S.E.T. (Student Electronics Technician)

Hands-On Practical Exams

Background: From time to time, during the past decade, suggestions have been made to offer hands-on practical assessment tests in conjunction with the ETA (Electronics Technicians Assn., Inc.) knowledge paper/pencil written examinations.

There are reasons to **not** attempt to make a hands-on test mandatory. #1 would be the fact that military, library, non-technical educational institutions and even association convention and seminar testing events would find setting up for a practical electronics exam virtually impossible or at least impractical.

Optional Hands-on:

Thus, discussion regarding the inclusion of a hands-on test, for S.E.T. (Student Electronics Technician), AST (Associate Certified Electronics Technician), or specialty CET exams should be confined to the 'optional' area. By that we mean: those individuals who take both the knowledge exam **and** have verified their practical hands-on abilities, would have that fact noted on their CET wall certificate and wallet card. No change will be made in the present program of written knowledge exam-only certifications.

We hate change:

Why consider a hands-on exam? Aren't things going OK now?
Yes, the certification programs are going well. Numbers are up in virtually every category. But here are the facts that require this discussion:

The State Departments of Education:

The consensus among national education and credentialing agencies has been expressed at several national conferences in recent years: Certification programs that do not include practical exams, **in addition** to knowledge tests, are not doing the job. Some national education spokespersons encourage school systems to not even consider adopting certification programs that do not have a hands-on component. As ETA'ers know, all of our fiber and copper cabling programs **DO** require hands-on exams. So this isn't a completely new idea for ETA Certification Administrators, instructors and members.

In Pennsylvania, Ohio and Indiana, state education departments have spent time in the past few years attempting to find a way to include proof that the students can perform actual electronics worker tasks. They have run into a certain amount of resistance, as any new program is bound to, but the handwriting is on the wall.

The State of Indiana has spent the past 10 years or so developing an assessment program. It is primarily hands-on. The State describes eleven different tasks. Examples: Troubleshooting; soldering and identifying parts on a board; instructing a new employee in the use of an oscilloscope; emergency custom-making a PC unit at the end of a manufacturing run that was short one unit; and so forth. These tasks are those that employers have indicated they expect electronics graduates to be able to master.

ETA now requires 20 practical tests. These are available from ETA for an SET or AST certificant to qualify for both the knowledge **and** the practical certification. Schools are being pressured by their departments of education and state legislatures now to require hands-on. Since the ETA Hands-On tasks are no more than most good electronics basics courses require now, ETA will require all 20 task sheets be signed sometime during the length of the course if the technician desires the Hands-On designation to be included on the SET or CETa certificate. The Hands-On verification sheets packet then is to be sent to ETA along with the SET or CETa examination answer sheet. The 20 Hands-On tasks are available now from ETA directly (eta@tds.net) and are posted on the www.etainternational.org website.

The Indiana Scene:
We talked to the Indiana Workforce Department people about the rather ambitious state-sponsored certification and its collaborative efforts with local employers, We have suggested that the least ETA can do is to modify the CET certificates for Indiana. We will include an indicator on the CET certificate verifying that an individual has also qualified with the State of Indiana by completing each of the eleven required practical skills tests the state requires. Employers will seek the most qualified technicians. Employers that have participated in the organization of the "Indiana Essential Skills and Technical Proficiencies" program, then, would have a means of identifying workers who have both ETA Industry Certification and have met the state requirements for hands-on. The state is warm to the idea of high schools (and post secondary career centers) offering both a knowledge exam AND the hands-on assessment. Both the Indiana State plan and the ETA national plan are available for implementation now.

WHAT TO DO:

Moving forward, ETA has received good dialog pertaining to Hands-On practical tests. Comments have been collected from instructors in several states and from various segments of the electronics industry, students; instructors; working journeyman technicians; school administrators and other interested agencies. (AST committee, Certification Administrators and officers.)

As a result ETA has established hands-on practical tests that can be used by instructors. These tests can be a part of the training course. They use a documentation procedure similar to that used by the State of Indiana that attests to the student having successfully mastered each required task. One or more tasks might be planned for the end of the course, somewhat like the SkillsUSA contests. However, most of the practical tests will come as a routine part of the normal electronics course training.

