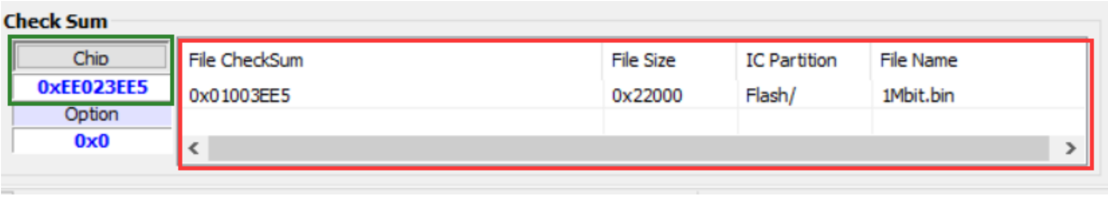
DediWare Checksum Calculation Methods

Table of Contents

I. The Scope of Checksum Calculation

There are two methods to calculate the checksum scope for the programmer, File Checksum and Chip Checksum. When the files are loaded into the buffer of the programmer software, the File Checksum will be displayed in the red box, while the Chip Checksum will be displayed in the green box.



The differences between File Checksum and Chip Checksum

File Checksum

It calculates the Checksum values for the programming file, and the calculation scope depends on the file size.

Chip Checksum

It calculates the checksum value of all partitions available in the programmer software. In other WORDs, it adds up the checksum values of the data stored in the memory partitions that can be programmed. Users can select which partitions to include in the Chip Checksum in the programmer software, as demonstrated in Example 2 below.

Example 1:

The programmed IC type is EEPROM, and its model name is ACE024C02. It only has one memory partition that can be programmed, called EEPROM, with a memory size of 256 bytes (which converts to hexadecimal as 0x100).

The programming file size is 128Byte (which converts to hexadecimal as 0x80).

Programming File (image1)																
Address offest (h)	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
0x0	image 1 data (0x0~0x7F) File Checksum															
0x10																
0x20																
0x30																
0x40																
0x50																
0x60																
0x70																

Programmer Buffer																
Address offest (h)	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
0x0	image 1 data (0x0~0x7F)															
0x10																
0x20																
0x30																
0x40																
0x50																
0x60																
0x70																
0x80	The remaining portion of the buffer that did not load with the file data will be the default value for the blank IC. For EEPROM, the default value is 0xFF.															
0x90																
0xA0																
0xB0																
0xC0																
0xD0																
0xE0																
0xF0																

Chip Checksum

File Checksum Calculation Scope = File's own data (0x0~0x7F)

Chip Checksum Calculation Scope =

Data imported from the file to the buffer address (0x0~0x7F)

+ Blank Data (0xFF) of the Buffer Address (0x80~0xFF)

To put it another way, it calculates the checksum for the range of the buffer addresses (0x0 to 0xFF) that have been loaded.

Example 2:

The programmed IC type is SPI NOR Flash, and its model name is S25FL032P. It has two memory partitions that can be programmed, that are called

1. Flash; memory size is 4194304 Bytes (which converts to hexadecimal as 0x400000)
2. 512Bytes OTP; memory size is 512 Bytes (which converts to hexadecimal as 0x200)

The programming file size is 2097152 Bytes (which converts to hexadecimal as 0x200000)

Programming File (image1)																
Address offest (h)	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
0x0	image 1 data (0x0~0x1FFFFF) File Checksum															
...																
...																
0x100000																
...																
...																
...																
0x1FFFFF																

File Checksum Calculation Scope = File's own data (0x0~ 0x1FFFFF)

Programmer Buffer (Flash)																
Address offest (h)	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
0x0																
…																
…																
0x100000	image 1 data (0x0~0x1FFFFF)															
…																
…																
…																
0x1FFFFF																
0x200000																
…																
…																
0X300000	The remaining portion of the buffer that did not load with the file data will be the default value for the blank IC. For SPI NOR, the default value is 0xFF.															
…																
…																
…																
0X3FFFFF																

Programmer Buffer (512Bytes OTP)																
Address offest (h)	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
0x0																
…																
…																
…	Since no file is loaded into this buffer partition, if this partition is blank, the default value is 0xFF.															
…																
…																
…																
0x1FF																

