

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LENNOX INDUSTRIES INC.,
Petitioner,

v.

ROSEN TECHNOLOGIES LLC,
Patent Owner.

Case No. IPR2023-00719
Patent 7,232,075 B1

**DECLARATION OF R. JACOB BAKER, PH.D., P.E. IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW OF CLAIMS 1-4 AND 11-15 OF
U.S. PATENT NO. 7,232,075 B1**

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Appendix A: CV of R. Jacob Baker, Ph.D., P.E.

I, R. Jacob Baker, Ph.D., P.E., declare as follows:

I. INTRODUCTION

1. My name is R. Jacob Baker, Ph.D., P.E., and I am a Professor of Electrical and Computer Engineering at the University of Nevada, Las Vegas. I have been retained by counsel for Lennox Industries Inc. (the “Petitioner”) in connection with the above-captioned *inter partes* review (“IPR”) of Claims 1-4 and 11-15 of U.S. Patent No. 7,232,075 B1 (the “’075 Patent”), entitled Thermostat System With Touchscreen With User Interfaces Or Operational Algorithms Via A Remote Correspondent, by named inventor Howard Rosen. I understand that the ’075 Patent is assigned to Rosen Technologies LLC (the “Patent Owner”). I have been asked to provide technical review, analysis, insights, and opinions regarding the ’075 Patent and the prior art references that form the basis for the ground of unpatentability set forth in the Petition for *Inter Partes* Review of the ’075 Patent (the “Petition”). I have been asked to provide a declaration regarding my opinions on the validity of Claims 1-4 and 11-15 of the ’075 Patent.

2. This declaration sets forth the opinions I have formed in this IPR and provides the bases and reasons for those opinions. This declaration is based on information currently available to me. I declare that I have personal knowledge of the facts set forth in this declaration and, if called to testify as a witness, could and would do so competently.

3. I am being compensated at my usual consulting rate of \$765 per hour for my work on this matter. I am also being reimbursed for any incurred expenses. My compensation is in no way dependent upon my opinions or testimony or the outcome of this proceeding. I have no other interests in this proceeding or with Petitioner or Patent Owner.

II. PROFESSIONAL BACKGROUND AND QUALIFICATIONS

4. A summary of my educational background, professional experience, publications, and other relevant qualifications is provided below. An additional account of my work experience and qualifications is included in my curriculum vitae, which is attached to this declaration as Appendix A. Appendix A also includes a list of the publications I have authored and a list of the other cases in which I have testified during the last four years.

5. I have been working as an Engineer since 1985 and I have been teaching Electrical and Computer Engineering courses since 1991. I am currently a Professor of Electrical and Computer Engineering at the University of Nevada, Las Vegas (“UNLV”).

6. I received B.S. and M.S. degrees in Electrical Engineering from UNLV in 1986 and 1988, respectively. I received my Ph.D. in Electrical Engineering from the University of Nevada, Reno, in 1993.

7. My doctoral research, culminating in the award of a Ph.D., investigated the use of power MOSFETs in the design of very high peak power, and high-speed, instrumentation. I developed techniques to reliably stack power MOSFETs to switch higher voltages, that is, greater than 1,000 V and 100 Amps of current with nanosecond switching times. This work was reported in the paper entitled “Transformerless Capacitive Coupling of Gate Signals for Series Operation of Power MOSFET Devices,” published in the IEEE Transactions on Power Electronics. The paper received the Best Paper Award in 2000.

A. Industry Experience

8. I have done technical and expert witness consulting for over 200 companies and their subsidiaries since I started working as an engineer in 1985. From 1985 to 1993, I worked for EG&G Energy Measurements and the Lawrence Livermore National Laboratory designing nuclear diagnostic instrumentation for underground nuclear weapon tests at the Nevada test site. During this time, I designed, and oversaw the fabrication of, over 30 electronic and electro-optic instruments, including high-speed cable and fiber-optic receiver/transmitters, PLLs, frame and bit-syncs, data converters, streak-camera sweep circuits, Pockel’s cell drivers, micro-channel plate gating circuits, charging circuits for battery backup of equipment for recording test data, and analog oscilloscope electronics.

9. My work during this time, as one example, had a direct impact on my doctoral research work using power MOSFETs, subsequent publishing efforts, and industry designs. In addition to the 2000 Best Paper Award from the IEEE Power Electronics Society, I published several other papers in related areas while working in industry. I hold a patent, Patent No. 5,874,830, in the area of power supply design, titled, “Adaptively biased voltage regulator and operating method,” which was issued on February 23, 1999. I have designed dozens of linear and switching power supplies for commercial products and scientific instrumentation.

10. I am a licensed Professional Engineer and have extensive industry experience in circuit design, fabrication, and manufacture of Dynamic Random Access Memory (DRAM) semiconductor integrated circuit chips, Phase-Change Random Access Memory (PCRAM) chips, and CMOS Image Sensors (CISs) at Micron Technology, Inc. (“MTI”) in Boise, Idaho. I spent considerable time working on the development of flash memory chips while at MTI. My efforts resulted in more than a dozen patents relating to flash memory. One of my projects at MTI included the development, design, and testing of circuit design techniques for a multi-level cell (MLC) flash memory using signal processing. This effort resulted in higher-density memories for use in solid-state drives and flash memory cards having an ATA interface that are ubiquitous in consumer electronics, including cameras and data storage systems. Further, the use of higher-density memory can

result in fewer changes in the flash translation layer for logical-to-physical addressing, less need for garbage collection, and larger data segments that can improve a computing system's performance. Another project I worked on at MTI focused on the design of buffers for high-speed double-data rate DRAM, which resulted in around 10 U.S. patents in buffer design. Among many other experiences, I led the development of the delay locked loop (DLL) in the late 1990s so that MTI DRAM products could transition to the DDR memory protocol, used in mobile and non-mobile (server, desktop, cell phones, tablets, etc.) computing systems as main computer memory, for addressing and controlling accesses to memory via interprocess communications (IPC) with the memory controller (MC). I provided technical assistance with MTI's acquisition of Photobit during 2001 and 2002, including transitioning the manufacture of CIS products into MTI's process technology. Further, I did consulting work at Sun Microsystems and then Oracle on the design of memory modules during 2009 and 2010. This work entailed the design of low-power, high-speed, and wide interconnection methods with the goal of transmitting data to/from the memory module and the MC at higher speeds.

11. I have extensive experience in the development of instrumentation and commercial products in a multitude of areas including: integrated electrical/biological circuits and systems, array (memory, imagers, and displays) circuit design, CMOS analog and digital circuit design, diagnostic electrical and

electro-optic instrumentation for scientific research, CAD tool development and online tutorials, low-power interconnect and packaging techniques, design of communication/interface circuits (to meet commercial standards such as USB, firewire, DDR, PCIe, SPI, etc.), circuit design for the use and storage of renewable energy, and power electronics. For example, a part of my research at Boise State, for many years, focused on the use of Thru-Silicon-Vias (TSVs), aka Thru-Wafer Vias (TWVs), for high-density packaging. These packaging techniques were utilized in the memory module development work I did with Sun Microsystems and Oracle. As another example, I designed circuitry for use in implementing Universal Serial Bus (USB) interface circuits while I did consulting at Tower Semiconductor. I designed PCI communication circuits for IPC between a Graphics Processor Unit (GPU) and memory while consulting for Rendition, Inc.

12. My current research work is focused in part on the design of integrated circuits for wireless sensing using LIDAR (Light Detection And Ranging). I have worked with several companies in the development of these circuits and systems including Freedom Photonics, Aeries Photonics, and FLIR. In the early 1990s, I worked on wireless systems for wideband impulse radar while at Lawrence Livermore Laboratory. Further, part of my research for several years focused on the digitization of IQ channels using delta-sigma modulation. The knowledge and experience gained from this effort are reflected in my textbook CMOS Mixed-Signal

Circuit Design and a presentation, which I have presented at several universities and companies, http://cmosedu.com/jbaker/papers/talks/BP_DSM_talk.pdf.

B. Academic Experience

13. I was an adjunct faculty member in the Electrical Engineering departments of UNLV and UNR from 1991-1993. From 1993 to 2000, I served on the faculty at the University of Idaho as an Assistant Professor and then as a tenured Associate Professor of Electrical Engineering. In 2000, I joined a new Electrical and Computer Engineering program at Boise State University (“BSU”), where I served as department chair from 2004 to 2007. At BSU, I helped establish graduate programs in Electrical and Computer Engineering including, in 2006, the university’s second Ph.D. degree. In 2012, I re-joined the faculty at UNLV. Over the course of my career as a professor, I have advised more than 100 masters and doctoral students.

14. I have been recognized for my contributions as an educator in the field. While at Boise State University, I received the President’s Research and Scholarship Award (2005), Honored Faculty Member recognition (2003), and Outstanding Department of Electrical Engineering Faculty recognition (2001). In 2007, I received the Frederick Emmons Terman Award (the “Father of Silicon Valley”). The Terman Award is bestowed annually upon an outstanding young electrical/computer engineering educator in recognition of the educator’s

contributions to the profession. In 2011, I received the IEEE Circuits and Systems Education Award. I received the Tau Beta Pi Outstanding Electrical and Computer Engineering Professor Award every year it was awarded while I have been back at UNLV.

15. I have authored several books and papers in the electrical and computer engineering area. My published books include CMOS Circuit Design, Layout, and Simulation (Baker, R.J., Wiley-IEEE, ISBN: 9781119481515 (4th ed., 2019)) and CMOS Mixed-Signal Circuit Design (Baker, R.J., Wiley-IEEE, ISBN: 9780470290262 (2nd ed., 2009) and ISBN: 9780471227540 (1st ed., 2002)). I co-authored DRAM Circuit Design: Fundamental and High-Speed Topics (Keeth, B., Baker, R.J., Johnson, B., and Lin, F., Wiley-IEEE, ISBN: 9780470184752 (2008)), DRAM Circuit Design: A Tutorial (Keeth, B. and Baker, R.J., Wiley-IEEE, ISBN: 0-7803-6014-1 (2001)), and CMOS Circuit Design, Layout and Simulation (Baker, R.J., Li, H.W., and Boyce, D.E., Wiley - IEEE, ISBN: 9780780334168 (1998)). I contributed as an editor and co-author on several other electrical and computer engineering books.

C. Other Relevant Experience

16. I have performed technical and expert witness consulting for more than 200 companies and their subsidiaries and given more than 50 invited talks at conferences, companies, and universities. Further, I am the author or co-author of

more than 100 papers and presentations in the areas of electrical and computer engineering design, fabrication, and packaging.

17. I currently serve, or have served, as a volunteer on the IEEE Press Editorial Board (1999-2004); as editor for the Wiley-IEEE Press Book Series on Microelectronic Systems (2010-2018); as the Technical Program Chair of the 2015 IEEE 58th International Midwest Symposium on Circuits and Systems (MWSCAS 2015); on the IEEE Solid-State Circuits Society (SSCS) Administrative Committee (2011-2016); as a Distinguished Lecturer for the SSCS (2012-2015); the Technology Editor (2012-2014) and Editor-in-Chief (2015-2020) for IEEE Solid-State Circuits Magazine; IEEE Kirchhoff Award Committee (2020-2023); and advisor for the student branch of the IEEE at UNLV (2013-present). These meetings, groups, and publications are intended to allow researchers to share and coordinate research. My active participation in these meetings, groups, and publications allowed me to see what other researchers in the field have been doing.

18. In addition to the above, I am an IEEE Fellow for contributions to semiconductor memory design and a member of the honor societies Eta Kappa Nu and Tau Beta Pi.

III. MATERIALS CONSIDERED

19. The analysis that I provide in this declaration is based on my education, research, experience, and professional judgment, as well as the documents I have

considered, including the '075 Patent (Exhibit 1001) and its prosecution history (Exhibit 1003). I have reviewed and am familiar with the specification of the '075 Patent. I have reviewed and am familiar with the file history of the '075 Patent.

20. In preparing this declaration, I have also reviewed and am familiar with the following prior art used in the Petition and in my declaration below:

- **Exhibit 1005** – U.S. Patent Application Publication No. 2003/0150926 A1 by Rosen (“*Rosen*”) was filed on February 13, 2002 and published on August 14, 2003, which is more than one year before the January 19, 2005 priority date of the '075 Patent.¹ I understand from counsel for Petitioner that *Rosen* qualifies as prior art under at least pre-AIA 35 U.S.C. §§ 102(a) and (b).
- **Exhibit 1006** – U.S. Patent Application Publication No. 2003/0142121 by Rosen (“*Rosen-II*”) was filed on January 30, 2002 and published on

¹ The '075 Patent was filed on January 19, 2005 and claims priority as a continuation-in-part of U.S. Patent Application No. 10/440,474 filed on May 15, 2003, now U.S. Patent No. 7,050,026. As I explain in Section V.D, in my opinion the disclosures of U.S. Patent Application No. 10/440,474 and U.S. Patent No. 7,050,026 do not support a claim of priority to the May 15, 2003 filing date of U.S. Patent Application No. 10/440,474.

July 31, 2003, which is more than one year before the January 19, 2005 priority date of the '075 Patent. I understand from counsel for Petitioner that *Rosen-II* qualifies as prior art under at least pre-AIA 35 U.S.C. §§ 102(a) and (b).

- **Exhibit 1007** – International Patent Application Publication No. WO 02/48851 A2 by Smith (“*Smith*”) was filed on November 1, 2001 and published on June 20, 2002, which is more than one year before the January 19, 2005 priority date of the '075 Patent. I understand from counsel for Petitioner that *Smith* qualifies as prior art under at least pre-AIA 35 U.S.C. §§ 102(a), (b), and (e).

21. I have considered the following documents in my analysis below:

Exhibit No. ²	Description
1001	U.S. Patent No. 7,232,075 (“’075 Patent”)
1003	Prosecution File History of the ’075 Patent
1004	U.S. Patent No. 7,050,026 to Rosen (“’026 Patent”)

² Citations to issued patents (Exhibits 1001, 1004, 1013-1015, 1021, 1024, and 1025) are made by column and line number. Citations to patent application publications (Exhibits 1005, 1006, 1023, and 1027) are made by paragraph number. Citations to Exhibits 1007, 1009, 1010, 1012, 1016-1019, 1022, and 1026 are to the original page numbering in the exhibits. Citations to Exhibits 1003, 1008, and 1020 are to the page number added by the exhibit label.

Exhibit No.²	Description
1005	U.S. Patent Application Publication No. 2003/0150926 A1 by Rosen (“ <i>Rosen</i> ”)
1006	U.S. Patent Application Publication No. 2003/0142121 A1 by Rosen (“ <i>Rosen-II</i> ”)
1007	International Patent Application Publication No. WO 02/48851 A2 by Smith (“ <i>Smith</i> ”)
1008	Prosecution File History of the ’026 Patent.
1009	Plaintiff’s Proposed Claim Constructions, <i>Rosen Technologies LLC v. Lennox Industries, Inc.</i> , No. 3:22-cv-00732-K (N.D. Tex. Feb. 2, 2023)
1010	Defendant’s Disclosure of Claim Constructions Extrinsic Evidence, <i>Rosen Technologies LLC v. Lennox Industries, Inc.</i> , No. 3:22-cv-00732-K (N.D. Tex. Feb. 2, 2023)
1012	Transcript of Deposition of Howard J. Rosen, December 14, 2022, <i>Rosen Technologies LLC v. Lennox Industries, Inc.</i> , No. 3:22-cv-00732-K (N.D. Tex.)
1013	U.S. Patent No. 4,071,745 to Hall (“ <i>Hall</i> ”)
1014	U.S. Patent No. 4,382,544 to Stewart (“ <i>Stewart</i> ”)
1015	U.S. Patent No. 4,669,654 to Levine (“ <i>Levine</i> ”)
1016	Excerpts of IEEE Standard Dictionary of Electrical and Electronics Terms, Fourth Edition, ANSI/IEEE Std 100-1988 (Nov. 3, 1988)
1017	R.L. Timings and P. Twigg, The Pocket Illustrated Dictionary of Engineering Terms (2001)
1018	International Patent Application Publication No. WO 03/040839 by Geiwitz (“ <i>Geiwitz</i> ”)
1019	Cardio manual, Secant home automation inc (“ <i>Cardio Manual</i> ”)
1020	Statutory Disclaimer filed in U.S. Patent Application No. 10/060,768
1021	U.S. Patent No. 6,161,133 to Kikinis (“ <i>Kikinis</i> ”)
1022	Gillett et al., A Taxonomy of Internet Appliances (September 2000)
1023	U.S. Patent Application Publication No. 2002/0083121 by Chang (“ <i>Chang</i> ”)
1024	U.S. Patent No. 5,848,064 to Cowan (“ <i>Cowan</i> ”)
1025	U.S. Patent No. 5,619,250 to McClellan (“ <i>McClellan</i> ”)

Exhibit No.²	Description
1026	Joint Claim Construction and Prehearing Statement, <i>Rosen Technologies LLC v. Lennox Industries, Inc.</i> , No. 3:22-cv-00732-K (N.D. Tex. Feb. 23, 2023)
1027	European Patent Application Publication No. EP2053505 A2 by Britt et al. (" <i>Britt</i> ")

IV. UNDERSTANDING OF APPLICABLE LEGAL STANDARDS

22. Although I am not an attorney, I have a general understanding of the applicable legal standards pertaining to the patentability issues presented in this proceeding. My understanding of legal principles as described in this section is based on communication of those principles to me by Petitioner's legal counsel. The analysis in this declaration is in accordance with the legal principles outlined below.

23. I understand that, in this *inter partes* review, Petitioner has the burden of proving that each challenged claim is unpatentable by a preponderance of the evidence.

A. My Understanding of Claim Construction

24. I have been informed by counsel that a purpose of claim construction is to determine what a person of ordinary skill in the art ("POSITA") would have understood the claim terms to mean. I understand that during an IPR proceeding, claims are to be construed in light of the specification as would be read by a POSITA at the time the application was filed. I understand that claim terms are given their ordinary and customary meaning as would be understood by a POSITA in the

context of the entire disclosure. A claim term, however, will not receive its ordinary meaning if the patentee acted as his own lexicographer and clearly set forth a definition of the claim term in the specification. In this case, the claim term will receive the definition set forth in the patent.

25. I understand that the prosecution history can inform the meaning of the claim language by demonstrating how the inventors understood the invention and whether the inventors limited the invention in the course of prosecution, making the claim scope narrower than it otherwise would be. I understand that extrinsic evidence may also be consulted in construing the claim terms, such as dictionary definitions and expert testimony.

26. I further understand that 35 U.S.C. § 112 ¶ 6 created an exception to the general rule of claim construction. I understand that patent claims may be drafted in means-plus-function format, in which a claim limitation is expressed as a means or step for performing a specified function, without a recital of structure. I understand that, under § 112 ¶ 6, a limitation will be presumed to be a “means-plus-function” limitation if (a) the claim limitation uses the word “means”; (b) the word “means” is modified by functional language; and (c) the word “means” is not modified by sufficient structure for achieving the specified function.

27. I understand that a means-plus-function limitation should be interpreted to cover only the recited function and the corresponding structure for performing the

function as described in the specification, as well as equivalent structures. I understand that a structure is deemed equivalent to the corresponding structure in the specification only if the difference between them is insubstantial. For example, two structures may be deemed equivalent if they perform the same function in substantially the same way to achieve substantially the same result. I further understand that a structural equivalent must have been available at the time of issuance of the claim.

B. My Understanding of Obviousness

28. I understand that a patent claim is unpatentable if, at the time of the invention, it would have been obvious to one of ordinary skill in the art to combine the teachings of the prior art to yield the patent claim. I also understand that it is not required (although it is acceptable) that each element of a patent claim be found in a single reference in order to find a patent claim obvious. This means that even if all of the requirements of the claim cannot be found in a single prior art reference that would anticipate the claim, the claim can still be invalid. For a patent claim to be found obvious, all the elements of the patent claim may be found in a combination of references at which a POSITA would have been reasonably expected to arrive.

29. I understand that the following factors should be considered in analyzing obviousness: (1) the scope and content of the prior art; (2) the differences between the prior art and the claims; (3) the level of ordinary skill in the pertinent

art; and (4) other objective considerations identified below. I understand that an invention is obvious when the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a POSITA at the time the invention was made.

30. I understand that a showing of obviousness requires some articulated reasoning with a rational underpinning to support the combination of references. I understand that in consideration of the issue of obviousness it is important to identify whether a reason existed at the time of the invention that would have led a person of ordinary skill in the pertinent art to combine elements of the references in a way that yields the claimed invention.

31. I understand that a POSITA is assumed to have knowledge of all prior art references. I also understand that when considering the obviousness of a patent claim, one may consider whether a teaching, suggestion, or motivation to combine the references exists so as to avoid impermissibly applying hindsight when considering the prior art. I understand this test should not be rigidly applied, but that the test can be important to avoiding such hindsight.

32. I understand that a POSITA can combine various prior art references based on the teachings of those prior art references, the general knowledge present in the art, or common sense. I understand that a motivation to combine the references may be implicit in the prior art, and there is no requirement that there be an actual

or explicit teaching to combine two references. Thus, one may take into account the inferences and creative steps that a POSITA would employ to combine the known elements in the prior art in the manner claimed by the patent-at-issue. I understand that one should avoid “hindsight bias” and ex post reasoning in performing an obviousness analysis. This does not mean, however, that a POSITA does not have recourse to common sense for purposes of the obviousness inquiry.

33. I understand that a claim may be considered unpatentable for obviousness for various reasons. I have been informed that the following exemplary rationales may support a finding of obviousness:

- A) combining prior art elements according to known methods to yield predictable results;
- B) simply substituting one known element for another to obtain predictable results;
- C) use of a known technique to improve similar devices (methods, or products) in the same way;
- D) applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
- E) choosing from a finite number of identified, predictable solutions with a reasonable expectation of success;

F) a predictable variation of work in the same or a different field of endeavor, which a POSITA would be able to implement;

G) if, at the time of the alleged invention, there existed a known problem for which there was an obvious solution encompassed by the patent's claim;

H) known work in one field of endeavor that prompts variations of it for use in either the same field or a different field based on technological incentives or other market forces if the variations would have been predictable to one of ordinary skill in the art; and/or

I) some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior-art reference or to combine multiple prior-art references or teachings to arrive at the claimed invention.

34. I understand that even if a prima facie case of obviousness is established, the final determination of obviousness must also consider objective indicia of nonobviousness, which I understand are also referred to as "secondary considerations," if presented. I understand that these objective indicia can be important evidence as to whether a patent is obvious or nonobvious. Such secondary considerations include: (1) commercial success of products covered by the patent claims; (2) a long-felt but unsolved need for the invention; (3) failed attempts by others to make the invention; (4) copying of the invention by others in the field; (5) unexpected results achieved by the invention as compared to the closest prior art; (6)

praise of the invention by the infringer or others in the field; (7) the taking of licenses under the patent by others; (8) expressions of surprise by experts and those skilled in the art at the making of the invention; and (9) the patentee proceeded contrary to the accepted wisdom of the prior art. I further understand that secondary considerations evidence is only relevant if the offering party establishes a connection, or nexus, between the evidence and the claimed invention.

35. I also understand that “obviousness” is a legal conclusion based on the underlying factual issues of the scope and content of the prior art, the differences between the claimed invention and the prior art, the level of ordinary skill in the prior art, and any objective indicia of non-obviousness. For that reason, I am not rendering a legal opinion on the ultimate legal question of obviousness. Rather, my testimony addresses the underlying facts and factual analysis that would support a legal conclusion of obviousness, and when I use the term obvious, I am referring to the perspective of a POSITA at the time of invention.

C. Level of Ordinary Skill in the Art

36. I understand that an assessment of the claims of the '075 Patent should be undertaken from the perspective of a POSITA as of the earliest claimed priority date. I understand that a POSITA is presumed to be aware of all pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity—not an automaton.

37. I understand that to determine the appropriate level of a POSITA, the following factors may be considered: (1) the types of problems encountered by those working in the field and prior art solutions thereto; (2) the sophistication of the technology in question, and the rapidity with which innovations occur in the field; (3) the educational level of active workers in the field; and (4) the educational level of the inventor.

D. Priority Date

38. I understand that, subject to the next paragraph, the asserted “priority date” of a patent is the earlier of: (a) the date on which a patent application is filed; or (b) the date on which an earlier-filed patent application is filed if the patentee claims the benefit of priority to that earlier-filed patent application.

39. I understand that it is not enough for a patent to merely claim the benefit of an earlier-filed application, but that additional criteria must be met. In particular, the prior application itself must describe the claimed invention, and must do so in sufficient detail that one skilled in the art can clearly conclude that the inventor invented the claimed invention as of the filing date sought. First, I understand that a priority-date analysis is on a claim-by-claim basis. Second, I understand that, in order for a patent claim to be entitled to the filing date of an earlier patent application, a “Section 112 analysis” must be conducted. I am informed that a “Section 112” analysis encompasses looking to the earlier patent application, and ascertaining

whether that earlier patent application meets both the written-description and enablement requirements as of the filing date of the earlier application. I understand that it is not enough that the claim would have been obvious from the earlier application, but that application itself must describe the claimed invention.

40. I understand that in order to satisfy the written description requirement the earlier application must reasonably convey to those skilled in the art that the inventors had possession of the subject matter of the patent as of the filing date of the earlier application. I have been informed that it is the disclosures of the earlier patent application that count, and that while the meaning of terms, phrases, or diagrams in the earlier patent application must be interpreted from the vantage point of one skilled in the art, all of the claimed limitations must appear in the specification. Further, I understand that this analysis is not a question of whether one skilled in the art might be able to construct the claimed invention from the teachings of the disclosure. The question is not whether a claimed invention is an obvious variant of that which is disclosed in the specification; rather, I understand that an earlier application must itself describe each of the claim limitations.

41. I also understand that in order to satisfy the enablement requirement, the earlier application must enable a person of ordinary skill in the art to practice the claimed invention without undue experimentation.

V. OVERVIEW OF THE '075 PATENT

42. I have reviewed the '075 Patent, which is entitled “Thermostat System With Touchscreen With User Interfaces Or Operational Algorithms Via A Remote Correspondent.” EX1001 at Cover. I understand that the '075 Patent was filed on January 19, 2005. As I describe in more detail below in Section V.D, I also understand that the '075 Patent claims priority to other documents, but it is nonetheless not entitled to a priority date any earlier than January 19, 2005.

A. Subject Matter

43. The '075 Patent describes and claims a thermostat system for controlling space conditioning equipment. EX1001 at 14:2-3. More particularly, the '075 Patent relates to “a thermostat system incorporating a communication interface for receiving functional programming from a remote correspondent.” *Id.* at 1:13-15.

44. The claimed thermostat system includes conventional components such as a temperature sensor, a touch screen for interactive interface with a user, a processor including a central processing unit, real time clock, memory, and input/output unit, and a control program. *Id.* at 14:2-48. The “Background of the Invention” section of the '075 Patent confirms that these components were well known by the time the '075 Patent was filed. For instance, the '075 Patent acknowledges that “[t]hermostats have been used for many years as a temperature

sensitive switch which controls heating and/or cooling equipment for conditioning a space[.]” EX1001 at 1:23-27. The ’075 Patent admits that “[m]any modern thermostat systems include a real time clock, a memory and a data processor to run a process control program stored in the memory to accurately measure the temperature of a temperature sensor disposed in the conditioned space and to send control signals to the heating and/or cooling equipment to closely control the temperature of the conditioned space.” *Id.* at 1:39-46. Additionally, the ’075 Patent admits that “[s]ome modern thermostat systems incorporate a touch sensitive screen which incorporate representations of buttons which a user may press as part of an interface with the thermostat system.” *Id.* at 2:50-53. Thus, the ’075 Patent teaches that the majority of the elements of the claimed thermostat system were well known in the art and in use in modern thermostat systems before the priority date of the ’075 Patent.

45. The ’075 Patent purports to address problems with existing user interface systems for programmable thermostat systems. According to the patent, “our knowledge of improvements in user interfaces and thermostat system equipment changes and control options are continuously evolving.” EX1001 at 2:56-58. The ’075 Patent describes that “[a]t a particular moment in time, a form of a user interface may best suit a user’s needs and incorporate modern equipment options. However, the day always arrives when an improved user interface is

conceived or space conditioning equipment is improved, where either or both require a change in the thermostat system and/or user interface.” *Id.* at 2:58-64.

46. According to the ’075 Patent, “[t]hermostats have in the past had very limited ability to be upgraded due to downward price pressure in the marketplace and the practical limitations of a user’s lack of inclination to learn a sophisticated interface.” *Id.* at 2:64-3:1. Thus, according to the ’075 Patent, “[t]here is a need for a programmable thermostat whose user interface can be easily changed after installation to accommodate equipment or control options not anticipated at installation or to change the user interface to a form not possible with a control program originally installed with the thermostat.” *Id.* at 3:5-10.

47. To that end, the ’075 Patent purports to have invented “a programmable thermostat capable of receiving functional programming from a remote correspondent or removable media so that representations of information or touch sensitive buttons on a liquid crystal display are changed from those available to the thermostat before said receipt of functional programming.” *Id.* at 3:14-19. According to the ’075 Patent, “[a] user may quite easily download such functional programming from a remote correspondent to implement through a control program of the programmable thermostat one or more new, improved, or desired user interfaces.” *Id.* at 3:19-25.

48. Figure 1 of the '075 Patent “is a block diagram of a first embodiment of a space conditioning system incorporating a thermostat system employing the present invention.” *Id.* at 5:7-9. The thermostat system includes admittedly conventional components including “a processor 1 and a temperature sensor 5 which is disposed in a conditioned space 4.” *Id.* at 5:59-61. The processor includes “a central processing unit (CPU) 9 in communication with a memory 8 which stores data and program information and also, via an input/output unit (I/O unit) 10, a touch pad 11 and a liquid crystal display (LCD) 12.” *Id.* at 6:1-5. “A settable real time clock 13 is used to keep time in the thermostat system to facilitate operation.” *Id.* at 9-10. Additionally, “[t]he I/O unit includes a communications interface 14 for coordinating communications between the CPU 9 and a remote correspondent 15. The communications interface 14 may be, for example, a conventional serial port.” *Id.* at 6:12-16.

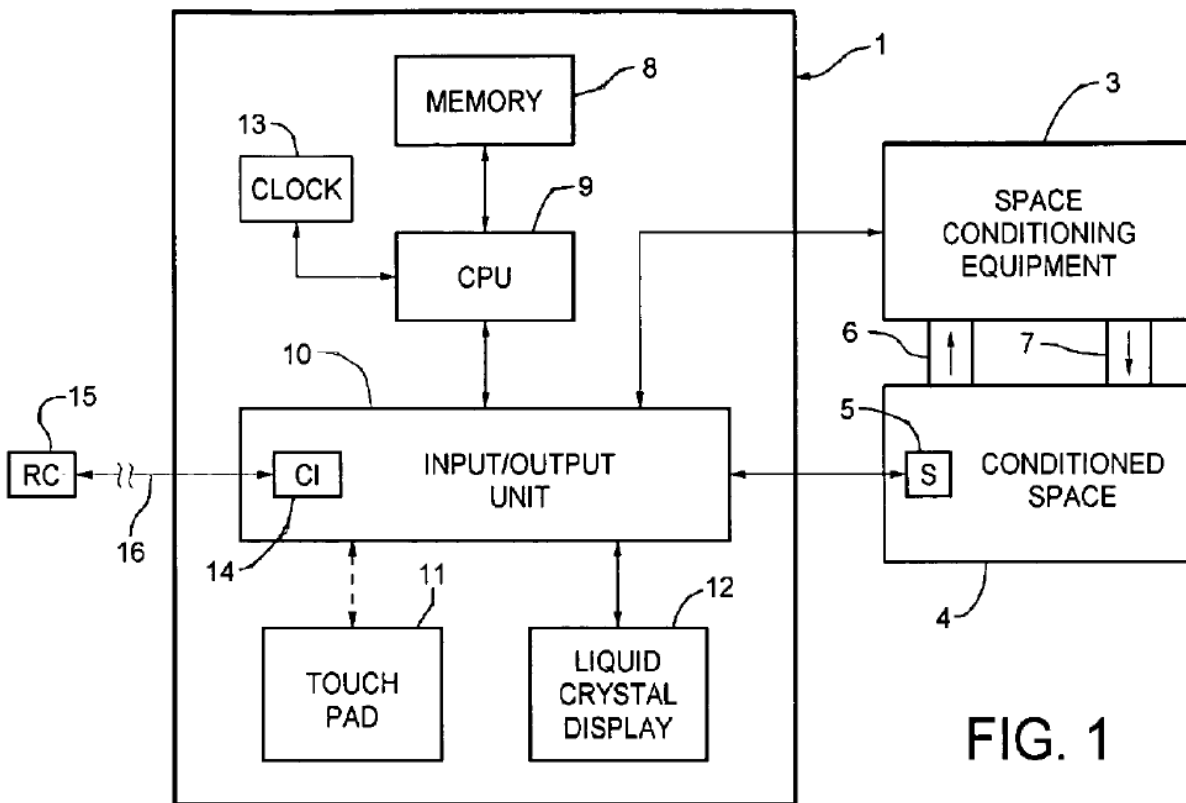


FIG. 1

Id. at Figure 1.

49. The '075 Patent explains that “[w]hile the Internet is not the only facility which the subject thermostat system may use to communicate with a remote correspondent, it is, at the state-of-the-art the most readily widely available and easily accessible.” *Id.* at 8:53-56. Figure 2 illustrates “a typical coupling in which the communications interface 14 sends/receives serial data to/from an external (to the thermostat system) modem 20 via serial link 16.” *Id.* at 8:56-59. “The modem conventionally interfaces with an Internet Service Provider (ISP) 21 which completes the communications link to the remote correspondent in the well-known

manner.” *Id.* at 8:59-62. In one embodiment, shown in Figure 3, “a modem 24 for communicating with the ISP 21 may be integrated into the communications interface 14 of the input/output unit 14 to eliminate the need for an external modem.” *Id.* at 8:66-9:2. Figures 2 and 3 of the ’075 Patent are reproduced below:

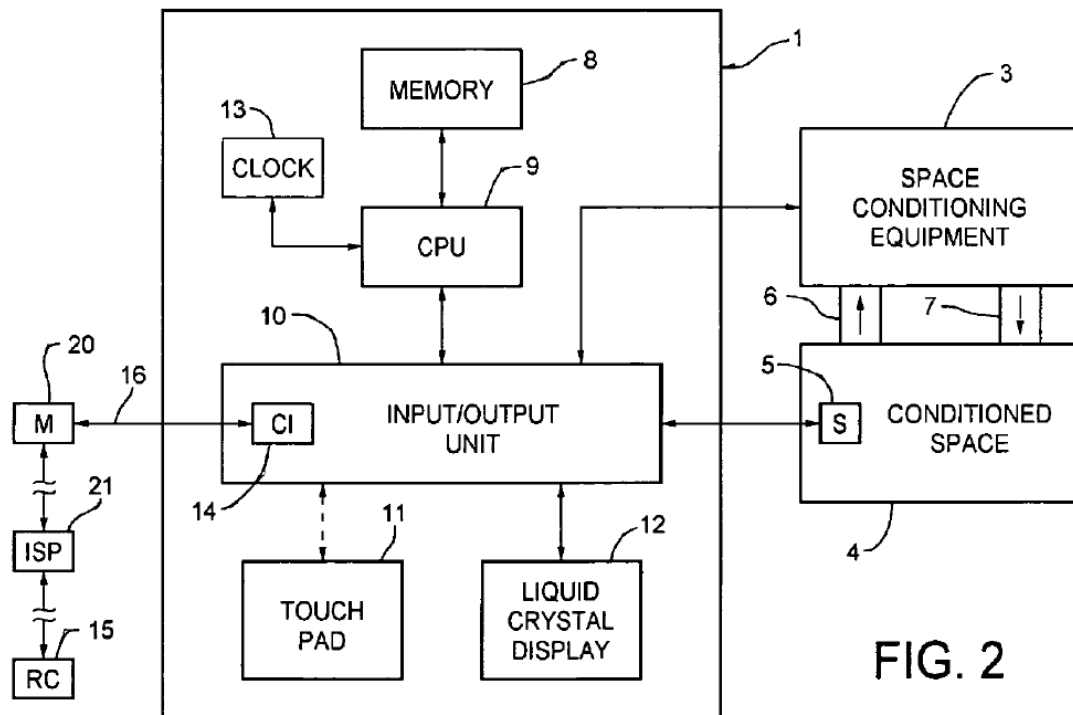


FIG. 2

Id. at Figure 2.

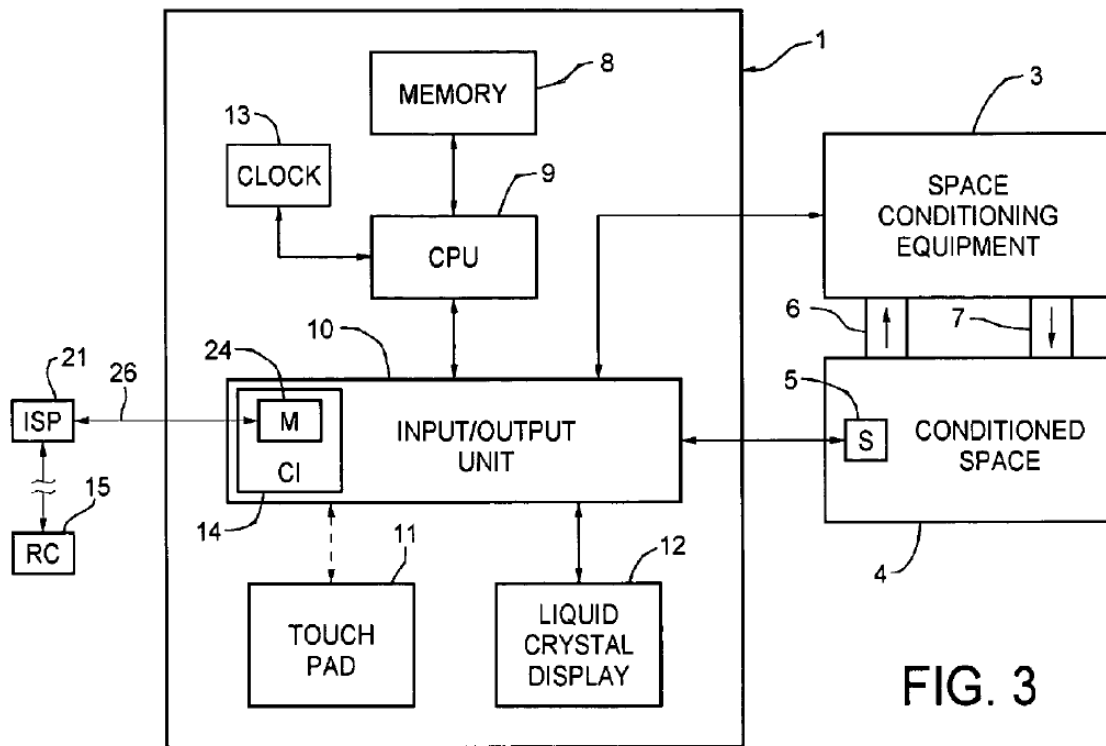
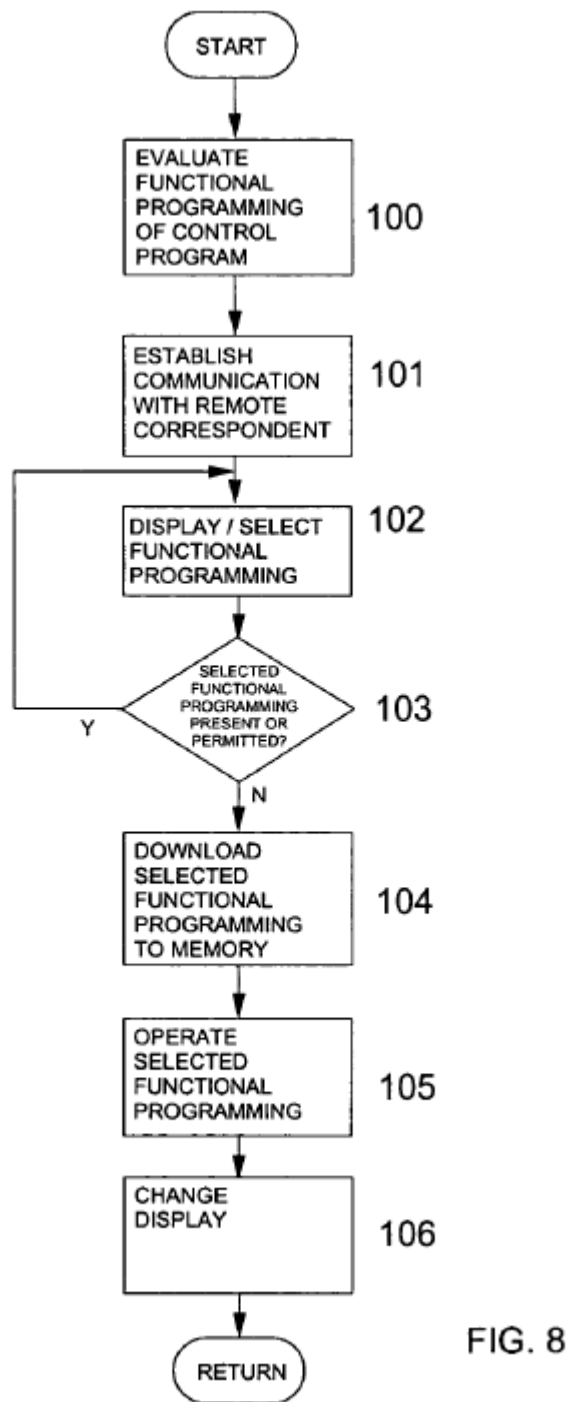


FIG. 3

Id. at Figure 3.

