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REVIEWS

Rev	Date	Reviewer	Department

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ABBREVIATIONS

Builder Operator	Operator of the “FW-Update Builder“ assembling the “FW-Update Safe”
Cordonel™	Ultra Sonic Water Meter
Cordonel Service FW-Update	Project name for entire product

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DLL	Dynamic Link Library
FW	Firmware, hardware depending software, here the colletion of all applications
FW-Update Builder	Builder of the “FW-Update Safe”, tool to select all needed components and to encrypt the “FW-Update Safe”
FW-Update Loader	Software for decryption of the “FW-Update Safe” and loader for the “FW-Update Software”
FW-Update Process	The process of installing the firmware in the Cordonel
FW-Update Safe	Encrypted container of all components needed for the “FW-Update Process” during offline operation
FW-Update SW	Software executing the “FW-Update Process”
Genesis	Legacy Name of Cordonel
HW	Hardware
Offline Operation	Without connection to the Xylem-Network
Online Operation	Directly or via VPN connected to the Xylem-Network
PCB ID	Printed Circuit Bord Identifier, unique identification number of the Cordonel HW
SW	Software
Update Opertor	Operator executing the “FW-Update Process“
VPN	Virtual Private Network

Table 1.1 Abbreviations

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1. Introduction

The “Cordonel Service FW-Update“ shall facilitate an update of the Cordonels™ in the field. As this may be somewhere in the desert, without any internet connectivity, the process has to be executed in offline-operation.

1.1 Content

This “Quick Reference Cordonel FW-Update Packet“ document gives an introduction to the entire project. It covers all common and general items.

2. Security Concept

For the “FW-Update Process” the Cordonel has to be unsealed. Therefore the administrator level password is needed. As this has to be delivered to the update operator, security concerns have to be taken into account.

2.1 FW-Update Process

The “FW-Update Process” is permitted exclusively for Xylem/Sensus employees.

2.2 FW-Update Builder

The “FW-Update Builder” is secured by:

- Online Operation is essential for the functionality (data base access, license, data collection),
- Program validation of a specific version taken from the data base, can be deactivated in the data base, program will exit immediately if validation expired,
- Validation refresh on day change,
- Builder Operator licensing, account will be controlled by the data base, the “FW-Update Builder” user interface is locked for disabled user accounts,
- The production data base access is protected by Web-Interfaces.

2.3 FW-Update Safe

The “FW-Update Safe” is a container for all data needed for the update process. As these data are potentially a high risk to the Cordonel access restrictions, these are secured by:

- The “FW-Update Safe” is encrypted with an AES-CGM algorithm and an AES256-Key,
- The safe does only contain the access codes for a selected subset of Cordonels,
- Every safe is strongly linked to a specific update operator,
- Each safe is usable exclusively on a dedicated hardware (Update Operator PC),
- The “FW-Update Safe” is additionally encrypted with a 256 bit random code, this safe cannot be used after new registration (not even an administrator can open this safe anymore),
- The “FW-Update Safe” has a validation date, beyond this date the “FW-Update SW” will become inoperable,
- If the update operator license expires, the builder operator cannot assign new “FW-Update Safes” to this user.

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2.4 FW-Update Loader

The “FW-Update Loader” program is not secured by any license information. This is not needed due to these conditions:

- Each Update Operator has to be registered to be able to decrypt the “FW-Update Safes”,
- As all “FW-Update Safes” are personalized, these can be exclusively decrypted by a specific user,
- One update operator can be registered per user profile on one hardware, multiple users can use the identical hardware but are unable to decode the “FW-Update Safes” of a colleague,
- Changing the hardware will require a new registration, which will automatically invalidate all previously generated “FW-Update Safes”,
- A registration is going to outdate after 21 days. If the update operator is still active, he can refresh this time as often as required,
- Each profile is secured by the Xylem-Password-Policy, every update operator has to be logged in to access his personal folders (Download – for the FW-Update Safes, App Roaming – for specific user settings).