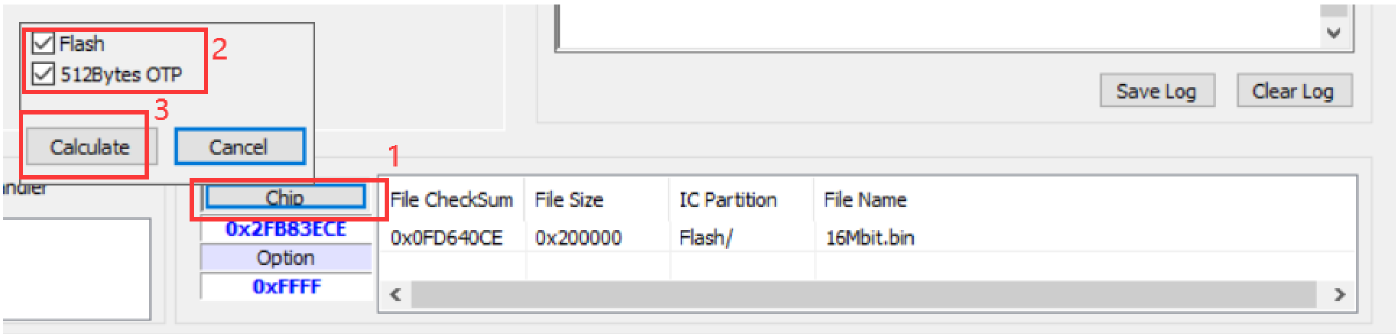
Chip Checksum = Flash(0x0~0x3FFFFF) + 512Bytes OTP(0x0~0x1FF)

Chip Checksum Calculation Scope =

Data imported from the file to the Buffer (Flash) Address (0x0~0x1FFFFF)

+ Blank Data (0xFF) of the Buffer (Flash) Address (0x200000~0x3FFFFF)

+ Blank Data (0xFF) of the Buffer (512Bytes OTP) Address (0x0~0x1FF)



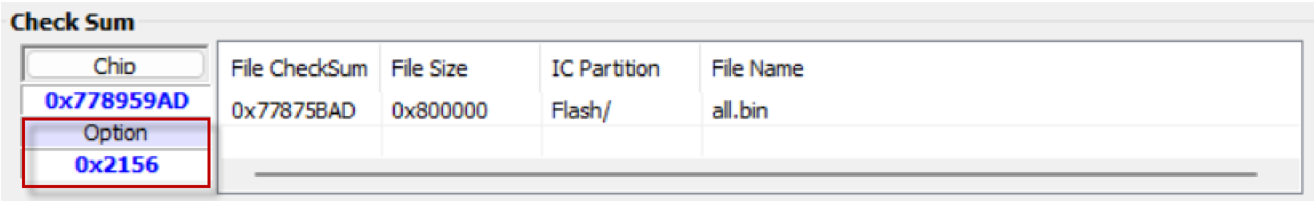
Programmer software allows the user to select which Buffer Partition can be included in the Chip Checksum calculation. To do so, please follow the steps below:

1. Click the Chip button
2. Choose the partition that will be calculated in the chip checksum
3. Click the Calculate button

- Example 2-1

If the user selects only the Buffer (Flash) Partition, then only that partition will be included in the calculation of the Chip Checksum.