50. With respect to “a functional programming embodiment of the invention,” the ’075 Patent describes, with reference to Figure 1, that “there is stored in the memory 8 a control program enabling functions of the programmable thermostat of the invention.” *Id.* at 9:31-34. Figure 8, reproduced below, “is a high-level flow chart describing the operation of the invention obtaining and incorporating functional programming with a control program.” *Id.* at 5:28-30.



Id. at Figure 8.

51. With reference to Figure 8, the '075 Patent describes that “[a]t the election of a user locally at touch pad 11 as provided for by the control program,”

the “CPU 9 at step 101 . . . communicates signals to the I/O unit 10 to facilitate the communications interface 14 to establish communications, via link 16, with a remote correspondent 15.” *Id.* at 9:49-56. “The remote correspondent 15 has a known data communications ‘address’” and “is a source of functional programming.” *Id.* at 9:58-60. “At step 102, a user is shown functional programming available for transfer to the programmable thermostat system and a user selects at least one of such functional programming selections.” *Id.* at 9:60-64. “At step 105, the selected functional programming is transferred and becomes part of the control program.” *Id.* at 9:65-66. “At step 106, the selected functional programming cause a change in the touch pad 11 and/or LCD 12 as appropriate for the current screen display requirements.” *Id.* at 9:66-10:2.

52. The ’075 Patent does not explicitly define functional programming, but provides examples of “functional programming transferred to the memory of the programmable thermostat and previously unavailable to the control program,” including: “one or more entire graphical user interfaces as represented on a touchscreen,” “portions of a graphical user interface,” “representations of the size, shape, colors, legends, locations, and other viewable aspects of virtual buttons on the touchscreen,” “representations of the size, shape, colors, locations and other viewable aspects of text or graphic devices on the touchscreen,” “operational algorithms for the control program other than those for the graphical user interface,”

“operational algorithms for control of existing or newly installed space conditioning equipment,” and “operational algorithms for communications with existing or newly installed environmental sensors.” *Id.* at 10:35-54.

53. According to the '075 Patent, “[f]unctional programming transferred to the thermostat according to the invention does not include data-only transfers.” *Id.* at 11:4-6. The '075 Patent does not define “data-only transfers,” but a POSITA would have understood from the disclosure of the '075 Patent that “data-only transfers,” in the context of the '075 Patent, refers to transfers of information such as “current local weather information” or “current stock quotations.”

54. For example, the '075 Patent describes a “first embodiment of the invention” separate from the “functional programming embodiment of the invention.” *Id.* at 6:49, 9:31-32. In relation to the “first embodiment,” the '075 Patent describes a thermostat system establishing communications with a remote correspondent to obtain “current information, such as local weather” or “current stock quotations” for display on the thermostat system. *Id.* at 6:49-8:3. The patent explains that the current information e.g., weather information, may be downloaded “as a data stream.” *Id.* at 7:35-39; *see also id.* at 9:18-23 (describing receiving “weather data”).

55. In contrast, with respect to the “functional programming embodiment” (*Id.* at 9:31-32), the '075 Patent describes functional programming that “is

transferred and becomes part of the control program” in order to “cause a change in the touch pad 11 and/or LCD 12 as appropriate for the current screen display requirements.” *Id.* at 9:65-10:2; *see also id.* at 10:34-11:3 (describing non-limiting examples of functional programming transferred to the memory of the programmable thermostat and previously unavailable to the control program); 14:42-46 (Claim 1 reciting operating functional programming to “change or add to representations on the touch screen, where said changes or additions of representation on the touch screen were not available to the control program before their transfer to the memory”).

B. Listing of Challenged Claims

56. Below I provide a listing of Claims 1-4 and 11-15 (collectively, the “Challenged Claims”) of the ’075 Patent. I will refer throughout this declaration to the elements of the claims with reference to the number and letter designations that have been added in the left column (e.g., “1[pre],” “1[a],” “1[b],” etc.).

Claim 1	
1[Pre]	A thermostat system for controlling space conditioning equipment comprising:
1[a]	A) a temperature sensor for providing an electrical signal indicative of the temperature of a conditioned space in which the temperature sensor is situated;
1[b]	B) a transparent touch pad juxtaposed over a liquid crystal display to constitute a touch screen for interactive interface with a user and for

	selectively displaying alphanumeric and graphic devices;
1[c]	C) a processor, said processor including 1) a central processing unit;
1[d]	2) a real time clock;
1[e]	3) a memory coupled to said central processing unit for storing program and data information; and
1[f]	4) an input/output unit including:
1[g]	a) a sensor input coupled to said temperature sensor for receiving said electrical signal therefrom;
1[h]	b) a control output coupled to the space conditioning equipment for issuing control signals thereto; and
1[i]	c) a communications interface adapted to establish communications between said processor and a first remote correspondent which is a source of functional programming; and
1[j]	D) a control program stored in said memory for causing said central processing unit to selectively: 1) establish on said liquid crystal display one or more representations of buttons at a separated and predetermined positions;
1[k]	2) read the position on the touch pad juxtaposed with said predetermined position to determine if said representation of a button has been touched; and
1[l]	3) if said a representation of a button has been touched, processing this information to establish a condition incorporated into the operation of said thermostat system;
1[m]	4) establish communications between said processor and a first remote correspondent from which is transferred to said memory one or more modules of functional programming; and
1[n]	5) operate said transferred functional programming to change or add to representations on the touch screen, where said changes or additions of representation on the touch screen were not available to the control

	program before their transfer to the memory;
1[o]	E) means coupling said communications interface and said first remote correspondent.
Claim 2	
2	The system of claim 1 in which in which said communications interface includes a modem.
Claim 3	
3	The system of claim 1 in which said communications interface is coupled to an external modem.
Claim 4	
4	The system of claim 1 in which transferred functional programming modules comprise means for controlling space conditioning equipment.
Claim 11	
11	The system of claim 1 in which in which said functional programming determines all or part of a graphical user interface.
Claim 12	
12	The system of claim 1 in which in which said functional programming determines size, shape, colors, legends, locations, or other viewable aspects of said buttons on the display.
Claim 13	
13	The system of claim 1 in which in which said functional programming determines representations of the size, shape, colors, locations and other viewable aspects of text or graphic devices on the display.
Claim 14	
14	The system of claim 1 in which in which said functional programming determines operational algorithms other than those for the graphical user interface.

Claim 15	
15	The system of claim 1 in which in which said functional programming determines operational algorithms for control of existing or newly installed space conditioning equipment.

C. Prosecution History

57. The '075 Patent was filed as Application No. 11/039,180 on January 19, 2005. EX1001 at Cover. The '075 Patent claims priority as a continuation-in-part of Application No. 10/440,474 (the "'474 Application"), filed on May 15, 2003, now U.S. Patent No. 7,050,026 (the "'026 Patent"). *Id.* As discussed in more detail below, the '474 Application and the '026 Patent do not support a claim to the benefit of the filing date of the '474 Application for the claims of the '075 Patent. *Infra*, §V.D.

58. The prosecution history for the '075 Patent is minimal. After the application was filed, the USPTO issued a Notice to File Missing Parts on March 7, 2005 related to failure to pay the application search fee. EX1003 at 57. The application was abandoned after no reply was received in response to the Notice. *Id.* at 55 (Notice of Abandonment Under 37 C.F.R. 1.53 (f) OR (g) dated September 20, 2006). The applicant petitioned for revival of the application on September 26, 2006. *Id.* at 48-49. The petition was granted in a Decision on Petition mailed February 5, 2007 (*Id.* at 47) and the Notice of Abandonment was withdrawn on February 12, 2007. *Id.* at 43.

59. During prosecution, the Examiner never issued an office action rejecting the claims. A Notice of Allowance and Fee(s) Due was mailed on April 27, 2007. *Id.* at 25. In the Reasons for Allowance, the Examiner stated that “[t]he prior art does not teach the thermostat system combination as recited in independent claim 1, and in particular the details of the control program recited in subsection D in combination with the coupling means of subsection E.” *Id.* at 29.

D. Priority Date

60. I understand that the '075 Patent claims priority as a continuation-in-part of the '474 Application filed on May 15, 2003, now the '026 Patent. EX1001 at Cover. I understand from counsel that to benefit from the priority date of a previously filed document, the claims of the '075 Patent must be fully supported by the disclosure within that document. I have reviewed the '026 Patent (EX1004) and the '474 Application (EX1008 at 53-68). The '026 Patent relates to reverse images in a dot matrix LCD for an environmental control device. EX1004 at Title. Although the '075 Patent claims priority to the '026 Patent/'474 Application as a continuation in part, it appears that very little of the disclosure of the '026 Patent/'474 Application is discussed in the application that issued as the '075 Patent. Although the '075 Patent briefly discusses dot matrix LCDs and purports to incorporate the '474 Application by reference (EX1001 at 1:61-2:26), the subject matter of the '075 Patent and the '026 Patent/'474 Application is quite different. In

my opinion, neither the '026 Patent nor the '474 Application fully supports independent Claim 1 of the '075 Patent, or any of its dependent claims.

61. Specifically, the '474 Application and the '026 Patent fail to disclose at least the following elements recited in independent Claim 1 of the '075 Patent:

- “a temperature sensor for providing an electrical signal indicative of the temperature of a conditioned space in which the temperature sensor is situated” (element 1[a]);
- “a transparent touch pad juxtaposed over a liquid crystal display to constitute a touch screen for interactive interface with a user and for selectively displaying alphanumeric and graphic devices” (element 1[b]);
- “a processor, said processor including: 1) a central processing unit; 2) a real time clock; 3) a memory coupled to said central processing unit for storing program and data information; and 4) an input/output unit including: a) a sensor input coupled to said temperature sensor for receiving said electrical signal therefrom; b) a control output coupled to the space conditioning equipment for issuing control signals thereto; and c) a communications interface adapted to establish communications between said processor and a first remote correspondent which is a source of functional programming” (elements 1[c]-1[i]);

- “a control program stored in said memory for causing said central processing unit to selectively: 1) establish on said liquid crystal display one or more representations of buttons at a separated and predetermined positions; 2) read the position on the touch pad juxtaposed with said predetermined position to determine if said representation of a button has been touched; and 3) if said a representation of a button has been touched, processing this information to establish a condition incorporated into the operation of said thermostat system; 4) establish communications between said processor and a first remote correspondent from which is transferred to said memory one or more modules of functional programming; and 5) operate said transferred functional programming to change or add to representations on the touch screen, where said changes or additions of representation on the touch screen were not available to the control program before their transfer to the memory” (elements 1[j]-1[n]); and
- “means coupling said communications interface and said first remote correspondent” (element 1[o]).

Compare EX1004 ('026 Patent) *and* EX1008 at 53-68 ('474 Application as-filed) *with* EX1001 ('075 Patent) at 14:2-48 (Claim 1).

62. Because the '474 Application and the '026 Patent fail to fully support independent Claim 1, from which all claims of the '075 Patent depend, it is my

understanding that the claims of the '075 Patent are not entitled to a priority date earlier than the January 19, 2005, filing date.

E. Level of Ordinary Skill in the Art

63. I have been asked to consider the level of ordinary skill in the field that someone would have had at the time the claimed invention was made. My opinions regarding the level of ordinary skill in the art are based on, among other things, my nearly 40 years of experience in the field of electrical engineering and computer science, as well as: the levels of education and experience of persons working in the field, the types of problems encountered in the field; and the sophistication of the technology.

64. Based on the disclosure of the '075 Patent, in my opinion a POSITA as of January 19, 2005 would have had a Bachelor of Science degree in Electrical Engineering or a year or two of experience working with or designing processor-based systems with network connectivity. This level of skill is approximate, and more experience would compensate for less formal education, and vice versa.

65. Based on my education and experience, I meet this definition of one of ordinary skill in the art, and I believe that I am qualified to provide opinions about how a POSITA at the relevant time would have interpreted and understood the '075 Patent and the prior art relied upon herein. Although my qualifications and

experience exceed those of a POSITA, both in January 2005 and today, I have nevertheless applied the perspective of a POSITA in rendering my opinions below.

66. My opinions below explain how a POSITA would have understood the technology described in the '075 Patent and the prior art references I have identified herein around the January 19, 2005 timeframe. For purposes of this declaration, in general, and unless otherwise noted, my testimony below refers to the knowledge of one of ordinary skill in the art during the time period around the priority date of the '075 Patent. I would have been a person with at least ordinary skill in the art at that time.

F. Claim Construction

67. It is my understanding that in order to properly evaluate the '075 Patent, the terms of the claims must first be interpreted. It is my understanding that the claims are to be construed according to the same claim construction standard that district courts use. I have been informed by counsel for Petitioner that the Challenged Claims of the '075 Patent are to be given their ordinary and customary meaning as understood by one of ordinary skill in the art at the time of the invention in light of the specification and the prosecution history pertaining to the patent.

68. In order to construe the claims, I have reviewed the entirety of the '075 Patent along with the prosecution history of the '075 Patent. Having reviewed the '075 Patent, its prosecution history, and the claim language, in my opinion the

applicant did not act as his own lexicographer and clearly set forth a definition of any claim term in the specification that is contrary to the plain and ordinary meaning of the claim language itself. Additionally, having reviewed the limited prosecution history of the '075 Patent, in my opinion the prosecution history does not evidence that the inventors understood the claim language contrary to its plain and ordinary meaning or otherwise limited the scope of the claim language to be narrower than it otherwise would be. Except as set forth below, it is my opinion that a POSITA would have understood each term of the Challenged Claims according to their plain and ordinary meaning as understood by a person of ordinary skill in the art.

1. Terms Governed By 35 U.S.C. § 112, ¶ 6

69. The Challenged Claims of the '075 Patent include certain claim elements that recite “means” for performing various functions. Element 1[o] of Claim 1 recites “means coupling said communications interface and said first remote correspondent,” and Claim 4 recites “[t]he system of claim 1 in which transferred functional programming modules comprise means for controlling space conditioning equipment.” EX1001 at 14:47-48, 14:53-55. I understand from counsel for Petitioner that the use of the word “means” creates a presumption that 35 U.S.C. § 112, ¶6 applies.

70. I understand that in the related district court litigation, Petitioner and Patent Owner agree that element 1[o] of Claim 1 and Claim 4 are governed by 35

U.S.C. § 112, ¶6. EX1009 at 5-6; EX1010 at 56, 71; EX1026 at 76-83. For purposes of this declaration, I was asked to apply Patent Owner’s proposed constructions for each of these claim elements. For purposes of this declaration, I have applied the constructions for element 1[o] of Claim 1 and Claim 4 shown in the table below, without conceding that they are correct.

Limitations	Structure and Function
1[o]: “means coupling said communications interface and said first remote correspondent,”	<u>Function</u> : coupling the communications interface and the first remote correspondent <u>Structure</u> : serial link and/or data link and any equivalents EX1001 at Abstract, Figures 1-4, 1:12-15, 3:14-20, 4:4-8, 4:59-62, 6:12-17, 6:59-7:8, 8:53-9:5, 9:49-56.
Claim 4: “means for controlling space conditioning equipment”	<u>Function</u> : controlling space conditioning equipment <u>Structure</u> : virtual buttons operating with control programs including as described in EX1001 at 11:7-13:62 and any equivalents

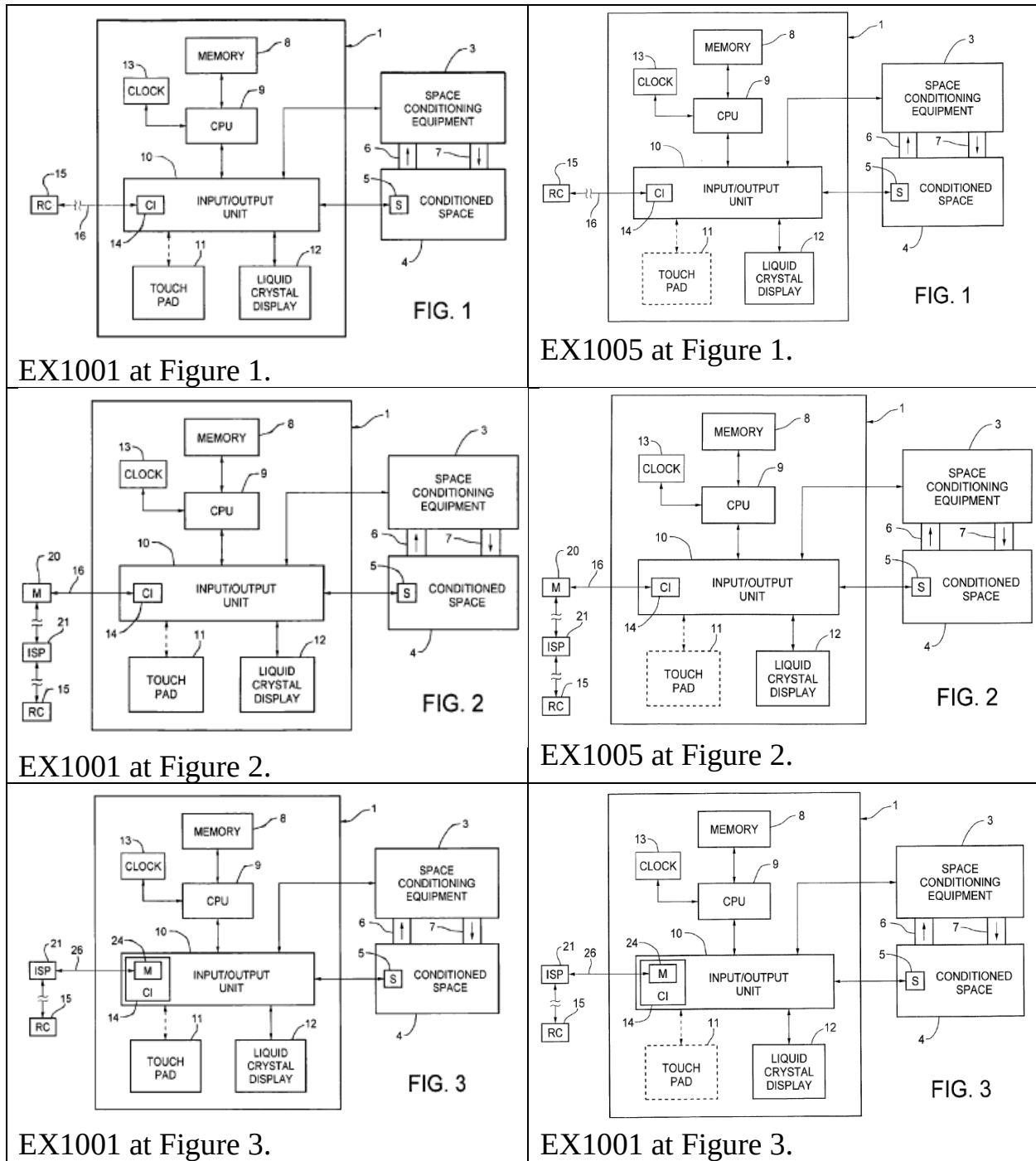
EX1009 at 5-6; EX1026 at 76-77, 80.

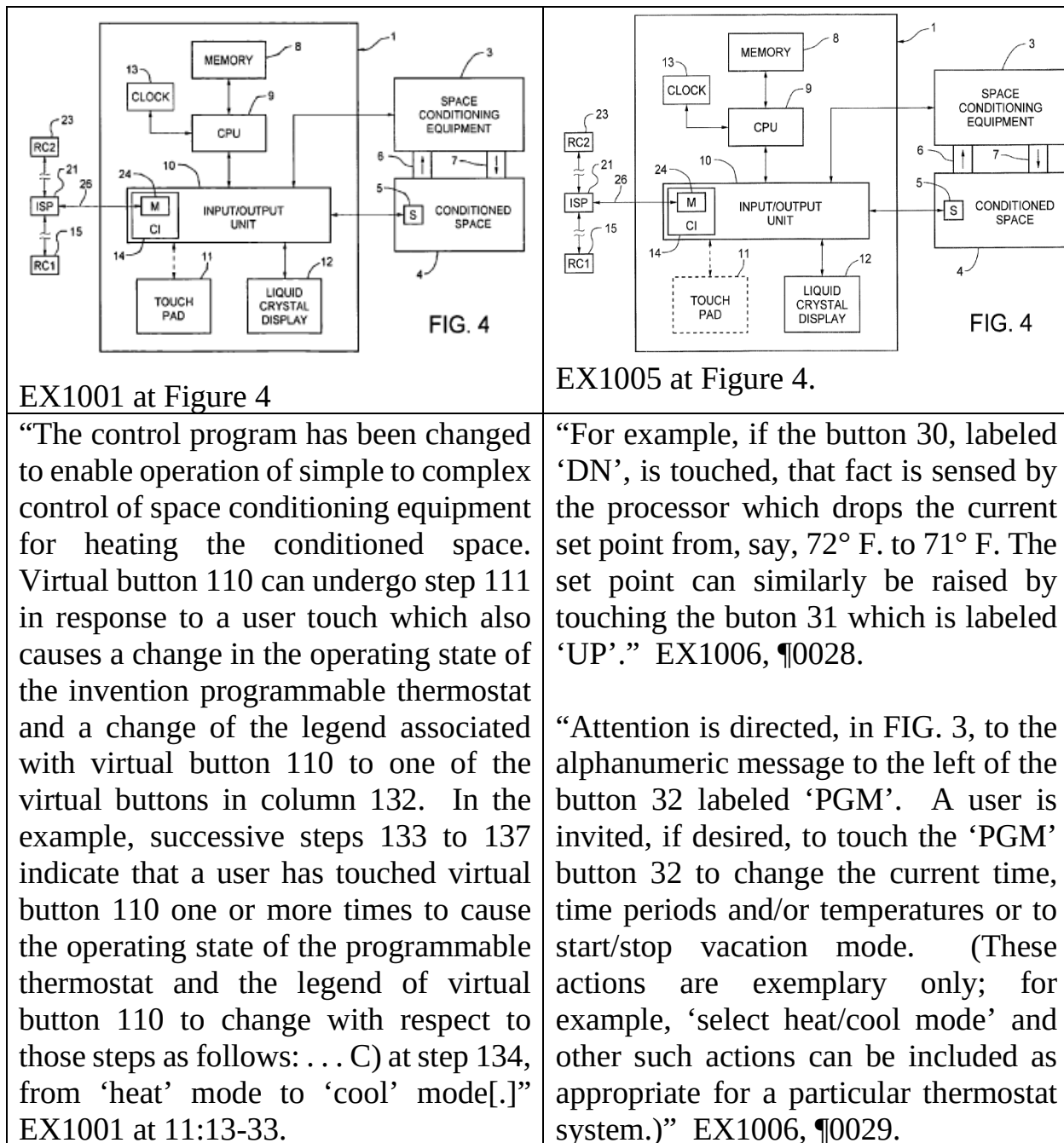
71. To the extent the Board disagrees with Patent Owner’s proposed constructions, in my opinion, to the extent the ’075 Patent discloses corresponding structure for element 1[o] and Claim 4, the combination of prior art references identified herein discloses the same. As shown in the table below and the invalidity

analysis that follows, *Rosen* and *Rosen-II* include virtually identical disclosure as the '075 Patent with respect to “coupling said communications interface and said first remote correspondent” and “controlling space conditioning equipment.”

'075 Patent	<i>Rosen/Rosen-II</i>
“A communications interface connects the processor and a remote correspondent which is a source of functional programing.” EX1001 at Abstract.	“A communications interface connects the processor and a remote correspondent which is a source of current information.” EX1005 at Abstract.
“The I/O unit includes a communications interface 14 for coordinating communications between the CPU 9 and a remote correspondent 15. The communications interface 14 may be, for example, a conventional serial port.” EX1001 at 6:12-16.	“The I/O unit includes a communications interface 14 for coordinating communications between the CPU 9 and a remote correspondent 15. The communications interface 14 may be, for example, a conventional serial port.” EX1005, ¶0018.
“[T]he CPU 9 starts the process shown in FIG. 5 by issuing signals to the I/O unit 10 to cause the communications interface 14 to establish communications, via link 16, with a remote correspondent 15. The remote correspondent 15 has a known data communications ‘address’ and, in the example, is a source of current information, such as local weather.” EX1001 at 6:62-7:1.	“[T]he CPU 9 starts the process shown in FIG. 5 by issuing signals to the I/O unit 10 to cause the communications interface 14 to establish communications, via link 16, with a remote correspondent 15. The remote correspondent 15 has a known data communications ‘address’ and, in the example, is a source of current information, such as local weather.” EX1005, ¶0022.
“When the current local weather information is transmitted from the remote correspondent 15 via link 16 to the communications interface 14 and thence to the CPU 9[.]” EX1001 at 7:4-6.	“When the current local weather information is transmitted from the remote correspondent 15 via link 16 to the communications interface 14 and thence to the CPU 9[.]” EX1005, ¶0023.
“While the Internet is not the only facility which the subject thermostat	“While the Internet is not the only facility which the subject thermostat

system may use to communicate with a remote correspondent, it is, at the state-of-the-art, the most readily widely available and easily accessible. Thus, FIG. 2 show[s] a typical coupling in which the communications interface 14 sends/receives serial data to/from an external (to the thermostat system) modem 20 via serial link 16. The modem conventionally interfaces with an Internet Service Provider (ISP) 21 which completes the communications link to the remote correspondent in the well-known manner. The modem 20, may be dial-up, cable, DSL, or any other type suitable for the communications environment in a given installation.” EX1001 at 8:53-65.	system may use to communicate with a remote correspondent, it is, at the state-of-the-art the most readily widely available and easily accessible. Thus, FIG. 2 show[s] a typical coupling in which the communications interface 14 sends/receives serial data to/from an external (to the thermostat system) modem 20 via serial link 16. The modem conventionally interfaces with an Internet Service Provider (ISP) 21 which completes the communications link to the remote correspondent in the well-known manner. The modem 20 may be dial-up, cable, DSL or any other type suitable for the communications environment in a given installation.” EX1005, ¶0032.
“At the state-of-the-art and as shown in FIG. 3, a modem 24 for communicating with the ISP 21 may be integrated into the communications interface 14 of the input/output unit 14 to eliminate the need for an external modem. Thus, when communications is established with the remote correspondent 15 according to a schedule or upon demand, the data transfer takes place via modem 24 and data link 26 as shown.” EX1001 at 8:66-9:5.	“At the state-of-the-art and as shown in FIG. 3, a modem 24 for communicating with the ISP 21 may be integrated into the communications interface 14 of the input/output unit 14 to eliminate the need for an external modem. Thus, when communications is established with the remote correspondent 15 according to schedule or upon demand, the data transfer takes place via modem 24 and data link 26 as shown.” EX1005, ¶0033.





2. Additional Terms of the '075 Patent

72. I understand that in the related district court litigation, Patent Owner contends that the claimed “sensor input coupled to said temperature sensor for receiving said electrical signal therefrom” in element 1[g], “control output coupled

to the space conditioning equipment for issuing control signals thereto” in element 1[h], “control program stored in said memory for causing said central processing unit to selectively” perform functions recited in elements 1[j]-1[n] are not subject to 35 U.S.C. § 112, ¶6, and argues that these and other terms should be accorded their plain and ordinary meaning. EX1009 at 5-7; EX1026 at 83-99. For purposes of this declaration, I was asked to apply Patent Owner’s “plain and ordinary meaning” interpretation. EX1009 at 5-7. For purposes of this declaration, I have applied Patent Owner’s “plain and ordinary meaning” interpretations, without conceding they are correct.

VI. TECHNOLOGY BACKGROUND AND STATE OF THE ART

73. Before providing my analysis of the ’075 Patent and the prior art references, as included below, a background discussion of the state of the art of thermostat systems and the technologies they employ is helpful.

A. Thermostat systems were well known before the ’075 Patent.

74. Thermostats, including programmable thermostat systems, for controlling space conditioning equipment were well known in the prior art before the priority date of the ’075 Patent. *Rosen*, for example, explains that:

Thermostats *have been used for many years* as a temperature sensitive switch which controls heating and/or cooling equipment for conditioning a space in which the thermostat, or a temperature sensor connected to the thermostat, is placed. *In the well known manner*, a

simple thermostat can be adjusted to establish a temperature set point such that, when the temperature in the conditioned space reaches the set point, the thermostat interacts with the heating and/or/cooling [sic] equipment to take suitable action to heat or cool the conditioned space as may be appropriate for the season.

EX1005, ¶0002 (emphasis added); *see also* EX1006, ¶0002 (similar description in *Rosen-II*); EX1001 at 1:23-33 (similar description in '075 Patent).

75. For example, U.S. Patent No. 4,071,745 to Hall (“*Hall*”) issued January 31, 1978—more than 25 years before the application leading to the '075 Patent was filed—relates to “a thermostatic system and method in which the reference temperature can be made to vary hour by hour in a programmed way.” EX1013, 1:8-10. *Hall* discloses a programmable thermostat system “for controlling a measured temperature during a sequence of time intervals, in accordance with a sequence of selected reference temperatures, each corresponding to one of the intervals.” EX1013 at Abstract; *see also* EX1014 at 1:36-37 (describing the system in *Hall* as “a programmable thermostatic control”). *Hall* “provides a system and method wherein the reference temperature [i.e., the desired temperature] is made to vary during the day, assuming a sequence of programmable values.” EX1013 at 1:11-37. *Hall* explains that “[t]his allows heating or cooling to be automatically initiated so as to reach a new reference temperature by a particular time, for example, when occupants of a home are to return.” *Id.* at 1:37-40.

76. As another example, U.S. Patent No. 4,382,544 to Stewart (“Stewart”), issued May 10, 1983—more than 20 years before the application leading to the ’075 Patent was filed—discloses “a user programmable thermostat for measuring temperature at the situs of the measurement unit and for signaling and controlling a remotely located energy controller which is connected to the programmable thermostat.” EX1014 at Abstract. The energy controller controls space conditioning equipment such as “a furnace and air conditioning units.” *Id.* Stewart explains that “[w]hen the actual room temperature falls below the minimum temperature setting and the thermostat operating in a heating mode, a heating unit is activated and when the actual room temperature rises above a maximum temperature and the thermostat operating in a cooling mode, the cooling unit is activated.” *Id.*, 1:22-35. The prior art is replete with examples of thermostat systems. *See, e.g.*, EX1005, EX1006, EX1007, EX1013, EX1014, EX1015.

B. It was well known for thermostat systems to include conventional components such as a temperature sensor, a processor, and a control program.

77. Prior art thermostats routinely included conventional components such as a temperature sensor, a touch screen, a processor, and control programs.

1. Temperature Sensors

78. Thermostat systems, by their very nature, are designed to control the temperature of given space. Thus, the use of a temperature sensor in a thermostat

system is ubiquitous in the prior art and it would have been common knowledge to a POSITA that thermostat systems include a temperature sensor. *See, e.g.*, EX1005, ¶0002 (“Thermostats have been used for many years as a temperature sensitive switch which controls heating and/or cooling equipment for conditioning a space in which the thermostat, ***or a temperature sensor connected to the thermostat***, is placed.”) (emphasis added). Before the priority date of the ’075 Patent, “several types of temperatures sensors [were] widely used.” *Id.*, ¶0019. One well known and commonly used type of temperature sensor is known as a thermistor. *Id.* A thermistor is an electrical resistor whose resistance is greatly reduced by heating. EX1016 at 1008 (defining thermistor as “[a] semiconductor device whose electric resistance is dependent upon temperature”); EX1017 at 293 (a thermistor’s “decrease in resistance is proportional to the rise in temperature”). They are frequently used for measurement and in control systems. EX1017 at 293 (defining thermistor as “semiconductor sensing element used for temperature measurement”).

79. It was common knowledge that temperature sensors provide an electrical signal indicative of the temperature of a conditioned space in which the temperature sensor is situated. For example, *Hall*, issued in January 1978 and discussed above, describes a thermostat system that has “means which can be connected to a sensor of the measured temperature for generating an electrical signal representation of the measured temperature.” EX1013 at 1:65-68. In *Hall*’s system,

“[a] comparison means, responsive to the signal representation, to the current reference temperature number and to the hysteresis number, repeatedly generates control signals suitable for heating and/or cooling systems affecting the measured temperature.” *Id.* at 1:68-2:5; *see also id.* at 13:46-48 (claiming “means connectable to be responsive to a sensor of said measured temperature for generating an electrical signal representation of said measured temperature”).

80. Similarly, the programmable thermostat system of *Stewart* includes “an input temperature sensor 30.” EX1014 at 3:47-62. *Stewart* describes that “[t]he temperature sensor 30 may be a conventional integrated circuit as manufactured by National Semiconductor” and “[t]he voltage output of the temperature sensor 30 is a function of the temperature and this signal is used by the comparator and multiplexer circuit 34 to determine whether the heating or cooling units should be activated.” *Id.* at 8:10-17. U.S. Patent No. 4,669,654 to Levine (“*Levine*”), issued June 2, 1987, similarly describes “an electronic programmable thermostat for the control of a furnace or air conditioner” that uses a “thermistor having a resistance dependent upon ambient temperature.” EX1015 at Abstract, 2:50-53, Figure 3. *Levine* explains that “[p]revious thermostats, such as the commercial version of the thermostat disclosed in Levine U.S. Patent No. 4,206,872, have utilized thermistors to sense ambient temperature[.]” *Id.* at 3:5-8.

81. Thus, the use of temperature sensors in thermostat systems, and thermistors in particular, was well known in the art many years before the priority date of the '075 Patent. As discussed above, it was well known for these types of temperature sensors to provide an electrical signal indicative of the temperature of a conditioned space in which the temperature sensor is situated. Indeed, *Rosen* describes that “[i]n the usual manner during normal operation, the temperature sensor 5 sends an electrical signal (e.g., if the sensor 5 is a simple thermistor, a resistance value; ***several types of temperature sensors are widely used***) representative of the temperature within the conditioned space 4 which the processor can compare against a previously entered set point to determine if control signals need to be sent to the space conditioning equipment 3.” EX1005, ¶0019 (emphasis added); *see also* EX1006, ¶0022 (similar disclosure).

82. Additionally, I understand that the inventor of the '075 Patent—Mr. Howard Rosen—was deposed in the related district court litigation. *See* EX1012. I have reviewed the transcript of Inventor Rosen’s deposition. Inventor Rosen acknowledges that the '075 Patent does not disclose any new type of temperature sensor:

Q. And you don’t disclose any new type of temperature sensor in the '075 Patent, correct?

A. Yes.

EX1012 at 264:2-5.

2. Processors and Control Programs

83. It was also well known for programmable thermostat systems to include a processor and control program. Each of the *Hall*, *Stewart*, and *Levine* systems discussed above, which date back decades before the '075 Patent's priority date, included a processor. For example, the approach described in *Hall* "employs a programmed microprocessor." EX1013 at 3:58-59. *Hall* describes functions that must be performed by units of the microprocessor and explains that "[f]or a particular function to be performed, the microprocessor must be programmed to step through a sequence of instructions that command the described function." *Id.* at 3:59-65. *Hall*'s programming is an example of a control program. *Stewart*'s programmable thermostat similarly includes "a microprocessor." EX1014 at 3:47-48. More particularly, *Stewart* claims as its invention "[a] system for controlling temperature in a user programmed manner comprising" a "programmable thermostat having a thermostat for measuring temperature at its location and a microprocessor capable of being programmed by a user to set a programmed temperature for each of selected periods of time." *Id.* at 15:67-16:5. Additionally, *Levine* describes "a microprocessor based thermostat having a rotary analog control device for operator adjustment of desired temperature." EX1015 at 1:7-10. *Levine* explains that "[t]he development of microprocessors and their rapid decrease in cost has lead to a class

of electronic programmable thermostats using microprocessors as a controller. These devices are capable of implementing relatively complex modes of control, such as the provision of different temperature schedules for different days of the week and adaptive techniques that adjust cycle time or the load turn-on time to achieve a desired temperature at a desired time.” *Id.* at 1:50-60.

84. Before the priority date of the '075 Patent, it was well known that processors used in thermostat systems included conventional elements such as a central processing unit (CPU), a real time clock, a memory coupled to the CPU for storing program and data information, and an input/output unit (also referred to herein as an I/O unit). For example, *Rosen* discloses that “[m]any modern thermostat systems include a real time clock, a memory and a data processor to run a process control program stored in the memory to accurately measure the temperature of a temperature sensor disposed in the conditioned space and to send control signals to the heating and/or cooling equipment to closely control the temperature of the conditioned space.” EX1005, ¶0003 (emphasis added); *see also* EX1006, ¶0003 (similar disclosure in *Rosen-II*); EX1001 at 1:39-46 (similar disclosure in the '075 Patent). *Rosen*’s processor also included an “input/output unit (I/O unit).” EX1005, ¶0018. Inventor *Rosen* admitted that for many years prior to the invention of the '075 Patent, prior art thermostats included these and other claimed features:

Q. Okay. Well, it is true that prior art thermostats for many years before your invention used a central processing unit such as a microprocessor, correct?

A. Correct.

Q. And it is true that thermostats for many years prior to your invention used a real-time clock, correct?

A. Correct.

Q. And it is true that thermostats for many years prior to your invention used a memory coupled to the central processing unit for storing program and data information, correct?

A. Correct.

Q. And it is true that for many years prior to your invention prior art thermostats used an input/output unit, correct?

A. Between the CPU and the outside world or the relays? Yes.

Q. Okay. So it is true that for many years prior to your invention, prior art thermostats used included a sensor input coupled to a temperature sensor for receiving an electrical signal therefrom, correct?

A. Correct.

Q. And it is true that for many years prior to your invention, thermostats had a control output coupled to the space conditioning equipment for issuing control signals thereto, correct?

A. Correct.

Q. Okay. It is also true that for many years prior art thermostats had some type of control program, correct?

A. Yes.

Q. That would be the software that's used –

A. To run the thermostat.

Q. To run the thermostat, correct?

A. Correct.

EX1012 at 273:18-275:7.

85. Indeed, these elements were included in thermostat systems dating back decades before the '075 Patent. For example, the thermostat system in *Hall*, which issued January 31, 1978, included “read only memory,” “random access memory,” an “arithmetic and control unit,” and an “output circuit” with outputs to cooling and heating systems. *See, e.g.*, EX1013 at Figure 1, 4:10-42. *Hall*’s system also included a clock. *Hall* describes that:

In order for the system 10 to keep time, an initial value is entered by means of the data entry switches 14 and function switches 15, and is stored by unit 11 in memory 13. Thereafter, circuits operating from a stable time base, such as the 60 Hz line frequency or a crystal controlled oscillator, provide periodic clock signals to unit 11. In response to the clock signals, unit 11 updates the value stored in the time location in memory 13. It is this updated time which is shown on display 18 as the current time, including an a.m.-p.m. indication.

Id. at 6:16-25. *Stewart* similarly described actuating “selected energy using units [e.g., furnace and air conditioning units for controlling temperature] in accordance with the program stored in the microprocessor.” EX1014 at 3:47-62, Abstract. Based on *Stewart*’s disclosure that its system “may be programmed by a user to

control temperature at the thermostat location for preselected times of day and days of week,” (*Id.* at 2:49-52) and that the system displays the time in hours and minutes (*Id.* at 5:19-56), a POSITA would have understood that *Stewart’s* system includes a real-time clock.

86. Additionally, *Rosen*, *Rosen-II*, and the ’075 Patent admit that processors having the features described and claimed in the ’075 Patent were commercially available, off-the-shelf components. EX1001 at 6:41-47; EX1005, ¶0020; EX1006, ¶0023. For example, the ’075 Patent states that:

It may be noted that integrated circuit chips including all the processor components with all the necessary interface conditioning circuits are available off-the-shelf and are under constant refinement for increased power. The subject invention only requires the capabilities of such a processor, and off-the-shelf integrated circuit processor chips may be used to advantage in the subject thermostat system.

EX1001 at 6:41-47. Furthermore, the inventor of the ’075 Patent admitted that the patent does not disclose any new type of memory, real time clock, CPU/microprocessor, space conditioning equipment, I/O unit, or communications interface:

Q. All right. So for the ’075 patent you were again using off-the-shelf components, correct?

A. Yes.

Q. All right. So, for example, if we look at Figure 1 in the '075 Patent, you don't disclose a new type of memory, correct?