The difference is a small amount of document signing and inclusion of the documentation sheets with the CET knowledge exam test forms. Accomplishing the hands-on portion will be indicated on S.E.T. or AST certificates as documentation is received. Those examinees that have also accomplished all of the Hands-On skills (verified by their instructor) will have a prominent Hands-On identification on their SET or CETa certificates.

The ETA Hands-On Tasks:

Here are the descriptions of the hands-on S.E.T. or AST tasks, some of which have been incorporated in the Indiana Plan, or which have been submitted for ETA's national/world-wide plan. We want all SMEs (subject matter experts) and CA's to become familiar with the 20 tasks and for schools to consider adopting the hands-on examinations for their students. #21 is an optional task that may be substituted for any one of the 1-20 tasks.

Thanks to all those who showed interest in refining the S.E.T. program and this hands-on feature. Should you have comments, you may send them to me at: dick@eta-i.org. Thanks.

(please view the 21 hands-on tasks below)

A LISTING OF HANDS-ON TASKS now outlined below numbered 1 thru 21:

1. Teach oscilloscope usage/functions to novice
2. Construct a basic electronic circuit and disassemble
3. Repair faulty game circuit PC board
4. Prep and install cable connectors (RG 6; UHF; RJ45; N)
5. Crash event: construct an electronics project as if the last unit of a production run was defective and you have to make one manually
6. Instruct another student in proper fabrication of a series/parallel circuit, possibly using EWB, explain and test for proper operation, voltages, etc.
7. Repair a marine ignition system and test *
8. Assemble, test, troubleshoot a new circuit, using proper soldering methods
9. Locate a bad component in a product, order replacement, replace and test
10. Troubleshoot primary gauges used in pleasure boats *
11. Construct a regulated power supply, obtaining parts, measuring results and noting voltages, current use and resistance readings, from schematic.
12. De-solder a 14 pin IC chip without damaging the PC board, or, if damaged, demonstrate repair of socket or traces
13. Demonstrate the art of cross-referencing electronic parts. A transistor; IC chip; transformer; surface-mount diode, capacitor, resistor.
14. Measure the current and calculate the battery life in a portable radio, CD player or similar device.
15. Breadboard a 4 bit binary parallel word register. Use a logic pulser and probe to demonstrate operation
16. Pass a wire loop between the poles of a magnet and measure the current induced with an ammeter noting the direction of current depending on the direction the loop is passed*
17. Wire an op amp for a gain of 5
18. Record battery capabilities and static voltages
19. Inject square waves, analyze frequency response and improve as necessary
20. Dissect CAT3 and CAT5e cables and compare theory and capabilities of each
21. Substitute task: Spectrum Analyzer familiarization

We are beta testing the hands-on skills to assure that they are not burdensome; that the students can easily measure their own progress; accumulate completed and signed performance documentation sheets and verified these in their personnel file.

On the succeeding pages are the description pages for each SET/AST task. This is the sheet an instructor uses to understand the tasks and that the student uses at the time the instructor feels he/she is ready to complete the task. Note that most of these are currently already included in many basic electronics courses.

Keep this document, as it is one of the required assessment certifications of the total array of practical tests for entry-level electronics technicians. All completed hands-on documents are to be included with the written ETA S.E.T. or AST written knowledge examinations.

* Alternative but similar tasks may be substituted

Hands-On Practical Electronics Assessment

(To accompany knowledge test for S.E.T., Student Electronics Technician, or A.S.T., Associate CET)

Basic Electronics performance Examination

TASK # 1

Task Description: Train new employee in oscilloscope usage.

Object: Student demonstrates his own knowledge of the functions and uses in electronics servicing by tutoring a new student or individual in the functions, calibration, safety, accessories and limits of electronic oscilloscopes.

