SMART TECHNOLOGY SYSTEMS – STS

ETA Environmental Controls endorsement to the STS

Competency Requirements

There are **two** levels of expertise for those who install and integrate smart electronics technology into structural systems which are residential and light commercial properties. **STS** installation technicians are responsible for interconnecting electronics communications, data, computer, control or entertainment equipment and converging signals into one faultless system. The two levels for those installation technicians are the **Basic STS**, Basic Smart Technology Systems and the **Master STS**, Smart Technology Systems Master (STSma).

The **BASIC STS** installation technician is proficient in the design of pre-wiring and wireless architectures in residential/light commercial for entertainment, internet of things, and telecommunications equipment interconnections. This will include installation of network wiring for TV, satellite and antenna outlets, voice equipment outlets, audio and video, media streaming, and computer equipment in such a manner that all control and communication signals can be integrated at the home or business system controller and converged into one cogent local network bit stream, to either be used within the system or to be passed back and forth through the system gateway. He/she will be proficient in the many protocols used over diverse media to communicate with and control an array of electronics systems, in addition to the skills required for low voltage wiring installation. Prior CAT, DCI, DVE, FOI, FOT, FOT-OSP, TTT certification is highly recommended to be proficient in STS skills. The Basic STS installation technician will work from telecommunications wireless and wiring plans, installing cable fittings and selecting the specified cabling for each technology and identifying wireless equipment requirements. He/she will test, mark and document all cabling and will have the ability to troubleshoot and restore pre-existing cabling and wireless systems. A Basic STS installation technician typically will also be qualified in one or more of four (4) endorsement specialty areas listed below.

The **MASTER STS** (STSma) will be proficient in **all** of the core STS skills and knowledge including planning and designing the layout for electronics and communications equipment systems for new construction and retro-fit/remodeling. The MASTER STS is capable of designing the entire system and network for audio, video, data and control of security and environment to function in one local network bit stream converged at the system controller. He/she is also capable of troubleshooting, debugging and optimizing the system of planned installations or modifications. The MASTER STS has extensive knowledge of the operation and technology and is proficient in each of the basic and four endorsements of STS electronics.

STS CERTIFICATION PROGRAM overview:

- **Basic STS**:

The Basic **STS** installation technician can become certified with ETA® International by passing the knowledge examination assessments, based on the **STS BASIC Skills & Knowledge Competency**.

In addition, **STS** certification holders can also acquire one or more of the four (4) endorsement certifications, as listed below:

1. **Audio-Video**
2. **Computer Networking**
3. **Environmental Controls**
4. **Security-Surveillance**

- **MASTER STS:**

The **MASTER STS** certification prerequisites include successfully completing the Basic STS certification requirements, plus earning **each** of the four (4) STS endorsements.
To qualify for the ETA **MASTER STS**, Smart Technology Systems Master, a technician must:

- Hold the STS Basic certification
- Hold each of the four (4) specialty endorsements
- Pass the separate Master STS examination

ETA STS Environmental Controls Endorsement (STS-EC)

Skills and Knowledge Competencies

Refer to the **BASIC STS** Competencies as the foundation for these E.C. endorsement competencies
There are several aspects to the control of a building's environment. For this specific endorsement, the environment for a building or home is defined as it's lighting, heating- venting- air conditioning (HVAC), along with inside features and outside features such as remote door entry, energy, curtains, aquariums, pools, ponds, water fountains and water sprinklers.