2.5 FW-Update Software

The “FW-Update SW” is secured by:

- Program validation of a specific version and due date contained as license in the “FW-Update Safe”, program will exit immediately if the license has expired,
- The “FW-Update SW” program is part of the “FW-Update Safe”, always the latest version is available to the update operator,
- The “FW-Update SW“ is delivered in an not executable format. The loader is needed to start this software,
- The security relevant data like passwords, license information and “FW-Update Packages” will be directly passed from the “FW-Update Loader” to the “FW-Update Software”. It will never be saved intermediately to the hard disk to avoid reading, copy or modifications.

3. FW-Update Process Security

The process security has to assure, that only validated FW is going to be installed on a specific Cordonel. Furthermore, the “FW-Update Process” has to be fail safe to keep the Cordonel operable, even if the update could not be finalized.

3.1 Early-Check - FW-Update Builder

- Collects data of the Cordonels and the FW-Packages and performs an Update-Capability-Check based on Core version, Metrology version, Size, Region and Radio-Frequency.
- FW-Update Safe contains exclusively approved FW-Packages.

3.2 Late-Check - FW-Update Software

- Compares FW-Package information with installed FW-Version and performs an Update-Capability-Check for the Core version, the installed Metrology and the Region/Radio-Frequency,
- Monitors download status of applications, retries on problems,

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- Executes “burn” command only after successful download.

3.3 Final-Check – Cordonel Bootloader FW

- Cordonel takes exclusively applications with a secured format,
- Update installation will be executed if all required applications are validated,
- If update will be denied, the Pre-Update-FW will be kept as it was, keeping the Cordonel fully functional.

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4. System Overview

The system has two operational modes:

- The online operation, used to collect the data, generate the “FW-Update Safe”, download the “FW-Update Safes” and upload the reports.
- The offline operation which performs the “FW-Update Process”.

