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AN049
EPC Control Modes Guide

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Application Note - AN049

EPC Control Modes Guide

Introduction

This document goes deep into the flow of the CAN communications depending on the EPC mode.

Current Controlled Mode (CCMode)

In this mode, the external controller will set the current reference for the High Voltage DC side (HVDC side) or de Low Voltage DC side (LVDC side).

- **Positive current:** is defined as transferring energy from High Voltage DC side (HVDC side) to Low Voltage DC side (LVDC side). It is also called charging direction.

- **Negative current:** is defined as transferring energy from Low Voltage DC side (LVDC side) to HVDC side. It is also called discharging direction.

In order to avoid errors during transfer process, there is a security signal that has to be sent to set the current direction.

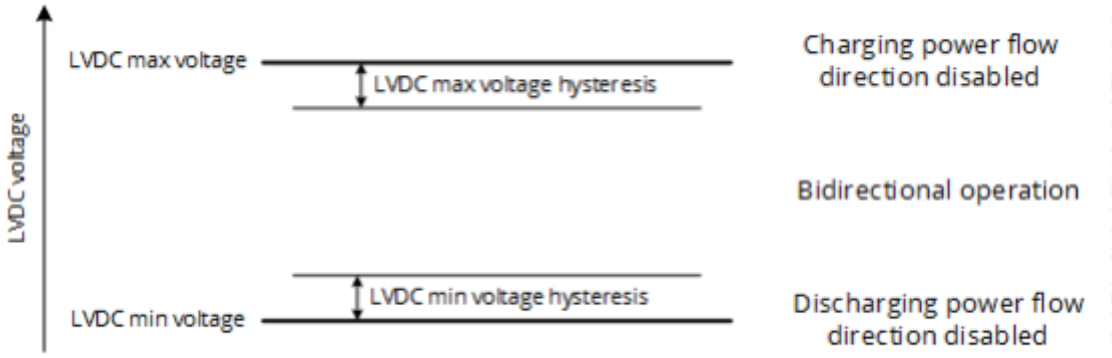
If the voltage (in high or low side) goes beyond the limits, the DCDC converter will stop and show an error. Once the voltage returns to the nominal range and a reset is performed, current control is re-established. When the EPC is disabled through CAN or hardware enable input, reset of errors is performed.

High Side Voltage Controlled Mode (HSVCMode)

In this mode, the external controller will set the voltage reference for the High Voltage DC side (HVDC side). Power and current limits can be configured.

EPC will manage the power flow aiming to maintain the high side voltage reference. The external controller is able to choose bidirectional operation or unidirectional in any direction thanks to “Power Flow Direction” signal.

Some limits in the LVDC can be configured in order to protect the energy source connected to the LVDC. If LVDC voltage goes above “LVDC max voltage”, charging power flow direction is disabled. When the voltage goes below “LVDC max voltage” minus “LVDC max voltage hysteresis” charging power flow direction is enabled. If LVDC voltage goes below “LVDC min voltage”, discharging power flow direction is disabled. When the voltage goes above “LVDC min voltage” plus “LVDC min voltage hysteresis” discharging power flow direction is enabled.

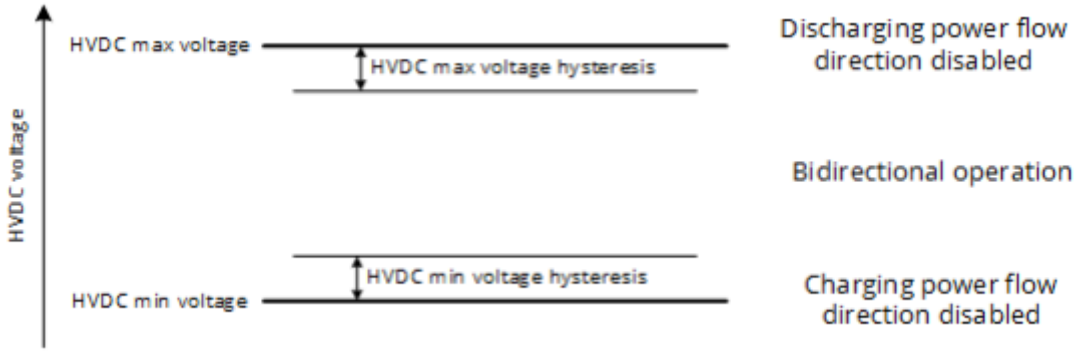


Low Side Voltage Controlled Mode (LSVCMode)

In this mode, the external controller will set the voltage reference for the Low Voltage DC side (LVDC side). Power and current limits can be configured.

