Date: 02nd Nov 2026

Mi-BEAM FIRMWARE PACKAGE V1.037

Firmware Versions:

1. Communication Controller : V5.085
2. System Interface Controller : V4.120
3. Primary Module Controller : V2.072
4. Secondary Module Controller : V3.046
5. Front Panel Controller : V6.048
6. CAN Controller : V7.14

Previous Firmware Versions:

Package Version	Communication Controller	System Interface Controller	Primary Module Controller	Secondary Module Controller	Front Panel Controller	CAN Controller
1.035	5.085	4.118	2.067	3.044	6.048	7.14
1.034	5.085	4.117	2.067	3.044	6.048	7.14
1.033	5.081	4.116	2.066	3.040	6.047	7.14
1.032	5.081	4.115	2.066	3.040	6.047	7.14
1.030	5.078	4.113	2.062	3.039	6.046	7.14
1.029	5.078	4.113	2.061	3.039	6.044	7.14
1.027	5.078	4.112	2.061	3.039	6.044	7.14
1.026	5.078	4.111	2.061	3.039	6.044	7.14
1.025	5.073	4.104	2.060	3.038	6.041	7.14
1.024	5.073	4.104	2.059	3.037	6.041	7.14
1.023	5.072	4.103	2.059	3.037	6.041	7.14
1.022	5.068	4.101	2.056	3.035	6.038	7.14
1.021	5.065	4.100	2.056	3.035	6.037	7.000

Release Notes:

Communication Controller Firmware:

V5.085: Date: 27-Aug-2026

1. Support for TCP/IP Protocol for Firmware update.
2. Support for Autobaud Rate Negotiation between Front Panel and Communication Controller.
3. SCPI support to configure Power Feed Forward state, Power Feed Forward state filter, vq limit.

V5.081: Date: 02-June-2026

1. (Bug Fix) When user config file gets corrupted and user query for DHCPMODE communication controller crashes.

V5.078: Date: 09-June-2026

1. (Bug Fix) In few units we have observed when unit output is ON and voltage transient from 20V to 110V communication crashes as it receives junk characters. To avoid the crash, fix is added to reject non-printable / binary junk in SCPI Parser

2. (Enhancement) validate pointer before validating the value.
3. (Enhancement) guard index to avoid Channel_Info[-1] in sserver
4. (Enhancement) validating if received count fits within remaining buffer available in sserver
5. (Enhancement) prevent overflow with a minimal bounds guard in sserver, ttyserv, serial and stdiosock.

V5.077: Date: 22-May-2026

1. Support to query Battery Test Sequence Profile data.
2. (enhancement) space is restricted in file or profile names.
3. Support to Series operation.
4. Support for Series and Split phase
5. New commands added for Series ground configuration.
6. Set commands for OVP1, OVP2, volt1, volt2 for series split phase
7. (Enhancement) avoiding space in profile names.
8. Support for *VMEAS

V5.072: Date: 19-Jan-2025

1. Added Slew Mode option.
2. Support for generic firmware capabilities for different models.

V5.068: Date: 19-Jan-2025

1. Support for CAN Settings such as Address, Baud Rate, Operating Mode.
2. Support for Front panel for Parallel operating Mode Settings.

V5.066: Date: 12-Jan-2025

1. Support for Parallel Operating Mode selection from Front Panel.
2. (Enhancement) Support for CAN Settings for Address, Baud Rate, operating mode (CANOpen or CAN 2.0).

V5.065: Date: 04-Dec-2025

1. (Bug Fixes) Resolved enumeration failure when 15 units are paralleled
2. (Enhancement) Reduced parallel bootup time for 15 units from 7–10 minutes to approximately 1.5 minutes
3. (Bug fix) related to OCP settings in Front panel.

V5.061: Date: 19-Nov-2025

1. (Bug fix) related to Transient slew settings.

V5.060: Date: 13-Nov-2025

1. Added support for External CAN.

V5.056: Date: 17-Oct-2025

1. Modified CAN receive thread to receive the CAN commands faster.
2. Added support for Parallel operation mode.
3. Added Remote Update Support for New Firmware Update tool.
4. Bootup Status is added.

Date: 02nd Nov 2026

V5.053: **Date: 22-Aug-2025**

1. Support for Battery Test Sequence Profiles
2. Improvement for Parallel Chassis Enumeration, tested up to 12 units.
3. support to communicate slew rate details to follower chassis.
4. Increased the Transmit queue length to 2000. Added Script to detect if CAN is down, script will automatically turn on the CAN communication back.

V5.052: **Date: 20-Aug-2025**

1. Support for GPIB Address setting via front panel.
2. YST:LOCAL? Will set to Remote only if set commands are sent via External Interface.