Option Checksum

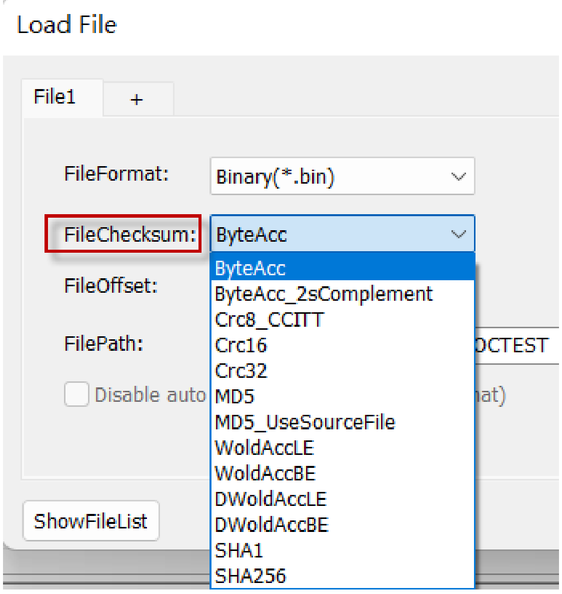


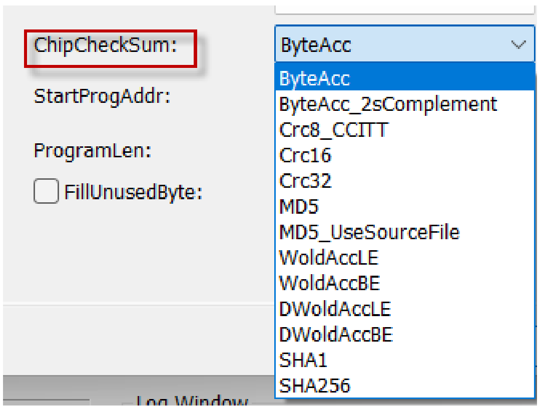
The Option Checksum is calculated using the CRC-16 algorithm based on the option bytes in the Config setting. The default value for the Option Checksum is 0xFFFF.

II. Checksum Algorithm Types

The programmer software supports the below Checksum algorithm types.

When loading a file, you can choose the type of algorithm you want to use to calculate the File Checksum and Chip Checksum.





Note: For SPI NAND and Parallel NAND chips, the Chip Checksum only supports ByteACC.

Take this file as an example for calculation.

```
DOCTEST
Offset(h) 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F  解碼的文字
00000000  00 11 22 33 44 55 66 77 88 99 AA BB CC DD EE FF  .."3DUfw^™ª»ÌÝîÿ
```

ByteACC (Byte sum (x8))

Algorithm Description:

Sum the data bytes byte by byte and disregard any carry beyond 32 bits.

Result:

00 + 11 + 12 + 33 + 44 + 55 + 66 + 77 + 88 + 99 + AA + BB + CC + DD + EE + FF = 0x7F8

ByteACC_2s complement

Algorithm Description:

Sum the data bytes byte-by-byte, and take the two's complement out of the sum. Any carry beyond 32 bits will be ignored.

Result: 0xFFFFF808

CRC8_CCITT

Algorithm Description:

Data are summed by bytes to sum by bytes to WORD using standard CRC-8 algorithm with polynomial x^8+x^2+x+1, (0x7), init value 0, and XOR out 0

Result: 0x0000004D

CRC16

Algorithm Description:

Data are summed by bytes to sum by bytes to WORD using standard CRC-16 algorithm with polynomial x^16+x^12+x^5+1 (0x8408), init value 0, and XOR out 0

Result: 0x00007842

CRC32

Algorithm Description:

Buffer data are summed by bytes to DWORD using standard CRC-32 algorithm with polynomial.

x^32+x^26+x^23+x^22+x^16+x^12+x^11+x^10+x^8+x^7+x^5+x^4+x^2+x+1 (0x04C11DB7), init value 0xFFFFFFFF, and XOR out 0xFFFFFFFF

Result: 0x8407759B

MD5

Algorithm Description:

The MD5 Message-Digest Algorithm is a widely used cryptographic hash function for passwords that can generate 128-bit (16-byte) hash values.

Result: 0x6E8311168EE16D6AA1AA48C64145003C

MD5_UseSourceFile

Algorithm Description:

Also use the MD5 algorithm, but the Chip Checksum will be calculated based on the programming file rather than the loaded Buffer data of the programmer.

Example:

The IC that is going to be programmed only has one available programmable memory partition. The memory size is 128 Bytes (equivalent to 0x80 in hexadecimal), and the programming file size is 256 Bytes (equivalent to 0x100 in hexadecimal).