Topics covered:

1. Theory of operation
2. Safety
3. Positioning, focus, timing, brightness controls
4. Free-running vs: Triggered
5. Sweep frequency/rate and frequency measurement
6. Patterns (lissajous, circle, oval, loop)
7. Triggering
8. Waveform interpretation
9. Probe options and factors
10. Storage (DSO) scope theory
11. Terminology

Time Allotment: **1 Hour**

Testing the effectiveness of instruction:

aa	Student can properly set up controls
bb	Controls lock signal pattern
cc	Frequency of display waves is determined
dd	Level of waveforms is expressed and corrrect
ee	Probes are used and their purposes defined
ff	Input levels are not exceeded
gg	X, Y and Z inputs are explained
hh	Peak, Peak-to-Peak, average and RMS relationships are compared

The following named individual is confirmed to have successfully provided the above instruction to a person representing a new co-worker or student unfamiliar with an oscilloscope:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

Return this form , along with all other Hands-On assessment sheets required to ETA: 5 Depot St., Greencastle, IN 46135.

Hands-On Practical Electronics Assessment

(To accompany knowledge test for S.E.T., Student Electronics Technician, or A.S.T., Associate CET)

Basic Electronics performance Examination

TASK # 2

Task Description: **Student demonstrates safe usage of a volt-ohm-amp meter.**

Object: Students demonstrate their knowledge of meters by listing on paper, anticipated voltages in an electronics product circuit. This can be a computer monitor, TV set or other product with a wide range of circuit voltages. The student will show careful test probe placement and how higher voltages call for one-hand insertion of test lead onto a test point. Also how carefully chip pins, transistor legs, high voltage transformer leads etc. must be probed.

Student will demonstrate proper use of anti-static wrist-strap, bench and floor mats and frequent personal grounding to AC building or other suitable grounds during work on static-sensitive PC or product parts.

Student will point out any potential fire or chemical hazards in the lab or shop and show how to minimize them. He/She will describe fire exits, first aid kit and extinguisher locations.

Time Allotment: **1 Hour**

Equipment required:

1. Product in working order
2. Digital or analog DMM or VOM
3. Pen/pencil document paper to be attached to this form. Shows anticipated voltages at a minimum of 6 schematic locations in the unit circuitry
4. Document paper showing emergency exits, fire extinguisher and first aid kit locations (to be attached). (In service department, lab, or work area.)

The following named individual is confirmed to have successfully demonstrated volt-ohm-amp meter usage and lab safety procedures:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

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Hands-On Practical Electronics Assessment

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Basic Electronics performance Examination

TASK # 3

Task Description: **Repair faulty video game circuit PC board.**

Object: A video game circuit board is exposed for the student's attempt at finding and repairing a defect in it. The defects available to the instructor should be several so that a class of students has no advance knowledge of them. A minimum of six types of defects should be available with each student being required to solve only one. The defects are of the following types:

Topics covered:

1. Bad battery connector (rusty or temporary paper/plastic/epoxy placed on connector). Or, bad AC cord or power supply transformer
2. Open PC trace, can be cut with an Exacto knife
3. Speaker wire broken off (if game has speakers)
4. Headphone plug damaged and not making contact (if used)
5. Paddle connecting-wire cut near paddle entry or near TV connector
6. Paddle actuator lever mechanically broken
7. Game connected to defective display device (TV, computer monitor, etc.)

Time Allotment: **1 Hour**

Equipment required:

1. Product capable of being in working order
2. Digital or analog DMM or VOM
3. Soldering equipment
4. Anticipated spare parts
5. Schematic diagram of unit

The following named individual is confirmed to have successfully repaired the circuit board described above:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

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Hands-On Practical Electronics Assessment

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Basic Electronics performance Examination

TASK # 4

Task Description: **Prep and install cable connectors.**

Object: Student is asked to properly prepare cable ends for coaxial (RG 59 or RG 6) cable; for ordinary 4-wire telephone cable; for CAT5 Data cable; and for RG-11. Also to properly install one of each type of connector, to properly crimp them, and to test the cable upon completion to ascertain proper function of the cable. Student will test the cables for shorts, continuity and signal loss (if any)

Supplies needed:

1. Roll or lengths of RG-59 and RG-6 coaxial cable; Roll or lengths of 4-wire telephone cable; Roll or lengths of CAT 5; CAT 5e; CAT 3 or similar data cable; a length of RG11 or equivalent cable.
2. Fittings: RG-59; RG-6; RJ 11, RJ 45; BNC; UHF and N
3. Crimp tools for RG 6 and 59; Crimp tools for RJ 11 and RJ 45
4. Side-cut pliers; scissors; coax prep tool/stripper; soldering iron for UHF and N, solder/flux
5. Signal sources/generator; signal level meter