A. Of course not.

Q. You are using memory that's been used for years that you can acquire off the shelf, correct?

A. Yes.

Q. And similarly you don't disclose any new real-time clock in the '075 Patent, correct?

A. Correct.

Q. And you don't disclose any new CPU or microprocessor in the '075 Patent, correct?

A. Correct.

Q. You don't disclose any new space conditioning equipment in the '075 Patent, correct?

A. Correct.

Q. You don't disclose any new input/output unit in the '075 Patent, correct?

A. Correct, yes.

Q. You don't disclose any new type of communications interface in the '075 Patent, correct?

A. Yes.

EX1012 at 262:19-263:23. Thus, these features would have been well known to a POSITA before the priority date of the '075 Patent.

C. Many prior art thermostat systems included touch screens.

87. Before the priority date of the '075 Patent, it was well known to use a touch screen in a thermostat system. In the Background of the Invention section, the '075 Patent admits that “[s]ome modern thermostat systems incorporate a touch sensitive screen which incorporate representations of buttons which a user may press as part of an interface with the thermostat system.” EX1001 at 2:50-53. Additionally, Inventor Rosen acknowledged that the '075 Patent does not disclose any new type of touch screen:

Q. You don’t disclose any new type of touchscreen in the '075 Patent, correct?

A. Yes.

EX1012 at 263:24-264:1.

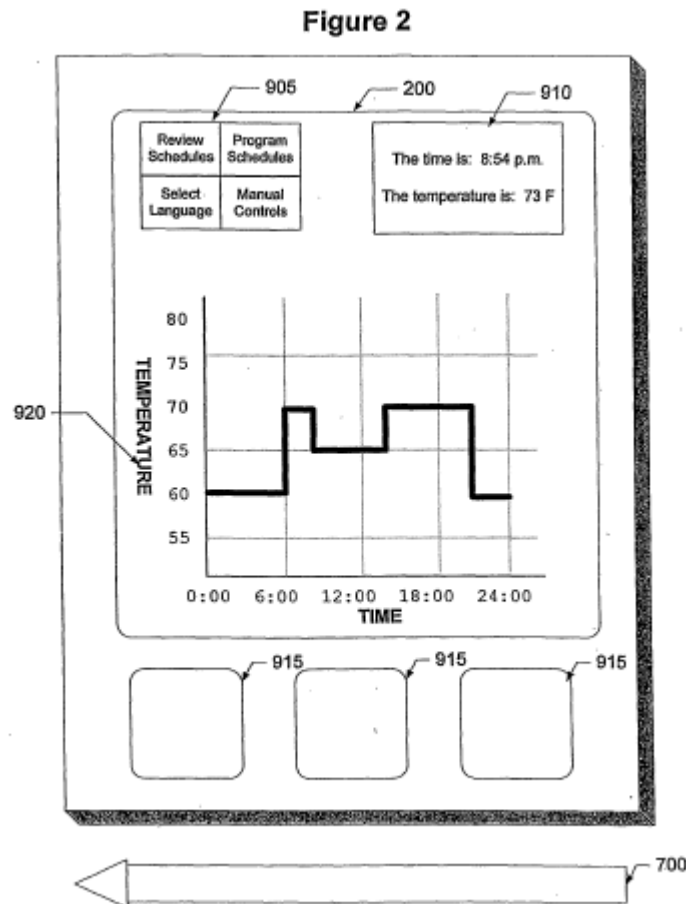
88. *Rosen-II* discloses a thermostat system that includes “a transparent touch pad juxtaposed over a liquid crystal display to constitute a touch screen for interactive interface with a user.” EX1006 at Abstract. *Rosen-II* discloses “[a] transparent touch pad 11, constituting generally planar layers 22-26, [that] is juxtaposed over a flat panel LCD 12 with RF shield layer 21 interposed.” *Id.*, ¶0026. *Rosen-II*, however, acknowledges that this “is only one of several types of transparent touch screens which can be juxtaposed with the LCD 12 to constitute the touch screen” and that “[t]he commercially available types of transparent touch pads

contemplated for alternate use in the invention at the current state-of-the-art are: resistive analog (4-wire as shown, 5-wire and 8-wire); resistive matrix; capacitive matrix; acoustic surface wave; near field imaging; capacitive overlay; and infrared scanning.” *Id.*, ¶0027. Thus, there were a wide variety of commercially available touch pads available for use with LCDs to constitute a touch screen which a POSITA would have been aware of.

89. The use of liquid crystal displays (LCDs) was also well known. For example, the thermostat system of *Hall*, issued in January 1978, included “[a] display unit 18” that “provides alphanumeric and on-off displays for a number of the variables and parameters of” the thermostat system. EX1013 at 4:20-22. *Hall* states that the display unit “can be of the light emitting diode type, a liquid crystal display or a gas-discharge type electronic display.” *Id.* at 4:23-25.

90. There are numerous examples of such touch screens in the prior art. *Smith*, for example, describes a thermostat system that includes a “display unit 200” including “a graphical display/touch sensitive screen” that “provides for very flexible graphical display of information along with a very user friendly data input mechanism” and may “be integrated with a thermostat itself.” EX1007 at 3:18-4:5. In particular, *Smith* describes the use of “a touch-sensitive LCD display” that is “coupled with the thermostat’s existing central processing unit and RAM.” *Id.* at 4:5-6. *Smith* explains that the touch-sensitive screen “allows the user to input data

without the need for a keyboard or mouse.” *Id.* at 3:11-12. An example of *Smith’s* user interface system is shown in Figure 2, reproduced below:



Id. at Figure 2, 2:23-24.

91. As another example, International Patent Application Publication No. WO 03/040839 A1 by Geiwitz (“*Geiwitz*”) describes “[a] programmable and expandable building automation and control system.” EX1018 at Abstract. The system in *Geiwitz* “provides direct automation and control of lighting, power outlets, security devices, heating, ventilation, and air conditioning (HVAC), access to the

system, information logging, audio control, energy management, messaging, and time and task management.” *Id.* at 3:26-28. Based on *Geiwitz*’s disclosure that its system provides automation and control of HVAC equipment (which is a type of space conditioning equipment), a POSITA would have understood that *Geiwitz*’s system is a type of thermostat system. *Geiwitz* describes that “[a] touchscreen or smart key access apparatus is used for user-interface with the system.” *Id.* at 4:15. *Geiwitz* explains that its “[t]ouchscreen 28 functions as the primary user interface for the system allowing the user to set and change parameters of the system[.]” *Id.* at 19:6-7. The touchscreen “acquires and represents system data to the user.” *Id.* at 19:8-9. *Geiwitz* explains that “[o]peration of the system touchscreen 28 is via a series of screen displays and navigational screens through which the user interfaces with the system.” *Id.* at 19:13-15.

92. As another example, the Cardio manual, which I understand was available to the public at least as early as 1995, describes a home automation system that “enables homeowners to better manage such basic functions as heating/air conditioning, security, lighting and appliance control.”³ EX1019 at 1. Based on the

³ I understand that the inventor of the ’075 Patent admitted to the USPTO that the Cardio manual was publicly available since 1995, well before the priority date of the

Cardio manual's disclosure that it allows homeowners to manage functions such as heating/air conditioning, a POSITA would have understood the home automation system to be a type of thermostat system. The system is controlled using a "touch screen," which is described as "offer[ing] user friendly features unmatched by any mass produced electronic system. A light touch is all that is necessary to turn on the screen and execute the commands." *Id.* The touch screen can be used to "control[] temperatures for heating and, if available, air conditioning," as shown in the figure below:

'075 Patent. EX1020 at 8-9 (declaration of Howard Rosen); *see also id.* at 10-11 (declaration of Jean Francois Boileau of Domotique Secant Inc. attesting to the public availability of the Cardio manual in the United States since 1995).

Temperature (Heating/Cooling)

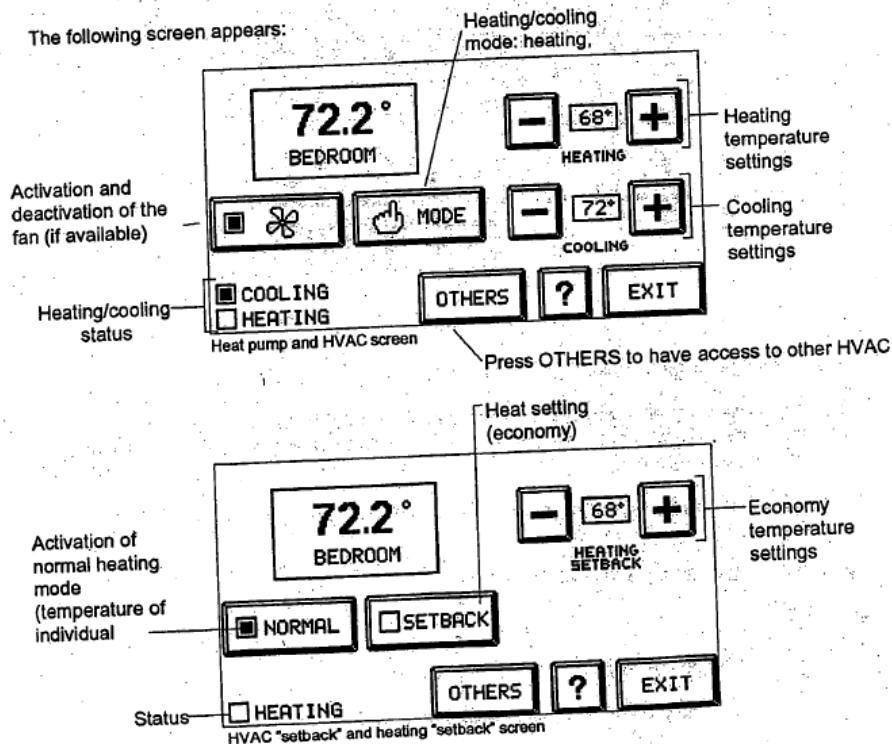
This feature controls temperatures for heating and, if available, air conditioning. Temperature readings are available either in celsius or Fahrenheit (to be set in temperature configuration). Cardio can also control various kinds of heating systems: heat pump, HVAC, HVAC setback, heating setback or central heating (to be defined at the time of installation).

Press



WARNING! Do not use Cardio for freeze protection. We strongly suggest to install an auxiliary mechanical freeze protection for this purpose.

The following screen appears:



7

EX1019 at 7.

93. Thus, as the prior art discussed above demonstrates, it was well known to include a touch screen in a thermostat system for interactive interface with a user and for displaying information and representations of buttons.

D. It was well known that consumer devices, such as thermostat systems, could be connected to the Internet.

94. By the priority date of the '075 Patent, it was well known to connect consumer devices, such as thermostat systems, to the Internet to, for example, enable them to download software updates or other information. Well before the priority date of the '075 Patent, there was recognition that the world was evolving from one in which almost all access to the Internet comes from personal computers to one in which so-called Internet appliances will make up a greater share of end-user equipment. See EX1022 at 1. One area of focus was connecting traditional household appliances to the Internet, for example “connecting thermostats so you can program them through a Web site, not have to reset time when power blinks, perform remote diagnostics on large appliances, etc.” *Id.* at 9, n.10.

95. As an example, U.S. Patent No. 6,161,133 to Kikinis (“*Kikinis*”), which issued on December 12, 2000, describes a method and apparatus for configuration of an internet appliance. EX1021 at Title. *Kikinis* explains that “Internet appliances include any device that is used for accessing and operating on the Internet, or other types of switch-packet networks that may stand alone or be linked to the Internet.” *Id.* at 4:42-45. Examples include “non-information appliances such as a refrigerator, ***air conditioning thermostat***, toy etc., which may be connected to and utilize information from the Internet.” *Id.* at 4:46-52 (emphasis added). *Kikinis* describes

a need for “a system including apparatus that allows a one-touch transparent set-up and configuration process” in order to “extend the market for Internet appliances considerably, bringing the advantages of such devices to more people[.]” *Id.* at 3:6-13. *Kikinis* also describes that its system “allows the offering of new software to existing, already set up users[.]” *Id.* at 6:28-30.

96. The prior art includes a number of examples of thermostat systems that are capable of connecting to the Internet to download software or other information. For example, *Smith* describes a thermostat system that “has a network interface for connecting to the Internet or other network.” EX1007, Abstract; *see also id.* at 2:10, 3:10-11 (describing a central processing unit coupled to a network interface). *Smith* describes a process by which initial interface objects, user interface objects, and control algorithms are “loaded over the Internet or other network after installation.” *Id.* at 2:3-5; *see also id.* at 2:17-19. For example, *Smith* discloses:

In one embodiment of the invention, the comfort controller would be installed without any user interface objects, initial interface objects, or control algorithms stored in memory. When first powered-up after installation, the comfort controller is programmed to load the initial interface objects 600 via the network interface 950. For example, the comfort controller could retrieve the initial interface objects 600 from a web page on the Internet. Or the comfort controller’s network interface 950 could include a modem connected to a phone line. In such an embodiment, the initial interface objects 600 can be downloaded as

files. The initial interface objects 600 are presented on the display unit 200 and request the user to choose a preferred language. Once the preferred language is chosen, the proper user interface objects 400 are then downloaded. In another embodiment, the comfort controller can be connected via the network interface 950 to a PDA, laptop computer, or similar device carried by the comfort controller installer. The installer's PDA or computer can have libraries of control algorithms, initial interface objects, and user interface objects accessible from memory which can be transferred by a cable, infra-red port, radio-frequency port or other communication method.

Id. at 5:8-22. *Smith* discloses that a user “can choose to download updated or additional control algorithms 500 via the network interface 950.” *Id.* at 5:30-31. Additionally, loading user interface objects from the Internet allows a user to “select a preferred language” and “[o]nce a preferred language is chosen, the display unit uses user interface objects 400 in the memory to correctly display all of the textual information in the preferred language.” *Id.* at 5:1-4.

97. *Rosen* also describes a thermostat system that connects to the Internet. *See, e.g.*, EX1005, ¶0032. *Rosen*'s thermostat system includes an input/output unit (I/O unit). *Id.*, ¶0018. The I/O unit includes a communications interface for coordinating communications between the CPU and a remote correspondent. *Id.* The communications interface may be, for example, a conventional serial port. *Id.* The remote correspondent has a known data communications “address” (e.g., an

Internet address) and may be a source of current information, such as local weather. *Id.*, ¶¶0022, 0029. *Rosen* explains that “[w]hile the Internet is not the only facility which the subject thermostat system may use to communicate with a remote correspondent, it is, at the state-of-the-art the most readily widely available and easily accessible.” *Id.*, ¶0032. *Rosen* describes “a typical coupling” in which the communications interface sends/receives serial data to/from an external (to the thermostat system) modem via serial link. *Id.* *Rosen* describes that “[t]he modem **conventionally** interfaces with an Internet Service Provider (ISP)” which “completes the communications link to the remote correspondent in the well-known manner.” *Id.* (emphasis added). The modem may be dial-up, cable, DSL or any other type suitable for the communications environment in a given installation. *Id.* Additionally, *Rosen* describes that the modem for communicating with the ISP may be “integrated into the communications interface” of the I/O unit to eliminate the need for an external modem. *Id.*, ¶0033.

98. As another example, *Geiwitz*, discussed above, discloses using the Internet to download and upgrade software for its thermostat system. *See* EX1018 at 9:22-24. In particular, *Geiwitz* discloses that “[s]oftware enables system 10 to be controlled, uploaded to, downloaded from, diagnosed, serviced and upgraded via standard telephone line through telephone interface 30, high speed Internet connection, or direct connection of a personal computer to the system platform.” *Id.*

99. Thus, before the priority date of the '075 Patent it was known to connect a thermostat system to the Internet to enable downloading of functional programming (e.g., the initial interface objects, user interface objects, and control algorithms of *Smith* or the software upgrades in *Geiwitz*) and other information (e.g., the current weather information of *Rosen*). In addition, the use of the Internet was a well-known technique for enabling device users to obtain software updates. As discussed above, *Kikinis* describes the use of the Internet to enable the offering of new software to existing, already set up users. EX1021 at 6:26-35.

100. Similarly, U.S. Patent Application Publication No. 2002/0083121 by Chang ("*Chang*"), published on June 27, 2002, describes a process for configuring information appliances, including "Internet appliances," which a POSITA would have understood includes thermostat systems as discussed above. EX1023, ¶0002. *Chang* describes that some information apparatuses "may allow users to install additional hardware components and application software" to "expand or change functionality." *Id.*, ¶0046. One known way of accessing software updates was via a network (e.g., the Internet). For example, U.S. Patent No. 5,848,064 to Cowan ("*Cowan*") relates to wireless software upgrades with version control. EX1024 at Title. *Cowan* describes a process by which "software upgrades are provided wirelessly to mobile devices upon detecting that software currently in the mobile devices is outdated." *Id.* at 1:6-10. As another example, U.S. Patent No. 5,619,250

to McClellan (“*McClellan*”) discloses downloading new software modules for an interactive television system. EX1025 at Abstract (“If a new system module is downloaded from the interactive television system, a description record corresponding to the new module can be added to the description block. Thus, real time system upgrades are accomplished without the need for user interaction and without the need for restarting the system. The updated system modules can either be stored in RAM for session only upgrades or the upgrade modules can be stored in FLASH memory for extended updating.”).

101. As a further example, European Patent Application Publication No. EP2053505 A2 (“*Britt*”), filed in 1997, relates to remote upgrade of software (e.g., for a set-top box) over a network. EX1027 at Title, Abstract, ¶0002. *Britt* recognizes that “software applications tend to become outdated quickly,” and that software suppliers periodically produce upgrades. *Id.*, ¶0007. *Britt* describes how conventional methods of distributing software (e.g., on magnetic or optical disks or other similar storage devices) have disadvantages. *Id.* For example, the process is “inconvenient” and “a user may not be aware that an upgrade is available or necessary, or he may forget to obtain or install the upgrade.” *Id.* *Britt* notes that “[t]he failure to install an upgrade or a delay in installing an upgrade can be detrimental, since the upgrade may add valuable new features to the software or remedy a bug (error) in the software.” *Id.* According to *Britt*, “what is needed is a

technique for allowing a software upgrade to be automatically provided over a network in a manner which requires little or no effort on the part of the user.” *Id.* Thus, *Britt* teaches upgrading device software over a network (e.g., to add new features).

102. Although some of the examples above are not specific to thermostat systems, it would have been well known to a POSITA that a network connection (e.g., to the Internet) could be used to provide software updates to a variety of devices, including Internet appliances such as thermostat systems. As shown above, a POSITA would have been familiar with allowing users to load new software through the Internet to various types of electronic devices in order to expand, update, or change software functionality.

103. As demonstrated above, prior to the January 19, 2005 priority date of the '075 Patent, all of the technology at issue in the Challenged Claims was well known and broadly applied in various commercial applications. Indeed, Inventor Rosen admitted that all of the hardware components disclosed in the '075 Patent were available in the prior art:

Q. All right. So would it be fair to say that all of the hardware components that are disclosed in the patent are off-the-shelf components that were available in the prior art?

A. Yes.

EX1012 at 264:6-10. Inventor Rosen also admitted that each of the hardware components are used as they were intended to be used:

Q. Right. Okay, so that's really my question. In your invention in the '075 Patent, the off-the-shelf components you are using, you are using them as they were intended to be used, correct?

A. Correct.

Id. at 264:24-265:4. Thus, in my opinion, no individual elements of the Challenged Claims of the '075 Patent were novel at the time of the alleged invention, and there was nothing novel or inventive about the manner in which those elements were combined in the Challenged Claims. Further, there were no technological barriers to combining these known elements to form the claimed inventions. Indeed, combining these elements would have yielded predictable results. As discussed above, it was well known for a thermostat system to include conventional components such as a temperature sensor, a touch screen, a processor (including a CPU, real time clock, a memory coupled to the CPU for storing program and data information, and I/O unit having a communications interface), and a control program (e.g., for establishing communication with the Internet to obtain software). These components were well known in the prior art and available off the shelf. The claimed components function as they were originally intended and in my opinion there is nothing inventive about the way they are combined in the Challenged Claims.

VII. APPLICATION OF THE PRIOR ART TO THE CHALLENGED CLAIMS

104. I have been asked to provide my opinion as to whether the Challenged Claims of the '075 Patent would have been anticipated by the prior art or obvious in view of the prior art. The discussion below provides a detailed analysis of how the prior art references I reviewed disclose, teach, or suggest the limitations of the Challenged Claims of the '075 Patent.

105. As part of my analysis, I have considered the scope and content of the prior art and any potential differences between the claimed subject matter and the prior art. I have conducted my analysis as of the filing/priority date of the '075 Patent: January 19, 2005. I have also considered the level of ordinary skill in the pertinent art as of that date.

106. Below, I describe in detail the scope and content of the prior art, as well as any differences between the subject matter claimed and the prior art, on an element-by-element basis for each challenged claim of the '075 Patent. The analysis supports my finding that the differences between the claims of the '075 Patent and the prior art discussed herein are such that the subject matter as a whole would have been obvious at the time of the priority date of the '075 Patent to a POSITA.

107. In the ground below, I describe on an element-by-element basis how the prior art discloses or teaches all elements of Claims 1-4 and 11-15 of the '075 Patent.

A. Grounds of Unpatentability

108. I have reviewed and analyzed the prior art references and materials listed in Section III above. In my opinion, the Challenged Claims of the '075 Patent are rendered obvious based on the following prior art set forth in Ground 1 below:

Ground	'075 Patent Claims	Basis for Challenge under §103
1	1-4 and 11-15	<i>Rosen</i> in view of <i>Rosen-II</i> and <i>Smith</i>

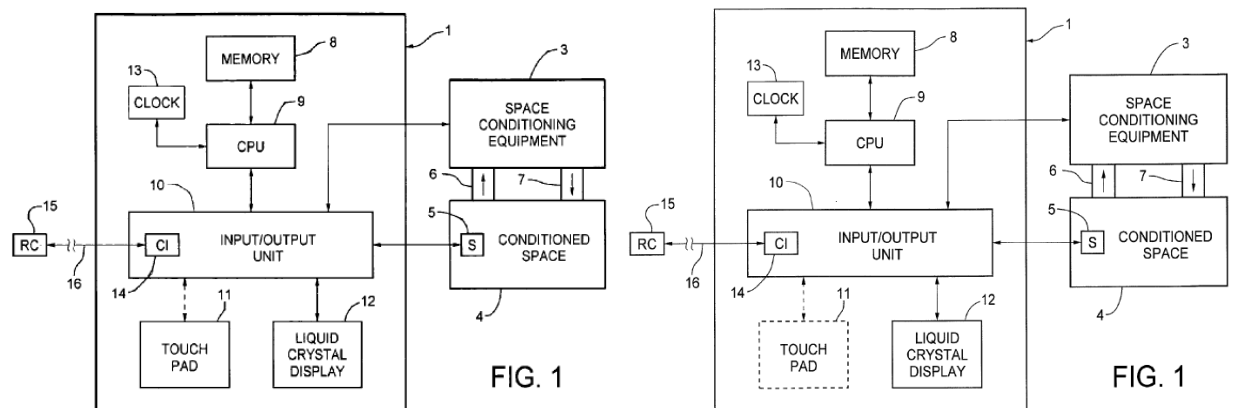
B. Summary of Prior Art

1. Overview of *Rosen* (Exhibit 1005)

109. *Rosen* (U.S. Patent Application Publication No. 2003/0150926 A1) was filed on February 13, 2002 as U.S. Patent Application No. 10/075,886 and published on August 14, 2003. EX1005 at Cover. *Rosen* was not disclosed to the USPTO by the applicant, nor cited or considered by the examiner, during prosecution of the '075 Patent. EX1001 at Cover.

110. *Rosen* describes a thermostat system that is very similar to the thermostat system described in the '075 Patent, and *Rosen* and the '075 Patent share much of the same disclosure. Similar to the '075 Patent, *Rosen* describes “a

thermostat system incorporating a communication interface for receiving and displaying diverse information from a remote correspondent.” EX1005, ¶0001. A comparison of Figure 1 of the '075 Patent with Figure 1 of *Rosen* reveals that the thermostat systems disclosed in each are virtually identical:



EX1001 at Figure 1 (above left); EX1005 at Figure 1 (above right). Compare EX1001 at Figures 2-4 with EX1005 at Figures 2-4.

111. Like the '075 Patent, *Rosen* describes “a thermostat system” that “includes a processor 1 and a temperature sensor 5 which is disposed in a conditioned space 4.” EX1005, ¶0017. “The processor 1 includes a central processing unit (CPU) 9 in communication with a memory 8 which stores data and program information and also, via an input/output unit (I/O unit) 10, an optional touch pad 11 and a liquid crystal display (LCD) 12.” *Id.*, ¶0018. “A settable real time clock 13 is used to keep time in the thermostat system to facilitate diverse operations[.]” *Id.* “The I/O unit includes a communications interface 14 for

coordinating communications between the CPU 9 and a remote correspondent 15.”
Id.

112. *Rosen* describes a process by which its thermostat system obtains information (e.g., current weather information and/or stock quotes) from a remote correspondent. For example, “[a]t one or more predetermined times of day (and/or on-demand if provided for in the operating program) which have been previously stored in the memory 8 and established by the clock 13, the CPU 9 starts the process shown in FIG. 5 by issuing signals to the I/O unit 10 to cause the communications interface 14 to establish communications, via link 16, with a remote correspondent 15.” *Id.*, ¶0022. “The remote correspondent 15 has a known data communications ‘address’ and, in the example, is a source of current information, such as local weather.” *Id.*, ¶0022. *Rosen* describes a process by which the current information is displayed on the LCD 12. *See, e.g., id.*, ¶¶0023-26. In addition to weather information, *Rosen* describes that “other types of current information may be obtained and displayed in a like manner” and gives “current stock quotations” as an example. *Id.*, ¶0027.

2. Overview of *Rosen-II* (Exhibit 1006)

113. *Rosen-II* (U.S. Patent Application Publication No. 2003/0142121) was filed on January 30, 2002 as U.S. Patent Application No. 10/060,768 and published on July 31, 2003. EX1006 at Cover. *Rosen-II* was not disclosed to the USPTO by

the applicant, nor cited or considered by the examiner, during prosecution of the '075 Patent. EX1001 at Cover.

114. *Rosen-II* relates to “a programmable thermostat system incorporating an integrated liquid crystal display/touch pad unit, constituting a touch screen, for interactive intuitive interface with a user to facilitate programming the thermostat system.” EX1006, ¶0001. *Rosen-II* explains that “[t]here is a fundamental problem with the prior art programmable thermostat systems: they are difficult to program and some users are unable to successfully program them.” *Id.*, ¶0005. According to *Rosen-II*, “[t]his is because the user interfaces which have been employed in prior art programmable interfaces are not highly intuitive.” *Id.* To address the drawbacks of prior art interactive components for thermostat systems, *Rosen-II* “employs a different type of thermostat user interface; viz., the touch screen 2, in which the touch pad 11 and LCD 12 are integrated and coordinated[.]” *Id.*, ¶0024. Figure 1 of *Rosen-II* illustrates a programmable thermostat system similar to that of the '075 Patent and *Rosen*, which integrates the touch pad 11 and LCD 12:

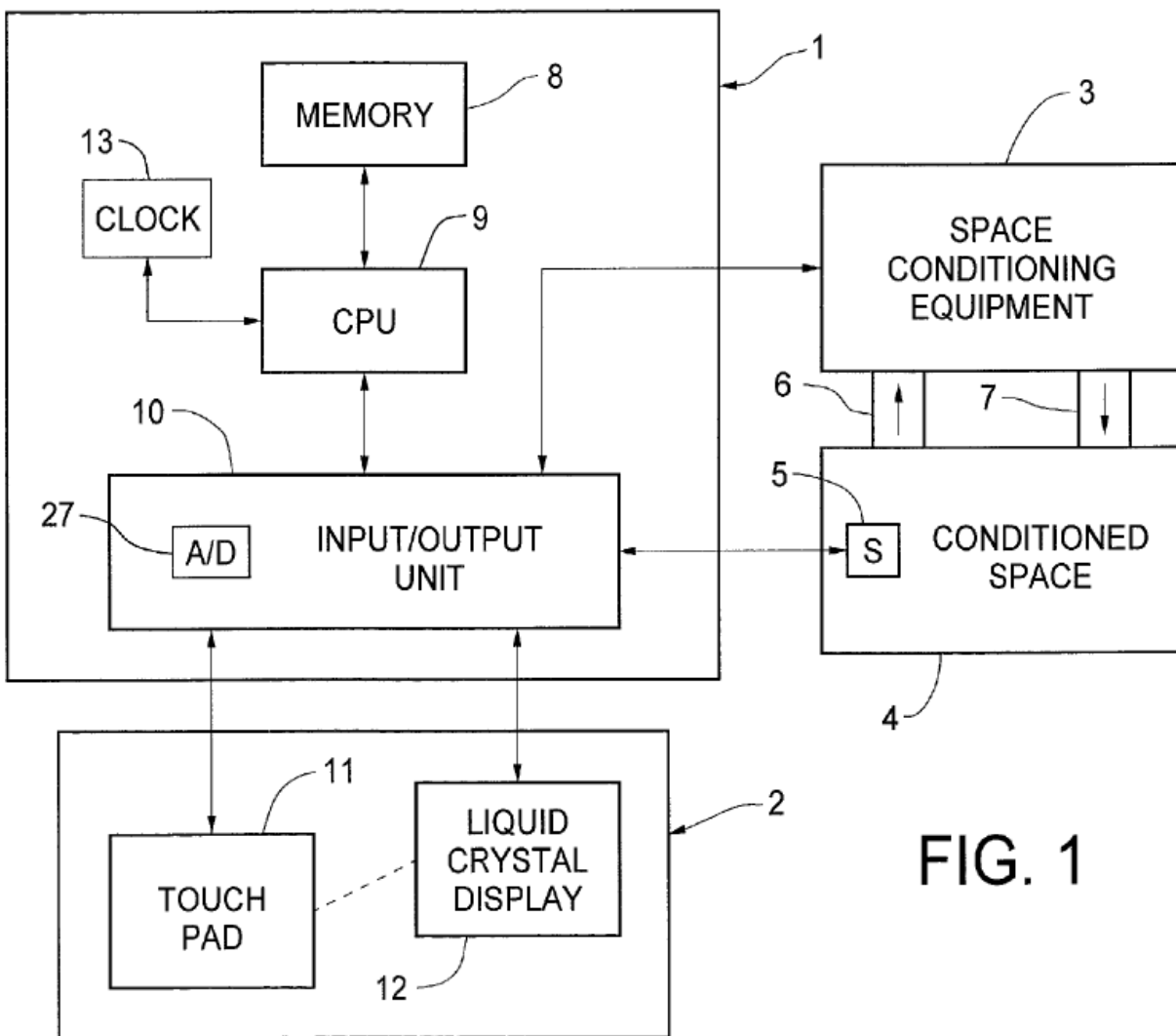


FIG. 1

Id. at Figure 1, ¶0024. Figure 2 illustrates an exploded view of an exemplary touch screen 2 according to the invention of *Rosen-II*:

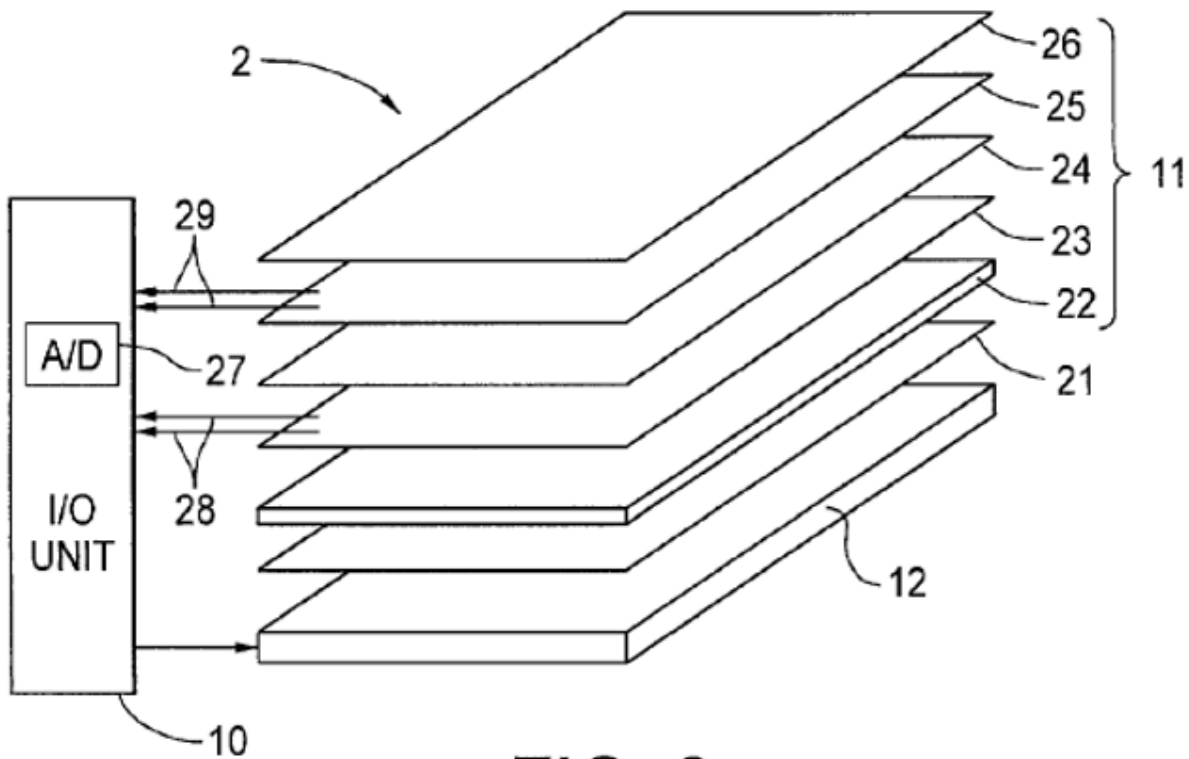


FIG. 2

Id. at Figure 2, ¶0025.

115. *Rosen-II* describes that “[b]y the use of a touch screen constituting a transparent touch pad juxtaposed over a liquid crystal display in a programmable thermostat system, programming is greatly simplified by the fact that various menus can have ergonomically variously placed ‘buttons’ along with intuitively variously placed messages associated with each button.” *Id.*, ¶0037.

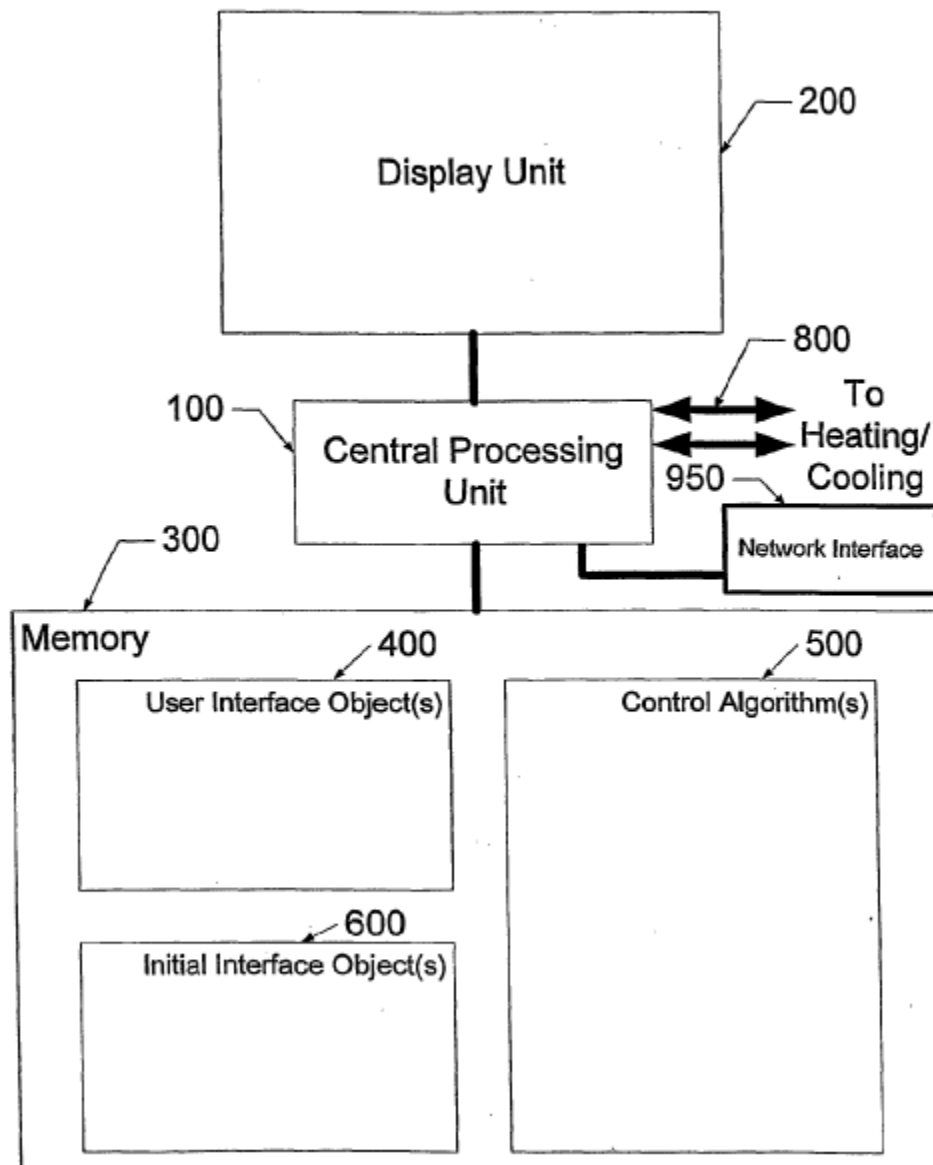
3. Overview of *Smith* (Exhibit 1007)

116. *Smith* (International Patent Application Publication No. WO 02/48851 A2) was filed on November 1, 2001 as International Application Number

PCT/US01/50672 and published on June 20, 2002. EX1007. Similar to *Rosen*, *Rosen-II*, and the '075 Patent, *Smith* “relates to thermostats and other thermal comfort controllers and particularly to a multiple language user interface for such thermal comfort controllers.” *Id.* at 1:6-7. *Smith* explains that “[p]rogrammable comfort controllers have been troublesome in the past because users often do not understand how to correctly program the controllers.” *Id.* at 1:24-25. According to *Smith*, “[w]hat is needed in the art is a user interface for a thermostat in which the temperature schedule is more easily programmed.” *Id.* at 1:29-30.

117. Similar to *Rosen*, *Rosen-II*, and the '075 Patent, *Smith* describes a user interface system for a thermal comfort controller (e.g., a thermostat) that includes a central processing unit, a memory, a display with a touch-sensitive screen used for input, a language selector, and a network interface. *See id.* at 2:7-10. Figure 1 of *Smith* “is a block diagram of a user interface system for a thermal comfort controller” in accordance with *Smith*’s invention:

Figure 1



Id. at 2:21-22, Figure 1.

118. *Smith* describes a process by which a comfort controller is “installed without any user interface objects, initial interface objects, or control algorithms stored in memory.” *Id.* at 5:8-9. “When first powered-up after installation, the

comfort controller is programmed to load the initial interface objects 600 via the network interface 950” (e.g., from a web page on the Internet). *Id.* at 5:10-12. The initial interface objects are downloaded and presented on the display unit to request the user to choose a preferred language. *See id.* at 5:15-16. “Once the preferred language is chosen, the proper user interface objects 400 are then downloaded.” *Id.* at 5:16-17. This enables the display unit to “correctly display all of the textual information in the preferred language.” *Id.* at 5:2-4. Additionally, control algorithms (e.g., a schedule of set back temperatures) “may also be loaded so that the user can choose from one that is suited for the user’s climate and personal preferences.” *Id.* at 1:20-21, 2:18-19.

C. Ground 1: Claims 1-4 and 11-15 are rendered obvious by *Rosen* in view of *Rosen-II* and *Smith*

119. In my opinion, the Challenged Claims would have been obvious over the *Rosen-Rosen-II-Smith* combination. The hardware elements in the Challenged Claims were well known and used in thermostat systems for many years before the ’075 Patent, as I’ve discussed above. *Supra*, §§VI.A-C. Indeed, the admissions in the specification of the ’075 Patent demonstrate that most of these elements would have been well known to a POSITA before the priority date. It was also well known to connect appliances—such as thermostat systems—to the Internet to obtain software updates to expand, update, or change system functionality. *Supra*, §VI.D.

120. Based on the following analysis, I conclude that a POSITA at the relevant time (January 19, 2005) would have understood the limitations of Claims 1-4 and 11-15 were expressly disclosed, taught, or suggested by *Rosen* in combination with *Rosen-II* and *Smith*, and it would have been obvious to a POSITA to combine them to arrive at the Challenged Claims.

1. Claim 1

(i) 1[Pre]: “A thermostat system for controlling space conditioning equipment comprising:”

121. If the preamble is limiting, *Rosen* discloses it. In the Background of the Invention section, *Rosen* explains that “[t]hermostats have been used for many years as a temperature sensitive switch which controls heating and/or cooling equipment for conditioning a space in which the thermostat, or a temperature sensor connected to the thermostat, is placed.” EX1005, ¶0002 (further describing how a thermostat is used to heat or cool a conditioned space “[i]n the well known manner”); *see also supra*, §VI.A. *Rosen* is titled “**Thermostat System** Communicating With A Remote Correspondent for Receiving and Displaying Diverse Information.” EX1005 at Title (emphasis added). *Rosen* discloses “[a] thermostat system” that “includes a temperature sensor[.]” *Id.* at Abstract. In particular, *Rosen* claims “[a] thermostat system for controlling space conditioning equipment” as recited in preamble 1[Pre]. *Id.* at Claim 1. Figure 1 of *Rosen*, reproduced below, “is a block diagram of a first

embodiment of a space conditioning system incorporating a thermostat system employing the present invention.” *Id.*, ¶0010.