MD5_UseSourceFile

Programming File (image1)																
Address offest (h)	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
0x0	image 1 data (0x0~0x7F)															
0x10																
0x20																
0x30																
0x40																
0x50																
0x60																
0x70																
0x80	The data located at addresses 0x80 to 0xFF in the file exceeds the size of the buffer and will not be loaded into the buffer.															
0x90																
0xA0																
0xB0																
0xC0																
0xD0																
0xE0																
0xF0																

Programmer Buffer																
Address offest (h)	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
0x0	image 1 data (0x0~0x7F)															
0x10																
0x20																
0x30																
0x40																
0x50																
0x60																
0x70																

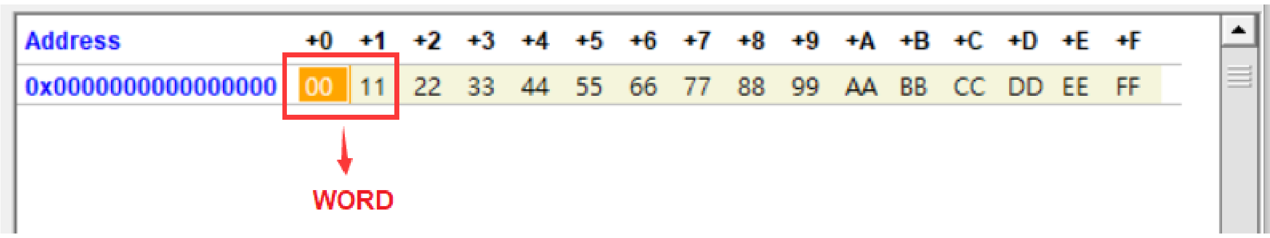
Result: 0x6E8311168EE16D6AA1AA48C64145003C

WoldAccLE (WORD)

Algorithm Description:

The actual name is WORD sum Little-Endian (x16). Sum the data WORD-by-WORD; any carry beyond 32 bits will be ignored. The technical term Little-Endian means that the checksum is calculated based on the WORD read from the programmer Buffer or the programming file in Little-Endian mode (The highest byte of the programming file or the programmer buffer data will be read and placed at the highest address).

Assume the programmer software Buffer has the data loaded as shown below:



Then, there will be eight sets of WORDs:

0x1100 in Little-Endian mode, the WORD will be read as 0x1100

0x3322 in Little-Endian mode, the WORD will be read as 0x3322

0x5544 in Little-Endian mode, the WORD will be read as 0x5544

0x7766 in Little-Endian mode, the WORD will be read as 0x7766

0x9988 in Little-Endian mode, the WORD will be read as 0x9988

0xBBAA in Little-Endian mode, the WORD will be read as 0xBBAA

0xDDCC in Little-Endian mode, the WORD will be read as 0xDDCC

0xFFEE in Little-Endian mode, the WORD will be read as 0xFFEE

The total Checksum of the above eight sets of WORDs = 0x000443B8

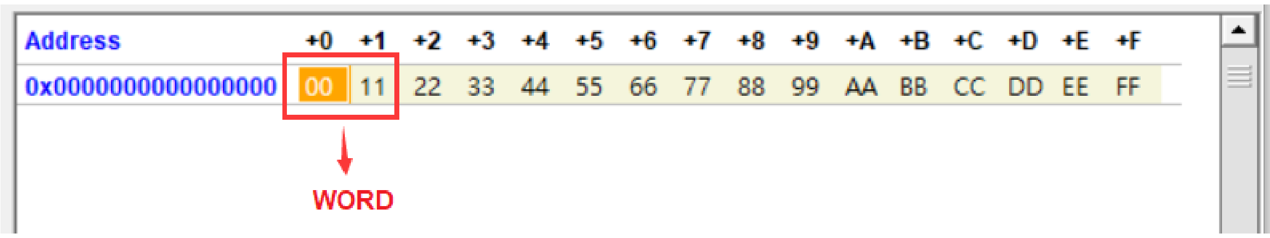
Result: 0x000443B8

WoldAccBE (WORD)

Algorithm Description:

The actual name is WORD sum Big-Endian (x16). The data is summed up WORD-by-WORD byte by byte, and any carry beyond 32 bits will be ignored. Technical term Big-Endian means that the Checksum is calculated based on the WORD read from the programmer buffer or the programming file in the Big-Endian mode (The highest byte of the programming file or the programmer Buffer data will be read and placed at the lowest address).