Time Allotment: **1 Hour**

Equipment required:

1. Multimeter
2. Telephone toner and handset
3. Signal generator/source
4. RF meter

Received ETA _____

The following named individual is confirmed to have successfully prepared the cable connectors and installed the fittings:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

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Hands-On Practical Electronics Assessment

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Basic Electronics performance Examination

TASK # 5

Task Description: **Construct the needed last unit, test it and complete the order.**

Object: A printed-circuit provider company found that an emergency run of operating PC boards was 1 less than ordered. Setting up the production line to run only 1 unit is not cost effective. The most practical solution is for a technician to construct the needed last unit, test it and complete the order. The technician is to collect all of the needed parts from stock and assemble the board quickly, testing the operation and passing it through quality-control before handing it off to packaging and shipping to be included with the order.

Supplies needed: Fairly simple kit. Student is to follow instruction book or schematic, assemble and test unit. Kits suggested are from Elenco Electronics Catelog #52, but any similar project can be substituted.

1. Burglar or Whooper alarm kit (K-23 or K24)
2. Metal Detector (K-26)
3. Touch Sensor or Photo Sensor (K-48 or K-50)
4. Sound activated switch (K-36)
5. Surface Mount Technology Solder Practice Kit (Mod SM-200K)
6. Your substitute project (please describe the project you, as an instructor have chosen to fulfill this hands-on task.

Time Allotment: **2 Hours**

Equipment required: Selected fabrication project. The hands-on tasks above are recommended, but in lieu of projects such as these, EWB/Multisim projects may be substituted.

The following named individual is confirmed to have successfully fabricated the electronic unit described above.

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

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Hands-On Practical Electronics Assessment

(To accompany knowledge test for S.E.T., Student Electronics Technician, or A.S.T., Associate CET)

Basic Electronics performance Examination

TASK # 6

Task Description: **Instruct another student in proper fabrication of a series/parallel circuit.**

Object: Instruct another student in proper fabrication of a series/parallel circuit, possibly using EWB, explain and test for proper operation, voltages, etc. Prefer circuit board so that soldering ability of student can be assessed during this test. Construct a circuit with at least 3 parallel legs with one leg having at least 2 series resistances and one leg having at least one parallel resistance in series with a series resistance. Using available parts, determine the anticipated resistances for each segment of the circuit; the voltage drops across each resistance and the current through each resistance. Demonstrate good soldering practices. Disassemble circuit and replace parts in proper storage bins. By demonstrating the procedure, the instructing student can obtain a Task #6 sign off sheet. The instructed student can follow up by using different part values and repeating the task, demonstrating soldering abilities and gaining his/her own sign off. Compare anticipated voltage/ resistance/current values with actual and explain if they do not match.

Supplies

1. Circuit board, with lugs for soldering components, miscellaneous parts as listed above
2. Volt-ohm-current meter
3. Pen and paper to draw schematic and to note resistance and voltage readings at key points
4. Soldering iron
5. Solder/flux
6. Battery

Time Allotment: **1 Hour**

Equipment required: "Junk" parts or parts removed from old equipment. Many labs have excellent bins of components such as are required for this project. If not, they are easily obtained and may be used multiple times by students who may also be asked to dismantle the circuit after it has been completed and approved

The following named individual is confirmed to have successfully provided the above instruction to a person representing a new co-worker or student unfamiliar with the fabrication of a series/parallel circuit:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

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Hands-On Practical Electronics Assessment

(To accompany knowledge test for S.E.T., Student Electronics Technician, or A.S.T., Associate CET)

Basic Electronics performance Examination

TASK # 7

Task Description: **Repair an ignition system.**

Object: Repair an ignition system. This can be a marine, lawn equipment, motorcycle or similar internal combustion engine system. The examinee is to locate a fault causing the system to malfunction. Sample faults are: ignition switch bad; ignition switch has wire off; solenoid actuator bad; battery/starter switch in solenoid bad; starter bad; ignition coil bad; ignition capacitor open or shorted; kill switch bad (any); light circuit open; light circuit shorted; fuse block has open due to rust; generator coil open; or other similar troubleshooting problem.