V5.050: **Date: 28-July-2025**

3. SYST:LOCAL? Will set to Remote only if set commands are sent via External Interface.

V5.049: **Date: 14-July-2025**

1. Support for front panel indicate output status in follower mode.

V5.045: **Date: 06-June-2025**

1. Added PONS support for Remote Output On/Off control feature.

V5.030: **Date: 23-May-2025**

1. Isolation Vsense ADC Calibration Support
2. Isolation Relay Control SCPI
3. DIO pins control SCPI
4. Isolation positive relay, isolation negative relay, external relay1, external relay2 controls can be done by SCPI
5. Chassis type information (LEADER or Follower or Standalone) is added as part of displed

V5.025: **Date: 14-May-2025**

1. Parallel chassis support

V5.024: **Date: 26-Mar-2025**

1. Battery Test and Battery Sim bug fixes

V5.021: **Date: 24-Mar-2025**

1. Support for Slew Type and Slew time, which is further divided into raising slew and falling slew.
2. Support for Battery Simulator Battery Model and Table Model
3. Support for Battery Test with Steady state settings.
4. Support to set regulation mode with CV, CC, CP, etc

V5.013: **Date: 19-Feb-2025**

1. Support for Battery Test – Charge and Discharge Steady state.
2. Support for Battery Simulator – Battery Model.
3. Support for PVSIM User defined profiles.
4. Added Support for PVSIM Array operation

V5.012: **Date: 28-Nov-2024**

1. PV SIM EN50530 profile load issue fixed

2. Support to List
3. Support for Power Slew commands
4. Issue related to Low/high line configuration response

V5.010: Date: 21-Nov-2024

1. Bug Fix related to PVSIM Front panel Settings

V5.007: Date: 19-Nov-2024

1. Bug fixes related few SCPI commands.
2. Syst1:revision? added.
3. SCPI to query Interface LOG data, output protection fold back faults.
4. Added support to indicate operating mode and programming type as part of disp:led?

V5.005: Date: 03-Sep-2024

1. Fault Status details added
2. Sending Fault details and LED details to Front Panel and Virtual Panels

V5.004: Date: 23-Aug-2024

1. Bug fix for Module controller Firmware update failure.
2. Added RAMP Commands
3. Added SteadyState Profiles
4. Added required PONS SCPI

V5.003: Date: 12-Aug-2024

1. Added support for Temperature reading for Thermal testing.
2. Added support to know log data, control registers and msm state of module controllers and interface board.

V5.000: Date: 10-July-2024

1. Initial Release
2. Tested Steady state in Bidirectional Operating mode, CC programming type

System Interface Controller Firmware:

V4.120: Date: 14-Oct-2026

1. Updated the variables of voltage loop for 1200V model.

V4.118: Date: 31-Aug-2026

1. Parallel operation: More than 15 units were not functioning. The issue was traced to the left-shift operation, where the value 1 was being treated as a 16-bit integer. To resolve this, all left-shift operations were reviewed and exsplicitly typecast to either unsigned 32-bit or 16-bit integers, as appropriate.

V4.117: Date: 27-Aug-2026

1. Enhanced in detail with shutdown fault details in module fault register.
2. Data validation in the system interface for output voltage and current sensing.
3. (Bug Fix) Corrected limit calculations for Max Power mode during parallel operation.

4. CAN Communication for fault handling between interface & modules bypassing the Fault I/O's
5. Transferring current reference and feed forward reference signals from leader to follower via interrupt mode, avoiding SYNC signal.
6. Support to log reference signal data for the follower chassis received from the Leader chassis.
7. Enhanced Multiple packet Data handling between Module and System Interface Controller to receive the Log data.
8. During Parallel or Series Operation, if the units are not compatible for connected units, set appropriate error message in Bootup Status.

V4.116: Date: 03-Aug-2026

1. (Bug Fix) Remote Sense in follower mode during bootup, when unit were configured to Remote Sense in PONS

V4.115: Date: 23-July-2026

1. Disabled fault handling for Remote Inhibit and Remote Sense in follower mode, as both signals are connected only to the leader chassis.

V4.112: Date: 12-June-2026

1. Slew Max is not updating when there is change in slew mode.
2. Bug fix related to Remote Inhibit Live fault handling
3. Support to Series Operation
4. Support to 400V, 800V and 80V models
5. Front Panel support for Series Operation.
6. Added support to Parallel, Series and Series split phase modes.
7. In split phase, new commands introduced to set voltage1, voltage2, OVP1, OVP2.
8. In Series Common Ground Settings are added, based on the grounded and non-grounded voltage is limited. In non-grounded voltage is limited to half of the detected Voltage Model in Series and Series split phase.
9. Added Support to display Voltage in Follower unit in Series and Series split phase mode.
10. Enhanced CAN Communication stability.

V4.103: Date: 19-Feb-2026

1. Added Slew Mode option.
2. Support for generic firmware capabilities for different models.

V4.102: Date: 28-Jan-2026

1. Added qualification for GPIO pins used as interrupt to remove unwanted fault detection.

V4.101: Date: 19-Jan-2026

1. Improved Current Calibration.
2. Update limits when Parallel operating mode is switched between Max Power and Max Current Mode.

V4.100: Date: 11-Dec-2025

1. Improved PV SIM current control logic.
2. In CC/CV mode (both source and PVSIM), fixed issue with voltage controller.

Date: 02nd Nov 2026

V4.098: **Date: 05-Dec-2025**

1. (Bug fix) updating the model limits to parallel follower chassis.