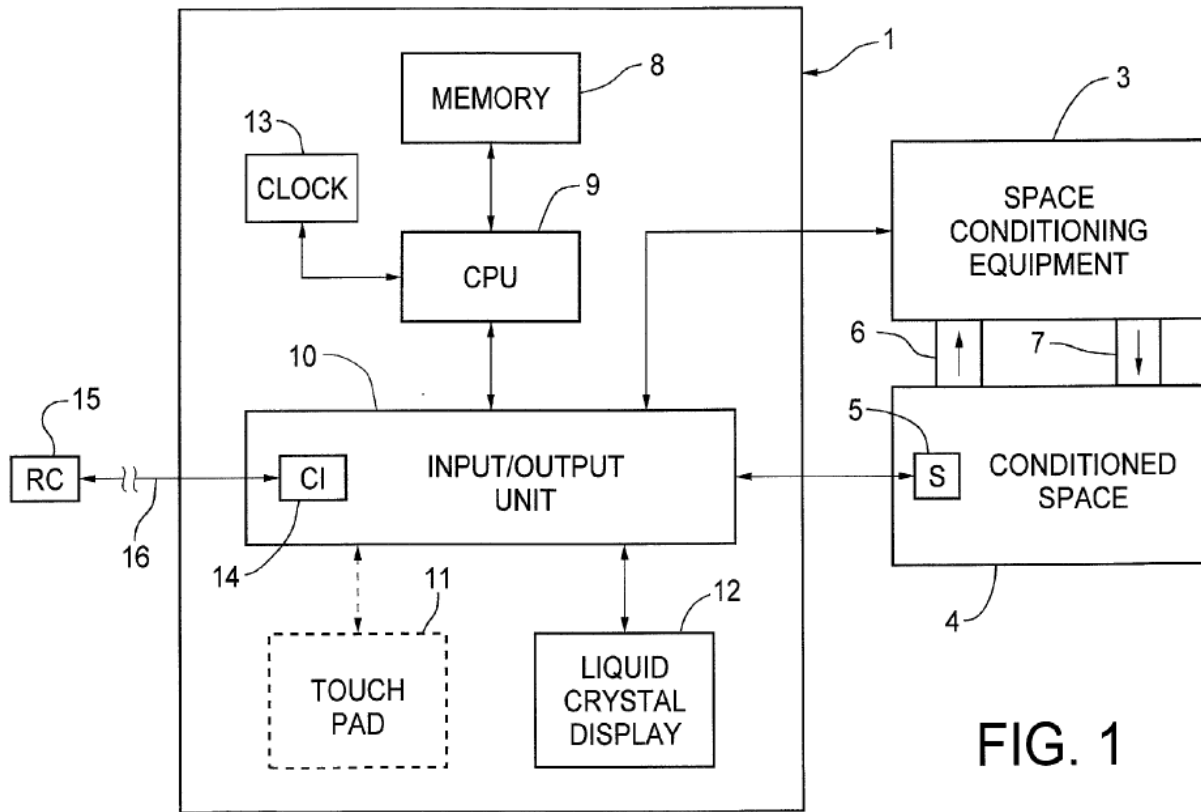


FIG. 1

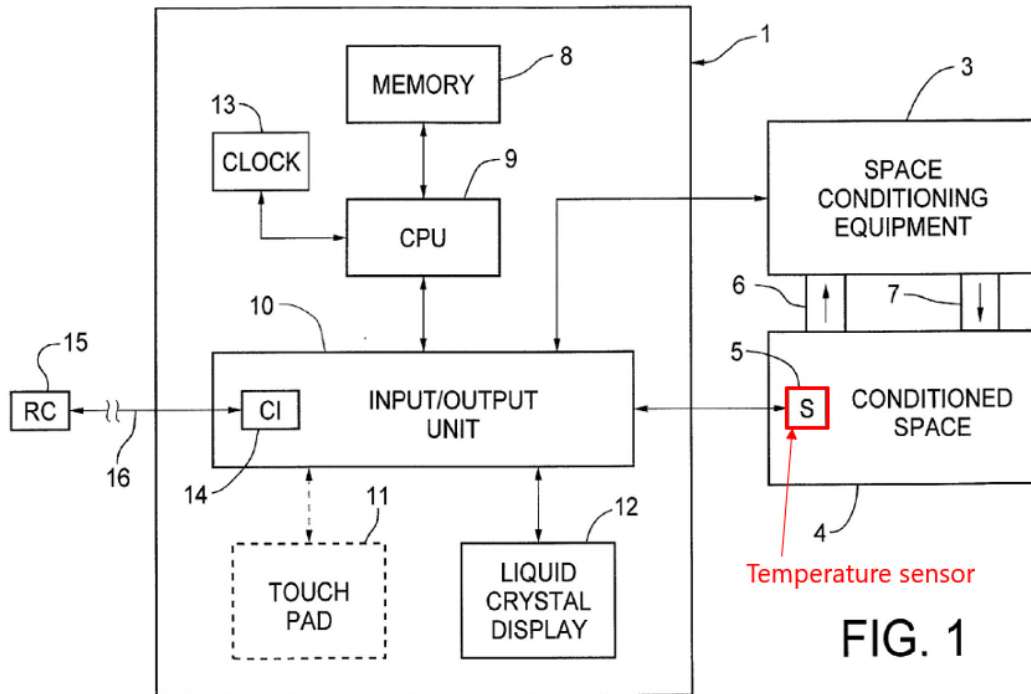
Id. at Figure 1; see also *id.*, ¶0017 (describing “a thermostat system” with reference to Figure 1), Figures 2-4 (each depicting an embodiment of a space conditioning system incorporating a thermostat system). Accordingly, *Rosen* discloses preamble 1[Pre].

(ii) 1[a]: “A) a temperature sensor for providing an electrical signal indicative of the temperature of a conditioned space in which the temperature sensor is situated;”

122. *Rosen* discloses element 1[a]. The '075 Patent does not disclose any new type of temperature sensor. EX1012 at 264:2-5. The use of temperature sensors with thermostat systems was well known before the priority date of the '075 Patent. *See, e.g.*, EX1005, ¶0002 (“Thermostats have been used for many years as a temperature sensitive switch which controls heating and/or cooling equipment for conditioning a space in which the thermostat, or a temperature sensor connected to the thermostat, is placed.”), ¶0003 (explaining that “[m]any modern thermostat systems include . . . a data processor to run a process control program stored in the memory to accurately measure the temperature of a temperature sensor disposed in the conditioned space”); *Supra*, §VI.B.1.

123. *Rosen* explains that “[a] thermostat system according to [its] invention includes: a temperature sensor for providing an electrical signal indicative of the temperature of a conditioned space in which the temperature sensor is situated,” as recited in element 1[a]. EX1005, ¶0007; *see also id.* at Claim 1 (reciting “a thermostat system for controlling space conditioning equipment comprising: . . . a temperature sensor for providing an electrical signal indicative of the temperature of a conditioned space in which the temperature sensor is situated”). Figure 1 of *Rosen*,

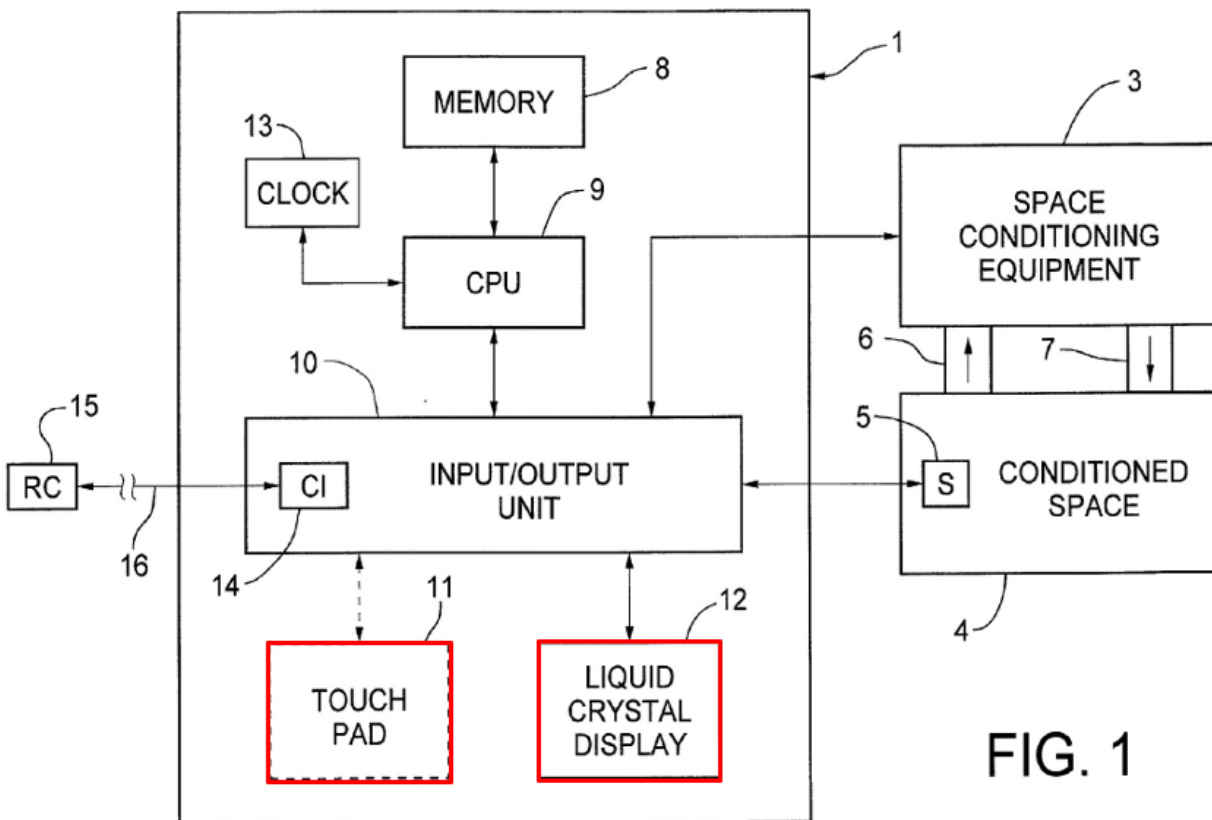
annotated below, illustrates “a thermostat system” that includes “a temperature sensor 5 which is disposed in a conditioned space 4.”



Id. at Figure 1 (annotated), ¶0017; *see also id.*, Figures 2-4 (each depicting temperature sensor 5). *Rosen* discloses that, “in the usual manner during normal operation, the temperature sensor 5 sends an electrical signal (e.g., if the sensor 5 is a simple thermistor, a resistance value; several types of temperature sensors are widely used) representative of the temperature within the conditioned space 4[.]” *Id.*, ¶0019. Thus, *Rosen* discloses element 1[a].

- (iii) 1[b]: “B) a transparent touch pad juxtaposed over a liquid crystal display to constitute a touch screen for interactive interface with a user and for selectively displaying alphanumeric and graphic devices;”

124. *Rosen* in combination with *Rosen-II* discloses element 1[b]. *Rosen* explains that “[t]ypically, prior art programmable thermostat system [*sic*] employ a tactile touch pad with various fixed position buttons to be touched in a precise sequence to program set points[.]” EX1005, ¶0004. *Rosen*’s thermostat system includes “an optional touch pad 11 and a liquid crystal display (LCD) 12.” *Id.*, ¶0018. “The liquid crystal display may optionally be backlit by any suitable means[.]” *Id.* *Rosen*’s touch pad 11 and LCD 12 are shown in Figure 1 below:

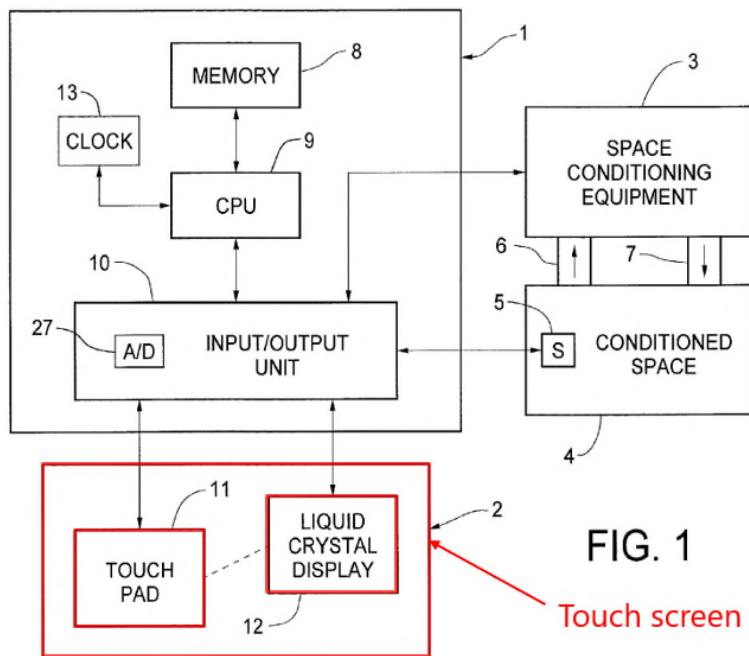


Id., Figure 1 (annotated).

125. *Rosen* teaches that a user may interact with its thermostat system using touch pad 11 and LCD 12. For example, *Rosen* explains that “many modern thermostats are programmable by a user” via “a tactile touch pad with various fixed position buttons to be touched in a precise sequence to program set points . . . for programmable time periods which may include a vacation mode. The programming sequence may be followed on a separate display, typically a liquid crystal display.” *Id.*, ¶0004. *Rosen* further describes that a user may enter key terms, or addresses, “using the touchpad 11 and LCD 12.” *Id.*, ¶0021, ¶0029.

126. Although *Rosen* discloses a thermostat system having a touch pad and a liquid crystal display for interfacing with a user, *Rosen* does not explicitly disclose “a transparent touch pad juxtaposed over a liquid crystal display to constitute a touch screen for interactive interface with a user and for selectively displaying alphanumeric and graphic devices” as claimed. Such touch screens, however, were well known in the art before the priority date of the ’075 Patent. *Supra*, §VI.C. Indeed, in the “Background of the Invention” section, the ’075 Patent admits that “[s]ome modern thermostat systems incorporate a touch sensitive screen which incorporate representations of buttons which a user may press as part of an interface with the thermostat system.” EX1001 at 2:50-53. *Rosen-II* discloses this aspect of Claim 1.

127. *Rosen-II* discloses “[a] programmable thermostat system for controlling space conditioning equipment” that includes “a transparent touch pad juxtaposed over a liquid crystal display to constitute a touch screen for interactive interface with a user.” EX1006 at Abstract. *Rosen-II* explains that its invention relates “to a programmable thermostat system incorporating an integrated liquid crystal display/touch pad unit, constituting a touch screen, for interactive intuitive interface with a user to facilitate programming the thermostat system.” *Id.*, ¶0001. Figure 1 of *Rosen-II* depicts “a thermostat system” that includes “a touch pad 11 and a liquid crystal display (LCD) 12 which constitute the touch screen 2.” *Id.*, ¶0020.



Id. at Figure 1 (annotated).

128. Figure 2 of *Rosen-II* shows “an exploded view of an exemplary touch screen 2 according to the invention.” *Id.*, ¶0025. In the example of Figure 2, “[a] transparent touch pad 11, constituting generally planar layers 22-26, is juxtaposed over a flat panel LCD 12 with RF shield layer 21 interposed.” *Id.*, ¶0026.

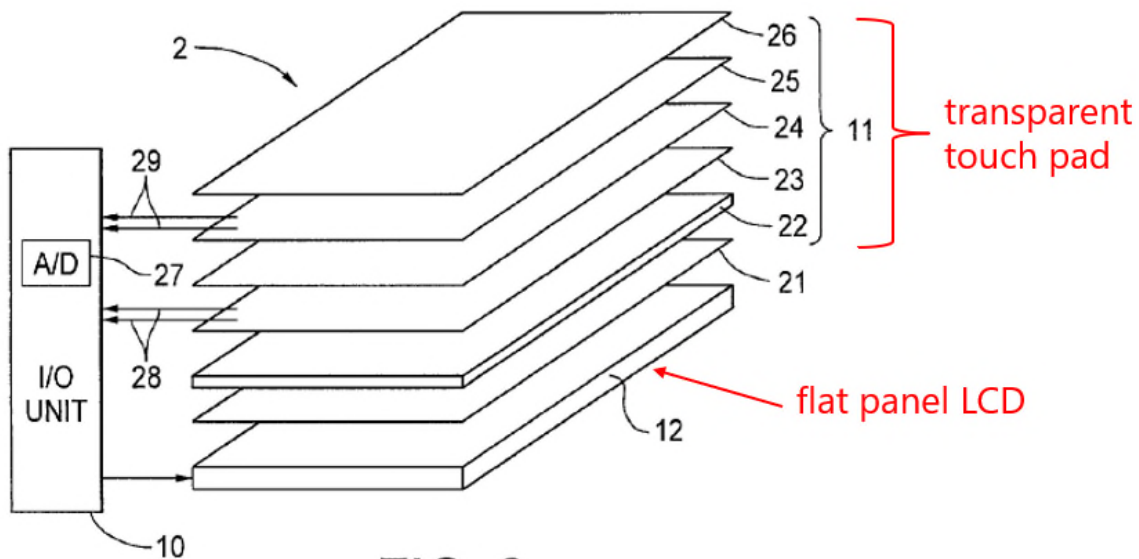


FIG. 2

Id. at Figure 2 (annotated). Thus, *Rosen-II* discloses “a transparent touch pad juxtaposed over a liquid crystal display to constitute a touch screen for interactive interface with a user.”

129. Further, *Rosen-II* discloses that its transparent touch pad juxtaposed over a liquid crystal display to constitute a touch screen is for “selectively displaying alphanumeric and graphic devices.” *Rosen-II* explains that “[b]y the use of a touch screen constituting a transparent touch pad juxtaposed over a liquid crystal display in a programmable thermostat system, programming is greatly simplified by the fact

that various menus can have ergonomically variously placed ‘buttons’ along with intuitively variously placed messages associated with each button.” *Id.*, ¶0037. For example, Figure 3 illustrates “an exemplary pictorial of a high level interactive interface displayed on the touch screen during normal operation.” *Id.*, ¶0011. Figure 3 depicts “buttons 30, 31, and 32” as well as “an alphanumeric message to the left of the button 32.” *Id.*, ¶¶0028-29.

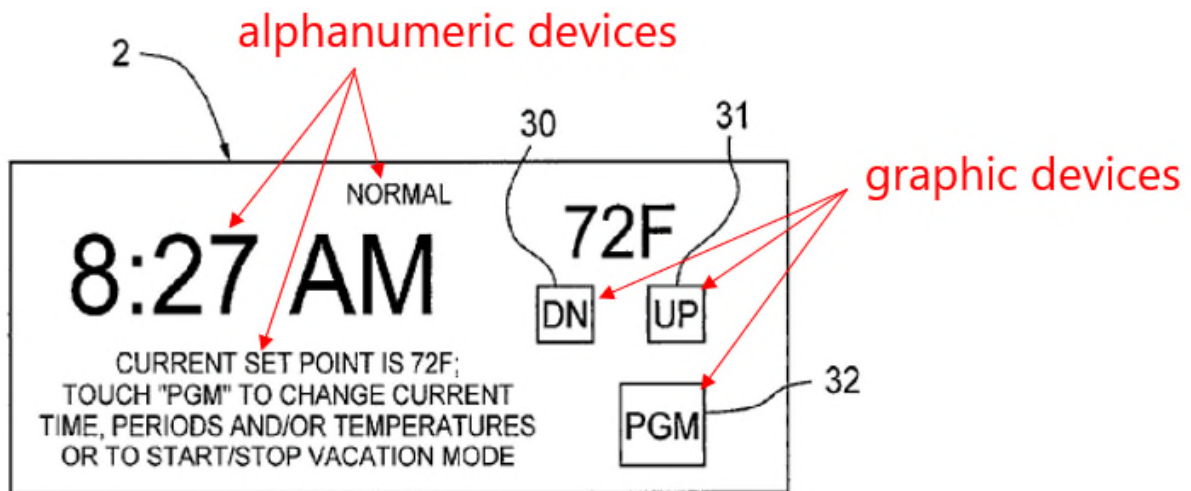


FIG. 3

Id. at Figure 3 (annotated).

130. A POSITA would have understood that the “buttons” of *Rosen-II* are one example of the claimed “graphic devices” and the “messages associated with each button” are examples of the claimed “alphanumeric” devices. The ’075 Patent explains that “text and graphic devices” are “viewable on the LCD 12” and that “text or graphic devices . . . form a part of a display.” EX1001 at 9:40-43, 4:12-16. For

example, “[a] user may desire that a touch pad button associated with the text ‘COOL’ be changed to the text ‘AC’ for air conditioning” or “desire that a touch pad button associated with the word ‘FAN’ be replaced with a graphic representation of fan blades connected to a central hub indicating fan function.” *Id.* at 4:16-21. The “messages” in *Rosen-II* are text viewable on the display and would have been understood by a POSITA to be “alphanumeric devices.” Additionally, the “buttons” viewable on the display of *Rosen-II* would have been understood by a POSITA to be “graphic devices.” Buttons with text would also have been understood to be “alphanumeric devices.”

131. The teaching of *Rosen-II* that “various menus” can have variously placed buttons and messages discloses “selectively displaying” alphanumeric and graphic devices as claimed. For example, in addition to the “high level interactive interface” shown in Figure 3 above, *Rosen-II* provides examples of “intermediate” and “low level” interactive interfaces displayed on the touch screen during normal operations. EX1006, ¶¶0012-13. For example, “[i]f the button 32 [in Figure 3] is touched, a menu such as that shown if [sic] FIG. 4 replaces (using display information prestored in memory 8) the display shown in” Figure 3 above. *Id.*, ¶0029. Figure 4 of *Rosen-II*, reproduced below, “is an exemplary pictorial of an intermediate level interactive interface displayed on the touch screen.” *Id.*, ¶0012.

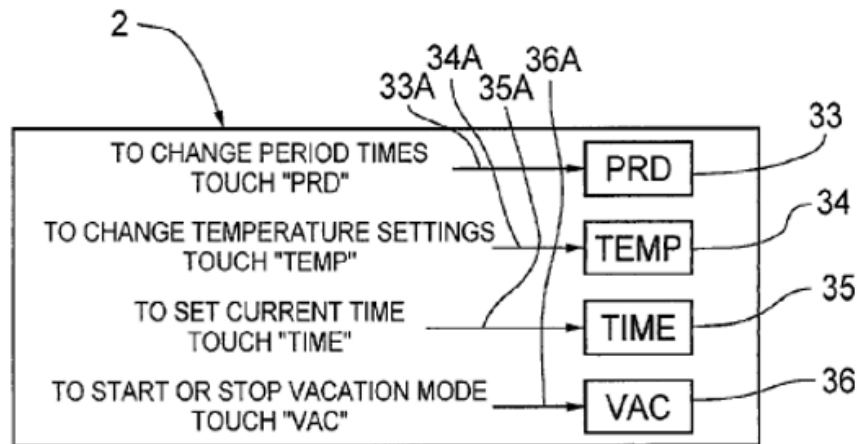
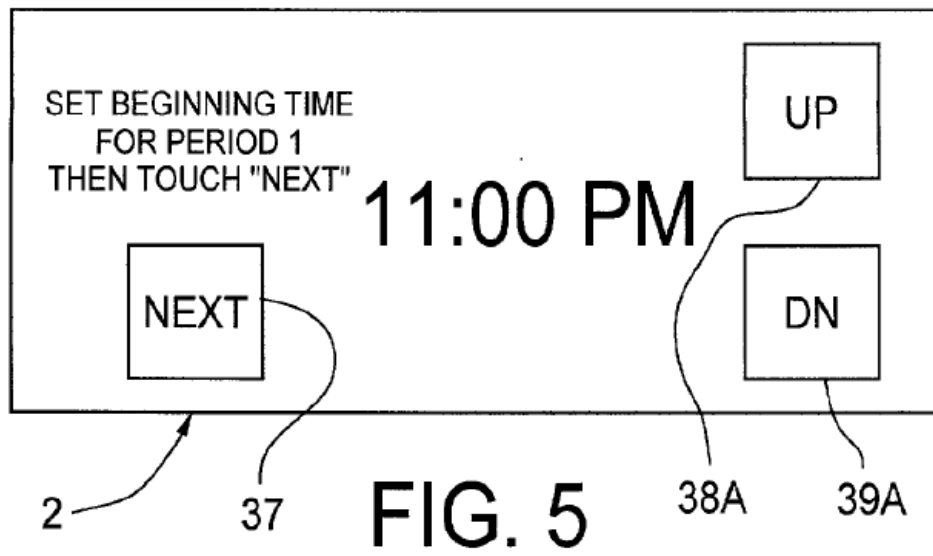


FIG. 4

Id. at Figure 4. In addition to buttons 33-36, the “icon indicators”—shown in FIG. 4 as “arrows 33A, 34A, 35A, 36A”—are an additional example of the claimed “graphic devices.” *Id.*, ¶0031.

132. *Rosen-II* describes that if a user wishes to change the period times by pressing the “PRD” button 33, the “processor 1 causes a lower level menu such as that shown in FIG. 5 to be displayed.” *Id.*, ¶0032. Figure 5, shown below, “is an exemplary pictorial of a low level interactive interface displayed on the touch screen.” *Id.*, ¶0013.



Id. at Figure 5.

133. As can be seen above, each of the high level, intermediate level, and low level interactive interfaces in Figures 3, 4, and 5, respectively, has a different arrangement of text (i.e., alphanumeric devices) and buttons (i.e., graphical and/or alphanumeric devices). Indeed, *Rosen-II* explains that “if [the positions of the choice buttons in Figure 4] are compared to the positions of the buttons 30, 31, 32 in FIG. 3, it will be seen that they would ‘interfere’ physically if conventional tactile buttons were used. With the present invention, however, the positions of buttons on different menus can be placed wherever it is most intuitive and convenient for the present selection of operations.” *Id.*, ¶0030. A POSITA would have understood that *Rosen-II*’s approach of using a transparent touch pad juxtaposed over a liquid crystal display constituting a touch screen for displaying different arrangements of buttons

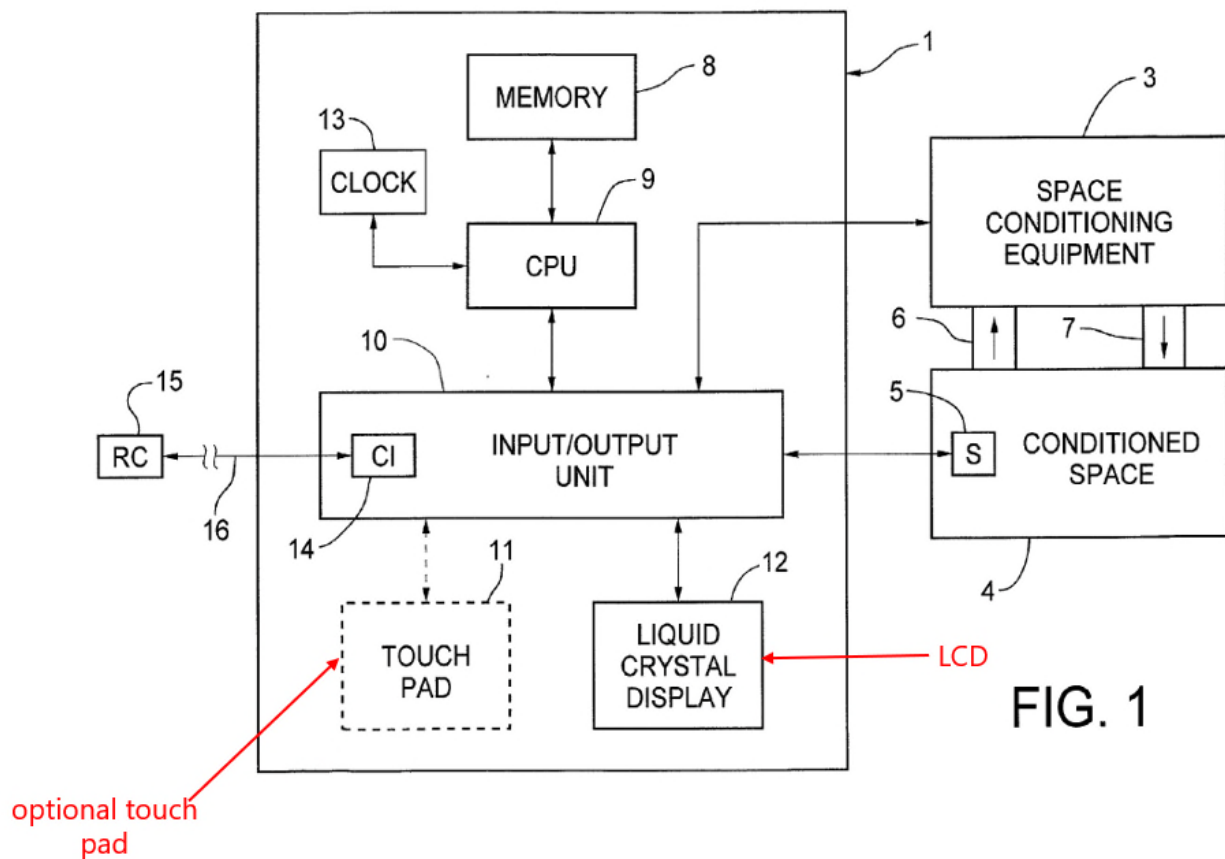
and text depending on the menu selected by the user discloses or at least renders obvious a “touch screen . . . for selectively displaying alphanumeric and graphic devices” as claimed.

(a) Rationale and motivation for combining *Rosen-II* with *Rosen*

134. It would have been obvious to a POSITA to combine *Rosen-II*’s transparent touch pad juxtaposed over a liquid crystal display to constitute a touch screen for interactive interface with a user and for selectively displaying alphanumeric and graphic devices with the thermostat system of *Rosen*. Indeed, modifying *Rosen* to incorporate the touch screen of *Rosen-II* would merely involve the simple substitution of one known element (the touch pad and LCD of *Rosen*) for another (the touch screen of *Rosen-II*) to obtain predictable results (a thermostat system that includes a transparent touch pad juxtaposed over a liquid crystal display to constitute a touch screen for interactive interface with a user and for selectively displaying alphanumeric and graphic devices).

135. *Rosen* and *Rosen-II* are in the same field of endeavor and are therefore analogous art to the ’075 Patent and each other. Both *Rosen* and *Rosen-II* relate to “the art of thermostats.” EX1005, ¶0001; EX1006, ¶0001. Based on the teachings of *Rosen-II*, a POSITA would have been motivated to modify *Rosen* to incorporate the touch screen of *Rosen-II* to improve upon *Rosen*’s user interface.

136. As discussed above, *Rosen* explains that “[t]ypically, prior art programmable thermostat system [*sic*] employ a tactile touch pad with various fixed position buttons to be touched in a precise sequence to program set points,” and that “[t]he programming sequence may be followed on a separate display, typically a liquid crystal display.” EX1005, ¶0004. *Rosen*’s thermostat system includes such an arrangement. For example, as shown in Figure 1, *Rosen*’s thermostat system includes “an optional touch pad 11” and a separate “liquid crystal display (LCD) 12.” *Id.*, ¶0018.



Id. at Figure 1 (annotated); *see also id.* at Figures 2-4 (each showing optional touch pad 11 and LCD 12).

137. Similar to *Rosen*, *Rosen-II* also acknowledges that “[t]ypically, prior art programmable thermostat system [*sic*] employ a tactile touch pad with various fixed position buttons to be touched in a precise sequence to program set points” and that “[t]he programming sequence may be followed on a separate display, typically a liquid crystal display.” EX1006, ¶0004. *Rosen-II*, however, explains that “[t]here is a fundamental problem with the prior art programmable thermostat systems: they are difficult to program and some users are unable to successfully program them.” *Id.*, ¶0005. *Rosen-II* explains that “[t]his is because the user interfaces which have been employed in prior art programmable interfaces are not highly intuitive.” *Id.* In particular:

Programmable thermostat systems have incorporated fixed position buttons, at least some of which have multi-functions depending upon the point at which a user has reached in the programming process. The user must usually refer to and attempt to decipher a programming manual (which is often difficult for the average user to readily understand) as the programming proceeds. But, the programming process is so complex to follow while trying to remember the instructions that many users give up, and the full capabilities of the thermostat system cannot be utilized.

Id. *Rosen-II* addresses these “drawbacks of the prior art interactive components” by “employ[ing] a different type of thermostat user interfaces; viz., the touch screen 2, in which the touch pad 11 and LCD 12 are integrated and coordinated” and which “provides a programmable thermostat systems which is very much easier to program than in the prior art.” *Id.*, ¶0024.

138. *Rosen-II* describes the “advantages of employing” its touch screen over prior art user interfaces for programmable thermostat systems such as the one in *Rosen*. *Id.*, ¶0028. *Rosen-II* explains that “[w]ith the present invention . . . the positions of buttons on different menus can be placed wherever it is most intuitive and convenient for the present selection of operations.” *Id.*, ¶0030. *Rosen-II* states that “[t]his is impossible to achieve with the prior art thermostat systems and is a prime factor in the ease of programming enjoyed by the use of the subject thermostat system.” *Id.* Additionally, “[b]ecause each menu can be displayed in any manner a system programmer wishes, icon indicators . . . can be included to further assist a user to select and touch the correct button to successfully move to the next menu or make other selections with confidence.” *Id.*, ¶0031.

139. Thus, *Rosen-II* teaches that “[b]y the use of a touch screen constituting a transparent touch pad juxtaposed over a liquid crystal display in a programmable thermostat system, programming is greatly simplified by the fact that various menus can have ergonomically variously placed ‘buttons’ along with intuitively variously

placed messages associated with each button.” *Id.*, ¶0037. I agree with *Rosen-II*’s statement regarding the benefits of a touch screen over prior art approaches that used fixed buttons. As evidenced above, a POSITA would have appreciated that fixed buttons require you to fit every conceivable operation a user might undertake to the arrangement of fixed buttons. A POSITA would have recognized that a touch screen, such as the one disclosed in *Rosen-II*, allows the placement of the buttons to be optimized for the various operations. In my opinion, based on the disclosures in *Rosen-II*, a POSITA would have been motivated to modify *Rosen* to incorporate the touch screen of *Rosen-II* (i.e., the transparent touch pad juxtaposed over a liquid crystal display to constitute a touch screen for interactive interface with a user and for selectively displaying alphanumeric and graphic devices) to improve upon *Rosen*’s user interface.

140. A POSITA would have had other reasons to modify *Rosen* to incorporate the touch screen of *Rosen-II*. One reason to combine the touch screen of *Rosen-II* with the thermostat system of *Rosen* is that doing so would allow one to increase the size of the display. A POSITA would have understood that fixed buttons take up a significant amount of space (e.g., on a control panel for the thermostat system). Replacing the fixed buttons of *Rosen* with the touch screen of *Rosen-II* would eliminate the need for many, if not all, of the fixed buttons. This frees up space on the control panel and enables the use of a larger display. A POSITA would

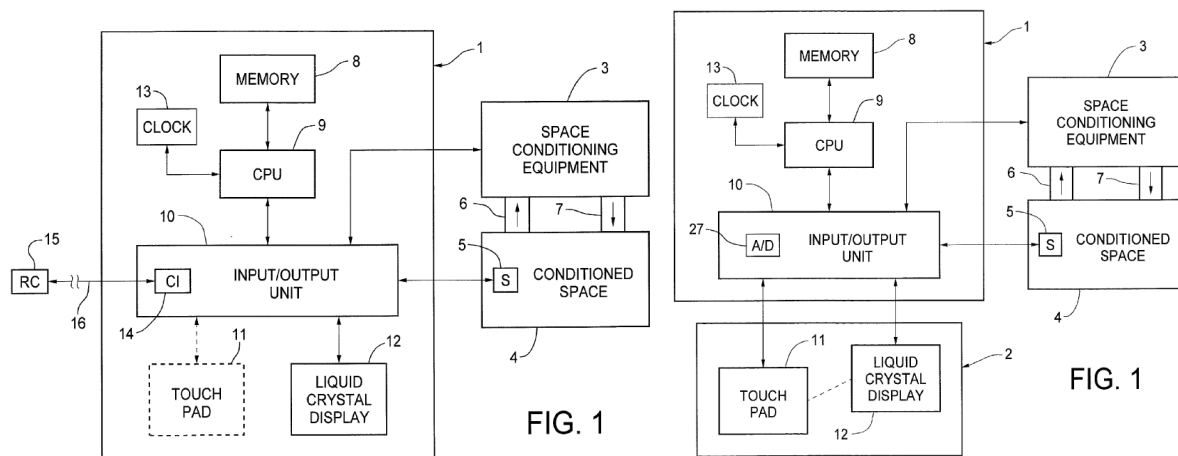
have understood that increasing the size of the display is advantageous. For example, increasing the size of the display can make the display easier to see, and also make designing the layout of the screen easier because there is more space to work with.

141. Additionally, the use of a touch screen, such as that described in *Rosen-II*, in the thermostat system of *Rosen* would be a simple matter of design choice for a POSITA. Every thermostat system that I am aware of has some sort of interface that allows the user to interact with the system (e.g., to set the temperature and decide whether to heat or cool a conditioned space). *Rosen* and *Rosen-II* both describe known options for that interface (fixed buttons and a separate LCD display in *Rosen* and a touch screen in *Rosen-II*). In designing a thermostat system, it would have been a simple matter of design choice for a POSITA as to what kind of user interface to use.

142. In addition to modifying *Rosen* to include the touch screen hardware of *Rosen-II* (i.e., the transparent touch pad juxtaposed over a liquid crystal display to constitute a touch screen), a POSITA would have also been motivated to modify *Rosen*'s control program to include the functionality required for operation of the touch screen of *Rosen-II* (e.g., by modifying *Rosen*'s control program to include the functionality of *Rosen-II*'s control program for "selectively establish[ing], on the liquid crystal display, a menu including a representation of a button at a

predetermined XY position,” “read[ing] the position on the touch pad juxtaposed with the first predetermined position to determine if the button has been touched,” and “if the button has been touched, change to a different menu or establish a condition incorporated into the thermostat system operation” as described in *Rosen-II*. EX1006, Abstract; *see also id.* at Claims 1, 3, and 17, ¶0007, ¶0026, ¶0028. These aspects of *Rosen* and *Rosen-II* are discussed in more detail with respect to elements 1[j]-1[l] below. *Infra*, §§VII.C.1.vii-ix.

143. A POSITA would have had a reasonable expectation of success in making the combination. As an initial matter, a POSITA would have recognized that the thermostat systems described in *Rosen* and *Rosen-II* are remarkably similar. Indeed, a comparison of Figure 1 of *Rosen* (below left) and Figure 1 of *Rosen-II* (below right) demonstrates that the thermostat systems are virtually identical but for the arrangement of the touch pad and LCD:



EX1005 at Figure 1 (above left); EX1006 at Figure 1 (above right). Thus, a POSITA would have recognized that the touch screen of *Rosen-II* is suitable for, and could be readily incorporated in, the thermostat system of *Rosen*.

144. Moreover, a POSITA would have had a reasonable expectation of success in making the combination because, like *Rosen*, *Rosen-II* explains that “integrated circuit chips including all the processor components with all the necessary interface conditioning circuits are available off-the-shelf” and that “[t]he subject invention only requires the capabilities of such a processor, and off-the-shelf integrated circuit processor chips may be used to advantage in the subject thermostat system.” EX1006, ¶0023; *see also* EX1005, ¶0020 (explaining that *Rosen*’s invention “only requires” the same off-the-shelf equipment). Additionally, *Rosen-II* explains that there are “several types of transparent touch screens which can be juxtaposed with the LCD 12 to constitute the touch screen” that are “commercially available.” EX1006, ¶0027. Because the systems of *Rosen* and *Rosen-II* utilize commercially available, off-the-shelf components, it would have been well within the abilities of a POSITA to modify *Rosen*’s thermostat system to include the touch screen of *Rosen-II* and its associated control program functionality. EX1012 at 264:6-265:4 (inventor of ’075 Patent admitting that all of the hardware components in Claim 1 are off-the-shelf components available in the prior art used as they were intended to be used).

(iv) Elements 1[c]-1[f]

1[c]: “C) a processor, said processor including 1) a central processing unit;”

1[d]: “2) a real time clock;”

1[e]: “3) a memory coupled to said central processing unit for storing program and data information; and”

1[f]: “4) an input/output unit including:”

145. *Rosen* discloses elements 1[c]-1[f]. The features in elements 1[c]-1[f] were well known in the art. See EX1012 at 262:19-263:23 (inventor of the ’075 Patent admitting that the patent does not disclose any new CPU, real time clock, memory, or input/output unit), 273:18-274:11 (elements 1[c]-1[f] used in thermostats for many years prior to the alleged invention of the ’075 Patent); *Supra*, §VI.B.2.