EPC will manage the power flow aiming to maintain the low side voltage reference. The external controller is able to choose bidirectional operation or unidirectional in any direction thanks to “Power Flow Direction” signal.

Some limits in the HVDC can be configured in order to protect the energy source connected to the HVDC. If HVDC voltage goes above “HVDC max voltage”, discharging power flow direction is disabled. When the voltage goes below “HVDC max voltage” minus “HVDC max voltage hysteresis” discharging power flow direction is enabled. If HVDC voltage goes below “HVDC min voltage”, charging power flow direction is disabled. When the voltage goes above “HVDC min voltage” plus “HVDC min voltage hysteresis” charging power flow direction is enabled.



High Side Voltage Photovoltaic Mode (HSPVMode)

In this mode, the EPC converter performs MPPT tracking algorithm in the HVDC side. This mode is used when solar panels are connected to the HVDC side. The external controller is able set the voltage reference for the LVDC side. Also current or power limits can be configured. LVDC voltage reference and HVDC voltage limits must be configured in the same way than LSVCMode).

The energy flows only in charging direction. (Energy is transferred from HVDC to LVDC side)

Low Side Voltage Photovoltaic Mode (LSPVMode)

In this mode, the EPC converter performs MPPT tracking algorithm in the LVDC side. This mode is used when solar panels are connected to the LVDC side. The external controller is able set the voltage reference for the HVDC side. Also current or power limits can be configured. HVDC voltage reference and LVDC voltage limits must be configured in the same way than HSVCMode).

The energy flows only in discharging direction. (Energy is transferred from LVDC to HVDC side)

Appendix

The communication flow charts for each EPC mode are shown below. In the cases of CCMode, HSVCMode and LSVCMode a battery discharge from the high side is simulated. In the PV cases, normal use is simulated.