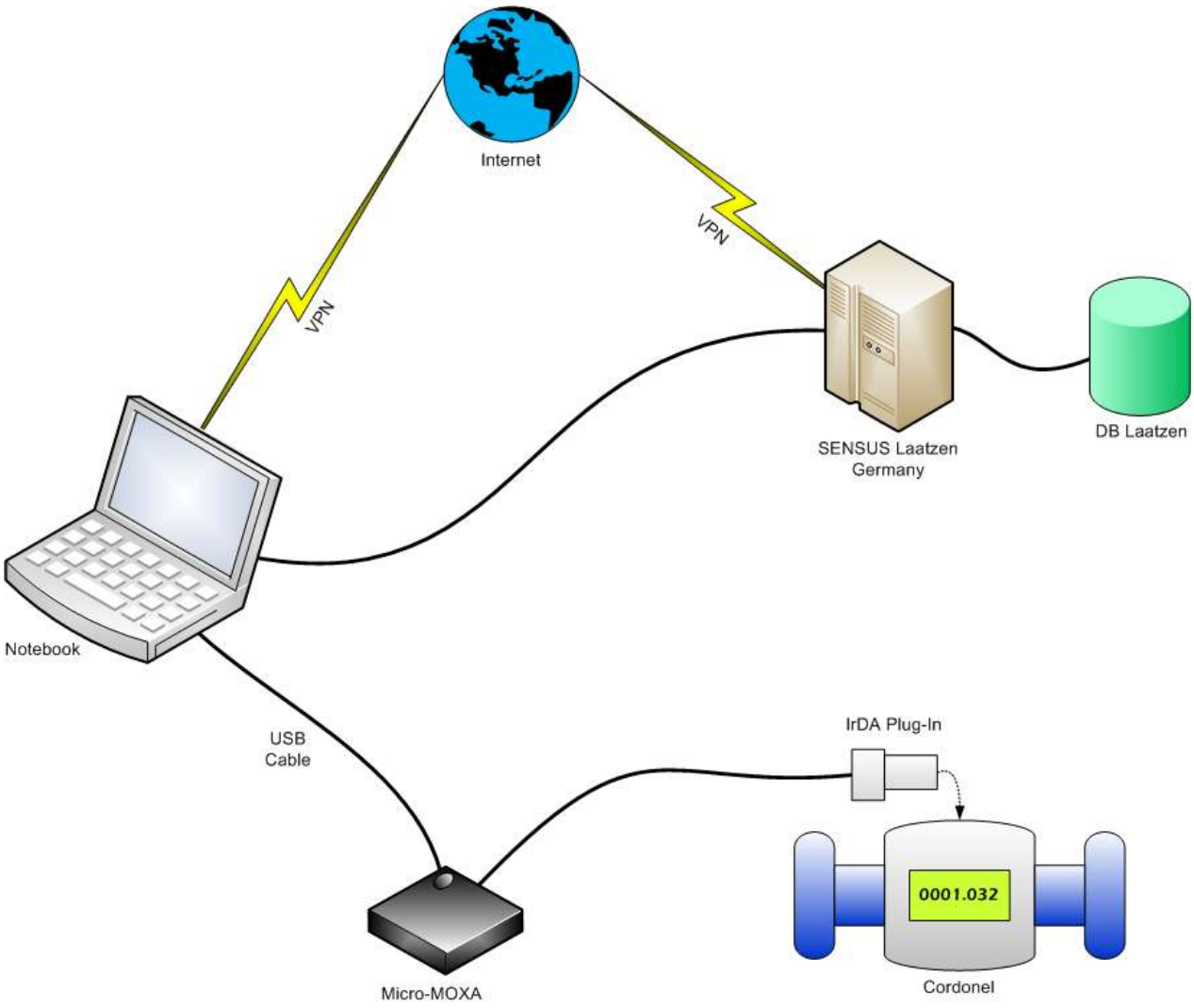


Figure 4.1 System Connections

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The System consists of three software products, the “FW-Update Builder“, the “FW-Update Loader“ and the “FW-Update SW“. Two data containers will be exchanged between the offline and online operation, the encrypted “FW-Update Safe“ and the “FW-Update Reports“.