V4.097: **Date: 04-Dec-2025**

1. Added Enumeration Status display on DISPLED
2. Added support for Bootup Status, I meas, and P meas for follower chassis via UART
3. Marked CPU1toCPU2Regs_t & CPU2toCPU1Regs_t structures as volatile to prevent optimization issues
4. Implemented required CAN commands for internal communication during parallel operation
5. Removed unused code and variables
6. (Bug Fixes) Corrected transient status handling
7. (Bug Fixes) Parallel chassis compatibility check now uses only voltage model; querying limited to model limits and total module count
8. (Bug Fixes) Fixed CPU2 crash during parallel bootup on some follower systems
9. (Bug Fixes) Resolved enumeration failure when 15 units are paralleled
10. (Enhancement) Reduced parallel bootup time for 15 units from 7–10 minutes to approximately 1.5 minutes
11. PONS voltage user limits now remain unchanged after reboot, as intended
12. - CPU1 will stay in init state until chassis enumeration completes to avoid unnecessary communication and interrupts

V4.094: **Date: 19-Nov-2025**

1. (bug fix) PONS user limit min and max data
2. (bug fix) few PONS commands were not updating to EEPROM
3. (bug fix) RAMP from & to values, both will be compared and make sure both data are not same.
4. (bug fix) RAMP once ABORT command is set VSet or ISet will be assigned with Vmeas and Imeas.
5. (enhancement) Current slew is changed from I rated Minimum to I rated Maximum from 2ms to 1ms.
6. (bug fix) prot_OCP_Pos_internal is increased to 1.3 times of model limit from 0.6 times of model limit in eLOAD Operating Mode.
7. (bug fix) prot_OPP_Pos_internal is increased to 1.6 times of model limit from 0.6 times of model limit across all the Operating Mode.

V4.093: **Date: 14-Nov-2025**

1. Added Support for Isolation Test Mode for ATE Test Case

V4.092: **Date: 14-Nov-2025**

1. 'Parallel chassis fault' is enabled only after a check confirming that all follower chassis are turned ON when 'output ON' command is given.
2. A minimum of 10ms delay is provided before enabling 'Parallel chassis fault'.
3. PONS improvement added.

V4.091: **Date: 17-Oct-2025**

1. Isolation relay chassis support

2. Added Parallel operating mode for 1500 and 2000V model, which user can select between max current and max power mode when different power model chassis are paralleled.

V4.089: Date: 19-Sep-2025

1. (Bug Fix) Voltage Oscillation below 100V at no load condition or with minimal load is fixed.

V4.086: Date: 22-Aug-2025

1. Reduced the fan speed at no-load to 35% duty instead of 50%. This change in duty is for the output power upto 10% (3.57 kW) of rated load. This reduced the noise level to less than 60dB. Once the power goes more than 10% of rated power, fan speed is with 50% duty.
2. (Bug Fix) Oscillation in output voltage at no-load or light-load when chassis are connected in parallel.
3. (Bug Fix) Current Slew rate settings when 'n' chassis are connected in parallel.
4. Support in CAN Communication to Display Measurements for follower chassis in Front Panel.
5. Hardware OVP is introduced, which will act as additional protection feature, which will trip the unit Incase if Firmware OVP trip doesn't happen beyond 5% of set ovp value

V4.077: Date: 16-July-2025

1. (bug_fix) When MiBEAM output is shorted and operated in CC/CV mode with Iset=0A, the output current was increasing to 164A and getting settled. The issue was resolved by reducing Vlow limit internal to -0.01*Vmodel_limit when Vlow_limit was set to zero. In all other cases, Vlow_limit is passed as such.

V4.045: Date: 23-May-2025

1. Analog programming Iprog_Volt bug resolved. -10V was corresponding to 0A in Source mode earlier.
2. Isolation Enable Disable Feature is added.
3. Isolation Relay IO status Query SCPI added.
4. Isolation Vsense Adc Calibration added.
5. Isolation VMEAS SCPI added.
6. Negative polarity fault range.
7. Negative polarity Fault and Output Voltage Sync fault is added.
8. (bug fix) related Mppt Efficiency.
9. *ADD SCPI added, System Interface will send its address to the Communication Controller.
10. When EEPROM Read fails for PONS, corresponding operation Mode PONS settings will be set to default values.
11. Isolation Pos, Neg relays, External Relay 1 & 2, DIO 1 & 2signals can be controlled by SCPI.
12. In Battery Simulator Mode, by default SOC high and Capacity high is set to Max of Battery Settings.
13. In Battery Test, to support Change CC & CC/CV mode is supported. Termination Current Enable is changed to Charge Current Type.
14. In Battery Test, Initial Capacity settings are restricted once output is turned on.
15. In Battery Test, DischargeStopCondition flags are reset in INIT state and default state.
16. Chassis type (Leader or Follower or Standalone) details are added as part of DISP:LED?
17. In Parallel Chassis, to identify which unit has generated fault STAT:CHASIS:FAULT? is added. each bit represents unit.

Date: 02nd Nov 2026

V4.041: Date: 28-April-2025

1. Added Qualification for critical GPIO signals
2. Reduced the memory requirement of CLA code by optimising the code.
3. Improved the transition time in CV/CP and CC/CP modes.
4. Rectified Module mismatch fault bug. It is still disabled for further testing.
5. Measured current is displayed as 0 when Output is OFF and measured current is less than 0.5A
6. feedforward input is included in 2P2Z controller for future use.
7. Broadcast and unicast CAN message are handled in single function.
8. Support for CAN to interact between System Interfaces.

V4.040: Date: 24-April-2025

1. Battey Test Sequence bug fixes.
2. Enabled Analog Programming
3. Low Line support

V4.035: Date: 24-March-2025

1. Support for All programming modes.
2. SLEW Rate and SLEW time settings are added. Which has been enhanced as Raising and Falling slew/time.
3. Battery Simulator Battery Model and Table Model Feature added.
4. Operating mode supports only SOURCE, BIDIRECTIONAL, eLoad, PVSIM, BAT SIM.