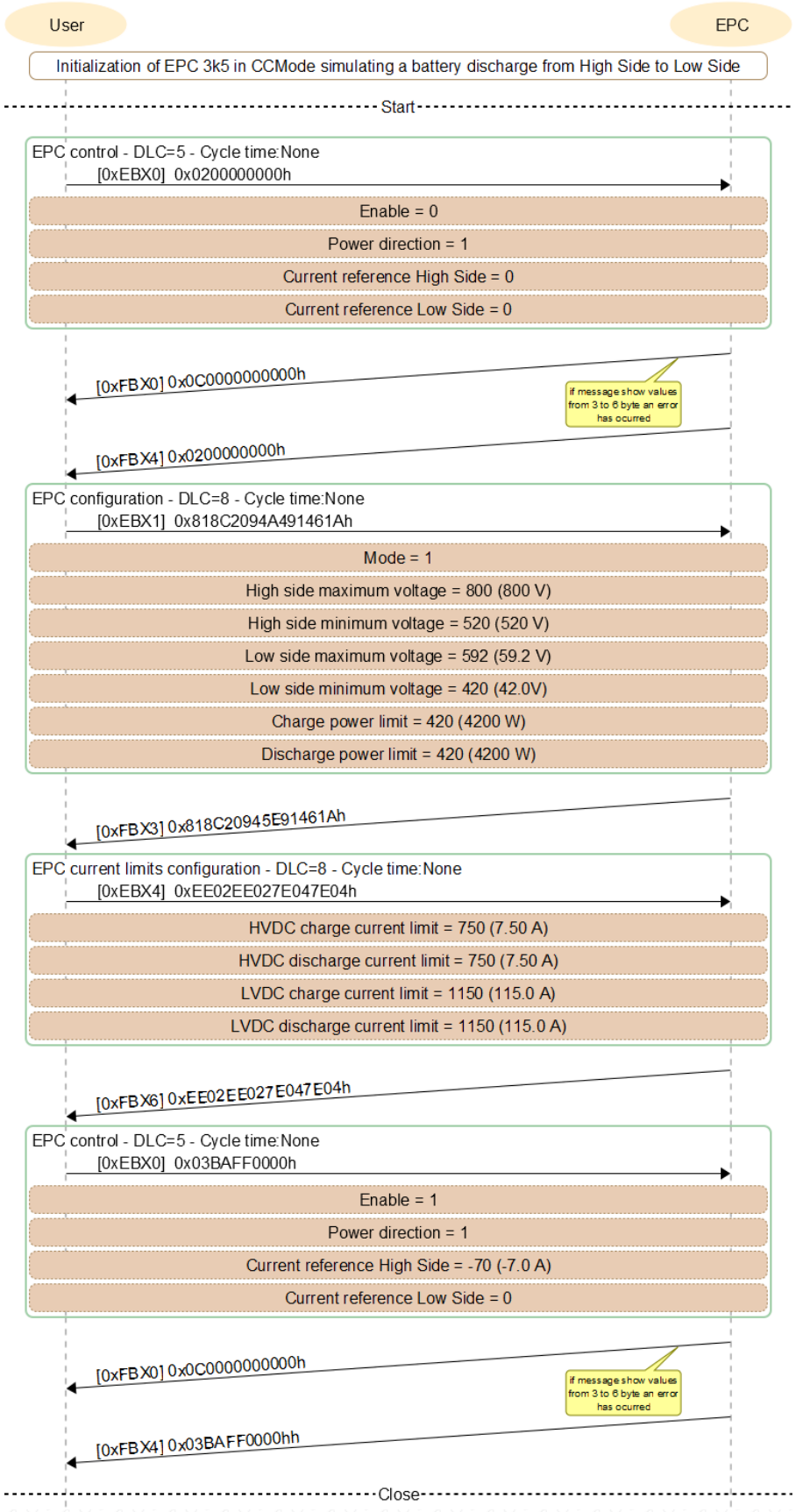


Figure 1. Flow chart CCMode