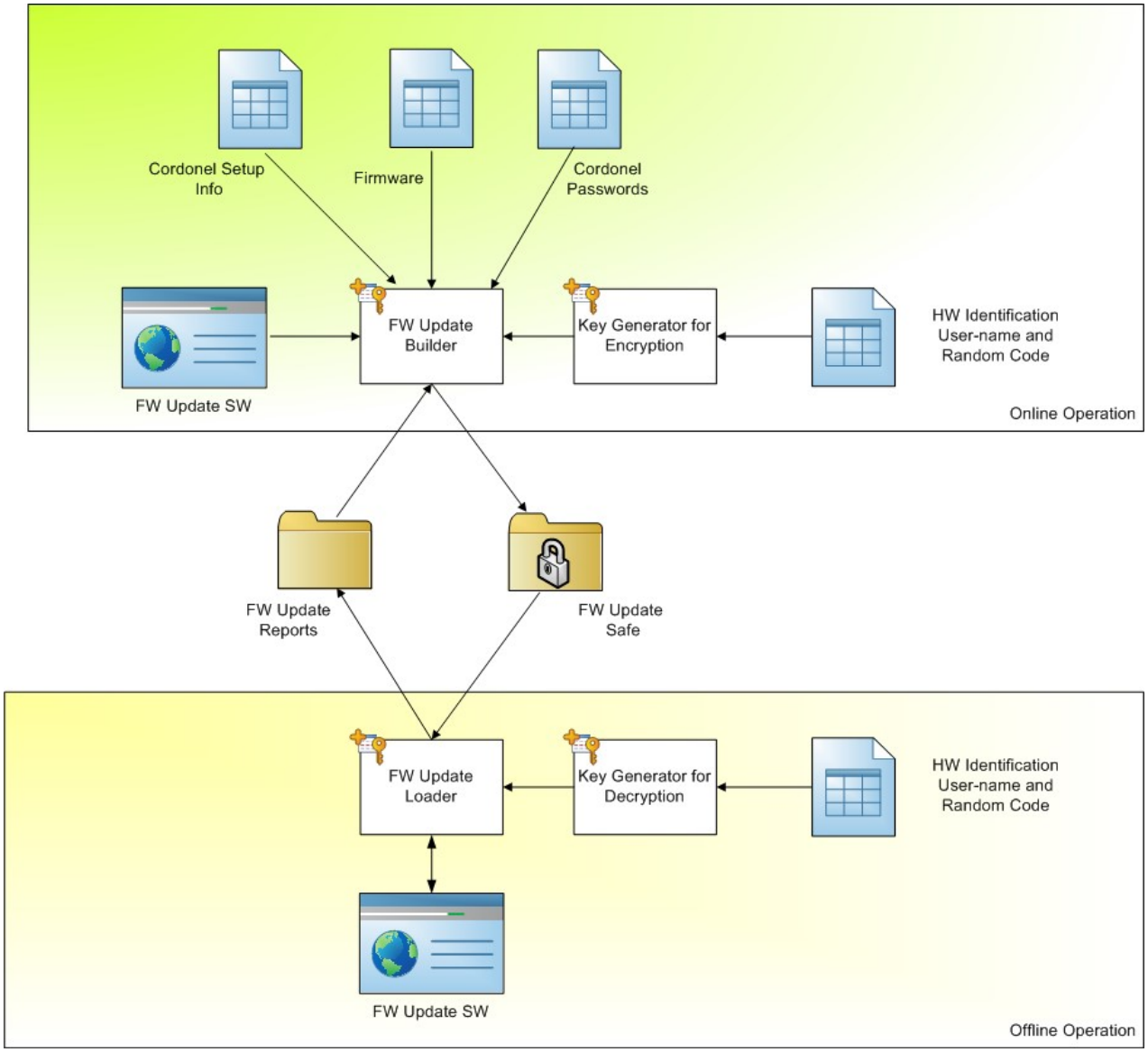


Figure 4.2 System Overview

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4.1 Software Products

The “FW-Update Builder” referenced in [FWU_BLD].