146. *Rosen* discloses that “[a] thermostat system according to [its] invention includes . . . a processor having: a CPU, real time clock and a memory for storing program and data information.” EX1005, ¶0007. More particularly, *Rosen*’s Figure 1 illustrates “a thermostat system” that “includes a processor 1.” *Id.*, ¶0017. “The processor 1 includes a central processing unit (CPU) 9 in communication with a memory 8 which stores data and program information and also, via an input/output unit (I/O unit) 10, an optional touch pad 11 and a liquid crystal display (LCD) 12.” *Id.*, ¶0018. “A settable real time clock 13 is used to keep time in the thermostat

system to facilitate diverse operations, such as different temperature set points (desired temperatures), during different periods of the day cycle.” *Id.* Rosen’s processor including a central processing unit (element 1[c]), a real time clock (element 1[d]), a memory coupled to the central processing unit for storing program and data information (element 1[e]), and an input/output unit (element 1[f]) is shown in annotated Figure 1 below:

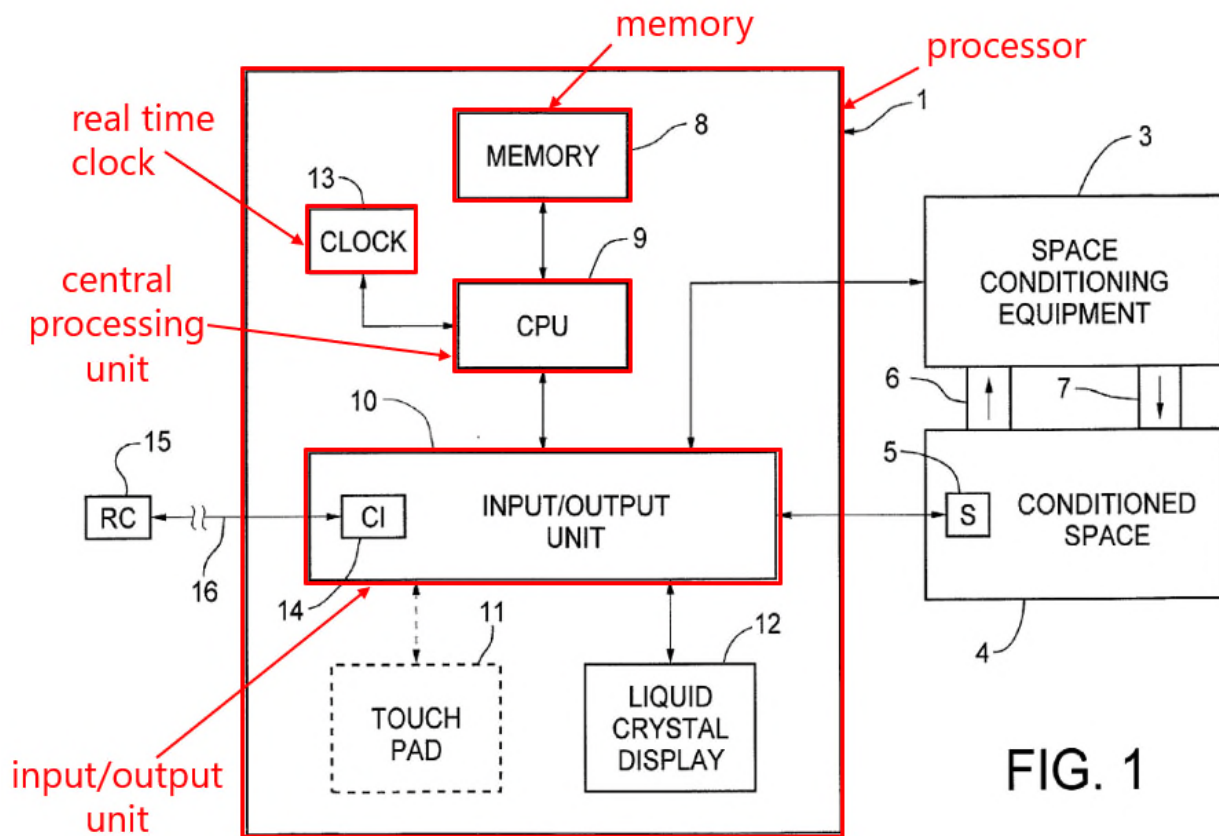


FIG. 1

Id. at Figure 1 (annotated); *see also id.* at Figures 2-4 (each depicting a “processor 1” including central processing unit 9, real time clock 13, memory 8, and input/output unit 10), Claims 1, 11 (each reciting a processor including the features

of elements 1[c]-1[f] verbatim). As can be seen from Figure 1 above, “memory 8” is coupled to central processing unit 9. *See id.*, Figure 1; *see also id.*, ¶0018 (describing “central processing unit (CPU) 9 in communication with a memory 8”); Thus, *Rosen* discloses elements 1[c]-1[f].

(v) Elements 1[g]-1[h]

1[g]: “a) a sensor input coupled to said temperature sensor for receiving said electrical signal therefrom;”

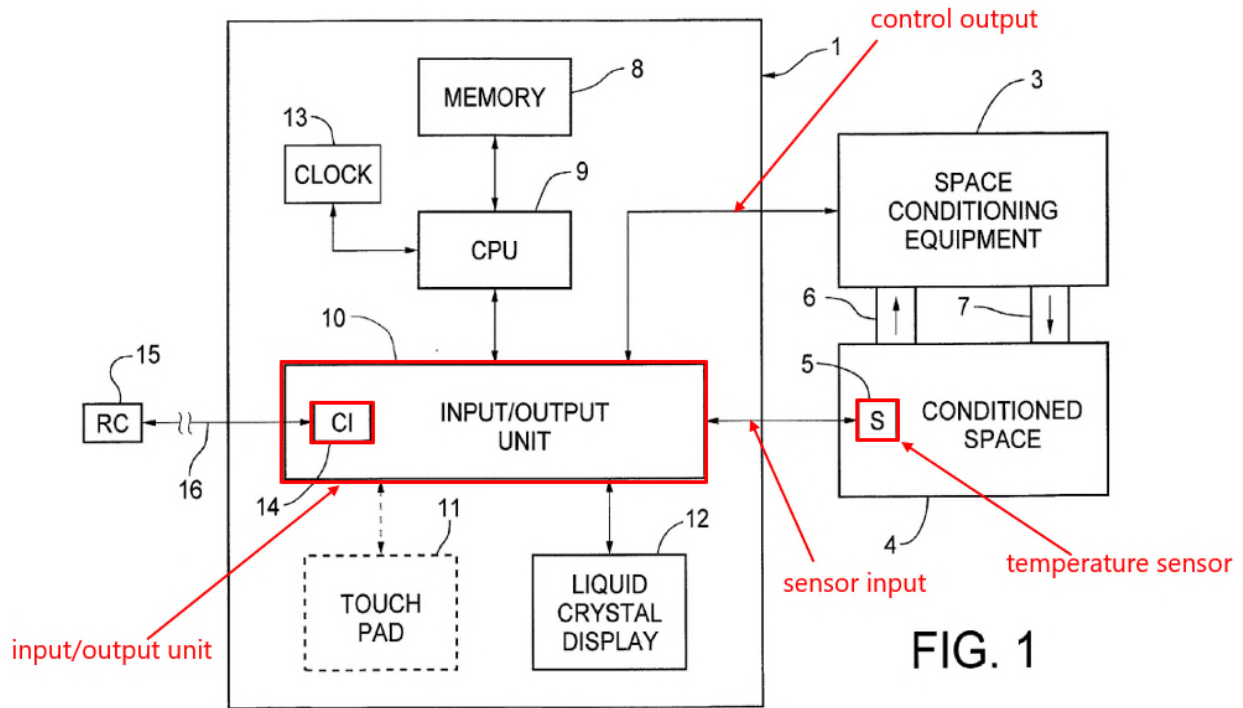
1[h]: “b) a control output coupled to the space conditioning equipment for issuing control signals thereto; and”

147. *Rosen* discloses elements 1[g]-1[h]. As discussed above for element 1[f], *Rosen* discloses the claimed input/output unit. *Supra*, §VII.C.1.iv; EX1005 at Figure 1, ¶0018. These elements were well known in the prior art. EX1012 at 274:12-23 (inventor of the ’075 Patent admitting that elements 1[g] and 1[h] were used in thermostats for many years before alleged invention of the ’075 Patent). *Rosen*’s input/output unit includes the features recited in elements 1[g]-1[h]. For instance, *Rosen*’s Claim 1 recites “[a] thermostat system for controlling space conditioning equipment comprising: . . . a processor, said processor including: . . . an input/output unit” including:

a) a sensor input coupled to said temperature sensor for receiving said electrical signal therefrom; [and]

b) a control output coupled to the space conditioning equipment for issuing control signals thereto[.]

EX1005, Claim 1; *see also id.*, Claim 11 (reciting the same features). These features of *Rosen*'s input/output unit are shown in annotated Figure 1 below:



Id. at Figure 1 (annotated).

148. With respect to Figure 1, *Rosen* describes that:

Thus, in the usual manner during normal operation, ***the temperature sensor 5 sends an electrical signal*** (e.g., if the sensor 5 is a simple thermistor, a resistance value; several types of temperature sensors are widely used) ***representative of the temperature within the conditioned space 4 which the processor can compare against a previously entered set point to determine if control signals need to be sent to the space conditioning equipment 3.*** For example, if the temperature in the

conditioned space 4 is found to be too low when operation is in the heating mode, the processor 1 signals the space conditioning equipment 3 circulate, through ducts 6, 7, air from/to the conditioned space 4 which is heated by the space conditioning equipment before return to the conditioned space.

Id., ¶0019 (emphasis added). Thus, *Rosen* discloses that its processor 1 has an input/output unit 10 that includes “a sensor input coupled to said temperature sensor for receiving said electrical signal therefrom” (e.g., the input to I/O unit 10 from temperature sensor 5 in Figure 1) and “a control output coupled to the space conditioning equipment for issuing control signals thereto” (e.g., the output from I/O unit 10 to space conditioning equipment 3 in Figure 1) as recited in elements 1[g] and 1[h], respectively.

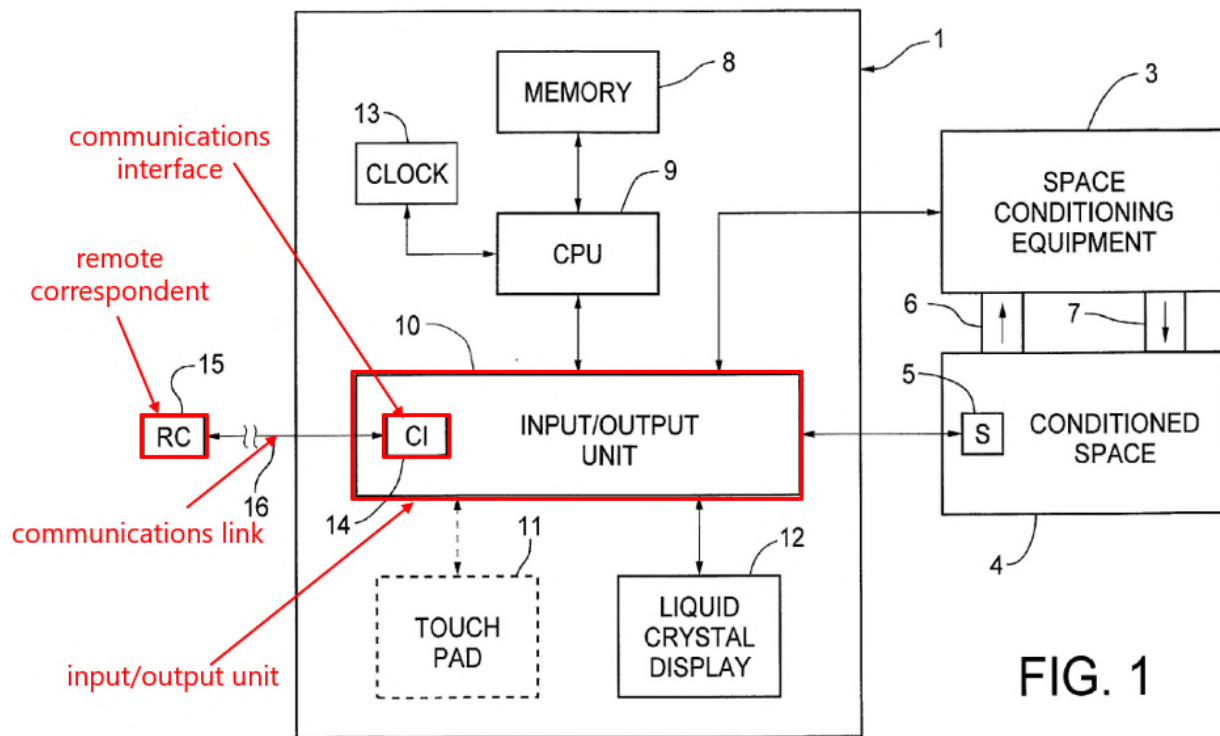
(vi) **1[i]: “c) a communications interface adapted to establish communications between said processor and a first remote correspondent which is a source of functional programming; and”**

149. *Rosen* in combination with *Smith* discloses element 1[i]. As discussed above for element 1[f], *Rosen* discloses the claimed input/output unit. *Supra*, §VII.C.1.iv; EX1005 at Figure 1, ¶0018. Communications interfaces were well known in the art. See EX1012 at 268:1-3; *Supra*, §§VI.B.2, VI.D. *Rosen*’s input/output unit includes a communications interface adapted to establish communications between said processor and a first remote correspondent as recited in limitation 1[i]. For example, *Rosen*’s Claim 1 recites “[a] thermostat system for

controlling space conditioning equipment comprising: . . . a processor, said processor including: . . . an input/output unit” including:

- c) a communications interface adapted to establish bi-directional communications between said processor and a remote correspondent;

EX1005, Claim 1; *see also id.* at Claim 11 (reciting the same feature). These features of *Rosen*’s input/output unit are shown in annotated Figure 1 below:



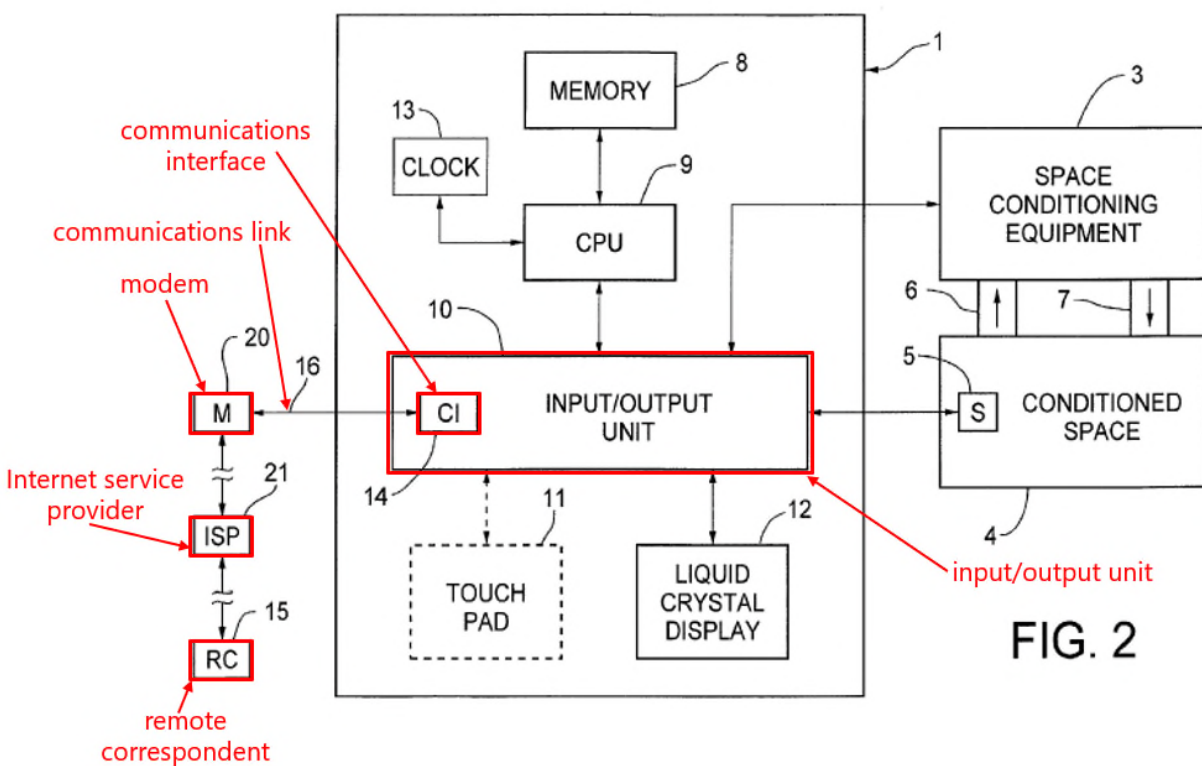
Id. at Figure 1 (annotated); *see also id.* at Figures 2-4 (each disclosing an I/O unit 10 including a communications interface 14 for establishing communications with a first remote correspondent 15).

150. *Rosen* describes that “[t]he I/O unit includes a communications interface 14 for coordinating communications between the CPU 9 and a remote

correspondent 15. The communications interface 14 may be, for example, a conventional serial port.” *Id.*, ¶0018; *see also id.*, ¶0022 (describing process by which the CPU “issu[es] signals to the I/O unit 10 to cause the communications interface 14 to establish communications, via link 16, with a remote correspondent 15”). *Rosen* discloses that the “communications interface is adapted to establish bi-directional communications (via the Internet or some other suitable facility) between the processor and a remote correspondent[.]” *Id.*, ¶0007. The “remote correspondent 15 has a known data communications ‘address’” and “is a source of current information, such as local weather.” *Id.*, ¶0022. *Rosen* explains that “[s]uch local current weather information sources are widely available and are routinely accessed by, for example, using the Internet.” *Id.*; *see also id.*, ¶0025 (describing an example of remote correspondent 15 as “a site providing local Montreal weather”), ¶0027 (describing accessing current information from a remote correspondent using “the address of a site which maintains such information”); ¶0029 (describing a “remote correspondent” that “has an Internet address”). *Rosen* discloses that “the processor 1 can communicate successively or at different times with different remote correspondents.” *Id.*, ¶0028.

151. Figure 2 of *Rosen* “show[s] a typical coupling in which the communications interface 14 sends/receives serial data to/from an external (to the thermostat system) modem 20 via serial link 16.” *Id.*, ¶0032. “The modem

conventionally interfaces with an Internet Service Provider (ISP) 21 which completes the communications link to the remote correspondent in the well-known manner. The modem 20 may be a dial-up, cable, DSL or any other type suitable for the communications environment in a given installation.” *Id.* Figure 2 of *Rosen* is reproduced below with annotations:



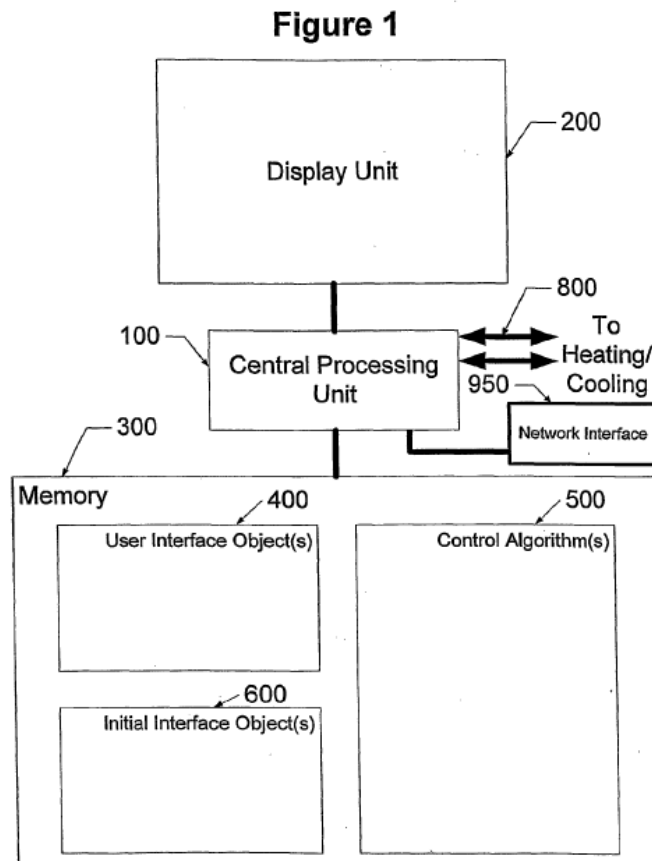
Id., Figure 2 (annotated). Thus, *Rosen* discloses “a communications interface adapted to establish communications between said processor and a first remote correspondent” as recited in element 1[i].

152. *Rosen* discloses that the “remote correspondent” may be a “current source of information,” such as “current weather information” (*Id.*, ¶0008, ¶0022)

or “current stock quotations.” *Id.*, ¶0027. *Rosen* also discloses that “other types of current information may be obtained” from the remote correspondent and “[a] wide variety of types of information may be programmed, accessed and displayed in a like manner.” *Id.* Although *Rosen* discloses that the remote correspondent is a source for information, *Rosen* does not explicitly disclose that the remote correspondent “is a source of functional programming” as recited in element 1[i]. *Smith* discloses this aspect of element 1[i]. Indeed, it would have been obvious to a POSITA that once a device, such as a thermostat system, is connected to the Internet that one would obtain or change firmware of the thermostat using “functional programming” obtained through the Internet, because doing so was well known. *Supra*, §VI.D. *Smith* teaches doing just that with a thermostat system.

153. Similar to *Rosen*, *Smith* “relates to thermostats and other thermal comfort controllers and particularly to a multiple language user interface for such thermal comfort controllers.” EX1007 at 1:6-7. In particular, *Smith* discloses a comfort controller (e.g., thermostat system) having a user interface system that “includes a central processing unit, a memory, a display with a touch-sensitive screen used for input, and a language selector.” *Id.* at 2:8-9. *Smith*’s “memory can store at least one control algorithm and at least one user interface object.” *Id.* at 2:10-11; *see also id.* at 3:8-17 (describing user interface system for a comfort controller having “a memory 300” that “can store one or more user interface objects

400 and one or more control algorithms 500”). Additionally, *Smith* discloses embodiments that “also include a network interface.” *Id.* at 2:10; *see also id.* at 7, Claim 2 (“a network interface for connecting to a network, the network interface coupled to the central processing unit”), Claim 4 (“wherein the network interface connects the user interface system to the Internet”). *Smith* discloses that the user interface objects and control algorithms “are loaded from the Internet” so the user can choose one that is suited for the user’s climate and personal preferences. *Id.* at 2:17-19. Figure 1 of *Smith*, reproduced below, “is a block diagram of a user interface system for a thermal comfort controller.” *Id.* at 2:21-22.



Id. at Figure 1.

154. *Smith* describes a process by which the user interface objects and control algorithms are obtained (e.g., downloaded) from a web page on the Internet and loaded on its thermostat system. For example, in one embodiment, the comfort controller of *Smith* is “installed without any user interface objects, initial interface objects, or control algorithms stored in memory.” *Id.* at 5:8-9. “When first powered-up after installation, the comfort controller is programmed to load the initial interface objects 600 via the network interface 950. For example, the comfort controller could retrieve the initial interface objects 600 from a web page on the Internet.” *Id.* at 5:10-12. Based on the ’075 Patent’s disclosure that a remote correspondent has an “Internet address,” a POSITA would have understood that a web page on the Internet is an example of a remote correspondent. EX1001, 8:18-19, 9:49-56. The “initial interface objects 600 can be downloaded as files” and then “presented on the display unit 200” to allow the user to choose a preferred language. EX1007 at 5:15-16. “Once the preferred language is chosen, the proper user interface objects 400 are then downloaded.” *Id.* at 5:16-17. Additionally, *Smith* discloses that a user “can choose to download updated or additional control algorithms 500 via the network interface 950.” *Id.* at 5:30-31. Based on *Smith*’s disclosure that “[t]he different control algorithms might be . . . loaded over the Internet or other network after

installation,” (*Id.* at 2:3-5; *see also id.* at 2:17-19), a POSITA would have understood that one source for the control algorithms is a web page on the Internet.

155. The initial interface objects and user interface objects downloaded from the Internet in *Smith* disclose or at least render obvious the claimed “functional programming” recited in limitation 1[i].⁴ For example, *Smith* describes that the initial interface objects 600, downloaded as files, are “presented on the display unit 200 and request the user to choose a preferred language.” EX1007 at 5:15-16; *see also id.* at Abstract (describing that after the user interface system is powered-up after installation, a first set of user interface objects are displayed on the display unit and the user selects a preferred language). Additionally, “[o]nce the preferred language is chosen, the proper user interface objects 400 are then downloaded” and displayed. *Id.* at 5:16-17; Abstract (describing that “[o]nce a preferred language is chosen, user interface objects can be loaded into the memory and the display unit will display the user interface objects in the preferred language”). Thus, *Smith*’s

⁴ Although the ’075 Patent does not expressly define “functional programming,” the ’075 Patent provides numerous examples of the claimed functional programming. EX1001, 10:34-11:3 (describing non-limiting examples (a)-(i) of “functional programming transferred to the memory of the programmable thermostat and previously unavailable to the control program”).

initial interface objects and user interface objects define the user interface displayed by *Smith*'s system and can be changed so that, for example, a user's preferred language is used. The initial interface objects and user interface objects in *Smith* are analogous to examples of "functional programming" provided in the '075 Patent, including "one or more entire graphical user interfaces as represented on a touchscreen," "portions of a graphical user interface," and "representations of the size, shape, colors, locations and other viewable aspects of text or graphic devices on the touchscreen." EX1001 at 10:34-47.

156. *Smith*'s control algorithms downloaded from the Internet also disclose or at least render obvious the claimed "functional programming" recited in limitation 1[i]. *Smith* describes that "[a]s is well known, thermostats often have setback capabilities which involves a programmed temperature schedule." EX1007 at 1:12-19 (describing heating and cooling a house according to a temperature schedule). *Smith* discloses that such "[a] schedule of set back temperatures is one example of a control algorithm that can be used by the comfort controller." *Id.* at 1:20-21. *Smith* explains that "such control algorithms will be different for different climates" and "vary based on personal preferences" (e.g., because some people like their homes warmer in the winter than other people do). *Id.* at 1:20-23. In *Smith*, control algorithms may be "loaded" from the Internet (e.g., downloaded) "so that the user can choose from one that is suited for the user's climate and personal preferences."

Id. at 2:17-19. Thus, *Smith*'s control algorithms are analogous to examples of "functional programming" provided in the '075 Patent, including "operational algorithms for the control program other than those for the graphical user interface," "operational algorithms for control of existing or newly installed space conditioning equipment," and "operational algorithms for communications with existing or newly installed environmental sensors." EX1001 at 10:34-37, 10:48-54.

157. Thus, *Smith* discloses a remote correspondent (e.g., "a web page on the Internet" (EX1007 at 5:11-12)) that is "a source of functional programming" (e.g., initial interface objects, user interface objects, and control algorithms). When *Smith*'s teachings are applied to *Rosen*, the remote correspondent of *Rosen* is a source of functional programming (e.g., initial interface objects, user interface objects, and control algorithms) as taught by *Smith*. Thus, *Rosen* in combination with *Smith* discloses element 1[i]. I provide an explanation of the rationale and motivation for combining *Smith* with *Rosen* (as modified by *Rosen-II*) in Section VII.C.1.xi.(a) below.

(vii) 1[j]: **"D) a control program stored in said memory for causing said central processing unit to selectively: 1) establish on said liquid crystal display one or more representations of buttons at a separated and predetermined positions;"**

158. *Rosen* in combination with *Rosen-II* discloses or at least renders obvious element 1[j]. For many years prior art thermostats had some type of control

program. *See* EX1012 at 274:24-275:7; *Supra*, §VI.B.2. As discussed above for element 1[e], *Rosen* discloses a memory for storing program and data information. *Supra*, §VII.C.1.iv. *Rosen* discloses that its thermostat system includes “a program stored in the memory” (i.e., a control program) that “causes the CPU to selectively” perform certain operations (e.g., “establish communications with the remote correspondent”). EX1005, ¶0007. In the combined system, the system of *Rosen* is modified to include the transparent touch pad juxtaposed over a liquid crystal display to constitute a touch screen as taught by *Rosen-II*, as discussed above. *Supra*, §VII.C.1.iii.

159. With respect to the operation of its touch screen, *Rosen-II* similarly discloses that “[a] program stored in the memory directs the central processing unit to communicate through the input/output unit to selectively: establish on the liquid crystal display a representation of at least one button at a predetermined XY position.” EX1006, ¶0007; *see also id.* at Claim 1 (reciting “a program stored in said memory for causing said central processing unit to communicate through said input/output unit to selectively: 1) a) establish on said liquid crystal display a representation of at least one button at a first predetermined position on the liquid crystal display”). This corresponds to the first step of the process illustrated in Figure 14 of *Rosen-II*, reproduced below:

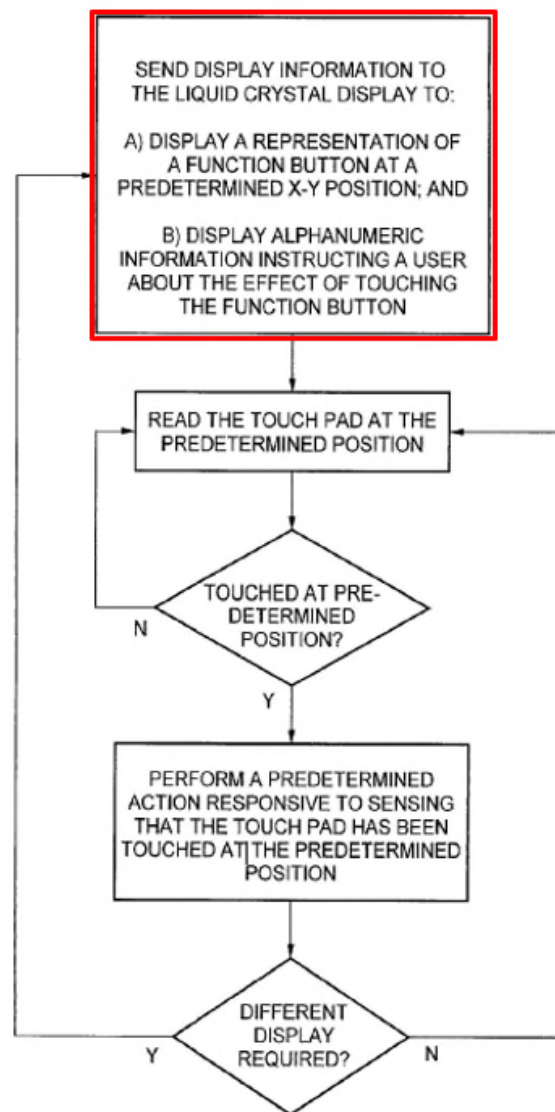
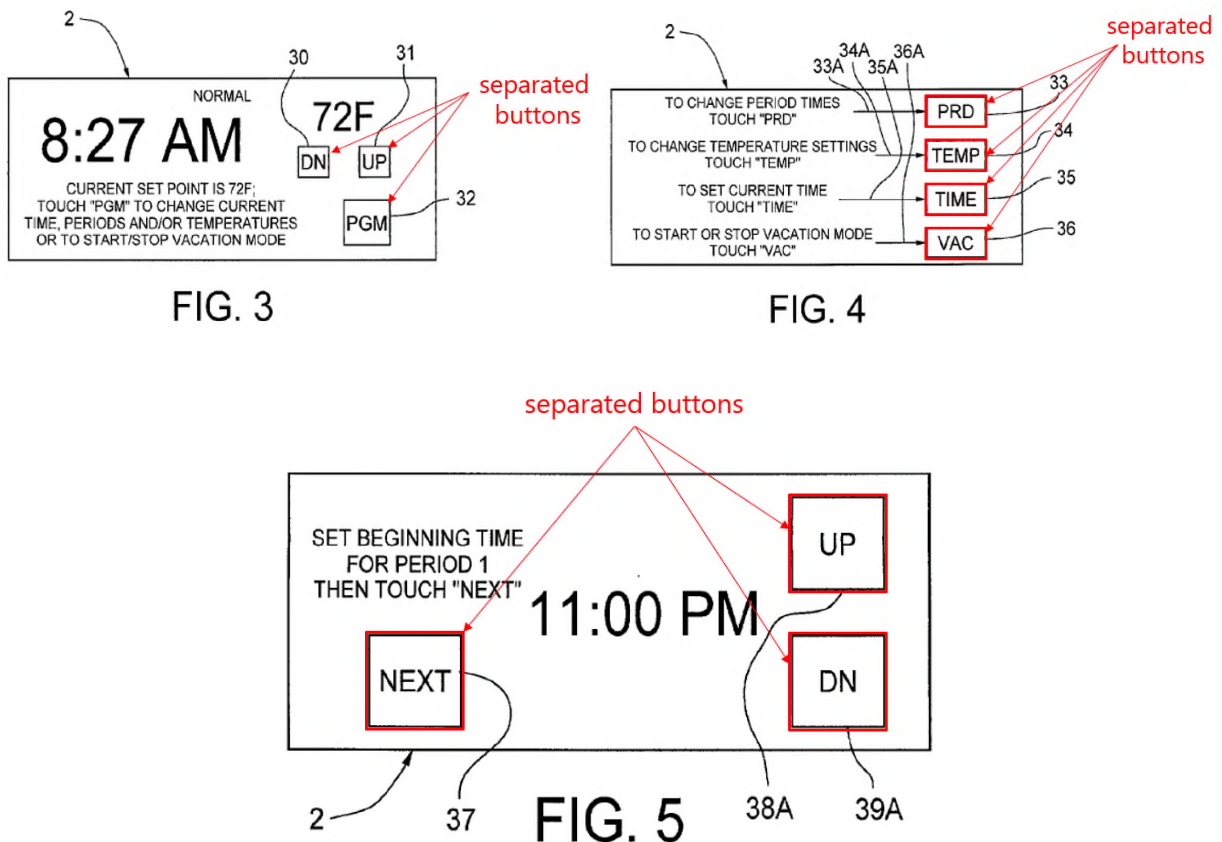


FIG. 14

Id. at Figure 14 (annotated).

160. *Rosen-II* explains that “[d]ifferent menus can place the buttons and messages in various positions on the touch screen to facilitate intuitive programming.” *Id.*, ¶0007. In addition to disclosing that the one or more representations of buttons are established on the liquid crystal display at

predetermined positions, *Rosen-II* discloses establishing the representations of buttons at “separated” positions. For example, each of Figures 3-5 of *Rosen-II* depicts representations of buttons at “separated” positions:



Id. at Figures 3-5 (annotated); *see also id.*, ¶0028 (describing “representations of buttons 30, 31, and 32” in Figure 3), ¶0030 (describing “four choice buttons” 33, 34, 35, and 36 in Figure 4); ¶0032 (describing “buttons” 37, 38A, and 39A in Figure 5). Accordingly, *Rosen* in combination with *Rosen-II* discloses limitation 1[j]. The rationale and motivation for combining *Rosen* with *Rosen-II* is the same as discussed above for element 1[b]. *Supra*, §VII.C.1.iii.(a).

(viii) 1[k]: “2) read the position on the touch pad juxtaposed with said predetermined position to determine if said representation of a button has been touched; and”

161. *Rosen* in combination with *Rosen-II* discloses or at least renders obvious element 1[k]. As discussed above, in the combined system, the system of *Rosen* is modified to include the transparent touch pad juxtaposed over a liquid crystal display to constitute a touch screen as taught by *Rosen-II*. *Supra*, §VII.C.1.iii. With respect to the operation of its touch screen, *Rosen-II* discloses that “[a] program stored in the memory directs the central processing unit to communicate through the input/output unit to selectively: . . . read the same XY position on the touch pad to determine if the ‘button’ has been touched[.]” EX1006, ¶10007; *see also id.* at Claim 1 (reciting “a program stored in said memory for causing said central processing unit to communicate through said input/output unit to selectively: . . . read the position on the touch pad juxtaposed with said first predetermined position on the liquid crystal display to determine if the representation of said at least one button has been touched”), Abstract (“read the position on the touch pad juxtaposed with the first predetermined position to determine if the button has been touched.”).

162. For example, *Rosen-II* describes that “[i]f one of the buttons is touched, the XY information describing the touch point is sent to the processor which recognizes that the position at which the touch screen has been touched is juxtaposed

with that particular button and responds by carrying out some predetermined associated action.” *Id.* at ¶0028. This corresponds to the second and third steps of Figure 14 of *Rosen-II*, reproduced below:

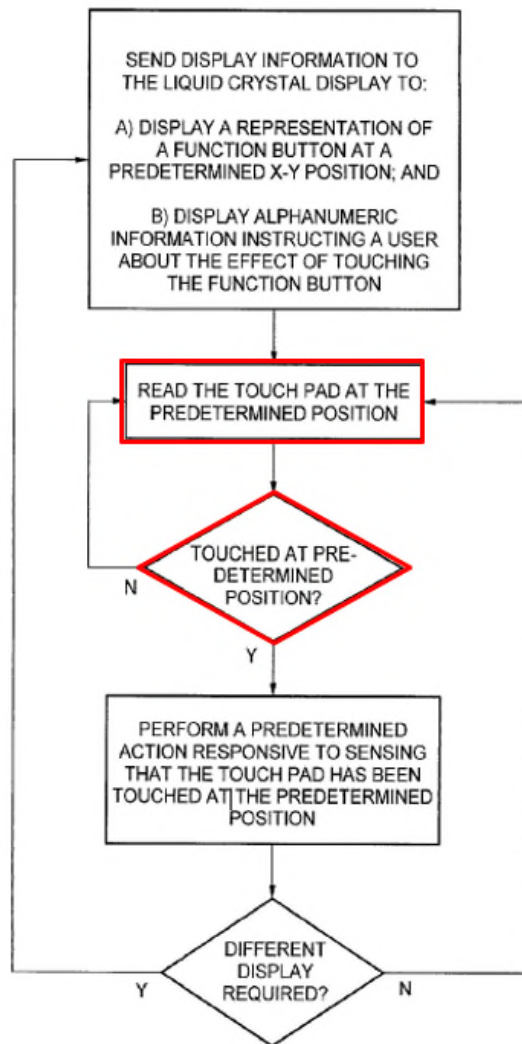


FIG. 14

Id. at Figure 14 (annotated). Thus, *Rosen* in combination with *Rosen-II* discloses element 1[k]. The rationale and motivation for combining *Rosen* with *Rosen-II* is the same as discussed above for element 1[b]. *Supra*, §VII.C.1.iii.(a).

(ix) 1[l]: “3) if said a representation of a button has been touched, processing this information to establish a condition incorporated into the operation of said thermostat system;”

163. *Rosen* in combination with *Rosen-II* discloses or at least renders obvious element 1[l]. As discussed above, in the combined system, the system of *Rosen* is modified to include the transparent touch pad juxtaposed over a liquid crystal display to constitute a touch screen as taught by *Rosen-II*. *Supra*, §VII.C.1.iii. With respect to the operation of its touch screen, *Rosen-II* discloses that “[a] program stored in the memory directs the central processing unit to communicate through the input/output unit to selectively: . . . if the button has been touched, perform a predetermined action such as moving to a different menu or changing operating criteria.” EX1006, ¶0007.

164. In particular, *Rosen-II* discloses “chang[ing] to a different menu or establish[ing] a condition incorporated into the thermostat system operation” if a button has been touched. *Id.* at Abstract; *see also id.*, Claim 1 (reciting “[a] program stored in said memory for causing said central processing unit to communicate through said input/output unit to selectively: . . . if said at least one representation of a button has been touched, making a predetermined response thereto”), Claim 3 (in response to a button being touched, reciting “processing this information to establish a condition incorporated into the operation of said thermostat system”), Claim 17

(reciting “if said second representation of a button has been touched, processing this information to establish a condition incorporated into the operation of said thermostat system”), Claim 18. This corresponds to the fourth step in Figure 14 of *Rosen-II*, reproduced below:

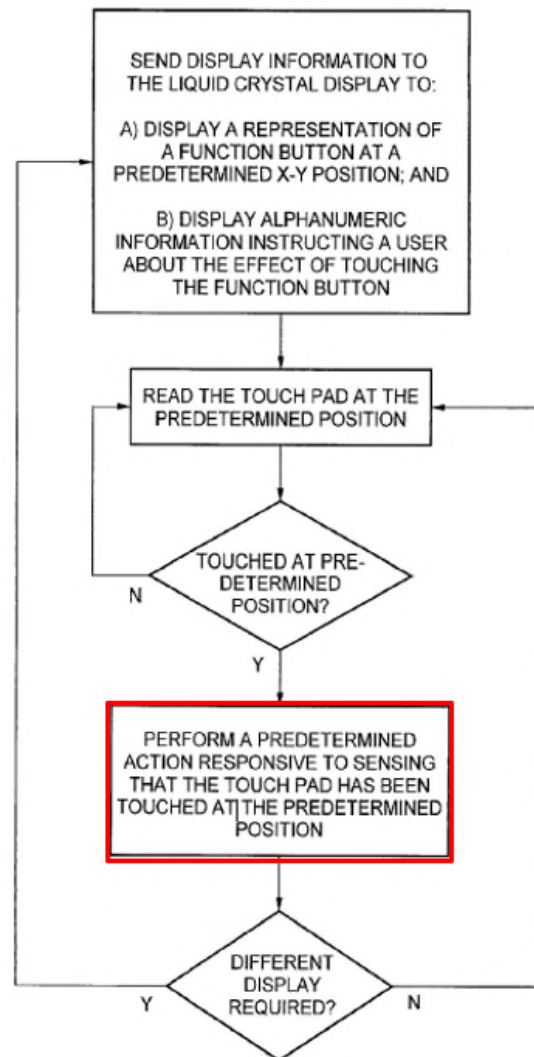


FIG. 14

Id. at Figure 14 (annotated).