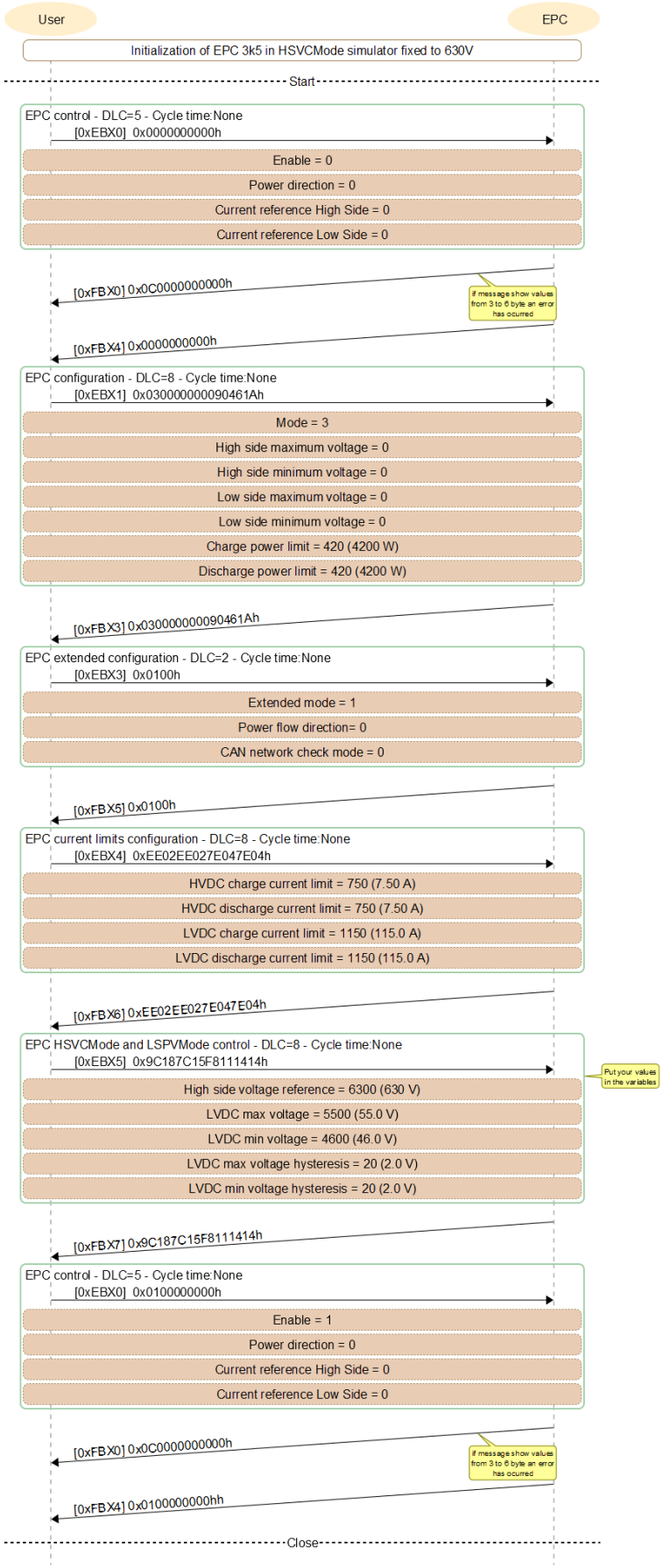


Figure 2. Flow chart HSVCMode

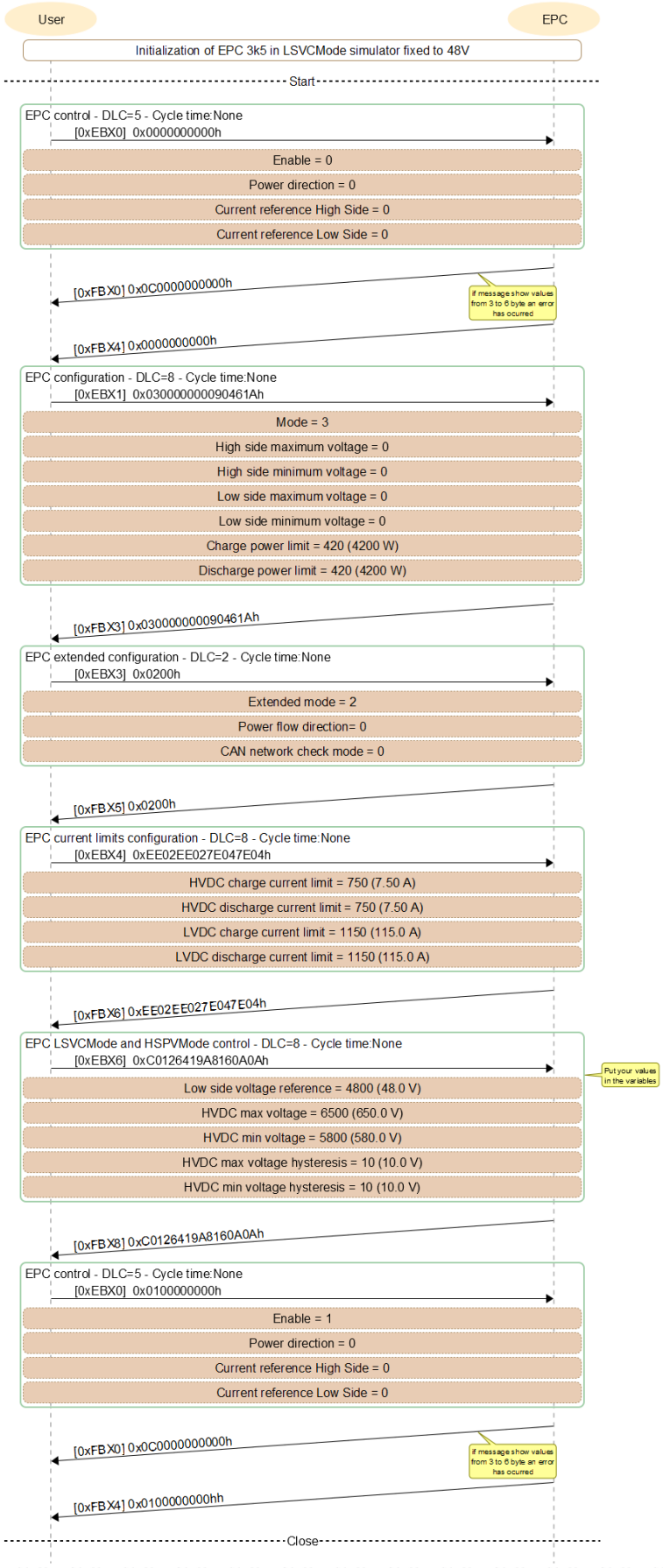