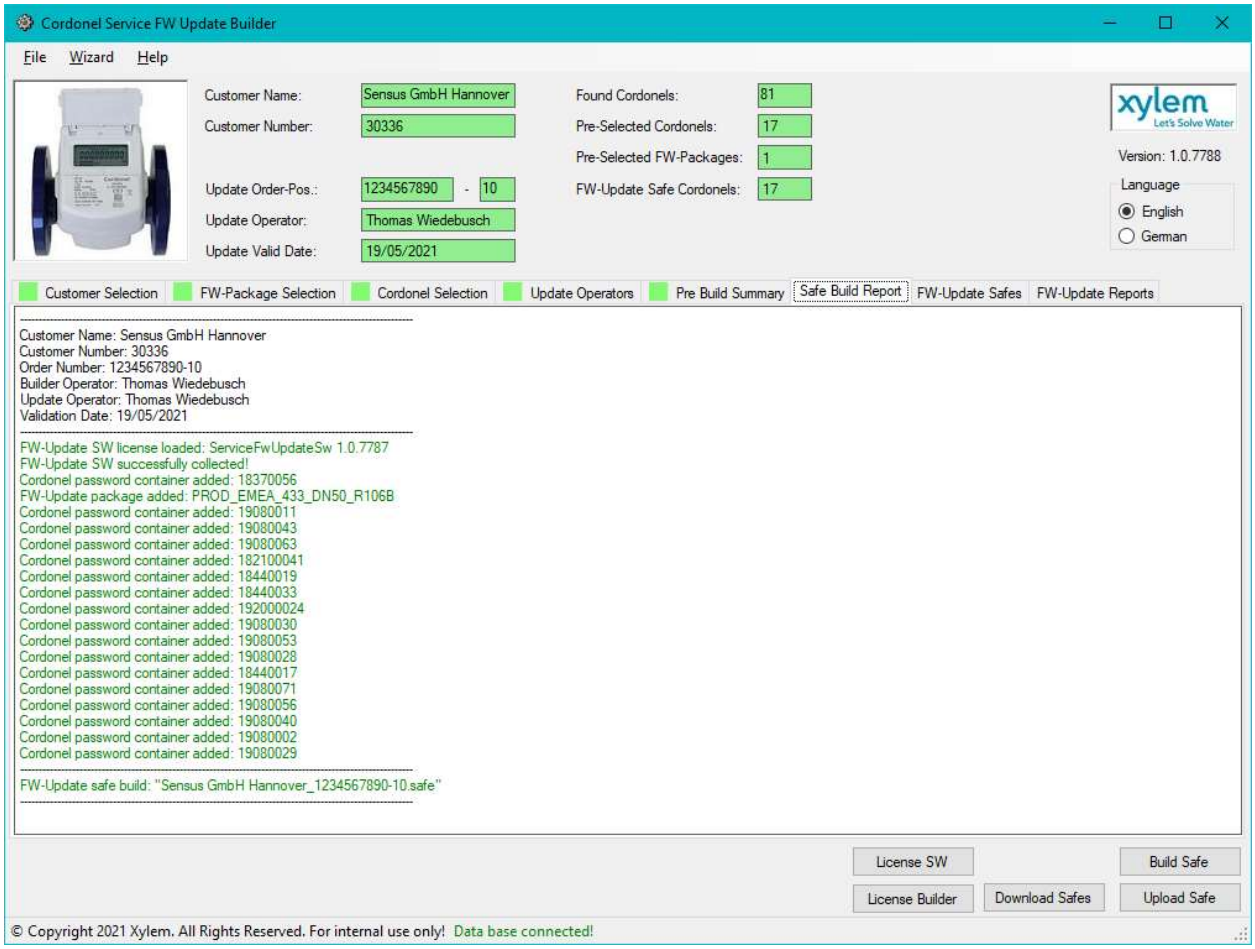


Figure 4.3 FW-Update Builder

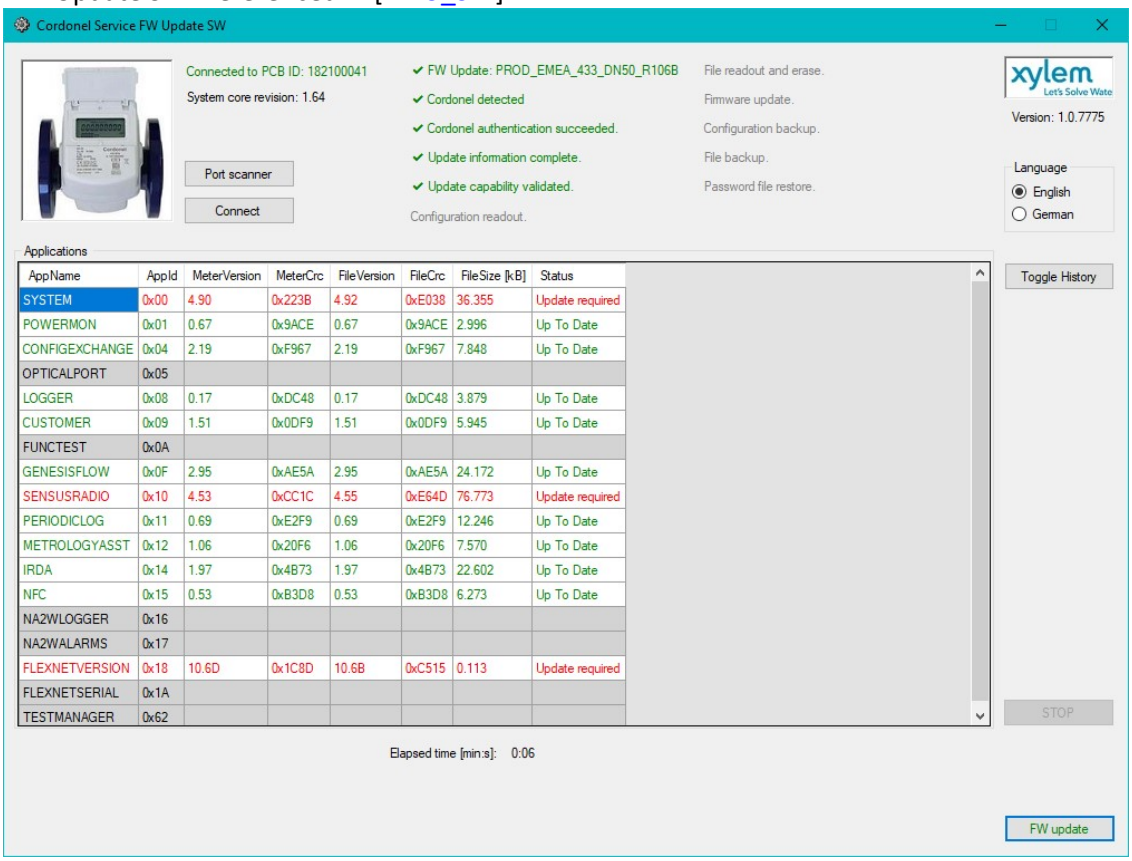
The “FW-Update Loader” referenced in [FWU_LDR].



