Software in W&M Certification and Inspection

- October 2023

Introduction

- The National Conference on Weights and Measures (NCWM) is a professional nonprofit association of state and local weights and measures officials, federal agencies, manufacturers, retailers and consumers.
  - NCWM has been developing national weights and measures standards since 1905
  - NCWM manages the content of NIST Handbook 44 and Handbook 130
- The National Type Evaluation Program (NTEP) is operated by NCWM. NCWM/NTEP maintain multiple NTEP Publication 14 documents to standardize the laboratory type evaluation procedure and expectations.
- The NTEP Committee has multiple technical subcommittees called 'Sectors' that manage each of the separate Publication 14 documents.
- The Software Sector maintains the Software Technical Policy and Supplemental checklist section of Publication 14 and makes recommendations related to software and software-based devices to the Conference.

Software Sector Role and Goals

- Develop NCWM Pub 14 guidance and supplemental checklist criteria for type evaluation of software / sw-based devices.
- Advise S&T committee on items for HB44 related to software
- Assist in the development of training materials and guidelines for Weights and Measures Inspectors
- Support the NTEP evaluation process and laboratories
- Promote a clear understanding of the use of software in weighing and measuring devices
- Consider the development of guidelines and training aides to educate manufacturers, designers, service technicians and end users

Agenda

- Describe concepts related to software in general and specifically software versioning
- Provide examples of how to identify software versions/revisions on several types of devices, such as retail scales, retail motor fuel dispensers, and LMD indicators.
- Provide an update on how software affects the field inspection process - and what's changing

State of the Art Review

- With the prevalence of the Personal Computer and the Smartphone, the idea of a software application is becoming more widely understood/used
- Many consumer software applications are now acquired online (for example Apple Store, Google Play Store, Xbox Live)
- For Corporations, software applications are typically pushed to the computer by the employer
- For other devices, applications may be built-in, e.g., your cable TV receiver box comes with pre-installed software designed for a specific purpose

State of the Art Review (cont.)

- Parts of a computer system and how they are organized
  - ✓ The computer - a collection of electronic hardware (processor, network card, memory, hard drive, display…)
  - ✓ The operating system software, which contains modules that allow the user (or other software) to access the hardware and organize files
  - ✓ End user applications that allow us to do meaningful things, like browse the web (IE, Chrome), edit documents (Microsoft Word),or create and give presentations (MS PowerPoint)

The Necessity of Software Maintenance

- Software is much more flexible than hardware
- Easy and (relatively) cheap to modify/update
- Ubiquitous networks (Ethernet, WiFi, cellular) make it easy to deliver these revisions
- Downside - these networked devices are now a potential vector that can be used by ill-intentioned individuals or groups to do undesirable stuff
- Bottom Line – Protection is required for mission critical systems

Software Maintenance

- Keeping track of all these updates requires that most chunks of software have some kind of revision or version number (revision and version are used interchangeably).
- The operating system also has a version number, like Windows 10. The Application has a version number, like PowerPoint Version 14.0.7214.5000.
- Which are important to W&M?

HB44 Guidelines on Software

- The NCWM recognizes this and has added some requirements recommended by the Software Sector to the General Code in HB44. The HB44 document currently uses these terms:

  - "**built-for-purpose device**" - any main device or element which was manufactured with the intent that it be used as, or part of, a weighing or measuring device or system. [1.10].

    This is the definition currently in Handbook 44, Appendix D. Definitions, though it is not used verbatim anywhere in Handbook 44.

  - "**not built-for-purpose, software-based device**" – the term that is *actually* used in G-S.1. It is not defined separately beyond the definition above.

HB44 Guidelines on Software

- **G-S.1. (d)** (device shall be marked for identification with…) "the current software version or revision identifier for not built for purpose, software based devices manufactured as of January 1, **2004 and all software-based devices (or equipment) manufactured as of Jan 1, 2022.“**

- **G-S.1. (d) (1) ii.** (the revision number shall be:) "continuously displayed or accessible via the display. Instructions for displaying the version or revision number shall be described in the CC (Certificate of Conformance).