Figure 3. Flow chart LSVCMode

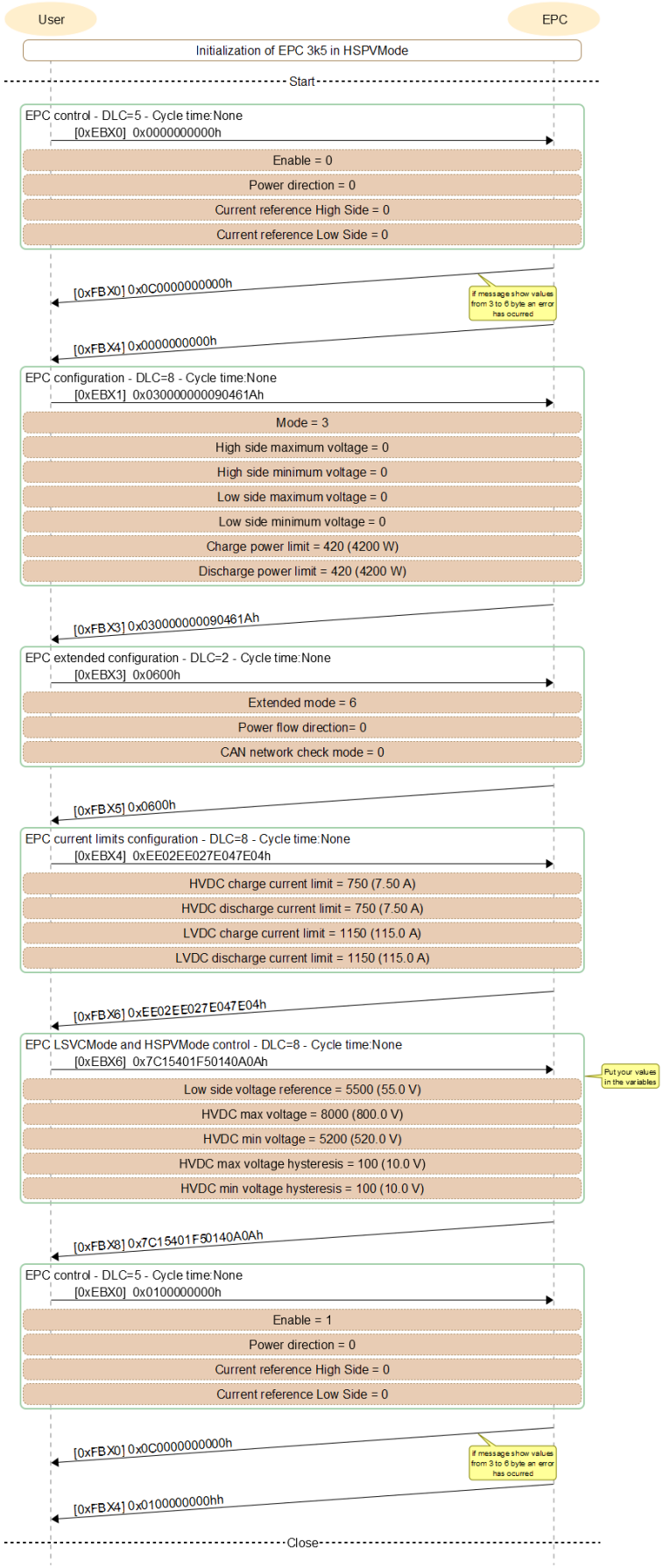