165. For example, if the button 30, labeled “DN” in Figure 3 of *Rosen-II* is touched, “that fact is sensed by the processor which drops the current set point from, say, 72° F. to 71° F. The set point can similarly be raised by touching the button 31 which is labeled ‘UP’.” *Id.*, ¶0028. As another example, a user touching the “‘RUN’ button 42 . . . returns the thermostat system to normal operation and again brings up the menu shown in FIG. 3.” *Id.*, ¶0032. Increasing and decreasing temperature set points, or returning the thermostat system to normal operation, in response to sensing that a button has been touched, are examples of processing “information to establish a condition incorporated into the operation of said thermostat system” as claimed. Thus, *Rosen* in combination with *Rosen-II* discloses element 1[l]. The rationale and motivation for combining *Rosen* with *Rosen-II* is the same as discussed above for element 1[b]. *Supra*, §VII.C.1.iii.(a).

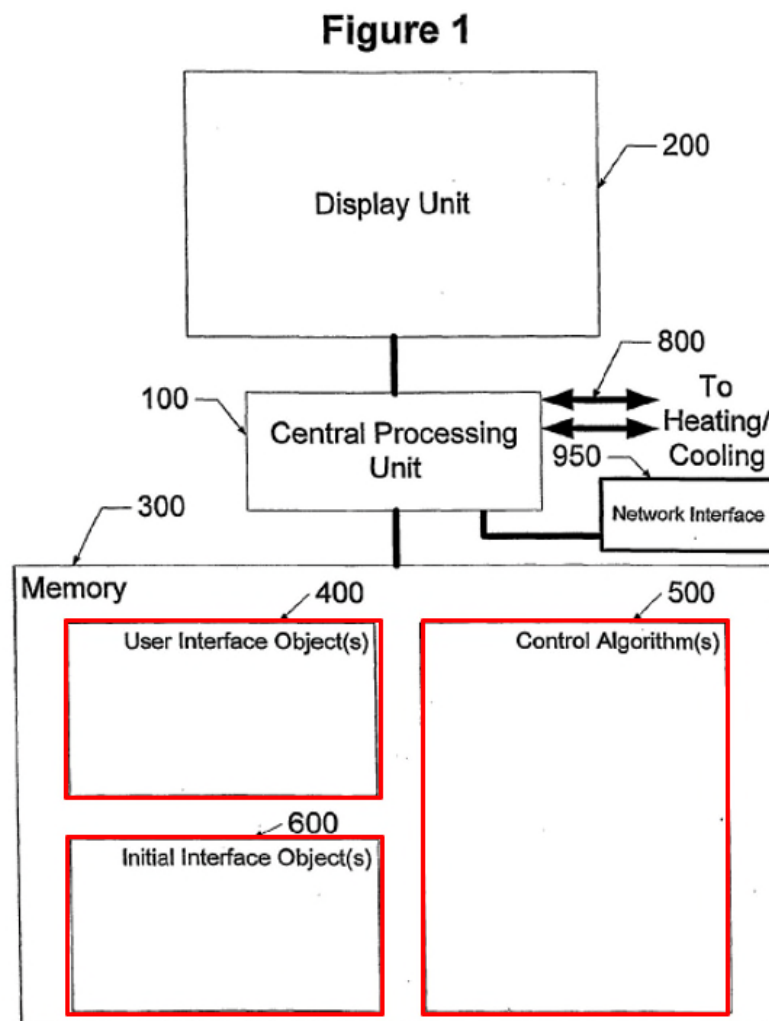
(x) 1[m]: “4) establish communications between said processor and a first remote correspondent from which is transferred to said memory one or more modules of functional programming; and”

166. *Rosen* in combination with *Smith* discloses or at least renders obvious element 1[m]. As discussed above for element 1[i], *Rosen* discloses “[a] communications interface is adapted to establish bi-directional communications (via the Internet or some other suitable facility) between the processor and a remote correspondent which is a source of current information on the predetermined

subject.” EX1005, ¶0007; *see also supra*, §VII.C.1.vi. In particular, “[p]eriodically, or on demand if provided for, a program stored in the memory causes the CPU to selectively: establish communications with the remote correspondent[.]” EX1005, ¶0007; *see also id.* at Claim 1 (reciting “a program stored in said memory for causing said central processing unit to selectively: 1) direct said input/output unit to establish communications with a first remote correspondent which is a source of current information through said communications interface”), Claim 11 (same). For example, “the CPU 9 starts the process shown in FIG. 5 by issuing signals to the I/O unit 10 to cause the communications interface 14 to establish communications, via link 16, with a remote correspondent 15.” *Id.*, ¶0022. “The remote correspondent 15 has a known data communications ‘address’” and can be “accessed, for example, using the Internet.” *Id.*

167. As discussed above, *Rosen* discloses establishing communications between the processor and a remote correspondent to obtain current information from the remote correspondent, such as weather information and/or stock quotes. *Supra*, §VII.C.1.vi. *Rosen*, however, does not explicitly disclose establishing communications between the processor and the remote correspondent “from which is transferred to said memory one or more modules of functional programming” as recited in element 1[m]. *Smith* discloses this aspect of element 1[m].

168. As discussed above for limitation 1[i], *Smith* discloses a comfort controller (e.g., thermostat system) having a user interface system that “includes a central processing unit, a memory, a display with a touch-sensitive screen used for input, and a language selector.” EX1007 at 2:8-9. *Smith*’s “memory can store at least one control algorithm and at least one user interface object.” *Id.* at 2:10-11; *see also id.* at 3:8-17 (describing user interface system for a comfort controller having “a memory 300” that “can store one or more user interface objects 400 and one or more control algorithms 500”). Figure 1 of *Smith* depicts initial interface objects 600, user interface objects 400, and control algorithms 500 stored in memory 300:



Id. at Figure 1 (annotated).

169. As discussed above, the initial interface objects, user interface objects, and control algorithms in *Smith* disclose the claimed “functional programming” recited in element 1[i]. *See supra*, §VII.C.1.vi. Based on *Smith*’s disclosure that the initial interface objects, user interface objects, and control algorithms are software “downloaded as files” from the Internet and “loaded into the memory” (EX1007 at 5:10-16, Abstract), a POSITA would have understood that *Smith*’s initial interface

objects, user interface objects, and control algorithms disclose or at least render obvious the claimed “modules of functional programming” in limitation 1[m].

170. *Smith* describes a process by which the functional programming modules (e.g., initial interface objects, user interface objects, and control algorithms) are transferred from a remote correspondent (e.g., a web page on the Internet) to memory. For example, in one embodiment, the comfort controller of *Smith* is “installed without any user interface objects, initial interface objects, or control algorithms stored in memory.” EX1007 at 5:8-9. “When first powered-up after installation, the comfort controller is programmed to load the initial interface objects 600 via the network interface 950. For example, the comfort controller could retrieve the initial interface objects 600 from a web page on the Internet.” *Id.* at 5:10-12. The “initial interface objects 600 can be downloaded as files” and then “presented on the display unit 200” to allow the user to choose a preferred language. *Id.* at 5:14-16. “Once the preferred language is chosen, the proper user interface objects 400 are then downloaded.” *Id.* at 5:16-17. Additionally, *Smith* discloses that a user “can choose to download updated or additional control algorithms 500 via the network interface 950.” *Id.* at 5:30-31; *see also id.* at 2:3-5 (disclosing that “[t]he different control algorithms might be . . . loaded over the Internet or other network after installation”).

171. A POSITA would have understood that the process described in *Smith* involves transferring *Smith*'s modules of functional programming (e.g., initial interface objects, user interface objects, and control algorithms) to memory in a thermostat system. *Smith* discloses that initial interface objects, user interface objects, and control algorithms are stored/loaded in memory. *Id.* at Abstract ("The memory (300) can store at least one user interface object (400) and at least one control algorithm (500). . . . Once a preferred language is chosen, user interface objects (400) can be loaded into the memory and the display unit will display the user interface objects in the preferred language. In some embodiments, control algorithms are loaded into memory."), 3:12-15 ("The memory 300 can store one or more user interface objects 400 and one or more control algorithms 500. In some embodiments, the memory 300 can also store one or more initial interface objects 600.").

172. When *Smith*'s teachings are applied to *Rosen*, the thermostat system in *Rosen* establishes communications between its processor and a remote correspondent (e.g., a web page on the Internet) from which modules of functional programming (e.g., *Smith*'s initial interface objects, user interface objects, and control algorithms) are transferred into the memory of *Rosen*'s thermostat system, as taught by *Smith*. Thus, *Rosen* in view of *Smith* discloses or at least renders obvious element 1[m]. I provide an explanation of the rationale and motivation for

combining *Smith* with *Rosen* (as modified by *Rosen-II*) in Section VII.C.1.xi.(a) below.

- (xi) 1[n]: “5) operate said transferred functional programming to change or add to representations on the touch screen, where said changes or additions of representation on the touch screen were not available to the control program before their transfer to the memory;”

173. *Rosen* (as modified by *Rosen-II*) in combination with *Smith* discloses or at least renders obvious element 1[n]. *Smith* discloses using the initial interface objects, user interface objects, and control algorithms (each of which is an example of “transferred functional programming” as discussed for elements 1[i] and 1[m]) to change or add to representations on the touch screen. With respect to the initial interface objects, *Smith* discloses that “[i]n one embodiment of the invention, the comfort controller would be installed without any user interface objects, initial interface objects, or control algorithms stored in memory.” EX1007 at 5:8-9. “When first powered-up after installation, the comfort controller is programmed to load the initial interface objects 600 via the network interface 950. For example, the comfort controller could retrieve the initial interface objects 600 from a web page on the Internet.” *Id.* at 5:10-12. “In such an embodiment, the initial interface objects 600 can be downloaded as files. The initial interface objects 600 are presented on the display unit 200 and request the user to choose a preferred language.” *Id.* at

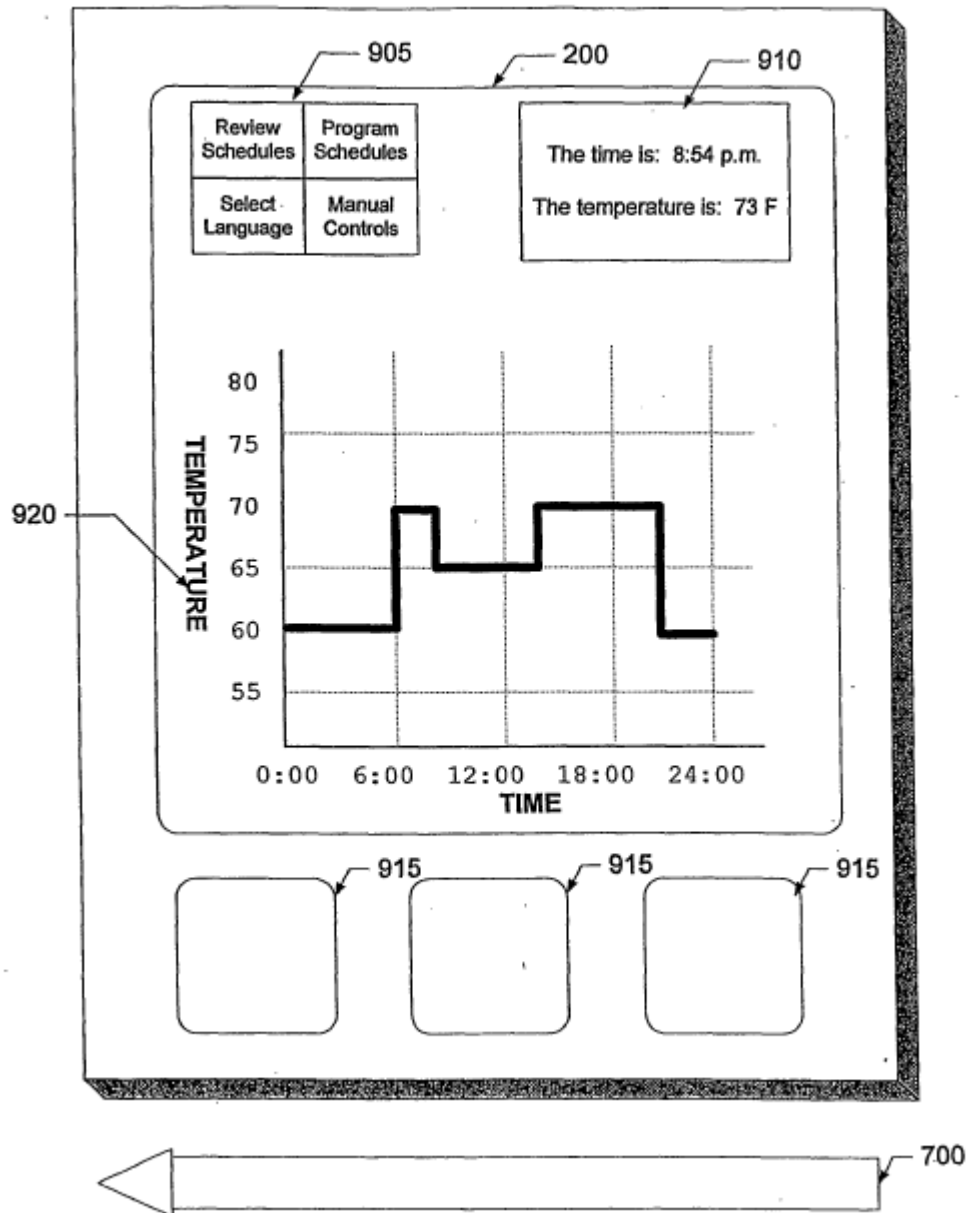
5:14-16. A POSITA would have understood that *Smith*'s initial interface objects "change or add to representations on the touch screen" as claimed, because their display adds an option for the user to choose a preferred language. A POSITA would have understood that this change or addition of representation on the touch screen (e.g., the ability to choose a preferred language) was not available to the control program before its transfer to memory, because prior to downloading the initial interface objects, the comfort controller was installed "without any" initial interface objects. *Id.* at 5:8-9.

174. With respect to the user interface objects, *Smith* describes that "[o]nce the preferred language is chosen, the proper user interface objects 400 are then downloaded." *Id.* at 5:16-17. A POSITA would have understood that *Smith*'s downloaded user interface objects "change or add to representations on the touch screen" as claimed. *Smith* discloses that, "[o]nce a preferred language is chosen, the display unit uses user interface objects 400 in the memory to correctly display all of the textual information in the preferred language. For example, in Figure 2, if a language other than English was chosen, the additional controls 905, the display information 910, and the labels 920 would be redisplayed in the chosen language." *Id.* at 5:2-6. A POSITA would have understood that this change or addition of representation on the touch screen (e.g., the display of textual information in the preferred language) was not available to the control program before its transfer to

memory, at least because prior to downloading the proper user interface objects, the comfort controller (e.g., thermostat system) was installed “without any” user interface objects.

175. With respect to the control algorithms, *Smith* discloses that “[c]ontrol algorithms may also be loaded [from the Internet] so that the user can choose from one that is suited for the user’s climate and personal preferences.” *Id.* at 2:17-19; *see also id.* at Abstract. A POSITA would have understood that *Smith*’s control algorithms “change or add to representations on the touch screen” as recited in element 1[n]. For instance, one example of a control algorithm in *Smith* is “a set-point schedule” that the thermostat controller uses to set-up or set-back the temperature according to the set-point schedule. *Id.* at 4:7-12. *Smith* discloses that its display unit 200 displays a “graphical representation of the set-point temperature schedule,” as shown by element 920 in Figure 2 of *Smith* below:

Figure 2



Id. at Figure 2, 4:13-20.

176. *Smith* describes that “to make programming and using the controllers easier, different control algorithms should be available to the user to choose from.”

Id. at 2:2-3. “The different control algorithms might be . . . loaded over the Internet

or other network after installation.” *Id.* at 2:3-5. *Smith* explains that the user “can choose to download updated or additional control algorithms 500 via the network interface 950.” *Id.* at 5:30-31. A POSITA would have understood from *Smith*’s disclosure that when a different control algorithm (e.g., a set-point schedule) is chosen by the user, the graphical representation of the set-point temperature schedule on the display would be changed to reflect the new set-point temperature schedule. Additionally, based on *Smith*’s disclosure that its comfort controller (e.g., thermostat system) may be installed “without any” control algorithms stored in memory (*Id.* at 5:8-9) and the user can “download updated or additional control algorithms” (*Id.* at 5:30-31), a POSITA would have understood that the “changes or additions of representation on the touch screen were not available to the control program before their transfer to memory.”

177. When *Smith*’s teachings are applied to *Rosen*, the control program in *Rosen* operates the transferred functional programming (e.g., the initial interface objects, user interface objects, and control algorithms taught by *Smith*) to change or add to representations on the touch screen of *Rosen* (as modified by *Rosen-II*) (e.g., by providing an option to choose a preferred language, changing the language displayed to the preferred language, or updating the set-point schedule according to a new control algorithm), where the changes or additions of representation on the

touch screen were not available to the control program before their transfer to the memory.

178. In my opinion, *Smith*'s disclosure of downloading and operating the initial interface objects, user interface objects, and control algorithms to change or add to representations on the touch screen discloses transferring one or more modules of functional programming and operating the transferred functional programming as claimed in the '075 Patent. As I discussed above, *Smith*'s initial interface objects, user interface objects, and control algorithms are analogous to the examples of functional programming provided in the '075 Patent. EX1001 at 10:34-11:3; *see also supra*, §VII.C.1.vi. To the extent Patent Owner argues that *Smith*'s initial interface objects, user interface objects, and/or control algorithms do not disclose the claimed "functional programming" or "modules of functional programming," in my opinion the claims would still have been obvious to a POSITA. As discussed above, it was well known in the prior art that software updates for Internet-connected appliances and the like can be obtained over the Internet and used to expand, update, or change software functionality. *Supra*, §VI.D. A POSITA would have understood from the combined teachings of *Rosen*, *Rosen-II*, and *Smith* that the techniques described therein could be used to transfer and operate a wide variety of software updates, including of the type described as functional programming in the '075 Patent. Thus, to the extent Patent Owner argues

that there is a distinction between *Smith*'s initial interface objects, user interface objects, and/or control algorithms, I disagree, but the claims nevertheless would have been obvious to a POSITA. Using the techniques described by the *Rosen-Rosen-II-Smith* combination to transfer and operate different types of software to expand, update, or change functionality would have been obvious to a POSITA as nothing more than the application of a known technique.

**(a) Rationale and motivation for combining *Rosen*
(as modified by *Rosen-II*) with *Smith*.**

179. It would have been obvious to a POSITA to modify *Rosen*'s thermostat system (as modified in view of *Rosen-II*) to incorporate *Smith*'s functionality for transferring functional programming (e.g., initial interface objects, user interface objects, and control algorithms) from a remote correspondent that is a source of functional programming (e.g., a website on the Internet) to a thermostat system and operating the transferred functional programming to change or add to representations on the touch screen and/or control space conditioning equipment. Doing so would have involved applying a known technique (e.g., *Smith*'s approach to transferring and operating functional programming) to a known device (e.g., *Rosen*'s thermostat system) ready for improvement to yield predictable results.

180. As an initial matter, *Smith* is analogous art to the '075 Patent, *Rosen*, and *Rosen-II*, because each is in the same field of endeavor. Similar to *Rosen*,

Rosen-II, and the '075 Patent, *Smith* “relates to thermostats and other thermal comfort controllers and particularly to a multiple language user interface for such thermal comfort controllers.” EX1007 at 1:6-7; *Compare id. with* EX1005, ¶0001 (“This invention relates to the art of thermostats[.]”) and EX1006, ¶0001 (“This invention relates to the art of thermostats[.]”); EX1001 at 1:12-13 (“This invention relates to the art of thermostats[.]”).

181. A POSITA would have been motivated to combine *Smith* with *Rosen* (as modified by *Rosen-II*) to provide flexibility to accommodate user preferences and facilitate customizing the user interface of the programmable thermostat system of *Rosen*. *Smith* explains that “[p]rogrammable comfort controllers [e.g., thermostat systems] have been troublesome in the past because users often do not understand how to correctly program the controllers.” EX1007 at 1:24-25. For example, “[f]or people whose first language is not English, or for people travelling to a foreign country and staying in a hotel or other housing, programming comfort controllers can be even more difficult because the buttons, controls, and displays on the controllers are usually labeled with English words.” *Id.* at 1:25-28. As another example, *Smith* explains that control algorithms (e.g., “[a] schedule of set back temperatures”) “will be different for different climates” and “vary based on personal preferences” (e.g., “[s]ome people like their homes warmer in the winter than other people do”). *Id.* at 1:20-23. Thus, *Smith* states that:

What is needed in the art is a user interface for a thermostat in which the temperature schedule is more easily programmed. To make the programming easier, users should be able to choose a preferred language and then view the switches, etc. on the comfort controller in the chosen preferred language. In addition, to make programming and using the controllers easier, different control algorithms should be available to the user to choose from. The different control algorithms might be programmed during manufacturing, or loaded over the Internet or other network after installation.

Id. at 1:29-2:5. Downloading user interface objects for a user's preferred language, as discussed above in relation to elements 1[i], 1[m], and 1[n], enables the "controls, labels, etc." of the thermostat system to be presented to the user on the display "in the user's preferred language." *Id.* at 2:12-18; *Supra*, §§VII.C.1.vi, VII.C.1.x-xi. According to *Smith*, "[t]his makes the comfort controller easier to use by someone for whom English is not his or her first language." EX1007 at 5:6-7. Additionally, loading control algorithms from the Internet enables the user to choose "one that is suited for the user's climate and personal preferences." *Id.* at 2:17-19.

182. Based on *Smith's* teachings, a POSITA would have been motivated to modify the thermostat system of *Rosen* (as modified by *Rosen-II*) to obtain functional programming modules (e.g., initial interface objects, user interface objects, and/or control algorithms) from its remote correspondent (e.g., a web page

on the Internet) and operate the obtained functional programming to add to or change representations on the touch screen of *Rosen* (as modified by *Rosen-II*).

183. Additionally, and as discussed above, it was well known in the prior art that software updates for Internet-connected appliances and the like can be obtained over the Internet and used to expand, update, or change software functionality. *Supra*, §VI.D. A POSITA would have recognized the benefits of being able to expand, update, or change software functionality over time. For example, *Smith* teaches that the ability to modify the user interface and download different control algorithms after installation is advantageous as discussed above. EX1007 at 1:29-2:5. *Smith*'s set-point schedule is only "one example of a control algorithm" that can be used by a thermostat system. *Id.* at 1:20-21. A POSITA would have recognized the benefit of being able to download other types of control algorithms, such as control algorithms for controlling newly added space conditioning equipment.

184. A POSITA in the art would have had a reasonable expectation of success in making the combination. First, a POSITA would have recognized that *Rosen* (as modified by *Rosen-II*) is an example of the type of system in which *Smith*'s teachings could be applied. *Rosen* relates to a programmable thermostat that operates under control of a processor (EX1005, ¶0006) and *Smith* describes

improvements to user interfaces for thermostat systems “in which the temperature schedule is more easily programmed.” EX1007 at 1:29-2:5.

185. Second, a POSITA would have understood that *Rosen* (as modified by *Rosen-II*) already includes the hardware and software needed to implement *Smith*’s teachings regarding obtaining and operating functional programming modules. *Smith* describes implementing its invention with a thermostat system having “a central processing unit, a memory, a display with a touch-sensitive screen used for input,” and “a network interface” (that can “include a modem”) used to download initial interface objects, user interface objects, and control algorithms “from a web page on the Internet.” *Id.* at 2:7-11, 5:8-17. *Rosen* (as modified by *Rosen-II*) similarly includes a central processing unit, a memory for storing program and data information, a touch screen for interactive interface with a user for displaying alphanumeric and graphic devices, and a communications interface adapted to establish communications with a remote correspondent (e.g., a web page on the Internet) as discussed above for elements 1[b], 1[c], 1[e], 1[i]. *Supra*, §§VII.C.1.iii-iv, VII.C.1.vi. Based on *Smith*’s teaching that its interface objects and control algorithms can be obtained from the Internet, a POSITA would have understood that the remote correspondent in *Rosen* (which *Rosen* describes is “routinely accessed by, for example, using the Internet (EX1005, ¶0022)) would be suitable to use as a

source of functional programming for *Rosen*'s thermostat system, consistent with *Smith*'s teachings.

186. It would have been well within the skill set of a POSITA to modify *Rosen*'s control program (*see Supra*, §VII.C.1.vii) to obtain functional programming and operate the functional programming to change and/or add to representations on the touch screen of *Rosen*'s thermostat system, as taught by *Smith*. *Rosen* (as modified by *Rosen-II*) already supplies all of the hardware elements, which are admittedly conventional as discussed above. Modifying *Rosen*'s control program to obtain and operate functional programming as taught by *Smith* would simply have involved routine programming of the control program logic of *Rosen* (as modified by *Rosen-II*) using the techniques described by *Smith*.

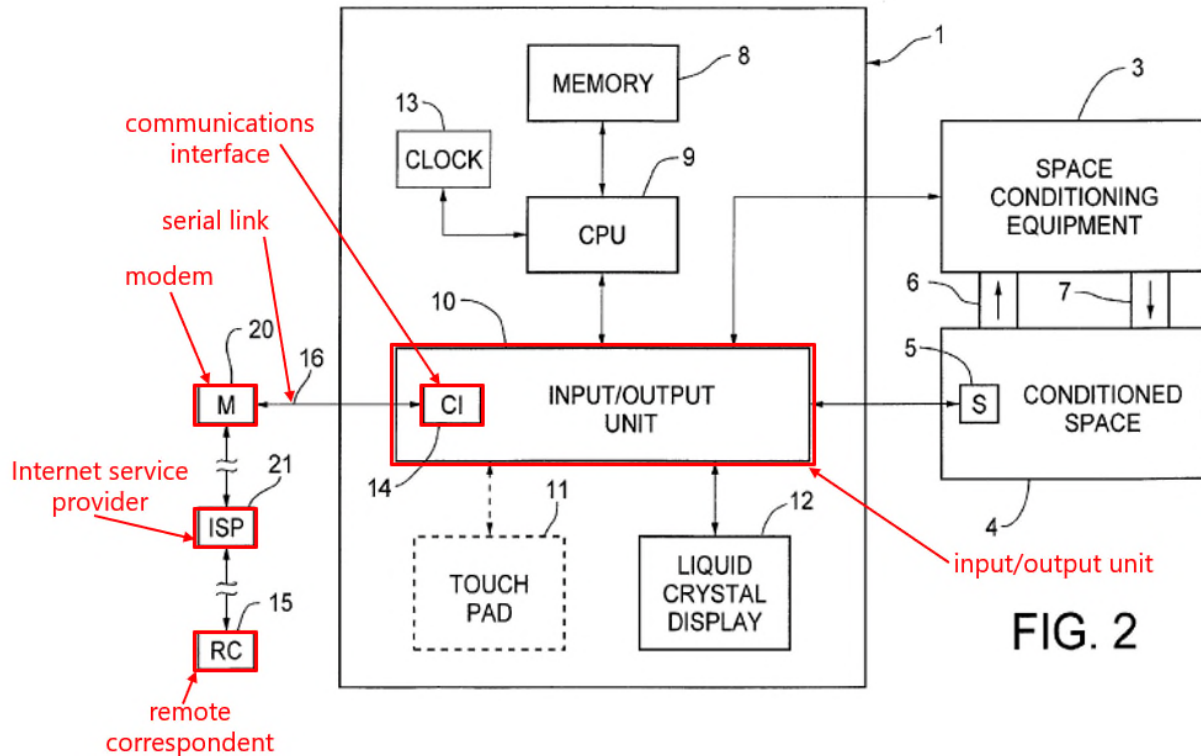
(xii) 1[o]: “E) means coupling said communications interface and said first remote correspondent.”

187. *Rosen* discloses element 1[o]. As discussed above, I understand that Petitioner and Patent Owner agree that this claim element is governed by 35 U.S.C. § 112, ¶6, and I have been asked to apply Patent Owner's proposed construction. *Supra*, §V.F.1. Under Patent Owner's interpretation, the function is “coupling said communications interface and said first remote correspondent,” and the corresponding structure is a serial link and/or data link and any equivalents. *Supra*, §V.F.1; EX1009 at 5; EX1026 at 76-77.

188. *Rosen* discloses “[a] thermostat system for controlling space conditioning equipment comprising . . . means coupling said communications interface and said first remote correspondent.” EX1005 at Claim 1. In particular, *Rosen* describes that the I/O unit of its thermostat system “includes a communications interface 14 for coordinating communications between the CPU 9 and a remote correspondent 15. The communications interface 14 may be, for example, a conventional serial port.” *Id.*, ¶0018. Additionally, *Rosen* describes that “the CPU 9 starts the process shown in FIG. 5 by issuing signals to the I/O unit 10 to cause the communications interface 14 to establish communications, via link 16, with a remote correspondent 15.” *Id.*, ¶0022. Thus, *Rosen* discloses the function of “coupling said communications interface and said first remote correspondent.”

189. *Rosen* also discloses the corresponding structure, namely a serial link and/or data link. Similar to the '075 Patent, *Rosen*’s Figure 2 shows “a typical coupling in which the communications interface 14 sends/receives serial data to/from an external (to the thermostat system) modem 20 via serial link 16.” *Id.*, ¶0032. “The modem conventionally interfaces with an Internet Service Provider (ISP) 21 which completes the communications link to the remote correspondent in the well-known manner.” *Id.* The “modem 20 may be dial-up, cable, DSL or any other type suitable for the communications environment in a given installation.” *Id.*

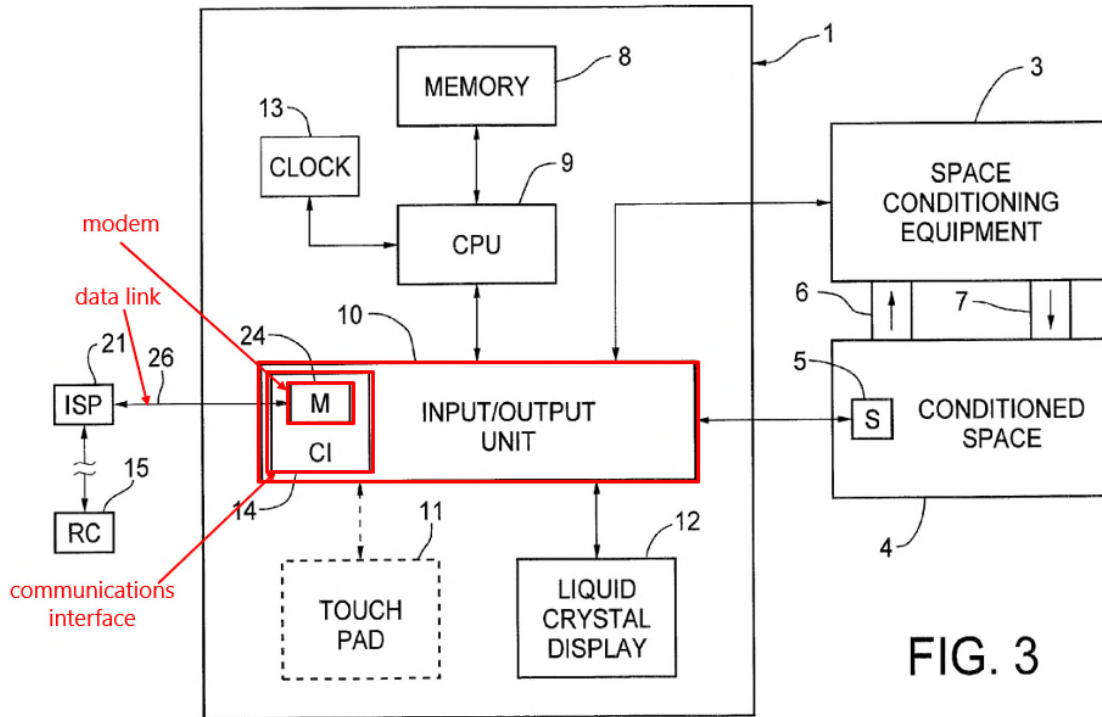
Figure 2 of *Rosen* is reproduced below with annotations showing the corresponding structure disclosed in the '075 Patent:



Id. at Figure 2 (annotated).

190. Additionally, *Rosen* discloses that “[a]t the state-of-the-art and as shown in FIG. 3, a modem 24 for communicating with the ISP may be integrated into the communications interface 14 of the input/output unit 14 to eliminate the need for an external modem.” *Id.*, ¶0033. “Thus, when communications is established with the remote correspondent 15 according to a schedule or upon demand, the data transfer takes place via modem 24 and data link 26 as shown.” *Id.*

Figure 3 of *Rosen* is reproduced below with annotations showing the corresponding structure disclosed in the '075 Patent:

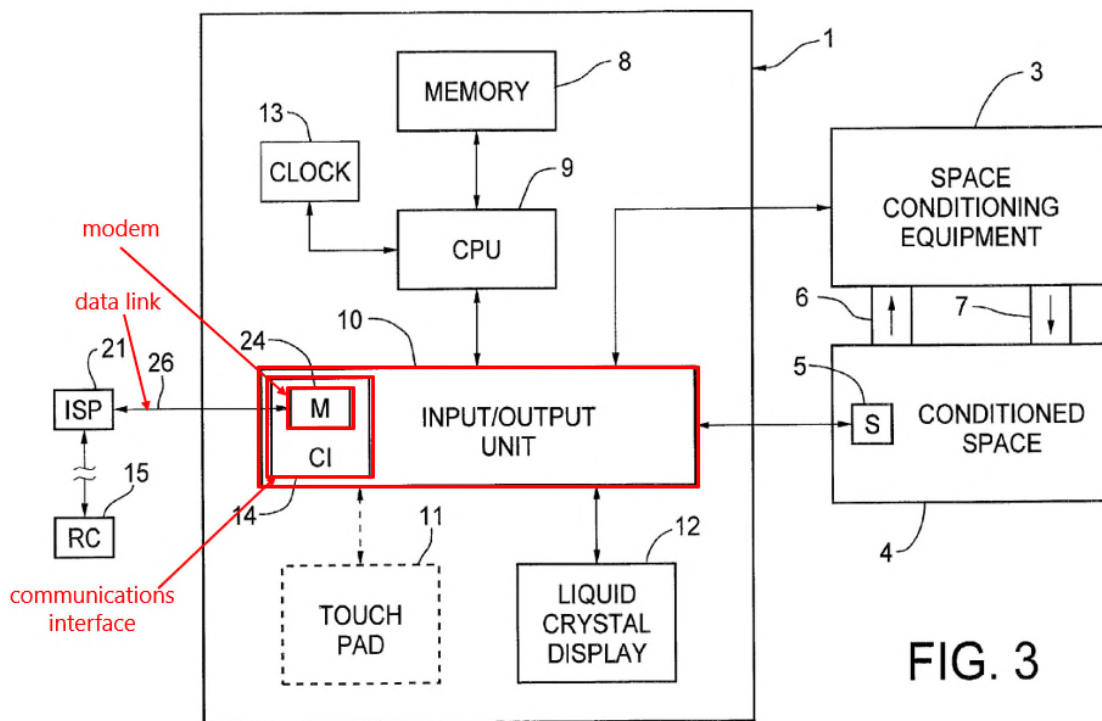


Id. at Figure 3 (annotated). Thus, *Rosen* discloses element 1[o].

2. Claim 2: “The system of claim 1 in which in which said communications interface includes a modem.”

191. *Rosen* discloses Claim 2. Modems were well known in the prior art, and the inventor of the '075 Patent admitted that he did not invent any new type of modem. EX1012 at 267:19-25. *Rosen* discloses that the communication interface of its thermostat system can include a modem. For example, as discussed above for element 1[o], *Rosen* discloses that “[a]t the state-of-the-art and as shown in FIG. 3, a modem 24 for communicating with the ISP may be integrated into the

communications interface 14 of the input/output unit 14 to eliminate the need for an external modem.” EX1005, ¶0033. “Thus, when communications is established with the remote correspondent 15 according to a schedule or upon demand, the data transfer takes place via modem 24 and data link 26 as shown.” *Id.* Figure 3 of *Rosen* illustrates the claimed communication interface including a modem:



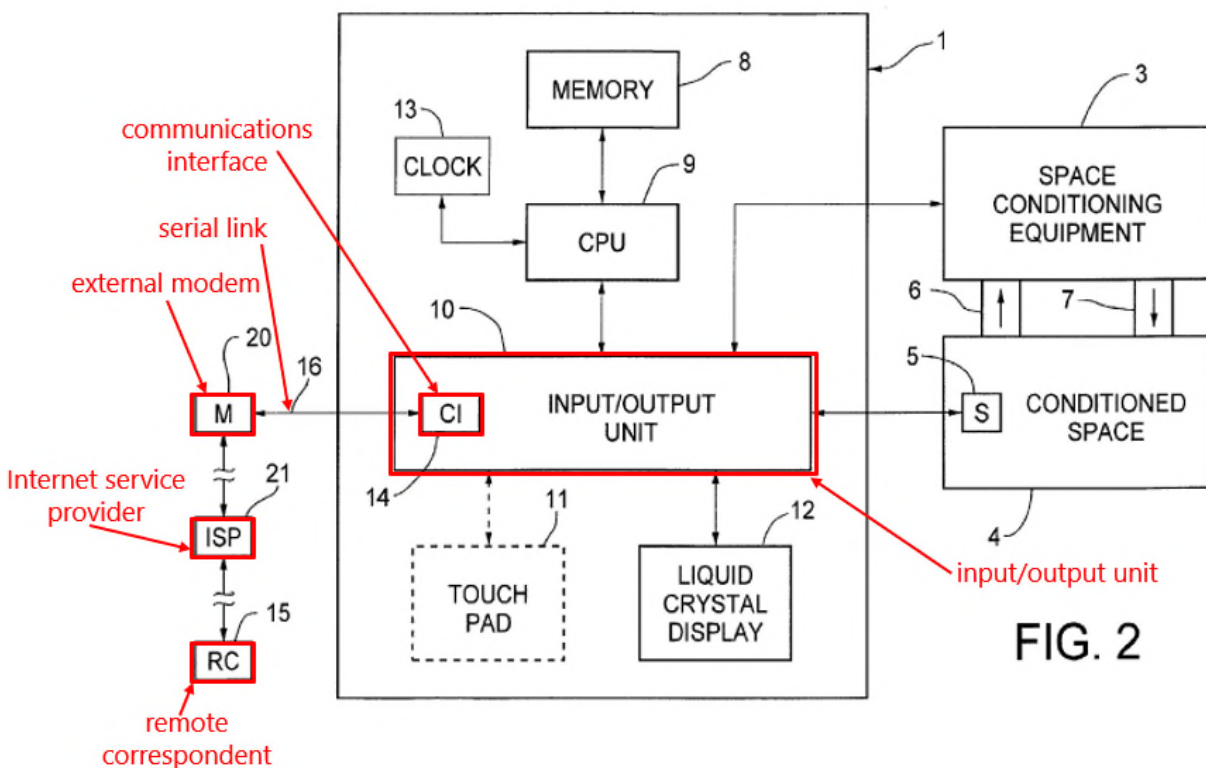
Id. at Figure 3 (annotated). Thus, *Rosen* discloses Claim 2.

3. Claim 3: “The system of claim 1 in which said communications interface is coupled to an external modem.”

192. *Rosen* discloses Claim 3. *Rosen* discloses that the communication interface of its thermostat system may be coupled to an external modem. For example, as discussed above for element 1[o], *Rosen*’s Figure 2 shows “a typical

coupling in which the communications interface 14 sends/receives serial data to/from an external (to the thermostat system) modem 20 via serial link 16.”

EX1005, ¶0032. “The modem conventionally interfaces with an Internet Service Provider (ISP) 21 which completes the communications link to the remote correspondent in the well-known manner.” *Id.* The “modem 20 may be dial-up, cable, DSL or any other type suitable for the communications environment in a given installation.” *Id.* Figure 2 of *Rosen* is reproduced below with annotations showing coupling of the communications interface to an external modem:



Id. at Figure 2 (annotated). Thus, *Rosen* discloses Claim 3.