- **G-S.1.1 Note** specifies that the instructions for accessing the relevant software information shall be listed on the Certificate of Conformance.

The Future Is Here

- Indication of current software version is now required for ***all*** software-based devices manufactured as of Jan 1, 2022.
- The implication is that the Certificate of Conformance for all these software-based devices will have instructions explaining how to identify the relevant software version(s) and follow basic rules to make identification of revision straightforward.

Metrologically Significant Software

- **Metrologically Significant Software** - the subset of software modules involved in the process of reading the signal from the transducer(s) up to the first indicated or recorded value of the final quantity on which the transaction is based.

Software Separation

- Note: Manufacturers may choose to separate metrologically significant software from non-metrologically significant software. Separation would allow the revision of the non-metrological portion without the need for further evaluation. In addition, non-metrologically significant software may be updated on devices without breaking a seal, if so designed. Separation of software requires that all software modules (programs, subroutines, objects, etc.) that perform metrologically significant functions or that contain metrologically significant data domains form the metrologically significant software part of a measuring instrument (device or sub-assembly). If the separation of the software is not possible or needed, then the software is metrologically significant as a whole.

Examples

- Examine instructions in certificate of conformance, then look at how each one indicates the software version.

Example 1: Scales

- Many digital scales are now made using the same pattern. For example, the scale shown is a collection of electronic hardware, practically the same as a PC, except is it purpose built.
- Most of the hardware components are the same as in a standard PC, except for the instrument-specific components - the load cell and custom-made integrated housing to contain the hardware.
- Devices are networkable, making it possible to update software