V4.031: Date: 12-Feb-2025

1. Output remote sense enabled
2. Autoranging restriction for set and limits removed
3. Autoranging implementation moved to interrupts.c
4. CLA code is restructured to reduce memory requirement
5. Remote sense fault check included.
6. Fan control delay changed to 200ms
7. Fan faults are disabled.
8. Fan speed and fault query enabled.
9. Initialisation added for max slew limiter
10. Max slew limiter is initialised to 0 for set values and to limit value for foldback operation.

V4.028: Date: 29-Jan-2025

1. Added support only for SOURCE, BIDIRECTIONAL and PV SIM mode only.
2. 332kohm resistor need to be used for 2000V model.
3. AUTO RANGING functionality is disabled via MACRO
4. support for Sink resistance
5. Output Sense in disp:led
6. support for SCPI command to change controller (Voltage and current) gain
7. support to know the Module presence via GPIO
8. support for PONS output fold prot delay
9. support for PONS Power SLEW SCPI
10. Additional SCPI commands for Bootloader

11. OCP limit changed to 1.2 times model limit
12. Support to update PONS setting depending on Operating mode we navigate to.
13. FAN RPM value updated upto 100% for full power
14. Modified OVP and OCP are independent settings
15. VOLT HIGH and VOLT LOW are interdependent
16. Support to save calibration as factory calibration and we can revert the factory calibration via SCPI
17. Voltage calibration support up to 120%

V4.000: Date: 23-July-2024

1. Initial Version

Primary Module Controller Firmware:

V2.072: Date: 02-Nov-2026

1. Updated the PFC reference voltage at Low-Line for 800V model.
2. Enabled the undervoltage and overvoltage faults for DAB.
3. The "Vgrid_Q_Limit_Low" value was not updating to the required value from CPU2. It is corrected in this version.

V2.070: Date: 09-Oct-2026

1. Updated the cut-off frequency of Low-Pass filter used for Power feedforward (for 400V model) from 30 kHz to 1 kHz.
2. The number of cycles used to calculate the RMS values of AC voltages and AC Currents is increased from 1 to 2.

V2.067: Date: 27-Aug-2026

1. Removed other stage fault and enhanced in detail with shutdown fault details in module fault register. (Module 1, 2, 3 and system interface shutdown inputs in the module fault register).
2. Receiving dab voltage from secondary module csontroller to primary controller via eCAP in interrupt mode, avoiding SYNC signal.
3. Data validation during eCapture by making sure eCAP DATA2 is always greater than eCAP DATA1.
4. Configurable power feed-forward functionality and low-pass filter value.
5. Configurable AC Line VQ limit for debugging purpose.
6. CAN Communication for fault handling between interface & modules, as well as between modules, bypassing the Fault I/O's.

V2.066: Date: 29-July-2026

1. Added support to configure the sense skip count.
2. Added support to configure the ac input line voltage and current limit.
3. Validation of ac input voltage and current validation with sum of all the phases with validation sense count to 2.

Date: 02nd Nov 2026

V2.062: **Date: 21-July-2026**

1. Enabled "skip_sense_disable" for PFC voltage sense, AC input voltage sense, and AC input current sense after buck normal off.

V2.061: **Date: 09-June-2026**

2. Added support for ERDA Release.

V2.060: **Date: 22-May-2026**

1. Updated the variables for 800V model.
2. Included the anti-islanding pre-defined symbol.

V2.059: **Date: 19-Feb-2026**

1. Added qualification for GPIO pins used as interrupt to remove unwanted fault detection.
2. Support for generic firmware capabilities for different models.

V2.058: **Date: 30-Jan-2026**

1. Updated the positions of "PFC_Other_Stage" and "DAB_Other_Stage" detection.

V2.057: **Date: 28-Jan-2026**

1. GPIO input qualification is added for interrupt pins. –
2. AC RMS fault detection is added for operation of Low voltages (180 - 264 V) during High-Line operation.

V2.056: **Date: 24-Nov-2025**

1. Updated the equation of Idref to solve the issue of higher AC input current when the reverse phase is connected at the input terminals.

V2.055: **Date: 29-Oct-2025**

1. Added the code for anti-islanding detection.

V2.054: **Date: 12-Sep-2025**

1. Updated the SOC point for temperature sense when two modules are present.

V2.053: **Date: 10-July-2025**

1. Cleaned the primary status register as per the required statuses.

V2.052: **Date: 25-June-2025**

1. -New state _msm_firmware_update_mode is added
2. -CAN support added to change to firmware_update mode whenever system interface detects a firmware update
3. -DAB power limits updated.

V2.051: **Date: 02-June-2025**

1. Changed the overvoltage limit for LOW_LINE operation from 470V to 504V.

V2.050: **Date: 26-May-2025**

1. One wrong sample skip for PFC parameters are present only during start-up.
2. Changed the version number to v2p050 for production release.

Date: 02nd Nov 2026

V2.042: **Date: 26-May-2025**

1. One wrong sample skip for PFC_Vdc, AC voltages and AC currents are present at steady-state also. In previous version, it was done only during start-up.

V2.041: **Date: 24-May-2025**

1. The limit for "AC_LINE_VQ_UNDRVOLT_FAULT" is changed to 200 at "HIGH_LINE".
2. The limit for frequency fault is changed to overcome faults at specified extreme frequencies.