Supplies needed:

1. Volt-ohm-current meter
2. Pen and paper to draw schematic of ignition system and to list voltage or resistance readings
3. Replacement parts where practical

Time Allotment: **1 Hour**

Equipment required:

1. An appropriate powered vehicle with practical electrical system that can acquaint student with the operation and teach troubleshooting skills
2. VOM and voltage indicator test set
3. Other replacement parts, depending on instructor's choice of product for this test

The following named individual is confirmed to have successfully repaired the ignition system described above:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

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Hands-On Practical Electronics Assessment

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Basic Electronics performance Examination

TASK # 8

Task Description: **Assemble, test and troubleshoot a new circuit, using proper soldering methods.**

Object: **Assemble, test and troubleshoot a new circuit, using proper soldering methods.** This is **not** a breadboard project. A 'kit' can be made from junk parts, or can be obtained from commercial suppliers such as Radio Shack, Elenco, Heathkit, or others. This task has some of the ingredients of # 5 and # 7 tasks but expects a slightly more difficult project with perhaps over 2 dozen components. Soldering skills are tested. Also completion with expected results, possible troubleshooting, using DMM and oscilloscope if necessary. One suggestion is: build a PC board logic gate circuit which utilizes each of the six gates (AND, OR, NAND, NOR, INVERTER, XOR), then using a pulser to activate/change each gate, hooking up power and grounds, establishing truth tables for each gate and for the combined circuit.

Supplies needed:

1. Volt-ohm-current meter
2. Pen and paper to draw schematic of gate system and to list voltages, logic levels and resistance readings
3. Logic gates as in the Scenario; paper/pencil for schematic and truth tables and for recording any initial faults before debugging
4. Replacement parts where practical
5. Soldering equipment
6. Blank circuit board
7. Battery or AC power supply

Time Allotment: **2 Hours**

Equipment required:

1. VOM and voltage indicator test set.
2. Logic probe.
3. All parts, other items under Supplies needed, above.

The following named individual is confirmed to have successfully assembled, tested, and completed the trouble-shooting process of a new circuit as described above, using proper soldering methods:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

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Hands-On Practical Electronics Assessment

(To accompany knowledge test for S.E.T., Student Electronics Technician, or A.S.T., Associate CET)

Basic Electronics performance Examination

TASK # 9

Task Description: **Locate a bad component in an audio product, order replacement, replace and test.**

Object: Locate a bad component in an audio product, order replacement, replace and test. Test unit can be a multistage amplifier that allows access to the PC board and/or parts. Use an audio signal source; oscilloscope or signal tracer; DMM and spare parts. Troubles inserted may be: defective power supply or power supply component; open control; bad/cracked pc board trace; bad feed-through rivet; defective or disconnected discrete volume or tone control; open speaker/headphone jack; open ground, open capacitor; etc.

Supplies needed:

1. Volt-ohm meter
2. Pen and paper
3. Soldering equipment
4. Signal source such as an audio generator
5. Microphone or a radio signal
6. CD player, etc.
7. Audio product and spare parts

Time Allotment: **1 Hour**

Equipment required:

1. VOM
2. Spare parts
3. DMM or analog VOM meter
4. Task audio amplifier
5. Soldering equipment and solder
6. Signal source
7. Oscilloscope may be used for troubleshooting

The following named individual is confirmed to have successfully located a bad component in an audio product, ordered a replacement, and replaced and tested for proper operation:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

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Basic Electronics performance Examination

TASK # 10

Task Description: **Troubleshoot primary gauges used in a pleasure boat.**

Object: Troubleshoot primary gauges used in a pleasure boat (Or substitute another vehicle such as a motorcycle, aircraft, lawnmower, tractor, utility equipment, construction equipment (Back-hoe; Bob Cat; dozer) or military truck). Determine if the bad indication is caused by a bad sensor, connection or actual defective meter/indicator. Repair or replace defective part. Record repair event in equipment log. Prepare repair, billing, equipment listing that shows time on job and materials used.

Supplies needed:

1. Volt-ohm meter
2. Pen and paper
3. Soldering equipment
4. Substitute parts
5. Wiring diagram
6. Hand tools for accessing sensors or meter connections
7. Fuse panels or kill switches, etc.