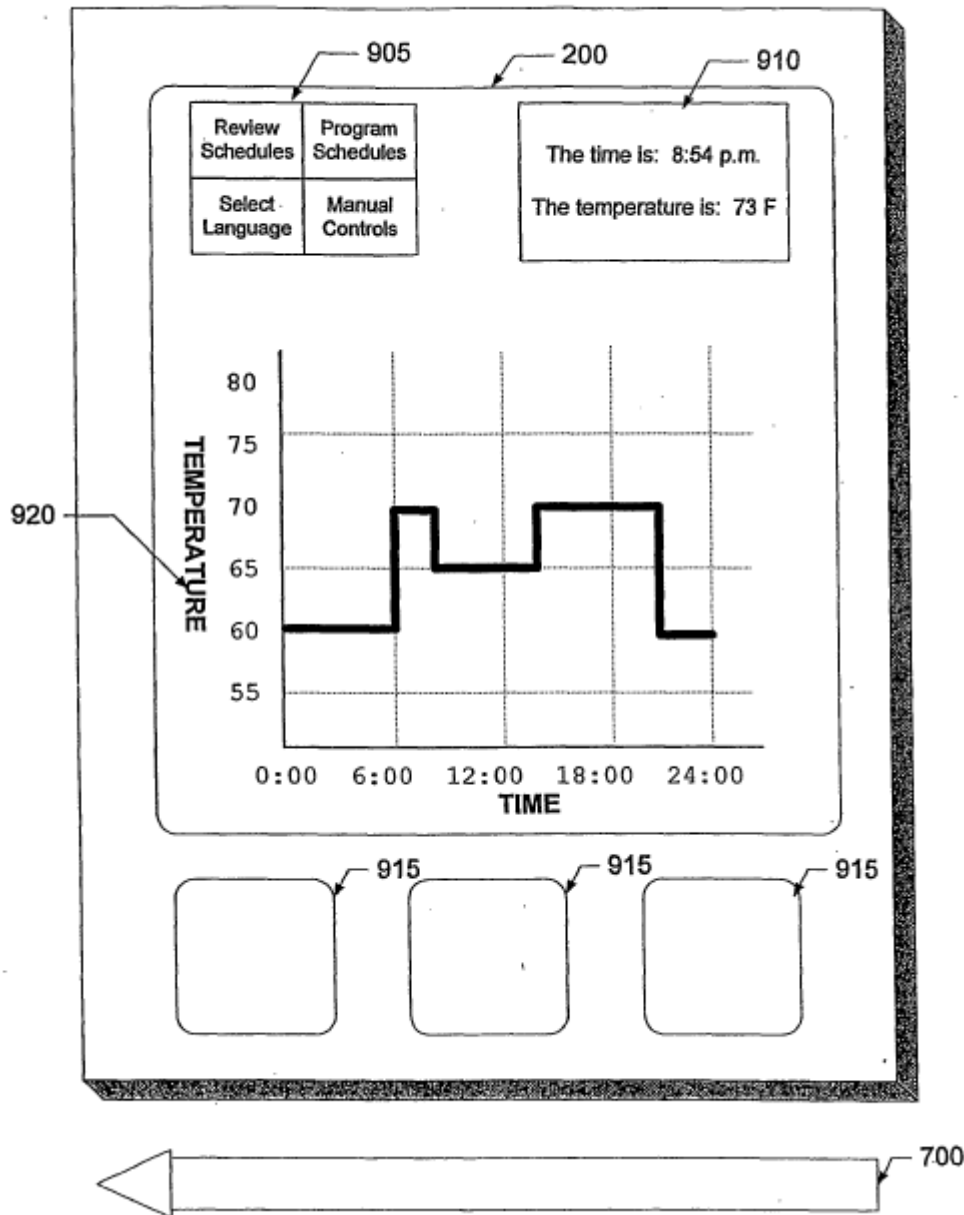
4. Claim 4: “The system of claim 1 in which transferred functional programming modules comprise means for controlling space conditioning equipment.”

193. The *Rosen-Rosen-II-Smith* combination renders obvious Claim 4. As discussed above, I understand that Petitioner and Patent Owner agree that this claim is governed by 35 U.S.C. § 112, ¶6, and I have been asked to apply Patent Owner’s proposed construction. *Supra*, §V.F.1. Under Patent Owner’s interpretation, the function is “controlling space conditioning equipment,” and the corresponding structure is virtual buttons operating with control programs. *Supra*, §V.F.1; EX1009 at 5-6; EX1026 at 80.

194. As discussed above for elements 1[m] and 1[n], *Smith*’s initial interface objects, user interface objects, and control algorithms disclose or at least render obvious the claimed modules of functional programming. *Supra*, §§VII.C.1.x-xi. *Smith*’s functional programming changes or adds to representations on the touch screen for example by adding an option for the user to choose a preferred language (initial interface objects), changing the language of the display buttons (user interface objects), or changing the display to reflect a new set-point schedule (control algorithms). EX1007 at 5:2-6, 5:14-16, 5:30-31. When *Smith*’s teachings are applied to *Rosen* (as modified by *Rosen-II*), the transferred functional programming comprises virtual buttons for controlling space conditioning equipment (i.e., means for controlling space conditioning equipment).

195. For example, *Smith* explains that “[f]or people whose first language is not English, or for people travelling to a foreign country and staying in a hotel or other housing, programming comfort controllers can be even more difficult because the buttons, controls, and displays on the controllers are usually labeled with English words.” EX1007 at 1:25-28. At a minimum, *Smith*’s initial interface objects and user interface objects enable a user to “choose a preferred language and then view the switches, etc. on the comfort controller in the chosen preferred language.” *Id.* at 1:30-2:2. Based on *Smith*’s disclosure that a user “view[s] the switches, etc.” in the chosen preferred language, a POSITA would have understood that the user interface objects are used to change the language used for buttons on a touchscreen, for example the “additional controls 905” in *Smith*’s Figure 2:

Figure 2



Id. at Figure 2; *see also id.* at 5:4-6 (“[I]f a language other than English was chosen, the additional controls 905, the display information 910, and the labels 920 would be redisplayed in the chosen language.”).

196. When *Smith*'s teachings are applied to *Rosen* (as modified by *Rosen-II*), the user interface objects are used to change the language of the buttons on the thermostat system's touch screen to the preferred language. As discussed above for element 1[j], *Rosen* (as modified by *Rosen-II*) discloses establishing "representations of buttons at a separated and predetermined positions" on a touch screen of the thermostat systems. *Supra*, §VII.C.1.vii. A POSITA would have understood the representations of buttons to be virtual buttons because they are "generated by the processor 1 at predetermined convenient and intuitive positions on the touch screen" (EX1006, ¶0028) as opposed to fixed, tactile buttons separate from the display. *Rosen-II* explains that these virtual buttons are used to control space conditioning equipment. For example, *Rosen-II* describes, with respect to Figure 3 reproduced below, that "[i]f the button 30, labeled 'DN', is touched, that fact is sensed by the processor which drops the current set point from, say, 72° F. to 71° F. The set point can be similarly raised by touching the button 31 which is labeled 'UP'." *Id.*, ¶0028.

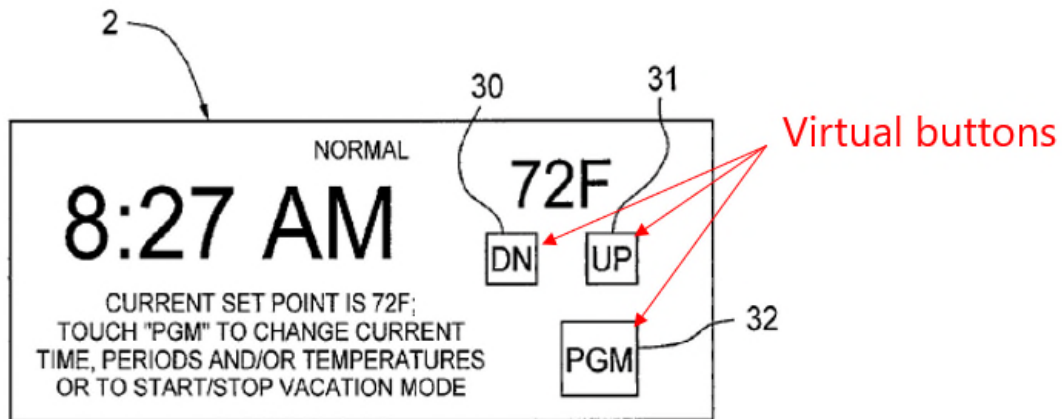


FIG. 3

Id. at Figure 3 (annotated). Additionally, with respect to Figure 3 above, *Rosen-II* describes that “[a] user is invited, if desired, to touch the ‘PGM’ button 32 to change the current time, time periods and/or temperatures or to start/stop vacation mode,” and further explains that “[t]hese actions are exemplary only; for example, ‘select heat/cool mode’ and other such actions can be included as appropriate for a particular thermostat system.” *Id.*, ¶0029.

197. Thus, the *Rosen-Rosen-II-Smith* combination renders obvious “in which transferred functional programming modules comprise means for controlling space conditioning equipment” as recited in Claim 4. The rationale and motivation for combining *Smith* with *Rosen* (as modified by *Rosen-II*) is the same as discussed above for Claim 1. *Supra*, §VII.C.1.xi.(a).

5. Claim 11: “The system of claim 1 in which in which said functional programming determines all or part of a graphical user interface.”

198. The *Rosen-Rosen-II-Smith* combination discloses Claim 11 for the reasons discussed above for elements 1[i], 1[m], and 1[n]. *Supra*, §§VII.C.1.vi, VII.C.1.x-xi. *Smith*’s initial interface objects “are presented on the display” and “request the user to choose a preferred language.” EX1007 at 5:15-16. *Smith*’s user interface objects cause information to be displayed in a different language. *See id.* at 5:4-6 (“[I]f a language other than English was chosen, the additional controls 905, the display information 910, and the labels 920 would be redisplayed in the chosen language.”). *Smith*’s control algorithm also changes the “graphical representation of the set-point temperature schedule.” *Id.* at 4:16-18. From these disclosures in *Smith*, a POSITA would have understood that the functional programming (e.g., *Smith*’s initial interface objects, user interface objects, and control algorithms) “determine[] all or part of a graphical user interface” as claimed in Claim 11.

6. Claim 12: “The system of claim 1 in which in which said functional programming determines size, shape, colors, legends, locations, or other viewable aspects of said buttons on the display.”

199. The *Rosen-Rosen-II-Smith* combination discloses Claim 12 for the reasons discussed above for Claim 11. *Supra*, §VII.C.5. A POSITA would have understood that the various text associated with buttons are an example of a “legend”

or, at a minimum, “other viewable aspects of said buttons on the display,” because the text is displayed on or close to the button and viewable by a user. Because *Smith*’s user interface objects define the language displayed, *Smith*’s user interface objects (i.e., functional programming) “determine[] . . . legends . . . or other viewable aspects of said buttons on the display” as claimed in Claim 12.

7. Claim 13: “The system of claim 1 in which in which [sic] said functional programming determines representations of the size, shape, colors, locations and other viewable aspects of text or graphic devices on the display.”

200. The *Rosen-Rosen-II-Smith* combination discloses Claim 13 for the reasons discussed above for Claims 11 and 12. *Supra*, §§VII.C.5-6. By enabling an option to choose a preferred language to be presented, redisplaying information in a preferred language, and changing the graphical representation of the set-point temperature schedule, *Smith*’s initial interface objects, user interface objects, and control algorithms (i.e., functional programming), respectively, “determine[] representations of . . . other viewable aspects of text or graphic devices on the display” as claimed in Claim 13.

8. Claim 14: “The system of claim 1 in which in which [sic] said functional programming determines operational algorithms other than those for the graphical user interface.”

201. The *Rosen-Rosen-II-Smith* combination discloses Claim 14. At a minimum, *Smith*’s control algorithms (i.e., functional programming) “determine[] operational algorithms other than those for the graphical user interface.”

202. *Smith* describes that “as is well known, thermostats often have setback capabilities which involves a programmed temperature schedule.” EX1007 at 1:12-14. “For example, a temperature schedule could be programmed so that in the winter months, a house is warmed to 72 degrees automatically at 6:00 a.m. when the family awakes, cools to 60 degrees during the day while the family is at work and at school, re-warms to 72 degrees at 4:00 p.m. and then cools a final time to 60 degrees after 11:00 p.m., while the family is sleeping.” *Id.* at 1:14-18. *Smith* explains that “[a] schedule of set back temperatures is one example of a control algorithm that can be used by the comfort controller.” *Id.* at 1:20-21. In particular, *Smith* teaches that one example of a control algorithm is “a set-point schedule,” and that “[t]he thermal controller sets-up or sets-back the temperature according to such a set-point schedule.” *Id.* at 4:7-10. As an example, *Smith* describes that “a set-point schedule could be configured to adjust the temperature to 60 degrees at 6:00 a.m., then to 67 degrees at 6:30 a.m., and up to 73 degrees at 8:00 a.m., etc.” *Id.* at 4:10-12.

203. Based on *Smith*'s disclosure that a thermal controller (e.g., thermostat) "sets-up or sets-back the temperature according to such a set-point schedule" in a control algorithm, a POSITA would have understood that *Smith*'s control algorithms are operational algorithms for control of existing space conditioning equipment. In other words, *Smith*'s control algorithms "determine[] operational algorithms other than those for the graphical user interface" as claimed in Claim 14.

9. Claim 15: "The system of claim 1 in which in which [sic] said functional programming determines operational algorithms for control of existing or newly installed space conditioning equipment."

204. The *Rosen-Rosen-II-Smith* combination discloses Claim 15 for the reasons discussed above for Claim 14. *Supra*, §VII.C.8. As discussed above, based on *Smith*'s disclosure that a thermal controller "sets-up or sets-back the temperature according to such a set-point schedule" in a control algorithm, a POSITA would have understood that *Smith*'s control algorithms (i.e., functional programming) "determine[] operational algorithms for control of existing . . . space conditioning equipment" as claimed in Claim 15.

VIII. SECONDARY CONSIDERATIONS

205. During prosecution of the '075 Patent, the applicant did not identify any evidence of secondary considerations of non-obviousness tied to the claimed invention of the '075 Patent. I understand from counsel for Petitioner that Patent

Owner in the co-pending district court litigation has not identified any evidence with respect to secondary considerations of non-obviousness. I am not aware of any objective evidence of nonobviousness of the Challenged Claims.

206. Accordingly, there is no objective evidence of non-obviousness that might warrant a finding that Claims 1-4 and 11-15 are patentable. To the extent Patent Owner at a later date cites or provides any other evidence regarding secondary considerations, including any expert opinions, I reserve the right to supplement my analysis and opinions to address it.

IX. CONCLUSION

207. For at least the above-described reasons, in my opinion Claims 1-4 and 11-15 of the '075 Patent would have been obvious to a POSITA based on the prior art references that I have cited and analyzed above.

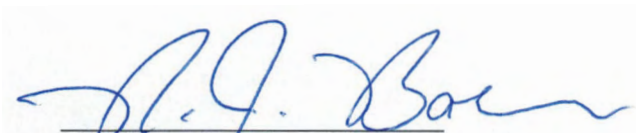
208. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

209. I reserve the right to supplement my opinions in the future to respond to any arguments raised by Patent Owner and to consider any new information that becomes available to me.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed this 28th day of March 2023, in LAS VEGAS, NV

Respectfully submitted,



R. Jacob Baker, Ph.D., P.E.

APPENDIX A

R. JACOB (JAKE) BAKER, PH.D., P.E.

*Professor Pristinus of Electrical and Computer Engineering
Independent Consultant*

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PROFESSIONAL SUMMARY

Russel Jacob (Jake) Baker, Ph.D., P.E. (IEEE Student Member 1983, Member 1988, Senior Member 1997, and Fellow 2013) was born in Ogden, Utah, on October 5, 1964. He received the B.S. and M.S. degrees in electrical engineering from the University of Nevada, Las Vegas, in 1986 and 1988. He received the Ph.D. degree in electrical engineering from the University of Nevada, Reno in 1993. His Google Scholar profile is [here](#) and his ResearchGate profile is [here](#).

From 1981 to 1987 he served in the United States Marine Corps (from September of 1982 in the Reserves, Fox Company, 2nd Battalion, 23rd Marines, 4th Marine Division). From 1985 to 1993 he worked for E. G. & G. Energy Measurements and the Lawrence Livermore National Laboratory designing nuclear diagnostic instrumentation for underground nuclear weapons tests at the Nevada Test Site. During this time, he designed, and oversaw the fabrication and manufacture of, over 30 electronic and electro-optic instruments including high-speed cable and fiber-optic receiver/transmitters, PLLs, frame- and bit-syncs, data converters, streak-camera sweep circuits, Pockels cell drivers, micro-channel plate gating circuits, and analog oscilloscope electronics. From 1991-1992 he was an adjunct faculty member in the department of electrical engineering at the University of Nevada, Las Vegas (UNLV). From 1993 to 2000 he served on the faculty in the department of electrical engineering at the University of Idaho (UI), first as an untenured Assistant Professor and then from 1998 as a tenured Associate Professor. In 2000 he joined a new electrical and computer engineering (ECE) program at Boise State University (BSU) where he was promoted to Full Professor in 2002. He then served as the ECE department chair at BSU from 2004 to 2007. At BSU he helped establish graduate programs in ECE including, in 2006, the university's second PhD degree. In 2012 he re-joined the faculty at UNLV as a tenured Full Professor of ECE. During his service at the UI, BSU, and UNLV he has been the major professor to more than [100 graduate students](#). In addition to this industry and academic experience, he has done consulting, both technical and expert witness, for over [200 companies](#).

Over the last 35+ years his [research/development interests](#) and [publications](#) have been, or currently are, focused on: analog-to-digital/digital-to-analog data conversion and transmission, optoelectronics (imagers, displays, LIDARs, APDs, SiPMs, and associated electronics), analog and digital integrated circuit design and fabrication, design of diagnostic electrical and electro-optic instrumentation for scientific research, integrated electrical/biological circuits and systems, array (memory, imagers, and displays) fabrication and design, CAD tool development and online tutorials, low-power interconnect and packaging (electrical and optical) techniques, design of wired/wireless communication and interface circuits, circuit design for the use and storage of renewable energy, power electronics and power supply design, and the delivery of [online engineering education](#).

Dr. Baker is the named inventor on over [150 US patents](#). He is a member of the honor societies Eta Kappa Nu and Tau Beta Pi, a licensed Professional Engineer, a popular lecturer that has delivered over [50 invited talks](#) around the world, an IEEE Fellow, and the author of the books CMOS Circuit Design, Layout, and Simulation, CMOS Mixed-Signal Circuit Design, and a coauthor of DRAM Circuit Design: Fundamental and High-Speed Topics. He received the 2000 Best Paper Award from the IEEE Power Electronics Society, the 2007 Frederick Emmons Terman Award,

the 2011 IEEE Circuits and Systems Education Award and the 2021 Wiley-IEEE Press Textbook Award for the 4th Edition of his book CMOS Circuit Design, Layout, and Simulation.

His service activities include the IEEE Press Editorial Board (1999-2004), editor for the Wiley-IEEE Press Book Series on Microelectronic Systems (2010-2018), the Technical Program Chair of the 2015 IEEE 58th International Midwest Symposium on Circuits and Systems (MWSCAS 2015), the IEEE Solid-State Circuits Society (SSCS) Administrative Committee (2011-2016), Distinguished Lecturer for the SSCS (2012-2015), Technology Editor (2012-2014) and Editor-in-Chief (2015-2020) for the IEEE Solid-State Circuits Magazine, IEEE Kirchhoff Award Committee (2020-2023), and advisor for the student branch of the IEEE at UNLV (2013-2023).

INDUSTRY EXPERIENCE

2008 - present: Expert witness in intellectual property disputes in electrical, electro-optic, and computer engineering matters for: 1) district court and ITC patent disputes, 2) inter partes reviews at the PTAB, and 3) arbitrations and mediations.

2013 - 2022: Worked with Freedom Photonics, Santa Barbara, CA, on the integration, fabrication and design, of optoelectronics with CMOS integrated circuits. Work includes the design of compact optical transceivers for range finding applications, high-efficiency integrated silicon avalanche photodetectors for quantum key receivers, Geiger mode SiGe receivers for long-range communications, cryptography, and the fabrication of near-infrared focal plane arrays. Packaging and testing of numerous chips fabricated in both CMOS and SiGe technologies using LEDs, ILDs, PIN, APDs, and ROICs.

2017 - 2019: Worked with Vorpil Research Systems, Las Vegas, NV on the design of integrated circuit electronics and optoelectronics for optical transceivers used in LIDARs/LADARs.

2016 - 2019: Worked with Attollo Engineering on the design of transient digitizers for the capture of high-speed signals for range finders using LEDs and lasers in compact optical transceivers.

2013 - 2018: Working with Mission Support and Test Services, LLC (MSTS, formerly National Security Technologies, LLC, [NSTec]) on the Design and Fabrication of Integrated electrical/photonics application specific integrated circuit (ASIC) design for use in the implementation of diagnostic instrumentation.

2013 - 2015: Consultant for OmniVision. Working on integrating CMOS image sensors (CIS) with memory for very high-speed consumer imager products. Design specialty DRAM, high-speed interfaces between CIS and DRAM, packaging techniques to pair the CIS with DRAM.

2010 - 2013: Worked with Arete' Associates on the design of high-speed compressive transimpedance amplifiers for LADAR projects and the design of ROIC unit cells. Work funded by the U. S. Air Force.

2013: Cirque, Inc. Consulting on the design of analog-to-digital interfaces for capacitive touch displays and pads.

2012: Consultant at Lockheed-Martin Santa Barbara Focal Plane Array. CMOS circuit design and fabrication for the development and manufacture of infrared components and imaging systems with an emphasis on highest sensitivity Indium Antimonide (InSb) focal plane arrays (FPAs) in linear through large staring formats. Product groups include FPAs, integrated dewar assemblies (IDCAs), camera heads, high-speed interfaces between image processors and imaging systems, and infrared imaging systems.

2010 - 2012: Working with Aerius Photonics (and then FLIR Inc. when Aerius was purchase by FLIR) on the design of Focal Plane Arrays funded (SBIRs and STTRs) by the U.S. Air Force, Navy, and Army. Experience with readout integrated circuits (ROICs) and the design/layout of photodetectors in standard CMOS.

2009 - 2010: Sun Microsystems, Inc. (and then Oracle) VLSI research group. Provided consulting on memory circuit design/fabrication and proximity connection (PxC) interfaces to DRAMs and SRAMs for lower power, 3D packaging, for memory modules and controllers implemented with FPGAs and custom ASICs.

2009 - 2010: Contour Semiconductor, Inc. Design of NMOS voltage and current references as well as the design of a charge pump for an NMOS memory chip.

1994 - 2008: Affiliate faculty (Senior Designer), Micron Technology. Designed CMOS circuits for DRAMs including DLLs, PLLs for embedded graphics chips, voltage references and regulators, data converters, field-emitting display drivers, sensing for MRAM (using delta-sigma data conversion topologies), SRAMs, RFIDs, CMOS active pixel imagers and sensors, power supply design (linear and switching), input buffers, etc. Worked on a joint research

project between Micron and HP labs in magnetic memory fabrication and design using the MTJ memory cell. Worked on numerous technologies ranging from LED lighting to medical imaging using CMOS image sensors (too many to list) resulting in numerous US patents (see following list). Considerable experience working with product engineering to ensure high-yield from the production line from fabrication to test. Co-authored a book on DRAM circuit design through the support of Micron. Gained knowledge in the entire memory design process from fabrication to packaging. Developed, designed, and tested circuit design techniques for multi-level cell (MLC) Flash memory using signal processing.

January 2008: Consultant for Nascentric located in Austin, TX. Provide directions on circuit operation (DRAM, memory, and mixed-signal) for fast SPICE circuit simulations.

May 1997 - May 1999: Consultant for Tower Semiconductor, Haifa, Israel. Designed CMOS integrated circuit cells for various modem chips, interfaces, and serial buses including USB circuits, charging circuits based upon power up/down circuits using an MOS or bandgap reference, pre-amplifiers, comparators, etc.

Summer 1998: Consultant for Amkor Wafer Fabrication Services, Micron Technology, and Rendition, Inc., Design PLLs and DLLs for custom ASICs and a graphics controller chip.

Summers 1994 - 1995: Micron Display Inc. Designing phase locked loop for generating a pixel clock for field emitting displays and a NTSC to RGB circuit on chip in NMOS. These displays are miniature color displays for camcorder and wrist watch size color television. Worked on the fabrication and design of video peripheral circuits for these displays.

September - October 1993: Lawrence Berkeley Laboratory. Designed and constructed a 40 A, 2 kV power MOSFET pulse generator with a 3 ns rise-time and 8 ns fall-time for driving Helmholtz coils.

Summer 1993: Lawrence Livermore National Laboratory, Nova Laser Program. Researched picosecond instrumentation, including time-domain design for impulse radar and imaging.

December 1985 - June 1993: (from July 1992 to June 1993 employed as a consultant while finishing up my Ph.D.), E.G.&G. Energy Measurements Inc., Nevada, Senior Electronics Design Engineer. Responsible for the design and manufacturing of instrumentation used in support of Lawrence Livermore National Laboratory's Nuclear Test Program. Responsible for designing and fabricating over 30 electronic and electro-optic instruments including: CCD camera design, communication networks, fiber optic transmitters employing high speed laser drive electronics, receivers employing envelop tracking for DC voltage restoration and regeneration of received information, receiver low noise amplifier design, frame synchronizers for re-assembling transmitted images, high-speed SRAM memory system design with battery back-up, calibration equipment design such as a tunnel diode pulse generator for testing compensation of oscilloscopes and DAC design for calibrating CCD readout electronics, power supply and battery charger designs, sweep circuits for streak cameras, Pockel's cell drive electronics, vertical amplifier design using HBTs for analog oscilloscopes used at the Nevada Test Site, and 10 kV ramp designs using a planar triode to name some of the designs.

This position provided considerable fundamental grounding in EE with a broad exposure ranging from the design of PC boards to, for example, the design of cable equalizers. Summarizing, gained experience in circuit design technologies including: bipolar, vacuum tubes (planar triodes for high voltages), hybrid integrated circuit fabrication and design, GaAs (high speed logic and HBTs), Mach-Zehnder interferometers, Pockels cells, krytrons, power MOSFETs, microwave techniques, power supplies, fiber optic transmitters/receivers, etc.

Summer 1985: Reynolds Electrical Engineering Company, Las Vegas, Nevada. Gained hands on experience in primary and secondary power system design, installation and trouble-shooting electric motors on mining equipment.

ACADEMIC EXPERIENCE

January 1991 – present: Professor of Electrical and Computer Engineering at the **University of Nevada, Las Vegas** from August 2012 to present. From January 2000 to July 2012 held various positions at **Boise State University** including: Professor (2003 – 2012), Department Chair (2004 - 2007), and tenured Associate Professor (2000 - 2003). From August 1993 to January 2000 was a tenured/tenure track faculty member at the **University of Idaho:** Assistant Professor (1993 - 1998) and then tenured Associate Professor (1998 - 2000). Lastly, from January 1991 to May 1993 held adjunct faculty positions in the departments of Electrical Engineering at the University of Nevada, Las Vegas and Reno. Additional details:

- Research is focused on analog and mixed-signal integrated circuit fabrication and design. Worked with multi-disciplinary teams (civil engineering, biology, materials science, etc.) on projects that have been funded by EPA, DARPA, NASA, Army, DMEA, Navy, and the AFRL.
- Current and past research and development interests are:
 - Design and packaging of electrical/optical systems (e.g., LiDARs/LADARs) using LEDs, semiconductor lasers, lens for focusing and directing light, integrated circuits, and associated control and communication systems/circuits.
 - Capacitive sensing techniques using delta-sigma modulation and interfacing to sensors
 - Design of high-voltage and energy switching circuits
 - Circuit design and fabrication for the control, use, and storage of renewable energy using thermoelectric generators
 - Design of electrical/biological/optical circuits and systems using electrowetting on dielectric for automating and controlling biological experiments
 - Design of readout integrated circuits (ROICs) for use with focal plane arrays (FPAs)
 - Heterogeneous integration of III-V photonic devices (e.g., FPAs and VCSELs) with CMOS
 - Methods (e.g., 3D packaging and capacitive interconnects) to reduce power consumption in semiconductor memories, memory modules, and digital systems using custom and non-custom (e.g., FPGAs) implementations
 - Analog and mixed-signal circuit fabrication and design for communication systems, synchronization, energy storage, data conversion, and interfaces
 - The design of writing and sensing circuitry for emerging nonvolatile memory technologies, focal planes, and displays (arrays) in nascent nanotechnologies (e.g., magnetic, chalcogenide)
 - Reconfigurable electronics design and fabrication using nascent memory technologies such as the memristor to implement FPGAs
 - Finding an electronic, that is, no mechanical component, replacement for the hard disk drive using nascent fabrication technologies
 - Power electronics circuit design for consumers and consumer electronics including power management and adaptive control to reduce power consumption
 - Design of bandpass delta-sigma modulators for IQ demodulation in wireless communication systems in OFDM, WiFi, 802.11, Bluetooth, 3G, 4G, etc.
 - University prototyping, fabricating, and packaging of integrated circuits
- Led, as chair, the department in graduate curriculum (MS and PhD), program development, and ABET accreditation visits.
- Worked with established and start-up companies to provide technical expertise and identify employment opportunities for students.
- Held various leadership and service positions including: ECE chair, graduate coordinator, college curriculum committee (chair), promotion and tenure committee, scholarly activities committee, faculty search committee, university level search committees, etc. Collaborate with College of Engineering faculty on joint research projects.
- Taught courses in circuits, analog IC design, digital VLSI design and fabrication, fiber optics, and mixed-signal integrated circuit design to both on- and, via the Internet, off-campus students. Research emphasis in integrated circuit design using nascent technologies.

EDUCATION

- Ph.D. in Electrical Engineering; December 1993; University of Nevada, Reno, GPA 4.0/4.0. Dissertation Title: *Applying power MOSFETs to the design of electronic and electro-optic instrumentation.*
- M.S. and B.S. in Electrical Engineering; May 1986 and May 1988; University of Nevada, Las Vegas. Thesis Title: *Three-dimensional simulation of a MOSFET including the effects of gate oxide charge.*

MEMBERSHIPS IN PROFESSIONAL AND SCHOLARLY ORGANIZATIONS

IEEE (student, 1983; member, 1988; senior member, 1997; Fellow, 2013)
Member of the honor societies Eta Kappa Nu and Tau Beta Pi
Licensed Professional Engineer

HONORS AND AWARDS

- Consolidated Students of the University of Nevada, Las Vegas (CSUN) Faculty Award, 2017
- Tau Beta Pi UNLV Outstanding Professor of the Year in 2013, 2014, 2015 and 2016
- UNLV ECE Department Distinguished Professor of the Year in 2015
- IEEE Fellow for contributions to the design of memory circuits - 2013
- Distinguished Lecturer for the IEEE Solid-State Circuits Society, 2012 - 2015
- IEEE Circuits and Systems (CAS) Education Award - 2011
- Twice elected to the Administrative Committee of the Solid-State Circuits Society, 2011 - 2016
- Frederick Emmons Terman Award from the American Society of Engineering Education - 2007
- President's Research and Scholarship Award, Boise State University - 2005
- Honored Faculty Member - Boise State University Top Ten Scholar/Alumni Association 2003
- Outstanding Department of Electrical Engineering faculty, Boise State 2001
- Recipient of the IEEE Power Electronics Society's Best Paper Award in 2000
- University of Idaho, Department of Electrical Engineering outstanding researcher award, 1998-99
- University of Idaho, College of Engineering Outstanding Young Faculty award, 1996-97

SERVICE

Reviewer for IEEE transactions on solid-state circuits, circuits and devices magazine, education, instrumentation, nanotechnology, VLSI, etc. Reviewer for several American Institute of Physics journals as well (Review of Scientific Instruments, Applied Physics letters, etc.) Board member of the IEEE press (reviewed dozens of books and book proposals). Reviewer for the National Institutes of Health. Technology editor and then Editor-in-Chief for the Solid-State Circuits Magazine.

Led the Department on ABET visits, curriculum and policy development, and new program development including the PhD in electrical and computer engineering. Provided significant University and College service in infrastructure development, Dean searches, VP searches, and growth of academic programs. Provided university/industry interactions including starting the ECE department's advisory board. Held positions as the ECE department Master's graduate coordinator and coordinator for the Sophomore Outcomes Assessment Test (SOAT).

Also currently serves, or has served, on the IEEE Press Editorial Board (1999-2004), as a member of the first Academic Committee of the State Key Laboratory of Analog and Mixed-Signal VLSI at the University of Macau, as editor for the Wiley-IEEE Press Book Series on Microelectronic Systems (2010-2018), on the IEEE Solid-State Circuits Society (SSCS) Administrative Committee (2011-2016), as an Advisory Professor to the School of Electronic and Information Engineering at Beijing Jiaotong University, as a Distinguished Lecturer for the SSCS (2012-2015), as the Technical Program Chair for the IEEE 58th 2015 International Midwest Symposium on Circuits and Systems, MWSCAS 2015, as advisor for the student branch of the IEEE at UNLV (2013-2023), and as the Technology Editor (2012-2014) and Editor-in-Chief (2015-2020) for the *IEEE Solid-State Circuits Magazine*, and IEEE Kirchhoff Award Committee (2020-2023).

ARMED FORCES

From 1981 to 1987 served in the United States Marine Corps (from September of 1982 in the Reserves, Fox Company, 2nd Battalion, 23rd Marines, 4th Marine Division), Honorable Discharge. Military Occupational Specialty (MOS) was Machine Gunner (MOS 0331)

TEXTBOOKS AUTHORED

Baker, R. J., "CMOS Circuit Design, Layout and Simulation, Fourth Edition" *Wiley-IEEE Press*, 1234 pages. ISBN 9781119481515 (2019) **Over 50,000 copies of this book in print.** (Third Edition published in 2010, Revised Second Edition published in 2008, and Second Edition Published in 2005)

Baker, R. J., "CMOS Mixed-Signal Circuit Design," *Wiley-IEEE*, 329 pages. ISBN 978-0470290262 (second edition, 2009) and ISBN 9780471227540 (First Edition published in 2002)

Keeth, B., Baker, R. J., Johnson, B., and Lin, F., "DRAM Circuit Design: Fundamental and High-Speed Topics", *Wiley-IEEE*, 2008, 201 pages. ISBN: 9780470184752

Keeth, B. and Baker, R. J., "DRAM Circuit Design: A Tutorial", *Wiley-IEEE*, 2001, 201 pages. ISBN 0780360141

Baker, R. J., Li, H.W., and Boyce, D.E. "CMOS Circuit Design, Layout and Simulation," *Wiley-IEEE*, 1998, 904 pages. ISBN 9780780334168

BOOKS, OTHER (edited, chapters, etc.)

Saxena, V. and Baker, R. J., "Analog and Digital VLSI," chapter in the CRC Handbook on Industrial Electronics, edited by J. D. Irwin and B. D. Wilamowski, *CRC Press*, 2009 second edition.

Baker, R. J., "CMOS Analog Circuit Design," (A self-study course with study guide, videos, and tests.) IEEE Education Activity Department, 2000. ISBN 0-7803-4822-2 (with textbook) and ISBN 0-7803-4823-0 (without textbook)

Baker, R. J., "CMOS Digital Circuit Design," (A self-study course with study guide, videos, and tests.) *IEEE Education Activity Department*, 2000. ISBN 0-7803-4812-5 (with textbook) and ISBN 0-7803-4813-3 (without textbook)

Li, H.W., Baker, R. J., and Thelen, D., "CMOS Amplifier Design," chapter 19 in the CRC VLSI Handbook, edited by Wai-kai Chen, *CRC Press*, 1999 (ISBN 0-8493-8593-8) and the second edition in 2007 (ISBN 978-0-8493-4199-1)

INVITED TALKS AND SEMINARS

Have given over 50 invited talks and seminars at the following locations: AMD (Fort Collins), AMI semiconductor, Arizona State University, Beijing Jiaotong University, Boise State University, Carleton University, Carnegie Mellon, Columbia University, Dublin City University (Ireland), E.G.&G. Energy Measurements, Foveon, the Franklin Institute, Georgia Tech, Gonzaga University, Hong Kong University of Science and Technology, ICSEng Keynote, ICySSS keynote, IEEE Computing and Communication Workshop (CCWC), IEEE Electron Devices Conference (NVMETS), IEEE Workshop on Microelectronics and Electron Devices (WMED), Indian Institute of Science (Bangalore, India), Instituto de Informatica (Brazil), Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM, Mexico), Iowa State University, Lawrence Livermore National Laboratory, Lehigh University, Lockheed-Martin, Micron Technology, Nascentric, National Semiconductor, Princeton University, Rendition, Saintgits College (Kerala, India), Southern Methodist University, Sun Microsystems, Stanford University, ST Microelectronics (Delhi, India), Temple University, Texas A&M University, Tower Semiconductor (Israel), University of Alabama (Tuscaloosa), University of Arkansas, University of Buenos Aires (Argentina), University of Houston, University of Idaho, University of Illinois (Urbana-Champaign), Université Laval (Québec City, Québec), University of Macau, University of Maryland, Université de Montréal (École Polytechnique de Montréal), Xilinx (Ireland), University of Nevada (Las Vegas), University of Nevada (Reno), University of Toronto, University of Utah, Utah State University, and Yonsei University (Seoul, South Korea).

RESEARCH FUNDING (LAST 5 YEARS AS A PROFESSOR)

Recent funding listed below. In-kind, equipment, and other non-contract/grant funding [e.g., MOSIS support, money for travel for invited talks, etc.] not listed.