V2.040: **Date: 21-May-2025**

1. Only changed the version to V2p040. No other change.

V2.038: **Date: 20-May-2025**

1. AC line frequency limits for the corresponding fault is modified (47 to 53Hz and 57 to 63Hz) to meet the specification.
2. For "LOW_LINE" operation, the PFC and DAB DC bus voltages are changed to 700V and 750V respectively.

V2.037: **Date: 15-May-2025**

1. Storing Module hardware revision details in EEPROM, enhanced support from float to String as we will be using alphabets for released revisions.

V2.036: **Date: 13-May-2025**

1. Skipping of one wrong sample for DAB current is done during "msm.normal" state also. The logic is to skip the wrong sense if the difference in DAB current is more than 40A in one switching cycle.

V2.035: **Date: 06-May-2025**

1. Changed the limits for frequency fault, as per the operating frequency (50Hz or 60Hz).
2. Added commands for communicating Primary test status.
3. The "AC_LINE_VQ_UNDRVOLT_FAULT" is such that this fault occurs if three continuous samples of 'Vq' is below the specified limit.

V2.034: **Date: 28-April-2025**

1. The SOC point of temperature sense for third module is changed such that it does not overlap with DAB switching (both primary and secondary pulses).
2. Corrected the equation to limit the duty ramp of PFC boost operation

V2.033: **Date: 17-April-2025**

1. The "PFC_DC_BUS_UNDR_VOLT_FAULT" is given if the PFC DC bus voltage stays below the corresponding limit for 30 switching cycles.
2. The "PFC_DC_BUS_OVR_VOLT_FAULT" is given if the PFC DC bus voltage stays above the corresponding limit for 10 switching cycles.
3. Limit for "ac_rms_ref_highline_min_limit" is changed to 307.8V (0.9*ac_rms_ref_highline_min).

V2.032: **Date: 11-April-2025**

1. Code to add module configuration details (including the PWBs details) to EEPROM is included.

2. The names of parameters in "eib_defines" is changed to include "MiBEAM" instead of "RDCMSG".
3. For temperature sensing, the reading of temperature value is done after 20 cycles of MUX change, for each temperature MUX channels.
4. The temperature sense is implemented with averaging instead of filtering.

V2.031: Date: 09-April-2025

1. The protection limit of "ac_volt_limit_lowline" is changed to 470 V.
2. The SOC for temperature sense is changed to rectify the random temperature sense faults.
3. The Temperature limits are updated.
4. The start of temperature sense fault check will now start after 1 second of main relay turn-on.
5. Log parameters of DAB are updated.

V2.030: Date: 02-April-2025

1. Shifted the PFC boost operation code from CPU1-CLA to CPU1-interrupts, to free the CLA memory.
2. Changed the SOC points for temperature sensing as per the phase-shift of ePWM carriers with respect to sync pulse.

V2.029: Date: 20-Mar-2025

1. Once the PFC boost operation is completed, the ePWM pulses are turned-off using trip-zone.
2. To start the PFC control operation, an interrupt (ePWM5) based trip-zone is implemented.
3. The code for neglecting one wrong sample is disabled once the System-Interface reaches "NORMAL-OFF".
4. For VQ fault, the AC signals are derived from a High-pass filter. This reduces the oscillation in Vq.
5. Limit for Vq fault (Vgrid_Q_limit_low) is changed to 90.
6. Max and Min limits are added for DAB duty.
7. A slew limit is introduced for power-feedforward received from interface.
8. SOC instant for temperature sensing is varied to avoid disturbance in temperature sensing due to DAB switching.

V2.028: Date: 26-Feb-2025

1. Added a pre-defined symbol for "ERDA_RELEASE".
2. Changed the Id_ref for PFC controller to 2A (for forward phase sequence) and -2A (for reverse phase sequence).
3. Moved the "DSP_PFC_EN_CLEAR" command to before trip-zone, in fault condition.

V2.027: Date: 05-Feb-2025

1. Changed the limit "ac_rms_ref_lowline_max_limit = 1.15 * ac_rms_ref_lowline_max"
2. Changed the VQ fault limit to 115 for "LOW_LINE".
3. Increased the PFC DC Bus over-voltage fault limit to (1.117*Vdc_ref) i.e, 950V for HIGH_LINE and 726V for LOW_LINE.

V2.026: Date: 31-Jan-2025

1. Updated the code for new bootloader (v12p002).

Date: 02nd Nov 2026

V2.025: **Date: 29-Jan-2025**

1. The "Id_ref" is changed to 0 A.
2. "ac_rms_ref_lowline_min_limit" is changed from (0.92*ac_rms_ref_lowline_min) to (0.9*ac_rms_ref_lowline_min).
3. For Low-Line operation, "Vgrid_Q_limit_low" is changed from 150 to 125.

V2.024: **Date: 07-Jan-2025**

1. The code to neglect one sample of sensed signals, if the data is corrupted, is included for both PFC and DAB signals.
2. In "LOW_LINE_USER_SET" condition, the PFC DC bus voltage is changed to 650 V.