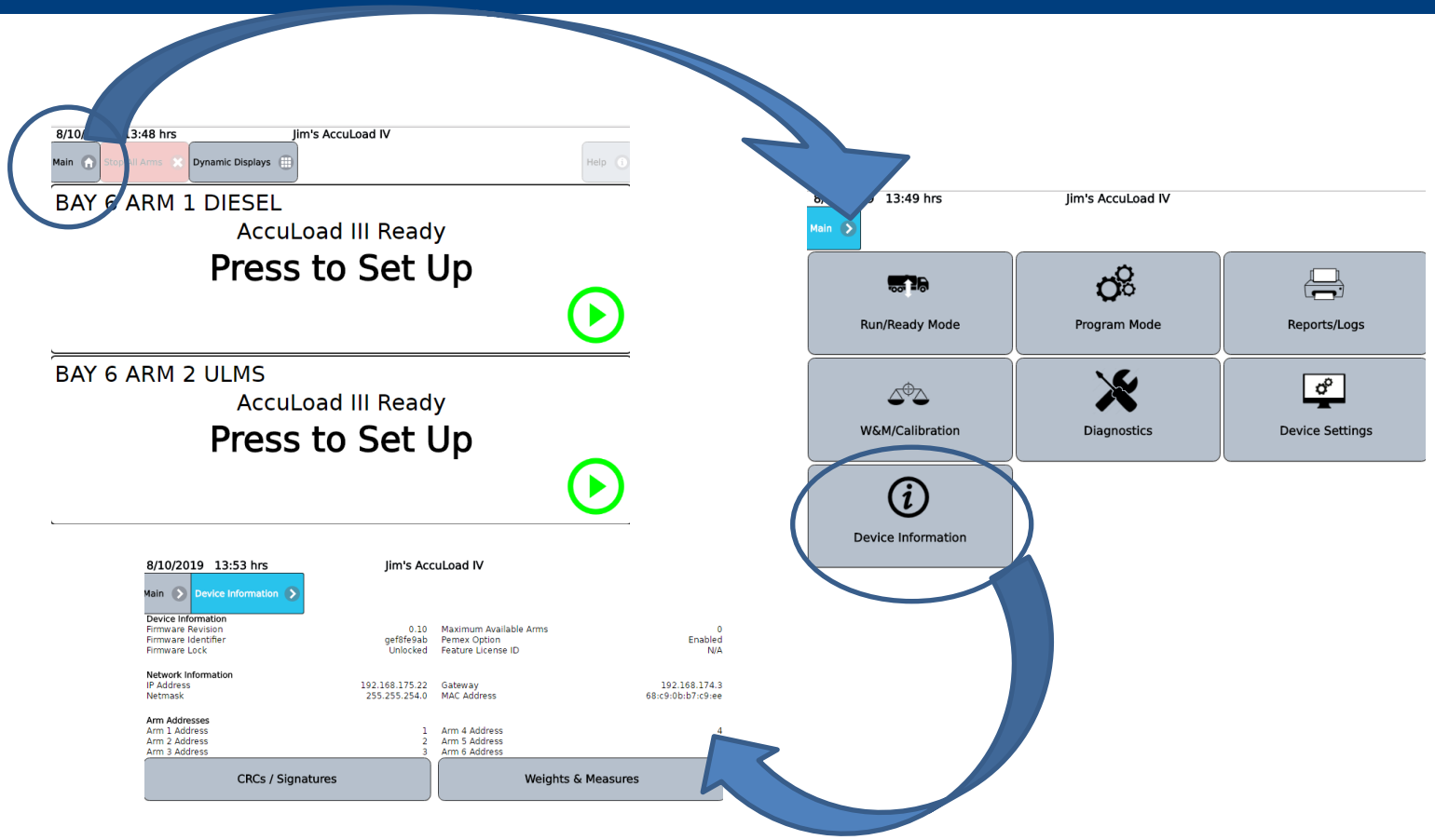
Example 1: Scales - Summary

- Many digital weighing products are made using PC hardware, an off-the-shelf operating system, and a Scale Application.
- Similar systems using tablet and smartphone hardware, mobile phone operating systems like Android and Apple IOS, with a Scale Application at the top level are becoming more prevalent.
- Some mechanism to ensure valid software is in place (and to prevent invalid software from being installed) is important to the design of these devices

Example 2 – LMD

- Wholesale Meter Register (Preset batch controller)
- Like the scale example, utilizes an off-the-shelf OS

Example 2 – LMD (cont.)



Example 2 – LMD - Summary

arrows on the keypad will allow the operator to step through the audit trail.

5. When finished with the audit trail displays, pressing the "CLEAR" key will return the display to the "Diagnostic" menu.

The AccuLoad III Manuals MN06118, MN06122 and MN06129 include an Appendix, which fully describes the audit trail.

Hand Book 44 requirement: The end user must make on site provisions for a personal computer communications link to the AccuLoad III for the purpose of printing the audit trail though the companion AccuMate program, printed Audit Trail information must be available onsite.

AccuLoad IV

1. From the Run/Ready mode screen, touching the "Main" (Home Icon) button will navigate the display back to the main menu.
2. From the main menu display, touching the "Reports/Logs" (Printer Icon) button will display all report and log type functions located under this screen selection.
3. Select the “Audit Trail” (Magnifying Glass Icon) to view the Audit trail log listings starting with the latest entry on top progressing down the list by date and time. The operator may scroll up and down the list by touching the appropriate arrow direction button.
4. Additionally, the Audit Trail screen has a Print button so the audit trail log may be printed on the printer connected to the controller, the user must select the start and end time and date range for the printed report. When finished viewing the audit trail log, touching the “Report/Logs" button on the top of the display will navigate the display back to the "Reports/Logs" menu. To exit this display menu all together, the user must touch the “Exit Icon”, which will transition the display back to the Main Menu.

The AccuLoad IV Manual MN06200 includes a section which describes the audit trail log, parameter security access levels and password security codes.

