

# **Development Guide for DCT\_100B Basic I/O Board V1.0**

**May,2013**

**Amp Display Inc.**

## Index

|                             |    |
|-----------------------------|----|
| 1 GENERAL INFORMATION ..... | 2  |
| 2 VARIABLE MEMORY .....     | 3  |
| 3 SCHEMATICS .....          | 4  |
| 4 BASIC HARDWARE SPEC.....  | 5  |
| 5 DATA COMMUNICATION .....  | 6  |
| 6 INSTALLATION:.....        | 8  |
| 7 DIMENSIONS .....          | 9  |
| 8 REVISION HISTORY .....    | 10 |

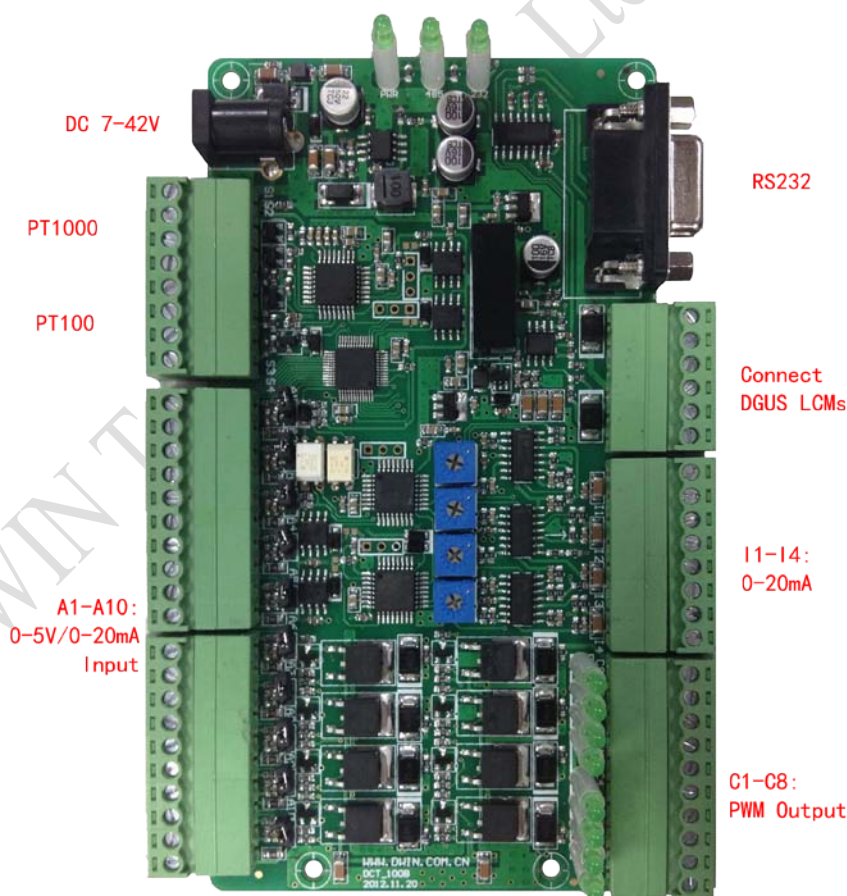


## 1 General Information

DCT\_100B I/O extension Device is designed to expand the functionalities of DGUS LCM. Seamless working with host device -DGUS LCM, a mid-small industrial automation system which is highly reliable and high cost effective can be easily built-up.

The features of DCT\_100B:

- Build-In DC/DC, support DC7-42V wide input voltage.
- 2 ways for PT1000 input, 2 ways for PT100 input.
- 10 ways of 0-5V or 0-20mA non-isolated analog input measurement, the tolerance is +/-1mV.
- 8 ways of non-isolated, 16bit PWM output, max output current can be 1A for single way.
- 4 ways of 0-20mA output.
- 1 RS232 port with fixed baud rate 115200bps.
- 1 RS485 port with baud rate can be set from 2400-115200bps.
- 100% compatible with DGUS LCMs.
- 8 16bits software timer, 4 32bit software timer, 4 32bit clock in BCD code.
- LEDs indicates the working status for Power, communication and PWM output.
- Use 3.81mm contact to connect with peripherals.
- Working temperature:-40/+85°C.
- Use Rails to install.