V2.023: **Date: 07-Jan-2025**

1. Removed unused functions

V2.022: **Date: 20-Dec-2024**

1. The position of T1 event check code is shifted to beginning of CLA1.
2. The Phase-Reversal logic is implemented using alpha-beta frame voltages.
3. Code is added to store the last logged data of PFC Fault register, PFC status register, PFC temperature log data, PFC log data, DAB status register, DAB fault register, DAB log data and DAB temperature log data in EEPROM.

V2.021: **Date: 16-Dec-2024**

1. Trip-zone is implemented for PFC and DAB PWMs
2. Phase reversal code is added. The Reference frequency is decided from PLL loop (omega_error value)
3. "AC_LINE_VQ_UNDRVOLT_FAULT" fault bit is added to denote the instantaneous AC voltage drop. This is based on the Vq value in dq-frame
4. The slope and limit for the ramp signal used during PFC startup operation is different for "LOW-LINE" and "HIGH-LINE" operations.

V2.020: **Date: 20-Nov-2024**

1. DAB Power feedforward added

V2.014: **Date: 14-Nov-2024**

1. DAB Power feedforward removed
2. AC voltage offset computation is removed (Vry, Vyb and Vbr offsets are set to zero).
3. CAN command for version query is added.

V2.013: **Date: 08-Nov-2024**

1. SOFT_START_RELAY_ON is checked for starting PLL loop
2. PLL Ki limits are updated to resolve Low frequency trip during PFC startup. The issue is now resolved.

V2.011: **Date: 30-Oct-2024**

1. EVT_UNIT_TESTING should be defined to run the code in EVT unit.
2. log_data_DAB[4] = P_out; is added to log data of DAB
3. dab_vdc_min_limit is changed from 750V to 720V
4. Temperature trip limits are updated.

5. CAN commands to support last log data is added. EEPROM is not configured yet to make this work.
6. Primary Fault registers (PFC and DAB) is updated

V2.000: **Date: 23-July-2024**

1. Initial Version

Secondary Module Controller Firmware:

V3.046: **Date: 09-Oct-2026**

1. Updated the variables for 400V model.
2. Updated the SoC points for 400V model.

V3.044: **Date: 27-Aug-2026**

1. CAN Communication for fault handling between interface & modules, as well as between modules, bypassing the Fault I/O's.
2. Removed other stage fault and enhanced in detail with shutdown fault details in module fault register. (Module 1, 2 , 3 and system interface shutdown inputs in the module fault register).

V3.040: **Date: 15-June-2026**

1. Updated the SoC points and current compensator for 400V model.
2. Updated the current estimation structure to incorporate all models.
3. Updated the parameters of 800V model.

V3.039: **Date: 09-June-2026**

1. Added support for ERDA Release.

V3.038: **Date: 22-May-2026**

1. Updated the variables for 800V model.
2. Updated the duty voltage range calculation for SoC change.

V3.037: **Date: 19-Feb-2026**

1. Added qualification for GPIO pins used as interrupt to remove unwanted fault detection.
2. Support for generic firmware capabilities for different models.

V3.036: **Date: 28-Jan-2026**

1. GPIO input qualification is added for interrupt pins.
2. "OTHER_STAGE_fAULT" is detected only if both the software and interrupt pin detects a change in state

V3.035: **Date: 22-Aug-2025**

1. Corrected the duty limit used for buck current compensator. Increased the duty saturation limit of buck converter to 0.96 from 0.92.

V3.034: Date: 22-July-2025

1. Increased the duty saturation limit of buck converter to 0.96 from 0.92. This is to trip the module output when the chassis output voltage is not sensing correctly.
2. The "BUCK_DC_BUS_OVR_VOLT_FAULT" will come if the voltage stays above the limit for more than 10 switching cycles, instead of instantaneous fault.

V3.033: Date: 10-July-2025

1. Cleaned the secondary status register as per the required statuses.

V3.032: Date: 25-June-2025

1. -New state _msm_firmware_update_mode is added
2. -CAN support added to change to firmware_update mode whenever system interface detects a firmware update

V3.031: Date: 23-June-2025

1. The SOC points for ADC sensing is updated for 600V operation, to reduce the output voltage oscillations.

V3.030: Date: 21-May-2025

1. Only changed the version to V3p030. No other change.

V3.021: Date: 20-May-2025

1. For "LOW_LINE" operation, the duty limit for the Buck is changed to 0.96. In "HIGH_LINE", it is 0.92.
2. Compensator coefficients for Buck control is modified with bandwidth of 1.5 kHz.
3. The SOC instants are toggled between "UP_COUNT" and "DOWN_COUNT" depending the operating output voltage of the module.
4. The average current of the switching cycle is estimated from theoretical equation using buck-inductor value. This current value is used for the control.

V3.020: Date: 11-April-2025

1. The temperature sense is implemented with averaging instead of filtering.

V3.019: Date: 10-April-2025

1. Limit for "BUCK_CHARING_FAULT" is changed to 7.5A.
2. Limit for "outputVoltage_min_limit" is changed to -15V.

V3.018: Date: 09-April-2025

1. The code for neglecting one wrong sample of sense signals is enabled only during module start-up.
2. The CMPA value of Buck ePWMs when the output is OFF is changed to the value corresponding to module's own output voltage instead of feedforward voltage.
3. Code to apply a slew to the voltage received from interface through eCAP is implemented.
4. The start of temperature sense fault check will now start after 1 second of main relay turn-on.
5. The names of parameters in "eib_defines" is changed to include "MiBEAM" instead of "RDCMSG".
6. GPIO for CAN term enable is implemented.