1.0 Lighting

- 1.1 Describe basic lighting controls, on/off switch, dimmer switch, wireless and voice control
  - 1.1.1 Identify how led color lighting controls work
  - 1.1.2 Identify what types of controls are needed for lights:
    - 1.1.2.1 Incandescent
    - 1.1.2.2 Compact Fluorescent lamp (CFL)
    - 1.1.2.3 Light emitting diode (LED)
  - 1.1.3 Explain how remote relay lighting switches work
- 1.2 Compare common remote control methods and list advantages or disadvantages of each
- 1.3 Explain time or event automatic control operation
  - 1.3.1 Identify how lighting integrated with sensors can save energy
- 1.4 Describe how lighting can be programmed for multiroom, multi-time and zone control
- 1.5 Identify how Li-Fi (light fidelity wireless communication technology) can turn LED lamps into internet and broadcast data transmitters
  - 1.5.1 Explain types of optical wireless communications
    - 1.5.1.1 Visible light
    - 1.5.1.2 Infrared (IR) light
- 1.6 Explain the purposes and reasons for technician adherence to National Electrical Code® (NEC®) and the other National Fire Protection Association® (NFPA®) codes for wiring (see STS-Basic competency 1.4)
  - 1.6.1 Describe wire size (conductor) choices and distribution for residences and light commercial electrical circuitry (see STS-Basic Comp.6.3)

2.0 Computer Interfacing

- 2.1 Describe a small building local area computer network - LAN
- 2.2 Compare Bus, Star, Ring and Mesh network configurations
- 2.3 Compare Z-Wave®, Zigbee, IEEE 802.15.4 (LR-WPAN), Bluetooth® (802.15.1) short range wireless and Universal Powerline Bus (UPB) technologies (see STS-Basic Comp.2.3.2 & 3.8)
- 2.4 List hardware components needed for small building network systems
  - 2.4.1 List additional wireless hardware required for automated control of lights, locks, motors, stepper motors, and HVAC units
  - 2.4.2 Identify how wireless sensors can be integrated into a small building LAN
- 2.5 Compare available small building automation hardware and software
  - 2.5.1 Identify how smart hubs are integrated into a LAN
  - 2.5.2 Identify how a UPB can be integrated into a LAN
    - 2.5.2.1 Explain the function of a signal bridge used for UPB systems
- 2.6 List usage of wireless control of elements of the small building/home automation/control system
  - 2.6.1 Explain how "If This, Then That" IFTTT scripts or "recipes" are used to develop rules for managing automated processes within a building (STS-Basic Comp.8.3.3)
- 2.7 Describe the role an STS may assume in implementing the completed control installation and programming/configuration of a system
- 2.8 Identify how computers can be used for energy monitoring and control of Photovoltaic and Wind systems integrated with a whole building energy management system
  - 2.8.1 Explain how data can be collected from small energy sources
  - 2.8.2 Identify how a building's energy consumption and savings can be used for LEED certification (Leadership in Energy and Environmental Design standards from the U.S. Green Building Council)
  - 2.8.3 Identify what building-Integrated photovoltaics (BIPV) are and how they can be used to convert buildings into electricity producers

3.0 Computer Control

- 3.1 List commercially available computer control applications and programs for small building or home control and automation
- 3.2 Identify the different types of voice activated systems available:
  - 3.2.1 Describe how voice activated systems can be programmed
- 3.3 Describe the computer encoding steps required to control a small building or home environmental control system
- 3.4 Identify how mobile devices can be used to manage a small building environment
- 3.5 Explain the difference between Fog and Cloud computing as they relate to storing and managing data generated and used by IoT devices (Internet of Things)
  - 3.5.1 Identify what types of IoT data can be stored and used to manage building environments

4.0 Sensors and Actuators

- 4.1 Describe where and how sensors (i.e., water, rain, temperature, motion, etc.) are used
  - 4.1.1 Explain where and how data from sensors is used
  - 4.1.2 Explain the safety features of an oxygen depletion sensor
  - 4.1.3 Explain how chemical sensors can be used to monitor the water conditions of pool water, fountains, and fish tanks
  - 4.1.4 Identify the uses of liquid level sensors and how they are applied
- 4.2 Describe actuators and relays along with their applications
  - 4.2.1 Describe how an actuator can be used to ignite a gas fireplace or heating system
  - 4.2.2 Explain how an actuator can open and close valves and vent dampers
  - 4.2.3 Explain how relays can be used by thermostats to control actuators in duct dampers and intelligent (smart) vents
    - 4.2.3.1 Differentiate between a smart vent and a duct-work damper
- 4.3 Differentiate between a Passive Infrared (PIR) sensor and a motion sensor