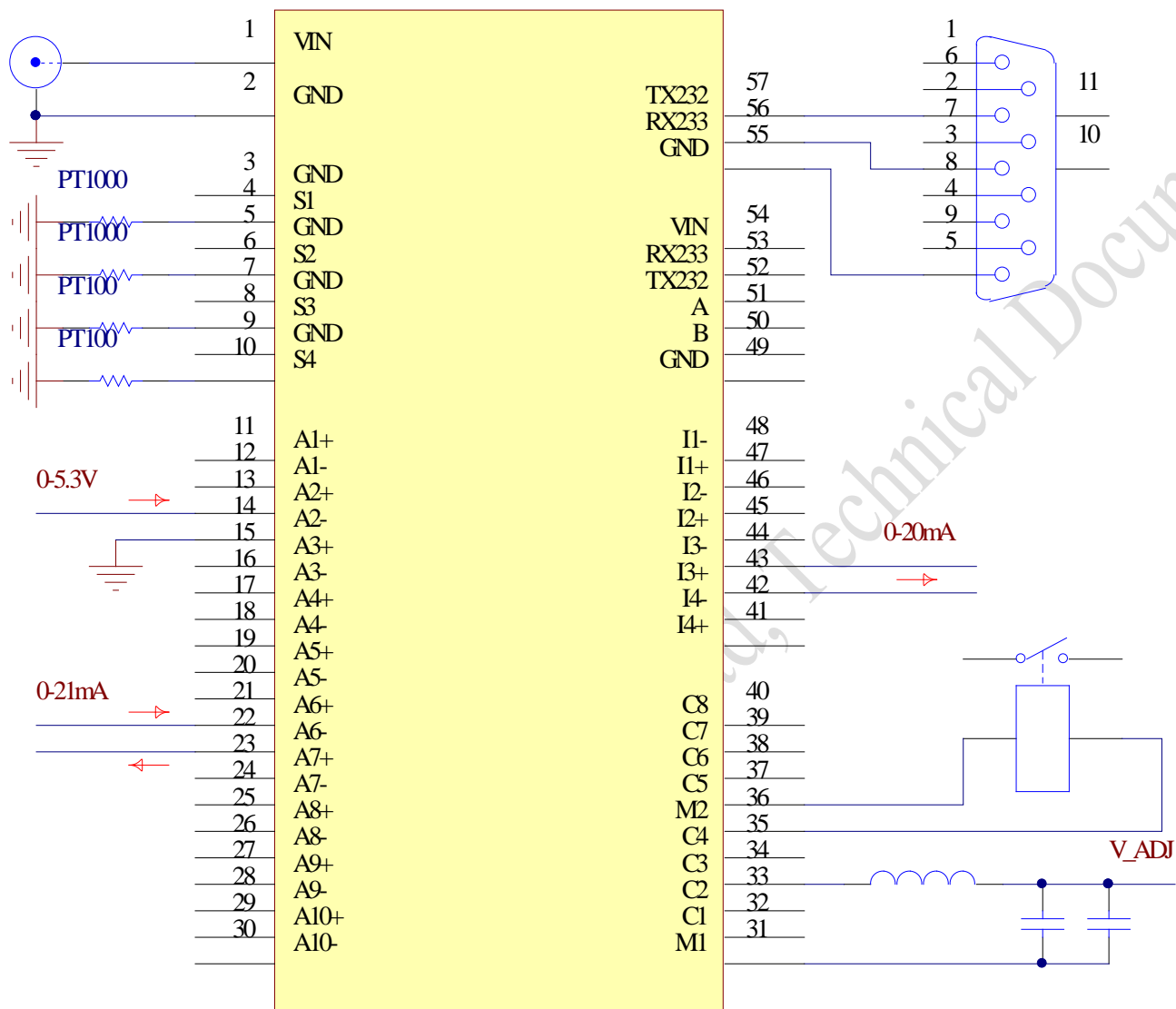
## 2 Variable Memory

Every DCT\_100B will take 64 words to store the device properties. When DGUS LCM is connected with it, DGUS LCM will allocate 64 words in the memory for mapping the variables in DCT\_100B correspondingly.