Date: 02nd Nov 2026

V3.017: **Date: 04-April-2025**

1. Changed the temperature fault limits.

V3.016: **Date: 27-Feb-2025**

1. Added a pre-defined symbol for "ERDA_RELEASE".
2. A second order filter of 1 kHz is added to "Iref_ffd" received from System Interface.
3. "BUCK_CURR_SHARING_FAULT" is included to identify if the current through all four legs of buck are similar.
4. A second order filter of 250 Hz is added to "Vout_ffd" received from System Interface.
5. SOC instants are modified to change as per the output voltage.

V3.015: **Date: 31-Jan-2025**

1. Updated the code for new bootloader (v13p002).

V3.014: **Date: 24-Jan-2025**

1. The SOC point for Buck current sensing is shifted to "CMPA = 750 during UPCOUNT".
2. The code to neglect one sample of sensed signals, if the data is corrupted, is included for DAB secondary current.
3. In module output voltage controller, the mistake of copying the previous error is rectified.

V3.013: **Date: 07-Jan-2025**

1. Removed unused functions

V3.012: **Date: 20-Dec-2024**

1. Code is added to store the last logged data of Secondary status register, secondary fault register, Secondary temperature log data and Buck log data in EEPROM.

V3.011: **Date: 16-Dec-2024**

1. Trip-zone is implemented for Buck PWMs
2. Position of T1 event is corrected depending on the value of CMPA

V3.010: **Date: 20-Nov-2024**

1. DAB Power feedforward added

V3.007: **Date: 14-Nov-2024**

1. 'dab_vdc_min_limit' was changed to 690V from 720V for working with "DAB Power feedforward removed" primary code.
2. RDCMSG_SEC_IDENTQ added in CAN

V3.006: **Date: 04-Nov-2024**

1. -All GPIOs are initialised properly.
2. -DSP_SECFLT1_CPU2,DSP_SECFLT2_CPU2,DSP_SECFLT3_CPU2 are initialised properly.

V3.005: **Date: 30-Oct-2024**

1. -Buck current compensator is initialized with module's own output voltage. So that unit can be turned ON in CV mode with voltage present at the output.
2. dab_vdc_min_limit is 720 V, dab_i_sec_max_limit is 50 A, outputVoltage_max_limit is 750 V
3. -Temperature trip limits are updated.

4. -CAN commands to support last log data is added. EEPROM is not configured yet to make this work.
5. -Secondary Fault register is updated

V3.000: Date: 23-July-2024

1. Initial Version

Front Panel Controller Firmware:

V6.048: Date: 27-Aug-2026

1. Added Auto Baud Rate support to enable faster firmware updates and improved response time, it also has backward compatibility.
2. Updated the Fault Screen to display non-clearable faults in red when a clear operation is attempted, along with an appropriate notification message.
3. Removed the Remote Screen from the application.
4. Fixed the tab order issue in the Output Program menu.
5. Updated the Firmware Update screen to hide the Cancel button once the update process is successfully completed.

V6.047: Date: 30-July-2026

1. Modified to check the checksum for the received response.

V6.046: Date: 21-July-2026

1. Updated to show Faults on the Follower Screen.
2. Modified to show "Front Panel Firmware Download Complete (Success) Please Power Cycle the unit." after Front Panel firmware update is finished.
3. Bug fix in hiding "Parallel Operation Mode" sub menu in Standalone Mode.
4. Bug fix for LEDs on the front panel flashing intermittently.
5. Bug fix in showing measurements in the follower screen.

V6.044: Date: 09-June-2026

1. Fixed the front panel freeze issue.
2. Bug fix in PONS Configuration in Series Operation.
3. Updated to support Series operation.
4. Modified Follower screen to show Series or Parallel Operation.
5. Bug fix in Regulation Settings delay.
6. Added PONS Multi Chassis Operation menu under PONS Configuration.
7. Bug fix related to the minimum and maximum for slew in PONS.
8. Added Chassis Type label in System Status.
9. Added Voltage 1 and Voltage 2 for Series Split Phase operation in Dashboard and Output Program.
10. Added OVP 1 and OVP 2 for Series Split Phase operation in Protection Settings.
11. Modified Regulation Settings screen to show only Voltage Programming Type and CV Regulation setting in Series and Series Split Phase Operation.
12. Modified PONS to change according to Parallel, Series and Serie Split Phase Operation.

13. Added Voltage measurement for Series and Series Split Phase Operation in Follower Screen .

V6.041: Date: 23-Feb-2026

1. Updated to support generic firmware capabilities across various models.
2. Added a Slew Mode option to the Slew Rate menu for both Steady State and PONS.
3. Added a Battery Mode menu for BATTEST Mode.
4. Updated the Dashboard, Output Program, and Configuration to adapt based on the Battery Mode in BATTEST operating mode.
5. Fixed an issue related to the minimum and maximum Ramp values.

V6.038: Date: 14-Jan-2026

1. Added the “External CAN” submenu under the Control Interface Menu, visible only when External CAN is available.
2. Implemented a notification screen displaying “Output is On” in BATSIM Configuration, BATTEST Configuration, and Curve Selection, as values cannot be modified during this state.
3. Fixed a Dashboard issue in BATSIM mode by disabling Start, Pause, and Stop buttons when no profile is loaded.
4. Removed Negative Power Limit from Output Program and PONS Output Program for CR/CV and CR/CC regulation modes.
5. Updated Ramp Time limits: Current Ramp now ranges from 0.001 to 65,535; Voltage Ramp from 0.03 to 65,535.
6. Corrected decimal point handling across all keypads.