- Baker, R. Jacob, (2017-2023) "Tiled Silicon Photomultiplier Array Read-Out Integrated Circuit," NASA, \$29,999 (Phase I), \$225,238 (Phase II), and \$79,697 (Phase IIE)
- Goldman, J., Menezes, J., and Baker, R. J., (2021-2022) "Monitored Compression Therapy: Using Smart Technology to Optimize the Treatment of Lower Extremity Swelling," UNLV Sports Research & Innovation Initiative. Proof of Concept Grant Program, \$50,000
- Baker, R. Jacob, (2019-2021) "Dual-Mode, Extended Near-Infrared, Focal Plane Arrays Fabricated with CMOS Compatible GeSiSn Alloy Materials," DARPA, \$149,998
- Baker, R. Jacob, (2018-2020) "Geiger Mode SiGe Receiver for Long-Range Optical Communications," NASA, \$99,996
- Baker, R. Jacob, (2019) "Improved Quantum Efficiency Photo-Detector," Navy, \$29,999

- Baker, R. Jacob, (2018-2019) "Tiled Silicon Photomultiplier Array Read-Out Integrated Circuit – Phase I," NASA, \$29,999
- Baker, R. Jacob, (2017-2019) "Quantum Cryptography Detector Chip," Defense MicroElectronics Activity (DMEA), \$266,029
- Baker, R. Jacob, (2017-2019) "Advanced Printed Circuit Board Design Methods for Compact Optical Transceiver," U.S. Army/DOD, \$299,605
- Baker, R. Jacob, (2016-2018) "High-Sensitivity Monolithic Silicon APD and ROIC," U.S. Air Force/DOD, \$299,665
- Baker, R. Jacob, (2017-2018) "Transimpedance Amplifier Integrated Circuit Collaboration," Department of Energy, National Security Technologies, LLC, \$100,436
- Baker, R. Jacob, (2017) "Geiger Mode SiGe Receiver for Long-Range Optical Communications," NASA, \$30,000
- Baker, R. Jacob, (2016-2017) "Testing and development of BiCMOS photodetectors and diagnostic instrumentation," Department of Energy, National Security Technologies, LLC, \$181,605
- Baker, R. Jacob, (2016-2017) "Dual-Mode, Extended Near Infrared, Focal Plane Arrays fabricated with a Commercial SiGe BiCMOS Process," DARPA, \$41,892

DOCTORAL STUDENT SUPERVISION

11. Mario Valles Montenegro (underway)
10. Sachin Namboodiri – A Multi-channel MCP-PMT based Readout Integrated Circuit for LiDAR Applications (2020)
9. Wenlan Wu – High-Speed Radhard Mega-Pixel CIS Camera for High-Energy Physics (2019)
8. Kostas Moutafis – A Highly-Sensitive Global-Shutter CMOS Image Sensor with On-Chip Memory for Hundreds of kilo-frames per second Scientific Experiments (2019)
7. Yiyan Li – Portable High Throughput Digital Microfluidics and On-Chip Bacteria Cultures (2016)
6. Yacouba Moumouni – Designing, Building, and Testing a Solar Thermoelectric Generation, STEG, for Energy Delivery to Remote Residential Areas in Developing Regions (2015)
5. Qawi IbnZayd Harvard – Low-Power, High-Bandwidth, and Ultra-Small Memory Module Design (2011)
4. Vishal Saxena – K-Delta-1-Sigma Modulators for Wideband Analog-to-Digital Conversion (2010)
3. Robert Russell Hay – Digitally-Tunable Surface Acoustic Wave Resonator (2009)
2. Xiangli Li (the first Boise State University College of Engineering PhD graduate) – MOSFET Modulated Dual Conversion Gain CMOS Image Sensors (2008)
1. Feng Lin, Research and Design of Low Jitter, Wide Locking-Range Phase-Locked and Delay-Locked Loops (2000)

MASTERS STUDENT SUPERVISION

93. Abraham Lopez (underway)
92. David Santiago (underway)
91. Khulan Tsogt (underway)
90. Jazmin Bolor (underway)
89. Chris Barr (underway)
88. Minsung Cho – Studies of Forward Projection Algorithms and Implementation on PC and FPGA (2023)
87. Armani Alvarez – A Control Integrated Circuit for a Hysteretic Flyback Power Converter (2022)
86. Francisco Mata-carlos – A Wearable Electronic Monitoring Device for Low Pressure Garment Applications and Temperature Analysis for Prevention of Ulceration and Infection (2022)
85. Daniel Senda – Designs and Outcomes of Transcranial Magnetic Stimulation (TMS) and Repetitive Transcranial Magnetic Stimulation (rTMS) Circuits (2021)
84. James Skelly – Monitored Compression Therapy: Using Smart Technology to Optimize the Treatment of Lower Extremity Swelling (2021)
83. Gonzalo Arteaga – Current-mode photon-counting circuit with SiGe BiCMOS input stage (2020)
82. Jason Silic – Design and Fabrication of a 6-bit Current-Mode ADC for Lidar and High-Speed Applications (2020)
81. Brandon Wade (2020)
80. Mario Valles Montenegro – Front-End CMOS Transimpedance Amplifiers on a Silicon Photomultiplier Resistant to Fast Neutron Fluence (2020)
79. Jonathan DeBoy (2018)
78. Dane Gentry – Design, Layout, and Testing of SiGe APDs Fabricated in a BiCMOS Process (2018)

77. James Mellot – Variable Transition Time Inverters in a Digital Delay Line with Analog Storage for Processing Fast Signals and Pulses (2018)
76. Eric Monahan – High Speed Fast Transient Digitizer Design and Simulation (2018)
75. Shada Sharif – Design and Analysis of First and Second Order K-Delta-1-Sigma Modulators in Multiple Fabrication Processes (2018)
74. Vikas Vinayaka – Analysis and Design of Analog Front-End Circuitry for Avalanche Photodiodes (APD) and Silicon Photo-Multipliers (SiPM) in Time-of-Flight Applications (2018)
73. Claire Tsagkari – Design, Fabrication and Testing of a Capacitive Sensor Using Delta-Sigma Modulation (2017)
72. Kevin Buck – Fast Transient Digitizer and PCB Interface (2015)
71. Marzieh Sharbat Maleki (2015)
70. Angsuman Roy – Design, Fabrication and Testing of Monolithic Low-Power Passive Sigma-Delta Analog-to-Digital Converters (2015)
69. Daniel Anderson – Design and Implementation of an Instruction Set Architecture and Instruction Execution Unit for the RZ9 Coprocessor System (2014)
68. Jared Gordon – Design and Fabrication of an Infrared Optical Pyrometer ASIC (2013)
67. Justin Butterfield (2012)
66. Adam Johnson – Methods and Considerations for Testing Resistive Memories (2012)
65. Ben Millemon – CMOS Characterization, Modeling, and Circuit Design in the Presence of Random Local Variation (2012)
64. Justin Wood (2012)
63. Chamunda Ndinawe Chamunda (2011)
62. Gary VanAckern – Design Guide for CMOS Process On-Chip 3D Inductors using Thru-Wafer Vias (2011)
61. Lucien Jan Bissey – High-Voltage Programmable Delta-Sigma Modulation Voltage-Control Circuit (2010)
60. Kaijun Li (2010)
59. Yingting Li (co-supervised with Maria Mitkova) (2010)
58. Lael Matthews (co-supervised with Said Ahmed-Zaid) (2010)
57. Priyanka Mukeshbhai Parikh (2010)
56. Todd Plum (co-supervised with Jeff Jessing) – Design and Fabrication of a Chemicapacitive Sensor for the Detection of Volatile Organic Compounds (2010)
55. Rahul Srikonda (2010)
54. Avani Falgun Trivedi (2010)
53. Kuang Ming Yap – Gain and Offset Error Correction for CMOS Image Sensors using Delta-Sigma Modulation (2010)
52. Mahesh Balasubramanian – Phase Change Memory - Array Development and Sensing Circuits using Delta-Sigma Modulation (2009)
51. Lincoln Bollschweiler (2009)
50. Shantanu Gupta (2009)
49. Qawi Harvard – Wide I_O DRAM Architecture Utilizing Proximity Communication (2009)
48. Avinash Rajagiri (2009)
47. Ramya Ramarapu (2009)
46. Harikrishna Rapole (2009)
45. Aruna Vadla (2009)
44. Hemanth Ande (2008)
43. Curtis Cahoon – Low-Voltage CMOS Temperature Sensor Design using Schottky Diode-Based References (2008)
42. Prashanth Busa (2008)
41. John McCoy III (2008)
40. Dennis Montierth – Using Delta-Sigma-Modulation for Sensing in a CMOS Imager (2008)
39. Rudi Rashwand (2008)
38. Barsha Shrestha (co-supervised with Zhu Han) – Wireless Access in Vehicular Environments using Bit Torrent and Bargaining (2008)
37. Eric Becker – Design of an Integrated Half-Cycle Delay Line Duty Cycle Corrector Delay Locked Loop (2007)

36. Matthew Leslie – Noise-Shaping Sense Amplifier for Cross-Point Arrays (2007)
35. Jose Monje (2007)
34. Sanghyun Park (2007)
33. Vishal Saxena – Indirect Feedback Compensation Techniques for Multi-Stage Operational Amplifiers (2007)
32. Meshack Appikarla (2006)
31. Eric Booth – Wide Range, Low Jitter Delay-Locked Loop Using a Graduated Digital Delay Line and Phase Interpolator (2006)
30. Sucheta Das (2006)
29. Krishna Duvvada – High Speed Digital CMOS Input Buffer Design (2006)
28. Krishnamraju Kurra (2006)
27. Soumya Narasimhan (2006)
26. Roger Porter (2006)
25. David Butler – Low-Voltage Bandgap Reference Design Utilizing Schottky Diodes (2005)
24. Dragos Dimitriu (2005)
23. Surendranath Eruvuru – Sensing Circuit Design for an Ion Mobility Spectrometer (2005)
22. Sandhya Sandireddy (2005)
21. Harish Singidi (2005)
20. Indira Vemula – Delta-Sigma Modulator Used in CMOS Imagers (2005)
19. Bhavana Kollimarla – A 1-Bit Analog-to-Digital Converter Using Delta Sigma Modulation for Sensing in CMOS Imagers (2004)
18. Sandeep Pemmaraju – High Voltage Charge Pump Circuit for an Ion Mobility Spectrometer (2004)
17. Ravindra Puthumbaka – Circuit Design for an Ion Mobility Spectrometer (2004)
16. Brandon Roth – Comparison of Asynchronous vs. Synchronous Design Technologies using a 16-bit Binary Adder (2004)
15. Jennifer Taylor – Reading and Writing Flash Memory Using Delta-Sigma Modulation (2004)
14. Jing Plaisted – Methods for Memory Testing (2003)
13. Murugesh Subramaniam – Flash Memory Sensing Using Averaging (2003)
12. Brian Johnson – Application of an Asynchronous FIFO in a DRAM Data Path (2002)
11. Scott Ward – Electrostatic Discharge (ESD) Protection in CMOS (2002)
10. Tyler Gomm – Design of a Delay-Locked Loop with a DAC-Controlled Analog Delay Line (2001)
9. Gexin Huang (2001)
8. Chris Atkins (2000)
7. Thaddeus Black (2000)
6. Zuxu Qin (2000)
5. Hao Chen (1999)
4. Doug Hackler (co-supervised with Steve Parke) – TMOS: A Novel Design for MOSFET Technology (1999)
3. Song Liu – Design of a CMOS 6-bit Folding and Interpolating Analog-to-Digital Converter (1999)
2. Ben Ba (1997)
1. Brent Keeth – A Novel Architecture for Advanced High Density Dynamic Random Access Memories (1996)

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152. Baker, R. J., "Quantizing circuits having improved sensing," **10,658,018**, May 19, 2020.
151. Baker, R. J., "Quantizing circuits having improved sensing," **10,403,339**, September 3, 2019.
150. Baker, R. J., "Digital Filters with Memory," **10,366,744**, July 30, 2019.
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148. Baker, R. J. and Parkinson, W., "NMOS regulated voltage reference," **9,753,481**, September 5, 2017.
147. Baker, R. J., "Digital Filters with Memory," **9,734,894**, August 15, 2017.
146. Baker, R. J. and Keeth, B., "Optical interconnect in high-speed memory systems," **9,697,883**, July 7, 2017
145. Baker, R. J., "Comparators for delta-sigma modulators," **9,641,193**, May 2, 2017.
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143. Baker, R. J., "Error detection for multi-bit memory," **9,336,084**, May 10, 2016.
142. Baker, R. J. and Keeth, B., "Optical interconnect in high-speed memory systems," **9,299,423**, March 29, 2016.

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140. Baker, R. J., "Comparators for delta-sigma modulators," **9,135,962**, September 15, 2015.
139. Baker, R. J., "Resistive memory element sensing using averaging," **9,081,042**, July 14, 2015.
138. Baker, R. J., "Digital Filters with Memory," **9,070,469**, June 30, 2015.
137. Baker, R. J., "Reference current sources," **8,879,327**, November 4, 2014.
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134. Baker, R. J., "Quantizing circuits with variable parameters," **8,830,105**, September 9, 2014.
133. Baker, R. J., "Integrators for delta-sigma modulators," **8,754,795**, June 17, 2014.
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128. Baker, R. J., "Reference current sources," **8,675,413**, March 18, 2014.
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126. Linder, L. F., Renner, D., MacDougall, M., Geske, J., and Baker, R. J., "Dual well read-out integrated circuit (ROIC)," **8,581,168**, November 12, 2013.
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119. Baker, R. J., "Digital Filters for Semiconductor Devices," **8,149,646**, April 3, 2012.
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117. Baker, R. J., "Integrators for delta-sigma modulators," **8,102,295**, January 24, 2012.
116. Baker, R. J., "Devices including analog-to-digital converters for internal data storage locations," **8,098,180**, January 17, 2012.
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114. Baker, R. J., "Quantizing circuits with variable parameters," **8,089,387**, January 3, 2012.
113. Baker, R. J., "Reference current sources," **8,068,367**, November 29, 2011.
112. Baker, R. J., "Methods of quantizing signals using variable reference signals," **8,068,046**, November 29, 2011.
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110. Baker, R. J., "Memory with correlated resistance," **7,969,783**, June 28, 2011.
109. Baker, R. J. and Keeth, B., "Optical interconnect in high-speed memory systems," **7,941,056**, May 10, 2011.
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106. Lin, F. and Baker, R. J., "Phase splitter using digital delay locked loops," **7,873,131**, January 18, 2011.
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99. Baker, R. J., "Quantizing circuits with variable reference signals," **7,733,262**, June 8, 2010.
98. Baker, R. J., "Quantizing circuits for semiconductor devices," **7,667,632**, February 23, 2010.
97. Baker, R. J., and Beigel, K. D., "Multi-resistive integrated circuit memory," **7,642,591**, January 5, 2010.
96. Baker, R. J., "Offset compensated sensing for a magnetic random access memory," **7,616,474**, November 10, 2009.
95. Baker, R. J., "Resistive memory element sensing using averaging," **7,577,044**, Aug. 18, 2009.
94. Baker, R. J., "Quantizing circuits with variable parameters," **7,538,702**, May 26, 2009.
93. Baker, R. J., "Method and system for reducing mismatch between reference and intensity paths in analog to digital converters in CMOS active pixel sensors," **7,528,877**, May 5, 2009.
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91. Taylor, J. and Baker, R. J., "Method and apparatus for sensing flash memory using delta-sigma modulation," **7,495,964**, February 24, 2009.
90. Baker, R. J., "Noise resistant small signal sensing circuit for a memory device," **7,489,575**, February 10, 2009.
89. Baker, R. J., "Per column one-bit ADC for image sensors," **7,456,885**, November 25, 2008.
88. Staples, T. and Baker, R. J., "Input buffer design using common-mode feedback," **7,449,953**, November 11, 2008.
87. Li, W., Schoenfeld, A., and Baker, R. J., "Method and apparatus for providing symmetrical output data for a double data rate DRAM," **7,421,607**, September 2, 2008.
86. Baker, R. J., "Methods for resistive memory element sensing using averaging," **7,372,717**, May 13, 2008.
85. Taylor, J. and Baker, R. J., "Method and apparatus for sensing flash memory using delta-sigma modulation," **7,366,021**, April 29, 2008.
84. Hush, G. and Baker, R. J., "Method of operating a complementary bit resistance memory sensor and method of operation," **7,366,003**, April 29, 2008.
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28. Baker, R. J., "High speed digital signal buffer and method," **6,683,475**, January 27, 2004.
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15. Miller, J., Schoenfeld, A., Ma, M., and Baker, R. J., "Method and apparatus for improving the performance of digital delay locked loop circuits," **6,316,976**, Nov. 13, 2001.
14. Keeth, B. and Baker, R. J., "Low skew differential receiver with disable feature," **6,256,234**, July 3, 2001.
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8. Baker, R. J., "Fully-differential amplifier," **5,953,276**, September 14, 1999.
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6. Hush, G. and Baker, R. J., "Field emission display having pulsed capacitance current control," **5,894,293**, April 13, 1999.
5. Baker, R. J., "Adaptively biased voltage regulator and operating method," **5,874,830**, February 23, 1999.
4. Hush, G. Baker, R. J., and Voshell, T., "Serial to Parallel Conversion with a Phase-Locked Loop," **5,818,365**, October 1, 1998.
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2. Wilson, A. J., Baker, R. J., and Schoenfeld, A., "Waveshaping circuit generating two rising slopes for a sense amplifier pulldown device," **5,614,856**, March 25, 1997.
1. Hush, G., Baker, R. J., and Voshell, T., "Serial to Parallel Conversion with a PLL," **5,598,156**, January 28, 1997.

INVITED TALKS (PARTIAL LISTING)

- Harvard, Q. I. and Baker, R. J., "Low-Power, High-Bandwidth, and Ultra-Small Memory Module Design," a presentation covering semiconductor packaging, DRAM architectures, and I/O circuits. The goal of this work is to investigate replacing the currently used dual in-line memory modules (DIMMs) with a smaller and a lower power memory module, a "Nano-Module."
- Baker, R. J., and Campbell, K. A., "Reconfigurable Analog Electronics using the Memristor."
- Baker, R. J., and Saxena, V., "A K-Delta 1-Sigma Modulator for Wideband Analog-to-Digital Conversion."
- Li, K., Saxena, V., and Baker, R. J., "The Baker ADC: An Overview,"
- Saxena, V., and Baker, R. J., "High-Speed Op-Amp Design: Compensation and Topologies for Two and Three Stage Designs,"
- Baker, R. J., "Circuit Design for MLC Flash: Towards a Semiconductor Replacement for the Hard Disk Drive."

- Baker, R. J., Terman Award Acceptance Speech, given at the Frontiers in Education Conference (FIE 2007), Milwaukee, WI, October 11, 2007.
- Baker, R. J., "The One-Transistor, One-Capacitor (1T1C) Dynamic Random Access Memory (DRAM), and its Impact on Society," presented at the Franklin Institute, in the symposium honoring Dr. Robert H. Dennard and his receipt of the 2007 Benjamin Franklin Medal in Electrical Engineering, April 25, 2007.
- Baker, R. J. and Saxena, V., "Design of Bandpass Delta-Sigma Modulators: Avoiding Common Mistakes."
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EXPERT WITNESS EXPERIENCE (LAST 4 YEARS)

The law firms and clients (underlined) whom I have provided expert witness services in electrical and computer engineering are listed below. I have been deposed 94 times, given expert testimony at 12 trials (7 USITC, 2 D. Del., 1 Arbitr., 1 S.D. Cal., and 1 E.D. Tex.), and participated in 1 mediation.

Bracewell LLP (New York, NY and Seattle, WA)

Case – Kioxia America, Inc. and Kioxia Corporation v. BiTMICRO LLC

Case Numbers – IPR2023-00741, IPR2023-00742, and IPR2023-00743. Petitions filed on March 23, 2023.

Case Subject Matter – Solid-state storage devices utilizing multi-profile memory controllers. Optimizing memory operations in a memory system suitable for use in an electronic storage device. Supplying energy to a cache memory using a supercapacitor.

Work Performed – Provided expert consulting services and wrote declarations for inter partes reviews.

Bookoff McAndrews, PLLC (Washington, DC)

Case – Lenovo Inc. and Motorola Mobility LLC v. Theta IP, LLC

Case Numbers – IPR2023-00694, IPR2023-00697, and IPR2023-00698. Petitions filed on March 7, 2023.

Case Subject Matter – Power in wireless communication circuits.

Work Performed – Provided expert consulting services and wrote declarations for inter partes reviews.

McDermott Will & Emery LLP (Chicago, IL and Austin, TX)

Case – Xilinx, Inc. v. Polaris Innovations Limited

Case Numbers – IPR2023-00513 and IPR2023-00514. Petitions filed on February 6, 2023.

Case Subject Matter – Methods for terminating a memory chip with various termination resistances and output drivers for integrated circuits.

Work Performed – Provided expert consulting services and wrote declarations for inter partes reviews.

Norton Rose Fulbright LLP (Austin, TX and Dallas, TX)

Case – Current Lighting Solutions, LLC d/b/a GE Current v. Jiaxing Super Lighting Electric Appliance Co., Ltd.

Case Number – IPR2023-00270. Petition filed on December 19, 2022.

Case Number – IPR2023-00271. Petition filed on December 14, 2022.

Case Subject Matter – LED lighting, lamps, tube lamps, assembly, and associated circuits and electronics.

Work Performed – Provided expert consulting services and wrote declarations for inter partes review.

Paul Hastings LLP (Washington, DC)

Case – Ex Parte Reexaminations

Case Numbers – 90/015155 and 90/015156. Requests filed on November 7, 2022.

Case Number – 90/015134. Request filed on October 14, 2022.

Case Number – 90/015130. Request filed on September 30, 2022.

Case Subject Matter – Packaging and fabrication of light emitting diodes (LEDs).

Work Performed – Provided expert consulting services and wrote declaration.

Sheppard, Mullin, Richter & Hampton LLP (Menlo Park, CA)

Case – Bell Semiconductor, LLC v. NXP, SMC, Micron, Nvidia, Advanced Micro Devices (AMD), Acer, Infineon, Qualcomm, Motorola Mobility, and Western Digital

Case Number – ITC Investigation No. 337-TA-1340. Complaint filed October 6, 2022.

Case Subject Matter – Electronic devices, semiconductor devices, and components.

Work Performed – Provided expert consulting services.

O'Melveny & Myers LLP (Los Angeles, CA)

Case – Daedalus Prime LLC v. Samsung Electronics and TSMC

Case Number – ITC Investigation No. 337-TA-1335. Complaint filed September 12, 2022.

Case Subject Matter – Semiconductor devices, mobile devices, and components.

Work Performed – Provided expert consulting services.

DLA Piper (Chicago, IL and Washington, DC)

Case – Ampt, LLC v. SolarEdge Technologies, Inc.

Case Number – ITC Investigation No. 337-TA-1327. Complaint filed July 28, 2022.

Case Subject Matter – Solar power optimizers, inverters, and components.

Work Performed – Provided expert consulting services including writing declarations for claim construction, expert reports, and was deposed.

Paul Hastings LLP (Austin, TX and Washington, DC)

Case – Samsung Electronics Co., Ltd. v. Scramoge Technology Ltd.

Case Numbers – IPR2022-01052, IPR2022-01053, and IPR2022-01058. Petitions filed on May 26, 2022.

Case Numbers – IPR2022-01054, IPR2022-01055, IPR2022-01056, and IPR2022-01057. Petitions filed on May 24, 2022.

Case Number – IPR2022-00939. Petition filed on April 29, 2022.

Case Subject Matter – An antenna that supports wireless charging.

Work Performed – Provided expert consulting services and wrote declarations for inter partes reviews.

Orrick, Herrington & Sutcliffe LLP (Houston, TX, Irvine, CA, and Menlo Park, CA)

Case – Ex Parte Reexaminations

Case Number – 90/015020. Request filed on May 2, 2022.

Case Number – 90/014906. Request filed on November 12, 2021.

Case Number – 90/014899. Request filed on November 10, 2021.

Case Number – 90/014888. Request filed on October 21, 2021.

Case Numbers – 90/014886 and 90/014887. Requests filed on October 20, 2021.

Case Number – 90/014885. Request filed on October 19, 2021.

Case Subject Matter – Universal Serial Bus (USB) for charging.

Work Performed – Provided expert consulting services and wrote declarations.

DLA Piper (Chicago, IL, Austin, TX, and Washington, DC)

Case – SolarEdge Technologies, Inc. v. Fronius International GMBH

Case Number – IPR2022-00849. Petition filed on April 14, 2022.

Case Subject Matter – Mechanical assembly and enclosure whereby an upper housing part is detached from a lower housing part using a “rotate-and-lift” feature.

Work Performed – Provided expert consulting services and wrote declaration for inter partes review.

Kirkland & Ellis LLP (New York, NY)

Case – Samsung Electronics Co. v. Sonrai Memory Ltd.

Case Numbers – IPR2022-00305 and IPR2022-00306. Petitions filed on December 10, 2021.

Case Subject Matter – USB devices and circuits for saving power.

Work Performed – Provided expert consulting services including writing declarations for inter partes reviews.

Haynes and Boone, LLP (Washington, DC)

Case – Unified Patents, LLC v. Arigna Technology Limited

Case Number – IPR2022-00285. Petition filed on December 9, 2021.

Case Subject Matter – High voltage driver circuit for driving power devices such as insulated gate bipolar transistors (IGBTs).

Work Performed – Provided expert consulting services, wrote declaration for inter partes review and was deposed.

Paul Hastings LLP (Washington, DC)

Case – Samsung Electronics Co., Ltd. v. Lynk Labs, Inc.

Case Numbers – IPR2022-00149 and IPR2022-00150. Petitions filed on November 12, 2021

Case Numbers – IPR2022-00100 and IPR2022-00101. Petitions filed on October 28, 2021.

Case Numbers – IPR2022-00051, IPR2022-00052, and IPR2022-00098. Petitions filed on October 27, 2021.

Case Numbers – IPR2021-01575 and IPR2021-01576. Petitions filed on October 1, 2021.

Case Numbers – IPR2021-01299, IPR2021-01300, IPR2021-01345, IPR2021-01346, and IPR2021-01347. Petitions filed on September 7, 2021.

Case Subject Matter – Circuit design, including switching power supply design, rectifiers, power factor correction, etc. for lighting and displays using light emitting diodes (LEDs).

Work Performed – Provided expert consulting services, wrote declarations, and was deposed ten times.

Haynes and Boone, LLP (Plano, TX)

Case – Pure Storage, Inc. v. Digital Cache, LLC

Case Number – IPR2022-00121. Petition filed on October 29, 2021.

Case Subject Matter – Non-volatile memory (NVM) devices capable of retaining stored data in case of a power failure.

Work Performed – Provided expert consulting services and wrote declaration for inter partes review.

Banner Witcoff (Washington, DC)

Case – SolarEdge Technologies Ltd. v. Koolbridge Solar, Inc.

Case Numbers – IPR2022-00007, IPR2022-00008, IPR2022-00009, IPR2022-00010, IPR2022-00011, and IPR2022-00012. Petitions filed on October 11, 2021.

Case Numbers – IPR2022-00013, IPR2022-00014, and IPR2022-00015. Petitions filed on October 8, 2021.

Case Subject Matter – DC-to-AC converters using full-bridges, multi-level conversion for power systems, and other electronics for harvesting solar energy.

Work Performed – Provided expert consulting services, wrote declarations for inter partes reviews, and was deposed.

Paul Hastings LLP (Austin, TX and Washington, DC)

Case – Samsung Electronics Co., Ltd. v. LED Wafer Solutions LLC

Case Number – IPR2021-01554. Petition filed on September 20, 2021.

Case Number – IPR2021-01526. Petition filed on September 10, 2021.

Case Number – IPR2021-01506. Petition filed on September 7, 2021.

Case Number – IPR2021-01491. Petition filed on September 3, 2021.

Case Subject Matter – Packaging of light emitting diodes (LEDs).

Work Performed – Provided expert consulting services and wrote declarations.

Paul Hastings, LLC (Washington, DC)

Case – Ex Parte Reexamination

Case Number – 90/014,846. Request filed on August 30, 2021.

Case Subject Matter – Wireless power transmission and ways to wirelessly charge and/or discharge a battery.

Work Performed – Provided expert consulting services and wrote declaration.

Jones Day (San Diego, CA and Pittsburgh, PA)

Case – SOLiD, Inc. v. CommScope Technologies LLC

Case Numbers – IPR2021-01390, IPR2021-01391, IPR2021-01392, IPR2021-01393, and IPR2021-01394. Petitions filed on August 12, 2021.

Case Subject Matter – Digital antenna system that enables extension of radio frequency (RF) analog signals from base stations to areas (e.g., inside of buildings) where access to such signals is inhibited.

Work Performed – Provided expert consulting services for inter partes reviews and wrote declaration.

Unified Patents, LLC (Washington, DC)

Case – Ex Parte Reexamination

Case Number – 90/019,015. Request filed on July 20, 2021.

Case Subject Matter – Voltage-controlled oscillator (VCO) temperature compensation.

Work Performed – Provided expert consulting services and wrote declaration.

Winston & Strawn LLP (Dallas, TX and Palo Alto, CA)

Case – Micron Technology, Inc.; Micron Semiconductor Products, Inc.; Micron Technology Texas LLC v. Unification Technologies LLC

Case Numbers – IPR2021-00940, IPR2021-00941, and IPR2021-00942. Petitions filed on June 4, 2021.

Case Subject Matter – Solid-State Drive (SSD), flash non-volatile memory management, memory controller operation and addressing.

Work Performed – Provided expert consulting services for inter partes reviews and wrote declarations.

Hill, Kertscher & Wharton, LLP (Atlanta, GA)

Case – Kaijet Technology v. Sanho Corporation

Case Number – IPR2021-00886. Petition filed on April 30, 2021.

Case Subject Matter – Port extension apparatus for headphone jack, USB (Universal Serial Bus or Type-C ports), and video ports such as VGA (Video Graphics Array), DVI (Digital Visual Interface), HDMI (High-Definition Multimedia Interface), DP (Display Port), and mini-DP.

Work Performed – Provided expert consulting services for inter partes review, wrote declaration, was deposed.

O'Melveny & Myers LLP (Los Angeles, CA and New York, NY)

Case – Solas OLED LTD. v. Samsung Electronics Co. LTD.

Case Number – Texas, ED (Marshall) 2:21-cv-00105. Complaint filed March 22, 2021.

Case Subject Matter – Touch-sensors for gesture recognition and signal processing for capacitive touch displays.

Work Performed – Provided expert consulting services including writing declaration for claim construction.

O'Melveny & Myers LLP (San Francisco, CA)

Case – Super Interconnect Technologies LLC v. Google LLC

Case Number – Texas, ED (Marshall) 2:18-cv-00463 (complaint filed November 2, 2018) and Texas, WD (Waco) 6:21-cv-00259 (complaint filed March 15, 2021).

Case Subject Matter – Transmission of data and clock signals. Serial signals such as transition minimized differential signaling. Communications between processors and non-volatile storage such as Universal Flash Storage (UFS) and embedded MultiMedia Controller (eMMC).

Work Performed – Provided expert consulting services and wrote expert reports.

Orrick, Herrington & Sutcliffe LLP (Houston, TX, and Irvine, CA)

Case – Fundamental Innovation Systems International LLC v. Anker Innovations and Fantasia Trading LLC d/b/a Ankerdirect

Case Number – Delaware, 1:21-cv-00339. Complaint filed on March 5, 2021.

Case Subject Matter – Universal Serial Bus (USB) for charging mobile devices.

Work Performed – Provided expert consulting services.

Orrick, Herrington & Sutcliffe LLP (Houston, TX, Irvine, CA, and Menlo Park, CA)

Case – TCT Mobile Inc. and TCL Communication, Inc. v. Fundamental Innovation Systems International LLC

Case Numbers – IPR2021-00597, IPR2021-00598, and IPR2021-00599. Petitions filed on February 26, 2021.

Case Number – IPR2021-00428. Petition filed on January 13, 2021.

Case Number – IPR2021-00410. Petition filed on January 11, 2021.

Case Number – IPR2021-00395. Petition filed on December 31, 2020.

Case Subject Matter – Universal Serial Bus (USB) for charging mobile devices.

Work Performed – Provided expert consulting services including writing declarations for inter partes reviews. Was deposed twice.

Paul Hastings LLP (Austin, TX and Washington, DC)

Case – Samsung, Inc. v. Pictos Technologies, Inc.

Case Number – IPR2021-00557. Petition filed on February 18, 2021.

Case Number – IPR2021-00436. Petition filed on January 19, 2021.

Case Numbers – IPR2021-00437 and IPR2021-00438. Petitions filed on January 15, 2021.

Case Subject Matter – Solid-state imaging devices including red, green, and blue pixels, data conversion circuits, and interpolation circuits. CMOS imagers including fabrication and design, active pixels, and semiconductor physics.

Work Performed – Provided expert consulting services and wrote declarations for inter partes reviews.

O'Melveny & Myers LLP (San Francisco, CA) and DLA Piper (New York, NY)

Case – Solas OLED Ltd. v. BOE Technology Group Co. Ltd. and Samsung Electronics

Case Number – ITC Investigation No. 337-TA-1243. Complaint filed January 5, 2021.

Case Subject Matter – Active matrix OLED display devices and components

Work Performed – Provided expert consulting services, wrote expert reports, was deposed, and testified at trial.

Paul Hastings LLP (Washington, DC)

Case – Samsung, Inc. v. Garrity Power Services LLC

Case Number – IPR2021-00389. Petition filed on December 31, 2020.

Case Subject Matter – Power electronics including full-bridge PWM modules for wireless power transmission using magnetic coupling via antennas and transformers. Design of inductors and coils.

Work Performed – Provided expert consulting services and wrote declaration for inter partes reviews.

Morgan, Lewis & Bockius LLP (Palo Alto, CA and Shanghai, CN)

Case – Monolithic Power Systems, Inc. v. Meraki Integrated Circuit Technology, Inc. and Promate Electronic Company, LTD.

Case Number – Texas, WD (Waco) 6:20-cv-00876. Complaint filed on December 24, 2020.

Case Subject Matter – Design of switching power supplies including synchronous rectification.

Work Performed – Provided expert consulting services including declaration for claim construction, trade secret analysis and declaration, and Markman tutorial.

Winston & Strawn LLP (Dallas, TX and Palo Alto, CA)

Case – Micron Technology, Inc.; Micron Semiconductor Products, Inc.; Micron Technology Texas LLC; Dell Technologies Inc.; Dell Inc.; and HP Inc. v. Unification Technologies LLC

Case Numbers – IPR2021-00343, IPR2021-00344, and IPR2021-00345. Petitions filed on December 22, 2020.

Case Subject Matter – Solid-State Drive (SSD), flash non-volatile memory management, memory controller operation and addressing.

Work Performed – Provided expert consulting services for inter partes reviews, wrote declarations, and was deposed.

Jones Day (Chicago, IL and Dallas, TX)

Case – WSOU Investments, LLC d/b/a Brazos Licensing and Development v. Xilinx, Inc.

Case Numbers – Delaware, 1:20-cv-01231 and Delaware, 1:20-cv-01233. Complaints filed on November 23, 2020 and September 16, 2020.

Case Subject Matter – Controlling power cycles in communication devices and transferring multiple asynchronous clock signals.

Work Performed – Provided expert consulting services, wrote claim construction declaration, wrote expert reports, and was deposed.

O'Melveny & Myers LLP (Los Angeles, CA)

Case – Cosemi Technologies, Inc. v. EverPro Technologies, Fibbr Technologies, Logitech, Inc., and Facebook Technologies

Case Number – ITC Investigation No. 337-TA-1233. Complaint filed October 28, 2020.

Case Subject Matter – Data cables, including HDMI, Display Port, and USB Type A, USB Type C and USB Type A/C data cables.

Work Performed – Provided expert consulting services.

Kirkland & Ellis LLP (Boston, MA and New York, NY)

Case – Pictos Technologies, Inc. v. Samsung Electronics Co., LTD. and Samsung Semiconductor, Inc.

Case Number – ITC Investigation No. 337-TA-1231. Complaint filed September 25, 2020.

Case Subject Matter – Solid-state imaging devices including red, green, and blue pixels, correction of bad pixels, data conversion circuits, and interpolation circuits. CMOS imagers including fabrication and design, active pixels, and semiconductor physics.

Work Performed – Provided expert consulting services and wrote expert report.

Orrick, Herrington & Sutcliffe LLP (Houston, TX, Irvine, CA, and Menlo Park, CA)

Case – Fundamental Innovation Systems International LLC v. TCT Mobile Inc. and TCL Communication, Inc.

Case Number – Delaware, 1:20-cv-00552. Complaint filed on September 11, 2020.

Case Subject Matter – Universal Serial Bus (USB) for charging mobile devices.

Work Performed – Provided expert consulting services including writing declarations, expert report on invalidity, and was deposed.

Walters Wilson LLP (Redwood City, CA)

Case – Western Digital Corporation and SanDisk, LLC v. Martin Kuster

Case Numbers – IPR2020-01410 and IPR2020-01411. Petitions filed on August 3, 2020.

Case Subject Matter – Computer connectors such as universal serial bus (USB) that connect to peripheral devices such as mice, keyboards, displays, printers, external storage, etc.

Work Performed – Provided expert consulting services for inter partes review, wrote declarations and was deposed.

O'Melveny & Myers LLP (Los Angeles, CA)

Case – Advanced Micro Devices, Inc. v. Monterey Research, LLC

Case Number – IPR2020-01315. Petition filed on July 16, 2020.

Case Number – IPR2020-00985. Petition filed on May 26, 2020.

Case Subject Matter – Reading and writing to semiconductor memory such as SRAM and double data rate (DDR) DRAM. Buffer circuits with variable current supplies for controlling the rise and fall times of output signals.

Work Performed – Provided expert consulting services for inter partes review, wrote declarations and was deposed twice.

Winston & Strawn LLP (Dallas, TX and Palo Alto, CA)

Case – Unification Technologies LLC v. Micron Technology, Inc.; Micron Semiconductor Products, Inc.; Micron Technology Texas LLC

Case Number – Texas, WD (Waco) 6:20-cv-00500. Complaint filed June 5, 2020.

Case Subject Matter – Solid-State Drive (SSD), flash non-volatile memory management, memory controller operation and addressing.

Work Performed – Provided expert consulting services, wrote declaration for claim construction, and was deposed.

Ari Law, P.C. (Palo Alto, CA) and Hill, Kertscher & Wharton, LLP (Atlanta, GA)

Case – Sanho Corporation v. Kaijet Technology, Magic Control Technology, and Star View Global

Case Numbers – Georgia, ND (Atlanta) 1:18-cv-05385 (third amended complaint filed November 14, 2019) and Georgia, ND (Atlanta) 1:20-cv-02150 (filed May 19, 2020).

Case Subject Matter – Port extension apparatus for headphone jack, USB (Universal Serial Bus or Type-C ports), and video ports such as VGA (Video Graphics Array), DVI (Digital Visual Interface), HDMI (High-Definition Multimedia Interface), DP (Display Port), and mini-DP.

Work Performed – Provided expert consulting services, wrote declaration for claim construction, and expert reports. Was deposed.

Orrick, Herrington & Sutcliffe LLP (Houston, TX, Irvine, CA, and Menlo Park, CA)

Case – Fundamental Innovation Systems International LLC v. Coolpad Group Limited, Coolpad Technologies, Inc., and Yulong Computer Telecommunication Scientific Co. Ltd.

Case Number – Texas, ED (Marshall) 2:20-cv-00117. Complaint filed on April 23, 2020.

Case Subject Matter – Universal Serial Bus (USB) for charging mobile devices.

Work Performed – Provided expert consulting services including writing declaration for claim construction.

Pillsbury Winthrop Shaw Pittman LLP (San Francisco, CA and Shanghai, China)

Case – SMIC, Americas v. Innovative Foundry Technologies LLC

Case Numbers – IPR2020-00837 and IPR2020-00839. Petitions filed on April 14, 2020.

Case Subject Matter – Methods of manufacturing a semiconductor component, such as a short-channel MOS device, including forming graded-junctions using spacers along the sidewalls of a transistor's gate.

Work Performed – Provided expert consulting services for inter partes reviews and wrote declarations.

Russ August & Kabat (Los Angeles, CA)

Case – Oyster Optics, LLC v. Ciena Corporation

Case Number – California, ND (Oakland) 3:20-cv-02354. Complaint filed on April 7, 2020.

Case Subject Matter – Fiber optic telecommunication systems.

Work Performed – Provided expert consulting services, wrote claim construction declaration, and was deposed.

Russ August & Kabat (Los Angeles, CA)

Case – Seoul Semiconductor Co., Ltd. v. Document Security Systems, Inc.

Case Number – IPR2020-00938. Petition filed on May 18, 2020.

Case – Nichia Corporation v. Document Security Systems, Inc.

Case Number – IPR2020-00908. Petition filed on May 18, 2020.

Case – Cree, Inc. v. Document Security Systems, Inc.

Case Number – IPR2020-00557. Petition filed on February 11, 2020.

Case Subject Matter – Light emitting diodes (LEDs) as a light source, extraction of light.

Work Performed – Provided expert consulting services, wrote declaration for inter partes reviews, and was deposed three times.

Paul Hastings LLP (Austin, TX and Washington, DC)

Case – Flex Logix Technologies, Inc. v. Konda Technologies Inc.

Case Numbers – IPR2020-00260, IPR2020-00261, and IPR2020-00260. Petitions filed on December 16, 2019.

Case Numbers – PGR2019-00037, PGR2019-00040, and PGR2019-00042. Petitions filed on March 18, 2019.

Case Subject Matter – FPGA layout routing for integrated circuits and networks, electrical and computer engineering.

Work Performed – Provided expert consulting services and wrote declarations for post grant and inter partes reviews.

DLA Piper (Chicago, IL, Houston, TX, and Washington, DC) and White & Case LLP (New York, NY and Washington, DC)

Case – M-Red Inc. v. Panasonic Corporation

Case Number – Texas, ED (Marshall) 2:19-cv-00251. Complaint filed on July 16, 2019.

Case Subject Matter – Integrated circuit electronics adjustment, such as ring oscillators, using auto calibration.
Evaluating a known good die using both wire and flip-chip interconnects.

Work Performed – Provided expert consulting services and wrote declaration for claim construction.

Paul Hastings LLP (Austin, TX and Washington, DC)

Case – Samsung, Inc. v. NuCurrent, Inc.

Case Number – IPR2019-01217. Petition filed on June 19, 2019.

Case Numbers – PGR2019-00049 and PGR2019-00050. Petitions filed on May 28, 2019.

Case Numbers – IPR2019-00858, IPR2019-00859, IPR2019-00860, IPR2019-00861, IPR2019-00862, and IPR2019-00863. Petitions filed on March 22, 2019.

Case Subject Matter – Wireless power transmission using magnetic coupling via antennas and transformers.
Design of inductors and coils.

Work Performed – Provided expert consulting services and wrote declarations for post grant and inter partes reviews. Was deposed five times.

DLA Piper (East Palo Alto, CA)

Case – Invensas Corporation and Tessera Advanced Technologies, Inc. v. NVIDIA Corporation

Case Number – Delaware, 1:19-cv-00861. Complaint filed on May 8, 2019.

Case Subject Matter – Reference voltage circuits (programmable bandgaps) having a substantially zero temperature coefficient using bipolar and MOS transistors.

Work Performed – Provided expert consulting services.

Irell & Manella LLP (Los Angeles, CA)

Case – VLSI Technology LLC v. Intel Corporation

Case Number – Texas, WD (Waco) 6:19-cv-00256. Complaint filed on April 11, 2019.

Case Subject Matter – Static Random Access Memory (SRAM) having a variable power supply using charge-sharing capacitors, methods for designing digital systems, and hardware managed interrupt control.

Work Performed – Provided expert consulting services, wrote expert reports, declaration, and was deposed.

Paul Hastings LLP (Austin, TX and Washington, DC)

Case – Samsung, Inc. v. ProMOS Technologies, Inc.

Case Numbers – IPR2019-00779, IPR2019-00780, IPR2019-00781, IPR2019-00784, and IPR2019-00785. Petitions filed on March 5, 2019.

Case Subject Matter – Programmable latches that include non-volatile programmable elements, digital delay elements, and decoders for memory chips.

Work Performed – Provided expert consulting services, wrote declarations for inter partes reviews, and was deposed four times.