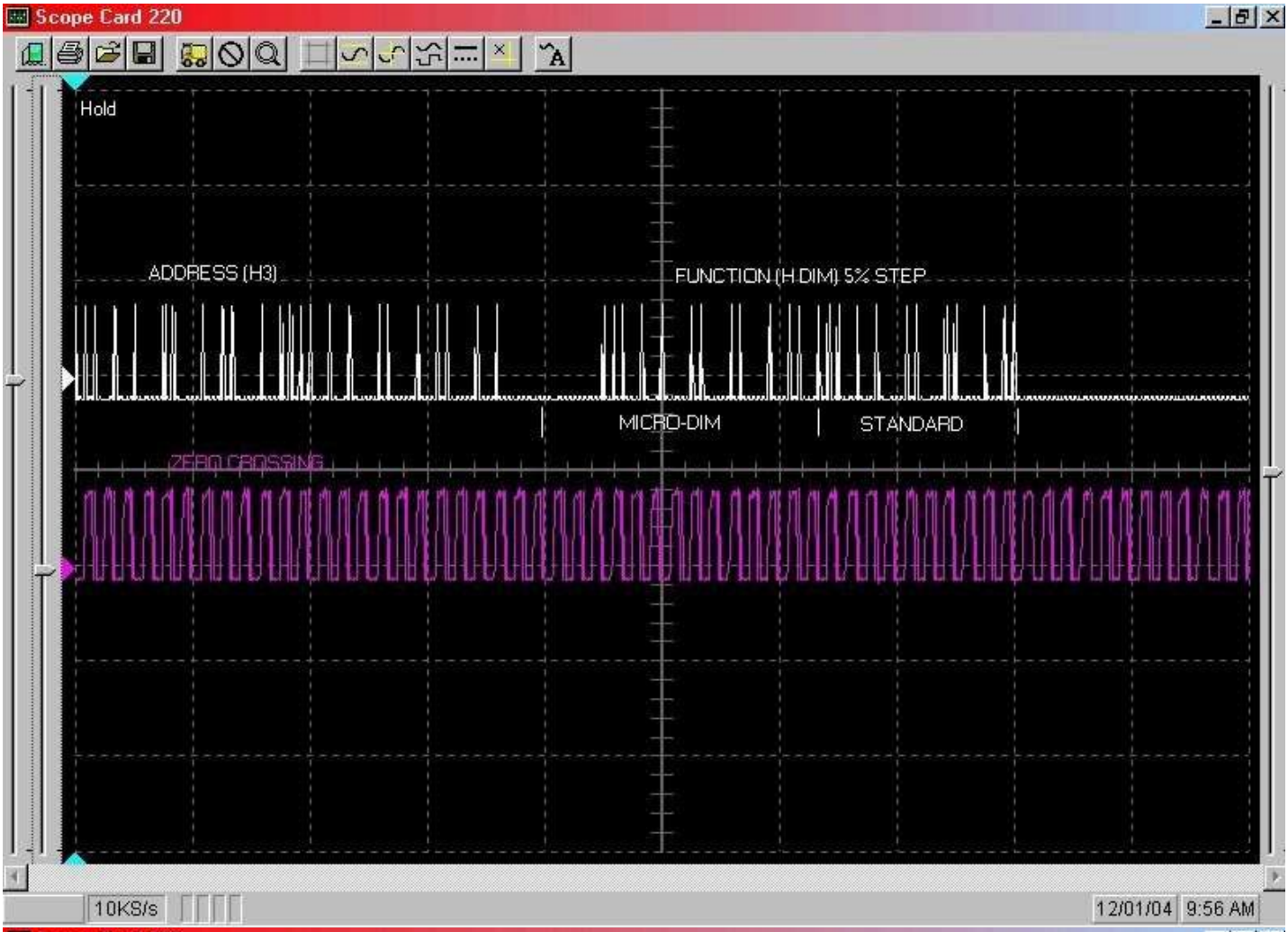
A standard X-10 Dim (or Bright) function command sends a series of contiguous (no gaps between) commands to the powerline with the total increment/decrement depending on the number of contiguous commands and on the receiver's interpretation of the commands. An LM465 requires 21 contiguous dims to go from maximum (96%) to minimum (0%) brightness. An LM14A only requires 17 contiguous dims but does not dim all the way to 0%.