| Type      | Variable Add. |      | Length<br>(Bytes) | Definition                               | Description   |
|-----------|---------------|------|-------------------|--|---|
|           | DCT_100B      | DGUS |                   |  |   |
| I/O       | 0x00          | 0x00 | 16                | Model, version and I/O                   | DCT_100B V1.0 1412<br>Note: 1412=14AI, 12AO   |
| AI        | 0x10          | 0x08 | 2                 | Data collected in S1 channel from PT1000 | Use BCD Code, 1 decimal, highest bit is signed/unsigned. If returned value is 0x8233, indicated the temperature is -23.3°C. This value can be calibrated by 0x8E via RS232.                         |
|           | 0x12          | 0x09 | 2                 | Data collected in S2 channel from PT1000 |   |
|           | 0x14          | 0x0A | 2                 | Data collected in S3 channel from PT100  |   |
|           | 0x16          | 0x0B | 2                 | Data collected in S4 channel from PT100  |   |
|           | 0x18          | 0x0C | 2                 | Input voltage for channel A1             | Input Voltage: 0-5.3V<br>Input Current: 0-21mA<br>Enable build-in resistant of $249 \pm 1\%$ Ohm if jumper is shortened.<br>Precision: $\pm 1\text{mV}$ , can be calibrated by 0x8E via RS232.      |
|           | 0x1A          | 0x0D | 2                 | Input voltage for channel A2             |   |
|           | 0x1C          | 0x0E | 2                 | Input voltage for channel A3             |   |
|           | 0x1E          | 0x0F | 2                 | Input voltage for channel A4             |   |
|           | 0x20          | 0x10 | 2                 | Input voltage for channel A5             |   |
|           | 0x22          | 0x11 | 2                 | Input voltage for channel A6             |   |
|           | 0x24          | 0x12 | 2                 | Input voltage for channel A7             |   |
|           | 0x26          | 0x13 | 2                 | Input voltage for channel A8             |   |
|           | 0x28          | 0x14 | 2                 | Input voltage for channel A9             |   |
|           | 0x2A          | 0x15 | 2                 | Input voltage for channel A10            |   |
| AO        | 0x34          | 0x1A | 2                 | Output current for I1,0-20mA             | Last 2 bits indicates the decimal numbers. For example: 0x320 indicates 8.00mA output.  |
|           | 0x36          | 0x1B | 2                 | Output current for I2,0-20mA             |   |
|           | 0x38          | 0x1C | 2                 | Output current for I3,0-20mA             |   |
|           | 0x3A          | 0x1D | 2                 | Output current for I4,0-20mA             | 16bit PWM output, 0x8000 is GND, 0x0000 is 1/2 power, 0x7FFF is full power.<br>Frequency for PWM is 732Hz, max current for single connection is 1A. Brightness of output LED indicates the voltage. |
|           | 0x3C          | 0x1E | 2                 | PWM output for C1 channel                |   |
|           | 0x3E          | 0x1F | 2                 | PWM output for C2 channel                |   |
|           | 0x40          | 0x20 | 2                 | PWM output for C3 channel                |   |
|           | 0x42          | 0x21 | 2                 | PWM output for C4 channel                |   |
|           | 0x44          | 0x22 | 2                 | PWM output for C5 channel                |   |
|           | 0x46          | 0x23 | 2                 | PWM output for C6 channel                |   |
|           | 0x48          | 0x24 | 2                 | PWM output for C7 channel                |   |
|           | 0x4A          | 0x25 | 2                 | PWM output for C8 channel                |   |
| Timer     | 0x4C          | 0x26 | 2                 | Timer0                                   | 16bit software timer:<br>Time unit is 1ms, max time is 65.335 seconds.<br>Count down will be stopped if 0.  |
|           | 0x4E          | 0x27 | 2                 | Timer1                                   |   |
|           | 0x50          | 0x28 | 2                 | Timer2                                   |   |
|           | 0x52          | 0x29 | 2                 | Timer3                                   |   |
|           | 0x54          | 0x2A | 2                 | Timer4                                   |   |
|           | 0x56          | 0x2B | 2                 | Timer5                                   |   |
|           | 0x58          | 0x2C | 2                 | Timer6                                   |   |
|           | 0x5A          | 0x2D | 2                 | Timer7                                   |   |
|           | 0x5C          | 0x2E | 4                 | Timer8                                   | 32bit software timer:<br>Time unit is 1ms, max time is 4294967.298 seconds.<br>Count down will be stopped if 0.   |
|           | 0x60          | 0x30 | 4                 | Timer9                                   |   |
|           | 0x64          | 0x32 | 4                 | Timer10                                  |   |
|           | 0x68          | 0x34 | 4                 | Timer11                                  |   |
|           | 0x6C          | 0x36 | 4                 | Timer12                                  | Clock timer:<br>Hours: Minute: Second, Millisecond in BCD code<br>Count down will stop at 00:00:00:00   |
|           | 0x70          | 0x38 | 4                 | Timer13                                  |   |
|           | 0x74          | 0x3A | 4                 | Timer14                                  |   |
|           | 0x78          | 0x3C | 4                 | Timer15                                  |   |
| Reserv ed | 0x7C          | 0x3E | 4                 | Not defined                              |   |