Assume the programmer software Buffer has the data loaded as shown below:



Then, there will be eight sets of WORDs:

0x1100 in Big-Endian mode, the WORD will be read as 0x0011

0x3322 in Big-Endian mode, the WORD will be read as 0x2233

0x5544 in Big-Endian mode, the WORD will be read as 0x4455

0x7766 in Big-Endian mode, the WORD will be read as 0x6677

0x9988 in Big-Endian mode, the WORD will be read as 0x8899

0xBBAA in Big-Endian mode, the WORD will be read as 0xAABB

0xDDCC in Big-Endian mode, the WORD will be read as 0xCCDD

0xFFEE in Big-Endian mode, the WORD will be read as 0xEEFF

The total Checksum of the above eight sets of WORDs = 0x0003BC40

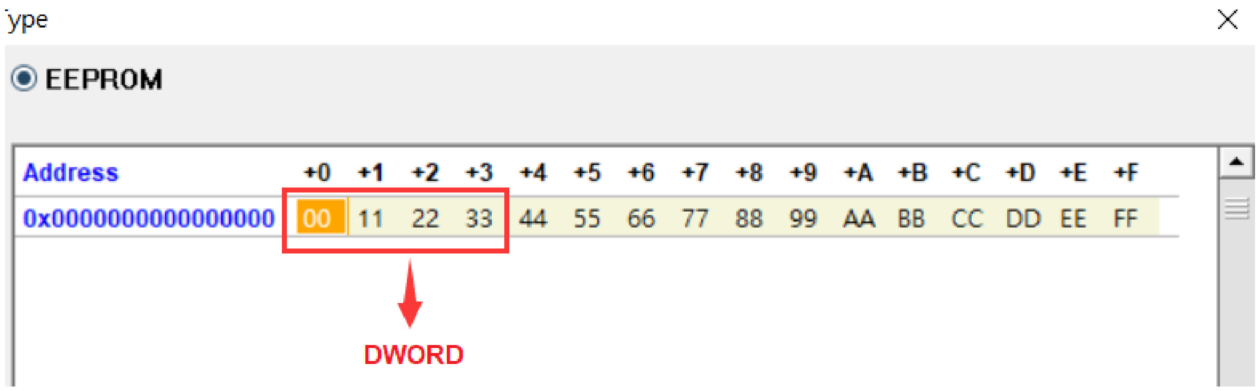
Result: 0x0003BC40

DWoldAccLE (DWORD)

Algorithm Description:

The actual name is DWORD sum Little-Endian (x16). Sum the data DWORD-by-DWORD; any carry beyond 32 bits will be ignored. The technical term Little-Endian means that the checksum is calculated based on the DWORD read from the programmer Buffer or the programming file in Little-Endian mode (The highest byte of the programming file or the programmer buffer data will be read and placed at the highest address).

Assume the programmer software Buffer has the data loaded as shown below:



Then, there will be four sets of DWORDs:

0x33221100 in Little-Endian mode, the DWORD will be read as 0x33221100

0x77665544 in Little-Endian mode, the DWORD will be read as 0x77665544

0xBBAA9988 in Little-Endian mode, the DWORD will be read as 0xBBAA9988

0xFFEEDDCC in Little-Endian mode, the DWORD will be read as 0xFFEEDDCC

The total Checksum of the above four sets of DWORDs = 0x26621DD98

Since any carry beyond 32 bits will be ignored, the 33rd bit and beyond will also be ignored.

Therefore, the final Checksum = 0x6621DD98.