Time Allotment: **1 Hour**

Equipment required:

1. VOM
2. Spare parts
3. DMM or analog VOM meter
4. Soldering equipment and solder
5. Oscilloscope may be useful in troubleshooting
6. Hand tools

The following named individual is confirmed to have successfully located the defect in the vehicle instruments:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

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Hands-On Practical Electronics Assessment

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Basic Electronics performance Examination

TASK # 11

Task Description: **Construct a 117 volt-to-12 volt power supply, using discrete parts.**

Object: Construct a 117 volt-to-12 volt power supply, using discrete parts. These include a 10 to 1 step-down transformer; 4 diodes or a bridge network; regulator transistor; zener diode; filter capacitor; load resistor; breadboard or circuit board; power cord/plug and inductor (for filter).
Student constructs power supply from existing shop parts; determines proper zener and regulator transistor and suitable load resistor. Measures resistances prior to energizing circuit to check for shorts or opens. Measures output voltage and adjusts selected parts if not within limits of +11 to +15 volts. Student measures current drawn by regulator and by total circuit (using clamp-on or current meter). Student draws schematic prior to constructing circuit, or studies a similar schematic and from that draws his version using common symbols and voltage call-outs. Notes are to be included with this sign-off sheet when project is completed.

Supplies needed:

1. Circuit board
2. Miscellaneous parts as listed above
3. Volt-ohm-current meter
4. If an oscilloscope is available student should be asked to measure the unregulated hum component in the rectified DC bridge output, then the regulated hum component at the output load resistor
5. Pen and paper to draw schematic and to note resistance and voltage readings at key points
6. Also soldering iron, solder/flux and, if available, a rheostat on the input power at start-up

Time Allotment: **1 Hour**

Equipment required: "Junk" parts or parts removed from old equipment. Many labs have excellent bins of components such as are required for this project. If not, they are easily obtained and may be used multiple times by students who may also be asked to dismantle the circuit after it has been completed and approved

The following named individual is confirmed to have successfully constructed a 117 volt-to-12 volt power supply, using discrete parts:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

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Hands-On Practical Electronics Assessment

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Basic Electronics performance Examination

TASK # 12

Task Description: **De-solder a 14 pin IC chip without damaging the PC board, or, if damaged, demonstrate repair of socket or traces.**

Supplies needed:

1. Circuit board with 14 pin IC chip (or chips) aboard (non-socketed)
2. Volt-ohm-current meter; soldering equipment
3. Solder removal equipment
4. Solder/flux; trace repair kit, if available
5. IC extraction equipment, if available
6. Insulated trace-jumper wire
7. Replacement 14 pin chip

Time Allotment: **30 minutes after supplies/equipment are acquired**

Equipment required: "Junk" parts or parts removed from old equipment; PC board with IC; schematic diagram of board for confirmation that feed-thru's and traces are secure; solder sucker and braid; rivet drill-bit; chip removal clip or pry.

The following named individual is confirmed to have successfully de-soldered a 14 pin IC chip without damaging the PC board, or, if damaged, demonstrated repair of the socket or traces:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

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Basic Electronics performance Examination

TASK # 13

Task Description: **Demonstrate the art of cross-referencing electronic parts.**

Object: Demonstrate the art of cross-referencing electronic parts. A transistor; IC chip; transformer; surface-mount diode, capacitor and resistor. Parts should have clear part identification numbers or values on them or a schematic diagram listing the part number or value should be provided to the student. The instructor should counsel the student, after the student has shown how to order replacement parts, in the most practical and quickest methods of cross-referencing the part(s).

Supplies needed:

1. Assorted electronic parts: transistor
2. multiple gate chip
3. power transformer
4. SM diode
5. SM Capacitor
6. SM Resistor
7. telephone access
8. computer Internet access
9. parts catalogs

(SM = surface-mount)

Time Allotment: **30 minutes after supplies/equipment are acquired**

Equipment required: Those listed above. Where classes of students are tested sequentially the part types may be varied to prevent students from collaborating and memorizing the routine for this task.