5.0 Needs Assessment

- 5.1 Explain the considerations involved in planning the control system and in tying it in with the other small building and home technologies:
  - 5.1.1 Documentation
  - 5.1.2 Compliance with local or state codes (Authorities Having Jurisdiction –AHJ)
- 5.2 Explain the steps in establishing timetables for:
  - 5.2.1 Customer approval
  - 5.2.2 Product procurement
  - 5.2.3 Installation sequences

6.0 HVAC (heating- venting- air conditioning) Interfacing

- 6.1 Identify various types of HVAC systems:
  - 6.1.1 Heat Pump
  - 6.1.2 Electric resistance heat furnace and air conditioner
  - 6.1.3 Gas heat
  - 6.1.4 Explain how a distributed heating and cooling system works and is used within a building
  - 6.1.5 Identify the characteristics of a centralized heating and cooling system
  - 6.1.6 Differentiate between a forced air system, boiler/hot water system and heat pump
- 6.2 Identify basic HVAC terminology used in designing a system for a building
  - 6.2.1 Explain the difference between BTUs (British Thermal Units) and a SEER (seasonal energy efficiency ratio) rating
    - 6.2.1.1 Explain how Coefficient of Performance (COP) helps evaluate systems
  - 6.2.2 Identify the components of a packaged HVAC system
    - 6.2.2.1 Identify the components of an air handler
    - 6.2.2.2 Identify the function of a heat exchanger
    - 6.2.2.3 Explain how the plenum and ductwork distribute air within a building
  - 6.2.3 Explain how a “whole house” fan works
  - 6.2.4 Identify the different types of thermostats and how they are used
    - 6.2.4.1 Explain how and where to place a thermostat for optimum performance
    - 6.2.4.2 Describe the options a control system may offer for programming thermostat control of living and machine areas in HVAC processes
    - 6.2.4.3 Explain how a staging thermostat provides control for a multistage HVAC system

6.2.4.4 Explain how automated thermostat controls can save energy
6.2.4.5 Explain how a zoned cooling and heating system works
6.2.4.5.1 Identify how a single thermostat with multiple sensors can control temperatures within multiple rooms
6.2.4.5.2 Explain how to integrate Smart Vents with thermostats and other smart devices
6.2.4.6 Describe how a smart thermostat can cut energy consumption using geo-location, weather forecasts, and integrated building characteristics

6.3 Describe the advantages of interfacing apps on the network with the heating, ventilation and cooling system of a small building or home

7.0 System Control

7.1 Describe how programmable logic controls (PLCs) are utilized in small building control systems
7.2 Describe the smart building/home technology and how it may be the most practical control method for some applications
7.3 Describe the different types of controller apps available for building and home automation
7.4 Event Recording and Storage
7.4.1 Explain how event sequences can be incorporated into a small building control system and the advantages of doing so
7.4.2 Describe why and how a building's events data may be accessed

8.0 Implementation

8.1 Explain how lawn water sprinkler systems can be incorporated into a building's control system, mechanically connected and programmed
8.1.1 Explain how irrigation supply lines are connected
8.1.1.1 Identify sprinkler irrigation supply line equipment requirements
8.1.2 Identify irrigation programming techniques
8.1.3 Explain how controller systems are connected
8.2 Explain how other building features both indoors and outdoors such as remote door entry, curtains, water fountains and fish tanks are interfaced and controlled by a building automation system
8.3 Describe how water features such as spas, hot tubs, ponds and pools may need different control algorithms than other building features
8.3.1 Identify filtration processes required for building water features
8.3.2 Identify chemical additives required to maintain building water systems
8.3.3 Explain how water feature processes and events can be automated
8.4 Describe how the entire system can be controlled and accessed via wireless or phone connections from remote locations