Example 3: Truck Weigh-in-Motion scale

Example(s) of Device:

Example 3: Truck Weigh-in-Motion scale

Identification: Access to system information is gained by pressing the W&M info icon next to the NTEP Certificate of Conformance (CC) number in the lower right-hand corner on the home screen of the user interface. See Figure 1. You will then see a page that contains the required markings, See Figure 2. The marking requirements and description for the Indicating Element, Weighing/Load Receiving Element, and the Load Cells can be found on the Certificate of Conformance for the element.

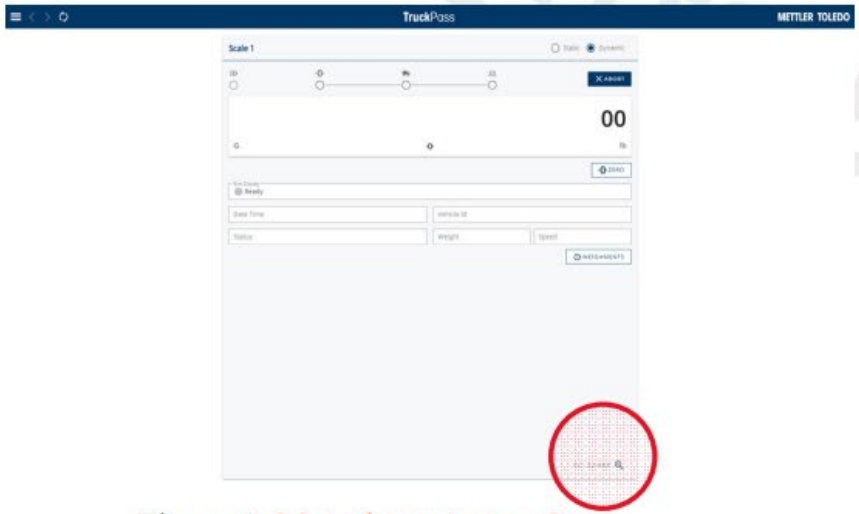


Figure 1, Metrology Access Icon

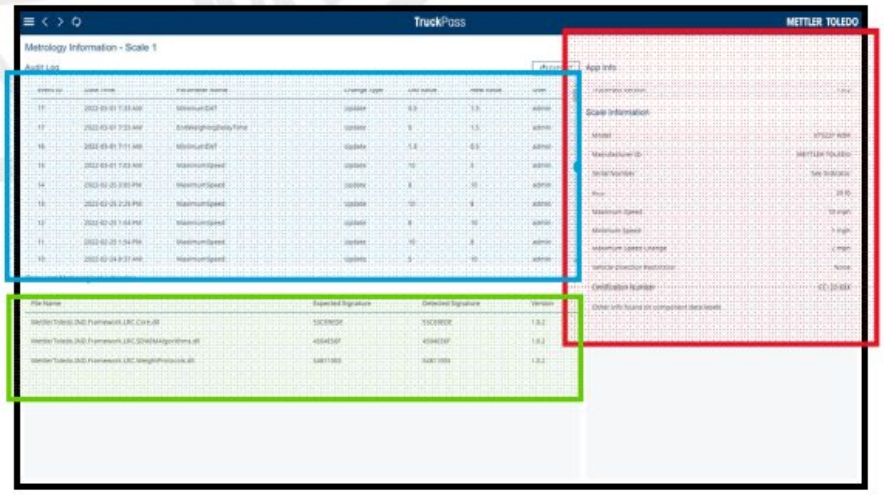


Figure 2, Marking Requirements, Audit Trail, and Software Revision and Sealing

Conclusion

- Weighing and measuring devices containing software typically have the same major components as a PC, including hardware, an operating system, and one or more software applications
- Software revision identification has been historically required only for not-built-for-purpose systems.; this changed on Jan 1, 2022 to include all software-based systems
- The Certificate of Conformance should include explicit instructions on how to identify the software, particularly if it deviates from standard methods