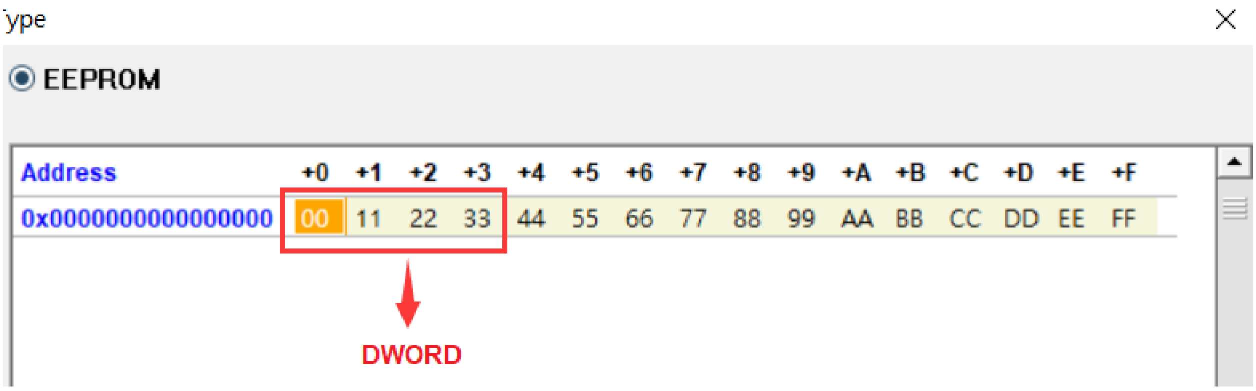
Result: 0x6621DD98

DWoldAccBE (DWORD)

Algorithm Description:

The actual name is DWORD sum Big-Endian (x16). The data is summed up DWORD-by-DWORD, and any carry beyond 32 bits will be ignored. Technical term Big-Endian means that the Checksum is calculated based on the DWORD read from the programmer buffer or the programming file in the Big-Endian mode (The highest byte of the programming file or the programmer Buffer data will be read and placed at the lowest address).

Assume the programmer software Buffer has the data loaded as shown below:



Then, there will be four sets of DWORDs:

0x33221100 in Big-Endian mode, the DWORD will be read as 0x00112233

0x77665544 in Big-Endian mode, the DWORD will be read as 0x44556677

0xBBAA9988 in Big-Endian mode, the DWORD will be read as 0x8899AABB

0xFFEEDDCC in Big-Endian mode, the DWORD will be read as 0xCCDDEEFF

The total Checksum of the above four sets of DWORDs = 0x199DE2264

Since any carry beyond 32 bits will be ignored, the 33rd bit and beyond will also be ignored.

Therefore, the final Checksum = 0x99DE2264

Result: 0x99DE2264

SHA1

Algorithm Description:

SHA-1 (Secure Hash Algorithm 1) is a type of cryptographic hash function designed by the US National Security Agency and published as a Federal Information Processing Standard (FIPS) by the US National Institute of Standards and Technology (NIST). SHA-1 can generate a 160-bit (20-byte) hash value known as a message digest, which is typically represented as 40 hexadecimal digits.

Result: 0x739E0E8490EACBCB2EA11D4A5DBEFBAE888B092E

SHA256

Algorithm Description:

SHA-256" is the English abbreviation for "Secure Hash Algorithm 256-bit". It is a cryptographic hash function that enhances security through encryption. SHA-256 can generate a 256-bit (32-byte) hash value known as a message digest, which is typically represented as 64 hexadecimal digits

Result:

0xA8FAED6ABBF35C12A4B26E40F6FEB19D736D90045C83B9F9A31F638D323E6811

III. Additional Information

What are Big-Endian and Little-Endian

Big-Endian: When data is imported into the buffer of the programmer software, the highest byte of the data will be placed at the lowest address of the buffer.

Little-Endian: When data is imported into the buffer of the programmer software, the highest byte of the data will be placed at the highest address of the buffer.

For example, if there is a 32-bit data such as 0x11223344, when it is input by a Big-Endian system into the buffer of the programmer software, it will be placed in the buffer according to the rule shown in the image below:

Big-Endian
The highest bytes of the data will be placed at the lowest address of the Buffer.

0x11223344

Programmer Buffer				
Address offest (h)	00 (Buffer lowest address)	01	02	03 (Buffer highest address)
0x0	0x11	0x22	0x33	0x44

However, if it is input by a Little-Endian system, it will be placed in the buffer in reverse order, as shown below:

Little-Endian
The highest bytes of the data will be placed at the highest address of the Buffer.

0x11223344

Programmer Buffer				
Address offest (h)	00 (Buffer lowest address)	01	02	03 (Buffer highest address)
0x0	0x44	0x33	0x22	0x11

IV. Revision History

Date	Version	Description
2023/3/16	1.0	Initial Release

DediProg Technology Co., Ltd. (Headquarter)
No. 142, Ankang Rd., Neihu Dist., Taipei City, Taiwan, R.O.C 114044
TEL: 886-2-2790-7932 FAX: 886-2-2790-7916

Technical Support: **support@dediprog.com** Sales Support: **sales@dediprog.com**