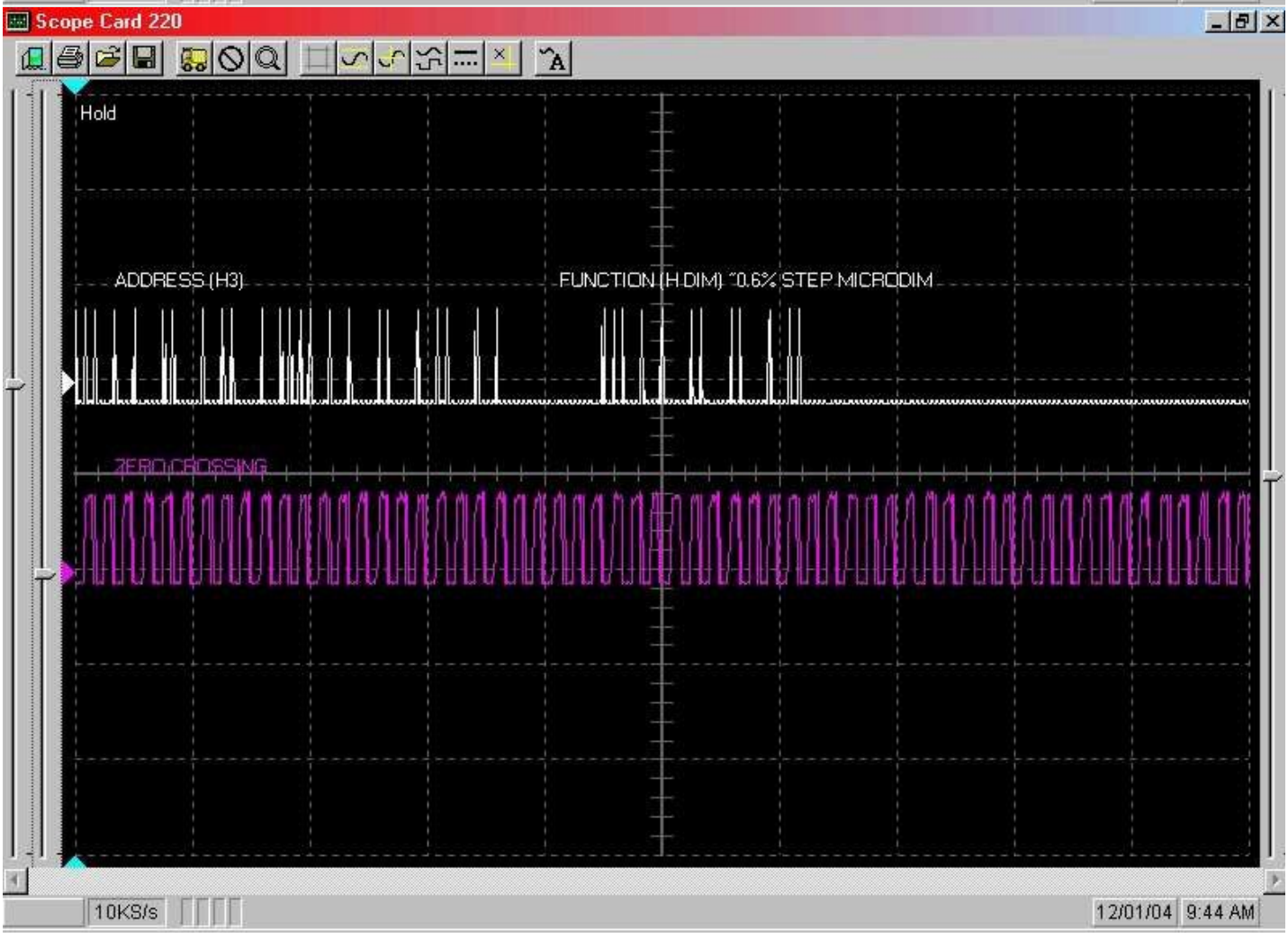
With the LM465 each micro-step represents 0.662% and a standard step is 4.7671%. 21 contiguous dims result in 0.662% + (20 * 4.7671%) or 96.004%. Most manual controllers (e.g. mini-controller) send a doublet (i.e. 2 contiguous) dim/bright commands. It takes 18 doublets to go from maximum to minimum brightness. The first command in each doublet will be interpreted as a micro-step (0.662%) and the second as a standard (4.7671%) step. (0.662 + 4.7671) * 18 = 97.652%. Using 100% as the maximum level, a micro-step becomes 0.690 and each standard step becomes 4.966 for 0.690 + (20 * 4.966) equals 100.01%.

21 contiguous commands require 231 half cycles of the powerline or 3.85 seconds @ 60Hz. If an address + gap precedes the sequence, the total becomes 4.27 seconds.