Note: During the storage and transmission, all the data are sent by MSB.

### 3 Schematics



## 4 Basic Hardware Spec.

| Type                     | Parameters                | Test Condition                                 | Min   | Type  | Max   | Unit |
|--------------------------|---------------------------|--|-------|-------|-------|------|
| Power Supply             | Voltage                   |  | 7     | 24    | 42    | V    |
|                          | Current                   | 24V, input and output is floating              |       | 10    |       | mA   |
| AI(S1-S2)                | Measuring range           |  | -50   |       | 130   | °C   |
|                          | Measuring tolerance       |  | -0.8  | 0     | 0.8   | Ω    |
| AI(S3-S4)                | Measuring range           |  | -50   |       | 130   | °C   |
|                          | Measuring tolerance       |  | -0.08 | 0     | 0.08  | Ω    |
| AI<br>(A1-A10)           | Input Voltage             | Jumper is open circuit, measure the voltage.   | 0     |       | 5.3   | V    |
|                          | Input Impedance           |  |       | 85    |       | K Ω  |
|                          | Input Current             | Jumper is open circuit, measure the voltage.   | 0     |       | 21    | mA   |
|                          | Input Impedance           |  | 248   | 249   | 250   | Ω    |
|                          | Resolution                |  |       | 1     |       | mV   |
|                          | Measurement               | 2.500V input                                   | -1    | 0     | +1    | mV   |
|                          | Cut-off frequency of DGUS |  |       | 2.5   |       | Hz   |
| AO<br>(C1-C8)            | Frequency of PWM          | Output is set to 0x0000, the duty ratio is 50% |       | 732   |       | Hz   |
|                          | Resolution of PWM         |  |       | 16    |       | bit  |
|                          | Output range of PWM       | Power voltage is 24V,no load                   | 0     |       | 24    | V    |
|                          | Load current of PWM       | Power voltage is 24V, pure resistor load       | 0     | 1     | 2     | A    |
| AO(I1-I4)                | Output range              |  | 0     |       | 20    | mA   |
|                          | Output tolerance          |  | -0.1  | 0     | 0.1   | mA   |
| RS485                    | Baud Rate                 | N81 mode, can be set via RS232                 | 2.4   | 115.2 | 115.2 | Kbps |
|                          | Load capacity of BUS      |  |       |       | 64    |      |
| RS232                    | Baud Rate                 |  |       | 115.2 |       | Kbps |
| Environment<br>Parameter | Operating Temperature     |  | -40   | 25    | 85    | °C   |
|                          | Storage Temperature       |  | -55   | 25    | 85    | °C   |
|                          | Operating Humidity        | 25   | 10%   |       | 90%   | RH   |

## 5 Data Communication

### 5.1 RS232 Interface

Serial connection properties:

115200bps, N81 (1 starting bit, 8 Data bits, 1 stop bit, No parity bit)