V6.037: Date: 14-Oct-2025

1. Changed the Keypads name in LAN Settings.
2. Bug fix in Regulation Settings and PONS Regulation Settings while changing from CV-Ser.Res to CP/CV.
3. Implemented Submenu “Parallel Operation Mode” in Configuration and PONS Configuration. Applicable only for Leader chassis with Voltage range 1500 and 2000.
4. Bug fix in Voltage High and Voltage Low Limit min and max value on Dashboard, Output Program and PONS.
5. Bug fix in Dashboard for BATSIM status update in Battery Mode.
6. Modified the message screen during bootup to show the IP address and Port number.
7. Added a screen to show if bootup status.
8. Bug fix in the banner screen where it was going blank without showing the System Details during bootup.
9. Bug fix in Dashboard timer.
10. Bug fix in Follower Mode chassis address update.

V6.036: Date: 19-Aug-2025

1. Added new Fault “Hardware OVP Fault”. This is to incorporate the hardware OVP fault implemented in “System Interface” firmware.
2. Added Measurements in Follower Chassis. This is to display the measurement values (voltage, current, power) in the front panel of the follower chassis instead of displaying “The unit is in Follower mode”.
3. Added Remote Output screen for Steady State and PONS.

4. Added GPIB Menu

V6.035: Date: 05-Aug-2025

1. Support in front panel to display its own measurements in follower chassis.
2. Added Remote Output screen for Steady State and PONS in Front Panel.
3. Added GPIB Menu.

V6.034: Date: 28-July-2025

1. Added new Fault “Hardware OVP Fault”.

V6.033: Date: 14-July-2025

1. Improved speed of front panel operation
2. Output led support in follower mode

V6.032: Date: 25-June-2025

1. Bug fix in Ramp.

V6.030: Date: 26-May-2025

1. Bug Fix for front panel crashing.
2. Bug Fix for Initializing screen.
3. Added Logic in Ramp for Analog Reference settings.

V6.020: Date: 24-May-2025

1. Made changes to support Follower Chassis.
2. Bug fix for front panel hanging.
3. Changed the "System Mode" to "Operating Mode" in steady state and PONS.
4. Re-layout done for Main Menu and Control Interface sub-menu based the priority.
5. Added System Status sub-menu in System Settings Menu.
6. Implemented PONS External Relay, PONS Analog and PONS AC Input Line Settings
7. Implemented PONS External Relay and PONS Analog.
8. Increased the Slew Rate decimal point to 5 digits.

V6.018: Date: 30-April-2025

1. Bug fix for timer stopping when keypad is closed.
2. Bug fix in the fault screen for OVP fault.
3. Parameter names change for Battery Test on Dashboard and Configuration.
4. Aligned the front panel download screen.

V6.017: Date: 11-April-2025

1. Added new Icons and images for Battery Test Mode.
2. Disabled Ramp Settings.
3. Implemented System Faults Menu.
4. Implemented Battery Test Related Sub-menus and measurements.

V6.016: Date: 26-March-2025

1. Supports Bi-Dir, SOUR, ELOAD, PVSIM and BATSIM.
2. Implemented the Slew Rate Settings with Rate and Time.
3. Implemented Battery Simulator related Sub-menus and measurements.

4. Added Power related Regulation Settings to Source, Bi-Direction and eLoad mode for applicable menus.
5. Bug Fix for Curve selection to enable or disable based on Curve Type.
6. Added Tab order for EN5053 Configuration.
7. Added Factory Default Sub-menu in System Settings.
8. Added Operating Mode Icon for Default Screen and Remote Screen.
9. Modified the Fault Screen Timer.

V6.014: Date: 14-Feb-2025

1. Supports Bi-Dir, SOUR, ELOAD and PVSIM.
2. Removed CP and CR option in Regulation settings and in PONS.
3. Fixed issue with Rotary Knob.
4. Changed the name 'Volt High' to 'Volt High Lim' in Dashboard, Output Program and PONS.

V6.012: Date: 07-Jan-2025

1. Enabled CP, CP/CC and CP/CV option in Regulation settings and in PONS

V6.004: Date: 18-Oct-2024

1. Changed Remote inhibit design and command for PONS and steady state.
2. Made changes in Protection and User Limits sub-menu to update based on System Mode for PONS and steady state.
3. Added Set Delay in Regulation Settings sub-menu for PONS and steady state.
4. Bug fix with the "Output is on" in the Regulation Settings.

V6.002: Date: 02-Sep-2024

1. Bug Fix in the Output Program min and max settings
2. Added LED and Fault details

V6.001: Date: 21-Aug-2024

1. Added a common Slew Rate sub-menu
2. Added Protection sub-menu
3. Modified the user limits based on the Regulation Settings
4. Implemented the Output Program menu to change based on Regulation Settings
5. Improved the measurement response updating time

V6.000: Date: 31-July-2024

1. Initial Release

CAN Controller Firmware:

V7.14 : Date: 19-Jan-2026

1. Bug fixes related to CANOpen and CAN 2.0
2. CAN Board Present detection logic added

V7.00 : Date: 30-Oct-2025

1. Initial Release

Date: 02nd Nov 2026