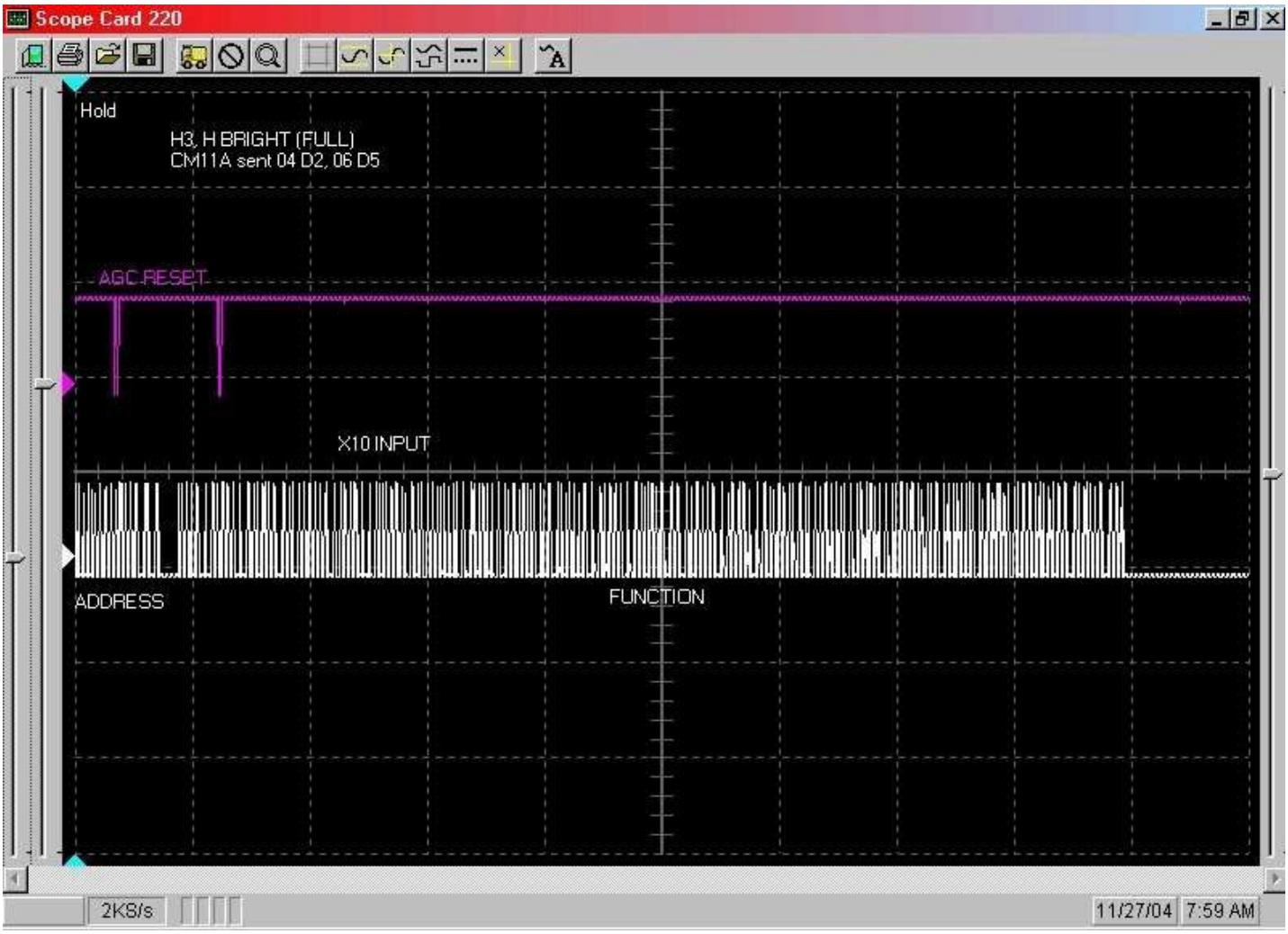
A single dim (or bright) PLC command preceded by a gap will be interpreted as a micro-step. With the need for a gap between each code, the minimum time per microstep is (11 + 3) / 60 = 0.233 seconds. 146 micro-steps will require a minimum of 34 seconds. If an address + gap (recommended) precedes each, the total becomes 87.6 seconds.

The oscilloscope screenshots below show the powerline activity with a doublet PLC dim (~5%) and a single micro-dim.


Scope Card 220
Hold
ADDRESS (H3)
FUNCTION (H.DIM) 5% STEP
MICRO-DIM
STANDARD
ZERO CROSSING
10KS/s
12/01/04
9:56 AM


Scope Card 220
Hold
ADDRESS (H3)
FUNCTION (H.DIM) ~0.6% STEP MICRODIM
ZERO CROSSING
10KS/s
12/01/04
9:44 AM

The following screenshot shows 21 contiguous BRIGHTs (at the X10 input pin of the Cypress microcontroller in a CM15A).



Charles Sullivan also made **some measurements** in this area.