The following named individual is confirmed to have successfully demonstrated the ability to cross-reference electronic parts:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

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Hands-On Practical Electronics Assessment

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Basic Electronics performance Examination

TASK # 14

Task Description: **Measure the current and calculate the battery charge life in a portable radio, CD player or similar device.**

Object: Measure the current and calculate the battery charge life in a portable radio, CD player or similar device. Student uses the current function of a VOM or DMM or current meter to measure current when unit is energized; ascertains the battery capacity and calculates useful battery charge time period. Checks current at time increments and concludes when useful life has ended. Calculates resistance of load. Calculates internal resistance of battery.

Supplies needed:

1. Battery-operated product
2. Flashlight
3. Remote control hand unit
4. Cordless drill
5. Automobile emergency-blinker light circuit
6. Solar powered night light, etc.

Time Allotment: **30 minutes after supplies/equipment are acquired**

Equipment required:

1. Current meter
2. Pen/paper for estimating life of charge and calculating battery current and voltage and making comments to instructor as to observations

The following named individual is confirmed to have successfully measured the current and calculated the battery charge life in the device described above:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

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Hands-On Practical Electronics Assessment

(To accompany knowledge test for S.E.T., Student Electronics Technician, or A.S.T., Associate CET)

Basic Electronics performance Examination

TASK # 15

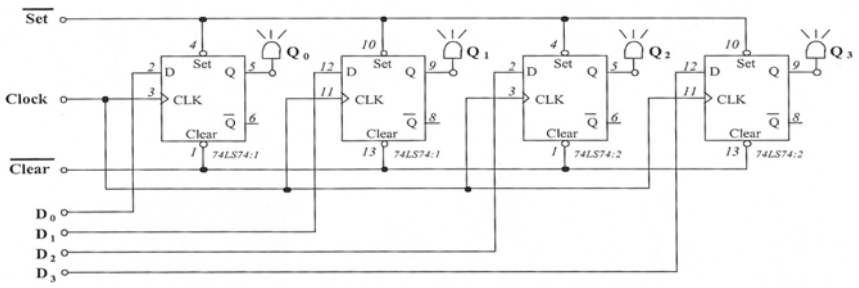
Task Description: **Breadboard a 4-bit binary parallel word register.**

Object: Breadboard a 4-bit binary parallel word register. Use a logic pulser and probe to demonstrate operation and correct construction. Input signals or voltage levels to demonstrate operation. Troubleshoot if necessary.

Supplies needed:

1. Breadboard
2. 5V power supply
3. 2 74LS74(D Flip Flop) IC chips
4. 4 LED's
5. Cutters
6. Pliers
7. Single-strand connection wire

Time Allotment: **1.5 Hours**



Equipment required:

1. Breadboard
2. Kit of gates/devices to construct the 4-bit binary register
3. Bread-boarding supplies
4. Pulser and logic probe
5. Multi-meter
6. Pen-paper for listing logic levels

The following named individual is confirmed to have successfully breadboarded a 4-bit binary parallel word register:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

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Basic Electronics performance Examination

TASK # 16

Task Description: **Pass a wire loop between the poles of a magnet and measure the current induced with an ammeter, noting the direction of current depending on the direction the loop is passed.**

Supplies needed:

1. Horseshoe or other magnet or magnets that have space to move wire loop between N-S pole pieces
2. Loop of wire to act as an armature
3. Connected to an ammeter

Time Allotment: **.5 Hour**

Equipment required: That listed above. This is also an opportunity to show the Right Hand and Left Hand rules for motors and generators.

The following named individual is confirmed to have successfully passed a wire loop between the poles of a magnet, measured the current induced with an ammeter, and noted the direction of current depending on the direction the loop was passed:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

Hands-On Practical Electronics Assessment

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Basic Electronics performance Examination

TASK # 17

Task Description: **Wire an Op-amp for a gain of 5; measure input/output signal levels; from schematic diagram determine required modification to convert op-amp to provide a gain of 5.**

Supplies needed:

1. Schematic of operating amplifier circuit
2. May use oscilloscope or signal level meter for voltage measurements
3. DMM may be used
4. Resistor assortment

Time Allotment: **.5 Hour**

Equipment required: Those listed above, plus pen and paper to describe calculations or substations of parts to accomplish task. For multiple students taking tests, different gain goals can be substituted for 5.