Figure 4.4 FW-Update Loader

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The “FW-Update SW” referenced in [FWU_SW].



AppName	AppId	MeterVersion	MeterCrc	FileVersion	FileCrc	FileSize [kB]	Status
SYSTEM	0x00	4.90	0x223B	4.92	0xE038	36.355	Update required
POWERMON	0x01	0.67	0x9ACE	0.67	0x9ACE	2.996	Up To Date
CONFIGEXCHANGE	0x04	2.19	0xF967	2.19	0xF967	7.848	Up To Date
OPTICALPORT	0x05						
LOGGER	0x08	0.17	0xDC48	0.17	0xDC48	3.879	Up To Date
CUSTOMER	0x09	1.51	0x0DF9	1.51	0x0DF9	5.945	Up To Date
FUNCTEST	0x0A						
GENESISFLOW	0x0F	2.95	0xAE5A	2.95	0xAE5A	24.172	Up To Date
SENSUSRADIO	0x10	4.53	0xCC1C	4.55	0xE64D	76.773	Update required
PERIODICLOG	0x11	0.69	0xE2F9	0.69	0xE2F9	12.246	Up To Date
METROLOGYASST	0x12	1.06	0x20F6	1.06	0x20F6	7.570	Up To Date
IRDA	0x14	1.97	0x4B73	1.97	0x4B73	22.602	Up To Date
NFC	0x15	0.53	0xB3D8	0.53	0xB3D8	6.273	Up To Date
NA2WLOGGER	0x16						
NA2WALARMS	0x17						
FLEXNETVERSION	0x18	10.6D	0x1C8D	10.6B	0xC515	0.113	Update required
FLEXNETSERIAL	0x1A						
TESTMANAGER	0x62						

Figure 4.5 FW-Update Software

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4.2 Data Containers

The “FW-Update Safe” is the central data exchange container between the “FW-Update Builder” and the “FW-Update Loader”. It contains:

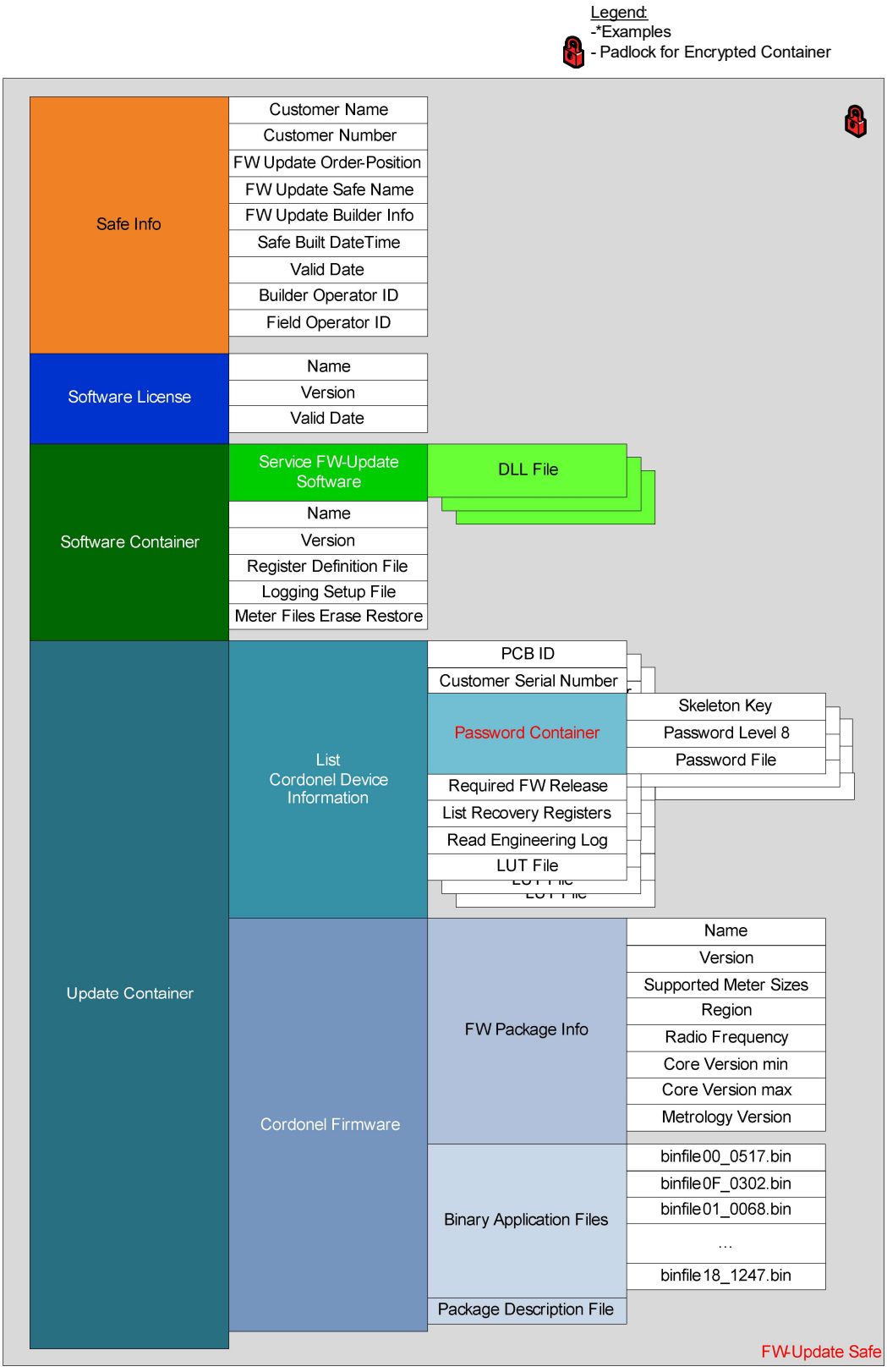


Figure 4.6 FW-Update Safe

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The “FW-Update Report” files are the application list and a readable text file with the update process information. The following listing will show one example (extraction of a few lines before and the after the update):

```
---------------------------------------------------------------------------------------------------
Date: 15/04/2021
FW-Update SW: 1.0.7775
Customer Name: Sensus GmbH Hannover
Order Number: 999991066-99
---------------------------------------------------------------------------------------------------
PCB ID: 182100041
System Core Revision:1.64
Installed applications:
AppId: 0x00 - V: 4.90 - CRC: 0x223B - AppName: SYSTEM
AppId: 0x01 - V: 0.67 - CRC: 0x9ACE - AppName: POWERMON
AppId: 0x04 - V: 2.19 - CRC: 0xF967 - AppName: CONFIGEXCHANGE
AppId: 0x05 - Not installed - AppName: OPTICALPORT
AppId: 0x08 - V: 0.17 - CRC: 0xDC48 - AppName: LOGGER
AppId: 0x09 - V: 1.51 - CRC: 0x0DF9 - AppName: CUSTOMER
AppId: 0x0A - Not installed - AppName: FUNCTEST
AppId: 0x0F - V: 2.95 - CRC: 0xAE5A - AppName: GENESISFLOW
AppId: 0x10 - V: 4.53 - CRC: 0xCC1C - AppName: SENSUSRADIO
AppId: 0x11 - V: 0.69 - CRC: 0xE2F9 - AppName: PERIODICLOG
AppId: 0x12 - V: 1.06 - CRC: 0x20F6 - AppName: METROLOGYASST
AppId: 0x14 - V: 1.97 - CRC: 0x4B73 - AppName: IRDA
AppId: 0x15 - V: 0.53 - CRC: 0xB3D8 - AppName: NFC
AppId: 0x16 - Not installed - AppName: NA2WLOGGER
AppId: 0x17 - Not installed - AppName: NA2WALARMS
AppId: 0x18 - V: 10.6D - CRC: 0x1C8D - AppName: FLEXNETVERSION
AppId: 0x1A - Not installed - AppName: FLEXNETSERIAL
AppId: 0x62 - Not installed - AppName: TESTMANAGER
---------------------------------------------------------------------------------------------------
FW Update: PROD_EMEA_433_DN50_R106B
Update information complete.
Core version is compatible.
Metrology version is approved
Update capability validated.
Reading configuration.....
Reading registers before update
Read register: CONFIGEXCHANGE_ConfigAccessRights - 00-00-01-80 – 384

....


Cordonel authentication succeeded.
---------------------------------------------------------------------------------------------------
Date: 15/04/2021
FW-Update SW: 1.0.7775
Customer Name: Sensus GmbH Hannover
Order Number: 999991066-99
---------------------------------------------------------------------------------------------------
PCB ID: 182100041
System Core Revision:1.64
Installed applications:
AppId: 0x00 - V: 4.92 - CRC: 0xE038 - AppName: SYSTEM
AppId: 0x01 - V: 0.67 - CRC: 0x9ACE - AppName: POWERMON
AppId: 0x04 - V: 2.19 - CRC: 0xF967 - AppName: CONFIGEXCHANGE
AppId: 0x05 - Not installed - AppName: OPTICALPORT
AppId: 0x08 - V: 0.17 - CRC: 0xDC48 - AppName: LOGGER
AppId: 0x09 - V: 1.51 - CRC: 0x0DF9 - AppName: CUSTOMER
AppId: 0x0A - Not installed - AppName: FUNCTEST
AppId: 0x0F - V: 2.95 - CRC: 0xAE5A - AppName: GENESISFLOW
AppId: 0x10 - V: 4.55 - CRC: 0xE64D - AppName: SENSUSRADIO
AppId: 0x11 - V: 0.69 - CRC: 0xE2F9 - AppName: PERIODICLOG
AppId: 0x12 - V: 1.06 - CRC: 0x20F6 - AppName: METROLOGYASST
```


