1. ***Calibration Command:***

1.1 Calibration general command:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Calibration Enable command:   |  |  |  |  | | --- | --- | --- | --- | | Addr\_w | 0xFD | 0x55 | 0x4C | |
| Write calibration command:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Addr\_w | 0xC9 | 0x08 | Index | Dataline | SlopeL | SlopeH | OffsetL | OffsetH | ThrL | ThrH | |
| Read calibration command:   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Addr\_w | 0xC9 | 0x02 | Index | Dataline | Addr\_r | 0x06 | SlopeL | SlopeH |  |  |  |  |  | | --- | --- | --- | --- | | OffsetL | OffsetH | ThrL | ThrH | |
| Calibration Disable command:   |  |  |  |  | | --- | --- | --- | --- | | Addr\_w | 0xFD | 0xAA | 0xAA | |
| Read ADC:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Addr\_wj | 0xFA | Index | Addr\_r | AdcL | AdcH | |

* 1. Calibration Index and dataline:

|  |  |  |  |
| --- | --- | --- | --- |
| **Index** | **Dataline** | **Write command** | **Read command** |
|  |
| 0x00 | 0x00 | Reserved | Reserved |  |
| 0x10 | 0x00 | Write calibration Vin data | Read calibration Vin data |  |
| 0x20 | 0x00 (10% - 20%) 0x01 (20% - 100%) | Write calibration Iin data - Low line | Read calibration Iin data - low line |  |
| 0x21 | 0x00 (10% - 20%) 0x01 (20% - 100%) | Write calibration Iin data - High line | Read calibration Iin data - high line |  |
| 0x30 | 0x00 (10% - 20%) 0x01 (20% - 100%) | Write calibration Pin data - Low line | Read calibration Pin data - Low line |  |
| 0x31 | 0x00 (10% - 20%) 0x01 (20% - 100%) | Write calibration Pin data - High line | Write calibration Pin data - High line |  |
| 0x40 | 0x00 | Write calibration Vout data | Read calibration Vout data |  |
| 0x50 | 0x00 (10% - 20%) 0x01 (20% - 100%) | Write calibration Iout data | Read calibration Iout data |  |
| 0x60 | 0x00 | Write calibration Vsb data | Read calibration Vsb data |  |
| 0x70 | 0x00 (10% - 20%) 0x01 (20% - 100%) | Write calibration Isb data | Read calibration Isb data |  |
| 0x80 | 0x00 | Reserved | Reserved |  |
| 0x90 | 0x00 (10% - 20%) 0x01 (20% - 100%) | Write calibration Ishare | Read calibration Ishare |  |
| 0xFE | 0x00 | Set calibration default data | Read calibration default data |  |

1.3 ADC Read Index:

|  |  |
| --- | --- |
| Index | ADC data read |
| 0x00 | Read Vin adc data |
| 0x01 | Read Iin adc data |
| 0x02 | Read Pin adc data |
| 0x10 | Read V1 int adc |
| 0x11 | Read V1 ext adc |
| 0x12 | Read I1 adc |
| 0x13 | Read Ishare adc |
| 0x14 | Read Ilocal adc |
| 0x15 | Read Vsb int adc |
| 0x16 | Read Vsb ext adc |
| 0x17 | Read Isb adc |

* 1. Calibration table buffer values

|  |  |  |
| --- | --- | --- |
| Index | Item | Meter Readings |
| — | Vin | Vin Meter \* 128 |
| — | Iin (Both of high/low line) | Iin Meter \* 128 |
| — | Pin (Both of high/low line) | Pin Meter \* 32 |
| — | Vout | Vout Meter \* 128 |
| — | Iout | Iout Meter \* 128 |
| — | 3.3V Vout | Meter \* 128 |
| — | 3.3V Iout | Meter \* 128 |

1. ***Calibration for Primary:***

2.1 Calibration point table:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Vin (V) | Vout  load (A) | Vsb  load (A) | Delay time (s) | Vin | Iin L | Iin H | Pin L | Pin H |
| 1 | 110 | 10% | 10% | 4 |  | 🗸 |  | 🗸 |  |
| 2 | 110 | 20% | 20% | 4 |  | 🗸 |  | 🗸 |  |
| 3 | 110 | 100% | 100% | 4 | 🗸 | 🗸 |  | 🗸 |  |
| 4 | 230 | 10% | 10% | 4 |  |  | 🗸 |  | 🗸 |
| 5 | 230 | 20% | 20% | 4 |  |  | 🗸 |  | 🗸 |
| 6 | 230 | 100% | 100% | 4 | 🗸 |  | 🗸 |  | 🗸 |