End of SMART TECHNOLOGY SYSTEMS ENVIRONMENTAL CONTROLS Endorsement Competency

Suggested Additional Environmental Controls Resource and Study Material:

National Electrical Code®, 2020; National Fire Protection Assn., Sept.,2019; www.nfpa.org
Commercial Low-Voltage Wiring; Brooks, Stroud; ISBN 978-1581220858; Marcraft, ETG Brand; 2012
Cabling: The Complete Guide to Copper and Fiber-Optic Networking, 5E; Oliviero & Woodward; ISBN 978-1118807323; Sybex, Inc.; 2014; softcover; 1284 ppg**.** Available through ETA 800-288-3824, www.eta-i.org
Introduction to Low Voltage Systems, 2E; DiPaola & DiPaola; ISBN 978- 1111639532; Delmar Cengage Learning; 2012; (with Lab Manual, ISBN 978-1111639549)
Residential Wiring and Smart Home Technology; Rockis & Rockis; ISBN 978- 0826918338; ATP; 2018
Cybersecurity Essentials, 1st Ed; Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short; ISBN 978-1119362395; Sybex; Oct.2018; 784 pgs
Telecommunications and Data Communications Handbook; Ray Horak; ISBN 978-0470041413; Wiley-Interscience; September 2007; Paperback; 791 ppg**.**
Sound Systems: Design and Optimization: Modern Techniques and Tools for Sound System Design and Alignment, 3E; Bob McCarthy; ISBN 978-0415731010; Routledge; 2016; 600 ppg**.**
Practical Home Theater: A Guide to Video and Audio Systems (2018 Edition); Mark Fleischmann; ISBN 978-1932732191; Quiet River Press, LLC; October 2017; 284(Xperi owned ppg**.**
RESI library; Charles J. Brooks with Max Main, eITPrep LLP, Marcraft: **5 texts in Basic, A&V, CN, EC, and S&S;** ISBNs various; 2007 - 2009;
Residential Integration Series library; Cengage Learning Delmar; **4 texts in Basic, P.M., Certification, and Integration;** ISBNs various; 2006 - 2008;
HTI+ Certification Concepts & Practice, v.2, Gerard O'Driscoll, Stuart C. Palmer, Whitney G. Freeman, Grigory Ter-Oganov, Jason T. Ho; Marcraft; ISBN 978-1581220704; 2004; 551 pgs

Many webpages and links are available searching online, some examples are:

http://www.eta-i.org/smart_home.html
https://www.caba.org/
https://www.buildinggreen.com/leed
http://simply-automated.com/index.php
https://www.hvac.com/faq/
https://www.smarthome.com
https://smarterhouse.org/heating-systems/types-heating-systems
https://seia.org/initiatives/building-integrated-photovoltaics
https://www.xperi.com/markets/home-solutions/?utm_source=top_nav
https://www.z-wave.com/
https://www.zigbee.org/
https://www.bluetooth.com/
https://www.nfpa.org/
https://www.wi-fi.org/
https://lora-alliance.org/
https://standards.ieee.org/standard/
http://www.marcraft.com/RESI.html
https://www.tiaonline.org/
http://www.iec.ch/
https://www.nema.org/pages/default.aspx
https://www.iccsafe.org/
https://www.electronicdesign.com
http://resources.rohde-schwarz-usa.com/c/white-paper-testing-?x=zQSHFI

Call (1-800-288-3824) or contact ETA (eta@eta-i.org) for other white papers, PDFs, power points, etc...
Including **STS Domain 1 training at Education Forum 2019 JB Groves III March 4-6, 2019**

Certified Basic Smart Technology Systems Endorsement Advisory Board:

ETA certification programs are accredited through ICAC, complying with the ISO/IEC 17024 standard.

ICAC International Certification Accreditation Council