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```
AppId: 0x14 - V: 1.97 - CRC: 0x4B73 - AppName: IRDA
AppId: 0x15 - V: 0.53 - CRC: 0xB3D8 - AppName: NFC
AppId: 0x16 - Not installed - AppName: NA2WLOGGER
AppId: 0x17 - Not installed - AppName: NA2WALARMS
AppId: 0x18 - V: 10.6B - CRC: 0xC515 - AppName: FLEXNETVERSION
AppId: 0x1A - Not installed - AppName: FLEXNETSERIAL
AppId: 0x62 - Not installed - AppName: TESTMANAGER
-------------------------------------------------------------------------------------------------------------


....

Read register: SYSTEM_UpgradePermissions - 00-00-00-00 - 0
Configuration readout succeeded.
File access active....
-------------------------------------------------------------------------------------------------------------
Files read from meter:
0\config
0\password
1\evtdata
1\logindex
1\fdrdata
1\logdata
-------------------------------------------------------------------------------------------------------------
File readout succeeded.
File access active....
-------------------------------------------------------------------------------------------------------------
Files restored to meter:
1\tstfile
-------------------------------------------------------------------------------------------------------------
File restore succeeded.
File access active....
-------------------------------------------------------------------------------------------------------------
Files read from meter:
0\config
0\password
1\evtdata
1\tstfile
1\logindex
1\fdrdata
1\logdata
-------------------------------------------------------------------------------------------------------------
File readout succeeded.
Password file restore succeeded.
Firmware update succeeded.
-------------------------------------------------------------------------------------------------------------
Firmware is up to date!
-------------------------------------------------------------------------------------------------------------
```

Figure 4.7 FW-Update Report- Example

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5. Contact Information

Name	Function	Mail

Table 5.1 Contacts

6. References

[FWU_MRD] **Cordonel Service FW-Update Process MRD**; ***Published: SENSUS GmbH***; Author: Thomas Wiedebusch; Edition: September 2020 - Revision B

[FWU_BLD] **Quick Reference Cordonel Service FW-Update Builder**; ***Published: SENSUS GmbH***; Author: Thomas Wiedebusch; Edition: April 2021 - Revision A

[FWU_LDR] **Quick Reference Cordonel Service FW-Update Loader**; ***Published: SENSUS GmbH***; Author: Thomas Wiedebusch; Edition: April 2021 - Revision A

[FWU_SW] **Quick Reference Cordonel Service FW-Update Software**; ***Published: SENSUS GmbH***; Author: Thomas Wiedebusch; Edition: April 2021 - Revision A

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