Figure 4. Flow chart HSPVMode

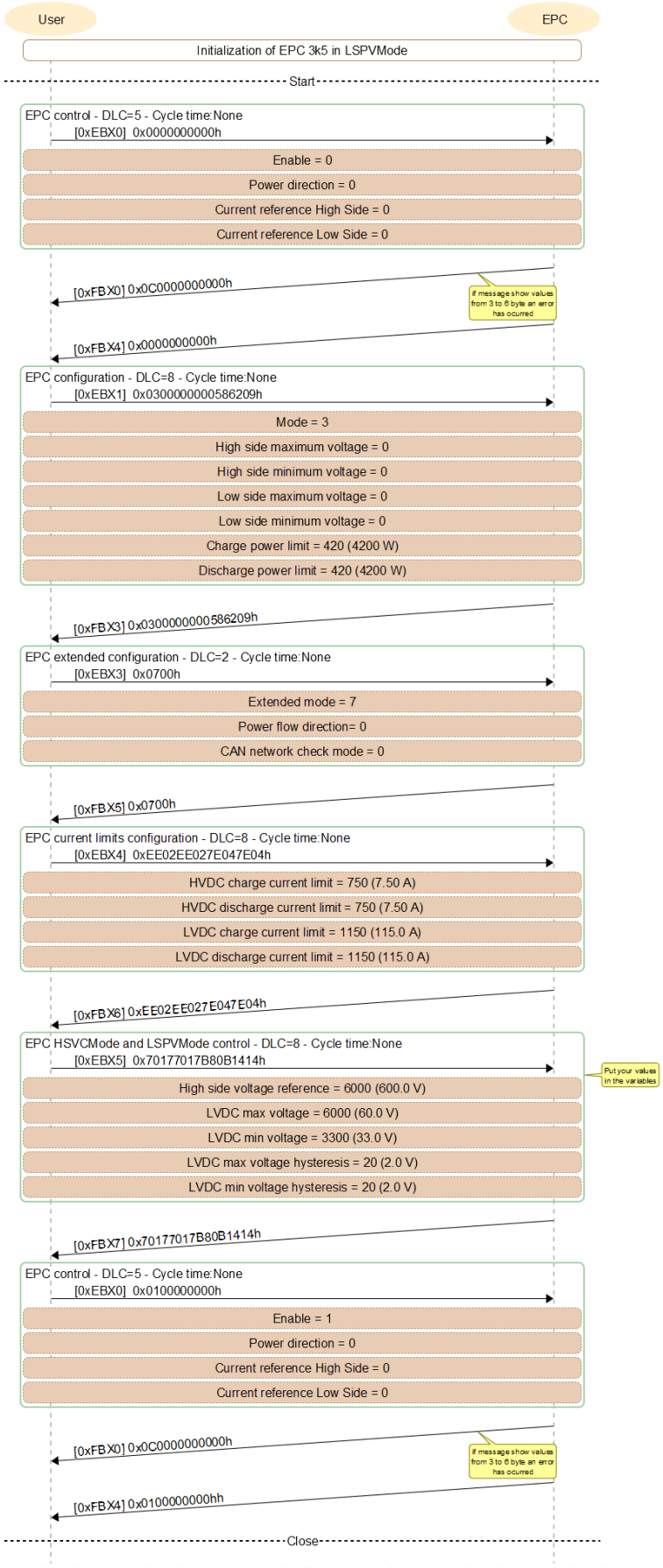


Figure 5. Flow chart LSPVMode