The following named individual is confirmed to have successfully wired an Op-amp for a gain of 5; measured input/output signal levels, and determined from a schematic diagram the required modification to convert op-amp to provide a gain of 5:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

Hands-On Practical Electronics Assessment

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Basic Electronics performance Examination

TASK # 18

Task Description: **Using a voltage meter or battery voltage checker, measure the fully-charged battery potentials on 6 types of batteries used in electronics.**

Object: Using a voltage meter or battery voltage checker, measure the fully-charged battery potentials on 6 types of batteries used in electronics. Record anticipated changes in voltages and currents using all four resistors for loads in each experiment. Record the actual measurements. Compare results and record the reasons for differences. List common types of usage for each battery.

Supplies needed:

1. Carbon - Zinc cell
2. Alkaline cell
3. Nickel – hydroxide cell
4. Nickel – cadmium cell
5. Lithium cell
6. Lead – acid cell
7. Current and voltage meter
8. Pen/paper for recording actual and expected voltage levels
9. Load resistances of 1 ohm/150 Watt; 10 ohm/ 15 Watt; 100 ohm/10 Watt; 1,000 ohm/1 Watt

Time Allotment: **.5 Hour**

Equipment required: Those listed above, plus pen and paper to describe calculations or estimates for each battery type and for explanation of differences in each type. 1 each battery type in good condition.

The following named individual is confirmed to have successfully used a voltage meter or battery voltage checker, and measured the fully-charged battery potentials on 6 types of batteries used in electronics:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

Hands-On Practical Electronics Assessment

(To accompany knowledge test for S.E.T., Student Electronics Technician, or A.S.T., Associate CET)

Basic Electronics performance Examination

TASK # 19

Task Description: **Student injects a good square wave into an amplifier circuit.**

Object: Student injects a good square wave into amplifier circuit. (Can be audio or video circuit). Instructor has replaced a coupling capacitor with a much smaller value creating a similar situation to that of a dried out electrolytic. Student compares input perfect square wave with output poor low frequency waveform and finds the cause.
Circuit is then changed to reduce a resistance value, or connect a capacitor across circuit to cause poor high frequency response. Student suggests possible causes and locates cause of high frequency suck-out.

Supplies needed:

1. Square wave generator and simple audio or video amplifier circuit
2. Oscilloscope
3. Spare parts

Time Allotment: **1 Hour**

Equipment required: Those listed above, plus pen and paper to describe causes of poor performances. Also to predict possible causes of poor square wave reproduction.

The following named individual is confirmed to have successfully injected a good square wave into an amplifier circuit:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

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Hands-On Practical Electronics Assessment

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Basic Electronics performance Examination

TASK # 20

Task Description: **Student dissects CAT5e and CAT3 telephone cable.**

Object: Student dissects CAT5e and CAT3 telephone cable, identifies pairs, compares frequency responses and recognizes cross-talk and its cause. Installs fittings and uses crimp tool for RJ 45.

Supplies needed:

1. Short lengths of CAT 3 and CAT 5e. Also long rolls of both (100 to 1,000 feet)
2. Signal source
3. Signal-level meter or oscilloscope
4. Telephone pair color code standards
5. Second signal used to simulate cross-talk interference
6. RJ 45 fittings
7. Crimp tool

Time Allotment: **.5 Hour**

Equipment required: Those listed above, plus pen and paper to describe anticipated results with each length and type of phone-data cable.

The following named individual is confirmed to have successfully dissected CAT5e and CAT3 telephone cable:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

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Basic Electronics performance Examination

TASK # 21

THIS ALTERNATE TASK CAN BE SUBBED FOR 1-20 WHERE EQUIPMENT IS AN ISSUE

Task Description: **Identify individual channels on a spectrum analyzer.**

Object: Identify individual channels on spectrum analyzer, using cable TV outlet as signal source, or off air signal source, or satellite TV transponder signals. Student learns functions of SA, compares signal levels, prepares list of channels and relative dB strengths.

Supplies needed:

1. Spectrum Analyzer capable of one or more of the above bands of RF frequencies

Time Allotment: **1 Hour**

Equipment required: That listed above, plus pen and paper to indicate relative signal levels, bands viewed and observations plus student's view of uses for the test equipment.

The following named individual is confirmed to have successfully identified individual channels on a spectrum analyzer:

Student: **X**_____ date tested: _____

Instructor—examiner **X**_____

School, facility, testing location _____

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