2.2 Calibration procedure:

**Enter Calibration Mode:**

Step 1: Set Input conditions to calibration point 1

|  |  |
| --- | --- |
| AC input | 110V/60Hz |
| 12V load | 10% |
| Vsb load | 10% |

Step 2: Use command “Write calibration key”

|  |  |  |  |
| --- | --- | --- | --- |
| Addr\_w | 0xFD | 0x55 | 0x4C |

Step 3: Set Vin and load according to calibration point table

Step 4: Delay 4s, Get input data from meter = X1

Step 5: Use sub command index to “Read ADC Raw data” = Y1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Addr\_w | 0xFA | Index | Addr\_r | AdcL | AdcH |

Step 6: Set Input conditions to calibration point 2

|  |  |
| --- | --- |
| AC input | 110V/60Hz |
| 12V load | 20% |
| Vsb load | 20% |

Step 7: Delay 4s, Get input data from meter = X2

Step 8: Use sub command to “Read ADC Raw data” = Y2

Step 9: Calculate G = (Y2-Y1)/(X2-X1) and offset = Y1-G\*X1.

**EEPROM writing and checking**

Step 10: Use command “Write all calibration data into EEPROM” to store data into EEPROM

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Addr\_w | 0xC9 | 0x08 | Index | Dataline | SlopeL | SlopeH | OffsetL | OffsetH | ThrL | ThrH |

Step 11: AC off and discharge PSU.

Step 12: Use command “Read calibration” to check contents of EEPROM Calibration data

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Addr\_w | 0xC9 | 0x02 | Index | Dataline | Addr\_r | 0x06 | SlopeL | SlopeH |

|  |  |  |  |
| --- | --- | --- | --- |
| OffsetL | OffsetH | ThrL | ThrH |

1. ***Calibration for Secondary:***

3.1 Calibration point table:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Vin (V) | Vout  load (A) | Vaux  load (A) | Delay time (s) | Vout | Iout | Vsb | Isb | Ibus |
| 1 | 230 | 10% | 10% | 4 | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |
| 2 | 230 | 20% | 20% | 4 |  | 🗸 |  | 🗸 | 🗸 |
| 3 | 230 | 100% | 100% | 4 | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |

* 1. Calibration procedure:

**Enter Calibration Mode:**

Step 1: Set Input conditions to calibration point 1

Step 2: Use command “Write calibration key”

|  |  |  |  |
| --- | --- | --- | --- |
| Addr\_w | 0xFD | 0x55 | 0x4C |

**Set Vin and Load**

Step 3: According to ‘Calibration point table’, set input conditions.

Step 4: Read Meter sampling values and store them as X1.

Step 5: Use sub command index to “Read ADC Raw data” = Y1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Addr\_w | 0xFA | Index | Addr\_r | AdcL | AdcH |

Step 6: Set Input conditions to calibration point 2

Step 7: Delay 4s, Get input data from meter = X2

Step 8: Use sub command to “Read ADC Raw data” = Y2

Step 9: Calculate G = (Y2-Y1)/(X2-X1) and offset = Y1-G\*X1.

**EEPROM writing and checking**

Step 10: Use command “Write all calibration data into EEPROM” to store data into EEPROM

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Addr\_w | 0xC9 | 0x08 | Index | Dataline | SlopeL | SlopeH | OffsetL | OffsetH | ThrL | ThrH |

Step 11: AC off and discharge PSU.

Step 12: Use command “Read calibration” to check contents of EEPROM Calibration data

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Addr\_w | 0xC9 | 0x02 | Index | Dataline | Addr\_r | 0x06 | SlopeL | SlopeH |

|  |  |  |  |
| --- | --- | --- | --- |
| OffsetL | OffsetH | ThrL | ThrH |

1. **PMBUS Verification (after calibration)**

4.1 Accuracy specification

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Load < 10% | 10% ≦ Load < 20% | 20% ≦ Load < 100% |
| Vin | — | +/- 5% | +/- 5% |
| Iin | — | +/- 10% | +/- 5% |
| Pin | — | +/- 10% | +/- 5% |
| Vout | — | +/- 5% | +/- 5% |
| Iout | — | +/- 10% | +/- 5% |
| Pout | — | +/- 10% | +/- 5% |

* 1. Accuracy verification point

|  |  |  |
| --- | --- | --- |
| Input | Vout Load | Vsb Load |
| 90V / 60Hz | 10%,  20%,  50%,  100% | 10%,  20%,  50%,  100% |
| 110V / 60Hz |
| 140V / 60Hz |
| 180V / 50Hz |
| 230V / 50Hz |
| 264V / 50Hz |