Data frame

| Address | 0x00       | 0x02        | 0x03    | 0x04 | 0x05      |
|---------|------------|-------------|---------|------|-----------|
| Def.    | 0x5AA5     | Length      | Command | 0x00 | DATA_Pack |
| Spec.   | Frame head | Data length | Cmd     |      | Data_pack |
| E.g.    | 0x5AA5     | 0x04        | 0x82    | 0x00 | 0x08 0x01 |

Instructions:

- 0x80: Configure properties of RS485 interface

TX: 5A A5 07 80 00 **ADR485** **BODE\_485** **ACK\_ADR\_START** **ACK\_ADR\_END**

RX: None

E.g: 5A A5 07 80 00 **0001** **07** **08** **21**

ADR485: RS485 address, 0x0001-0xFFFE. 0x0001 is factory default value;

BODE\_485: Baud Rate for RS485, 0x00-0x0F. Default value is 0x07. Please refer to the chart below.

| Bode_485  | 0x00  | 0x01  | 0x02  | 0x03   | 0x04   | 0x05   | 0x06   | 0x07   |
|-----------|-------|-------|-------|--------|--------|--------|--------|--------|
| Baud Rate | 2400  | 2400  | 4800  | 9600   | 19200  | 38400  | 57600  | 115200 |
| Bode_485  | 0x08  | 0x09  | 0x0A  | 0x0B   | 0x0C   | 0x0D   | 0x0E   | 0x0F   |
| Baud Rate | 28800 | 76800 | 62500 | 125000 | 250000 | 230400 | 345600 | 691200 |

ACK\_ADR\_START: Start address of the register for auto reply by RS485. Value is 0x00-0x3F

ACK\_ADR\_END: Final address of the register for auto reply by RS485. Value is 0x00-0x3F

- 0x81: Read the properties of RS485 interface

TX: 5A A5 03 81 00 05

RX: 5A A5 07 81 00 ADR485 BODE\_485 ACK\_ADR\_START ACK\_ADR\_END

- 0x82: Read from memory

TX: 5A A5 04 82 00 ADR(0x00-0x3F) RD\_LEN

RX: 5A A5 LEN 82 00 ADR DATA

ADR: Start address (Word) of variable memory to be read in DCT\_100B.

RD\_LEN: The length of the info to be read.

**Note: 0x82 command will clear the contents from memory after reading it.**

- 0x83: Write in memory

TX: 5A A5 LEN 83 00 ADR(0x1D-0x3F) WR\_LEN DATA

RX: None

ADR: Start address (Word) of variable memory to be changed in DCT\_100B.

WR\_LEN: The length of the info to be written.

DATA: The contents to be written.

## 5.2 RS485 Interface

### Serial Connection properties

Baud Rate can be set from 2400bps – 691.2Kbps via RS232. Transmit in N81 mode: 1 starting bit, 8 data bits, 1 stop bit, no parity bit)

### Data frame

|       |            |             |         |           |        |
|-------|------------|-------------|---------|-----------|--------|
| Addr. | 0x00       | 0x02        | 0x03    | 0x04      | 0x05   |
| Def.  | 0x5AA5     | Length      | Command | DATA_Pack | CRC16  |
| Spec  | Frame head | Data length | Cmd     | Data      | ECC    |
| E.g.  | 0x5AA5     | 0x03        | 0x8F    |           | 0xFEE4 |

CRC16 is the CRC sum in ANSI,  $X^{16}+X^{15}+X^2+1$  for instructions and data.

### Instructions

- 0x83: Write contents in memory via RS485

TX: 5AA5 LEN 83 ADR\_DGUS LEN\_DATA DATA CRC,

RX: None

E.g. 5AA5 10 83 005D 05 FF FF FF FF FF FF FF FF 00 00 25AE

ADR\_DGUS: Starting address of DGUS data variable memory which is mapped from DCT\_100B memory, every DCT\_100B will be assigned 64 words (128KB) according to the RS485 address.

ADR\_DGUS=ADR485\*64+DCT\_100B starting address

LEN\_DATA: Length of the contents to be written in Word

DATA: data to be written.

- 0x8F: Signal for reading request in RS485

TX: 5AA5 03 8F FE E4

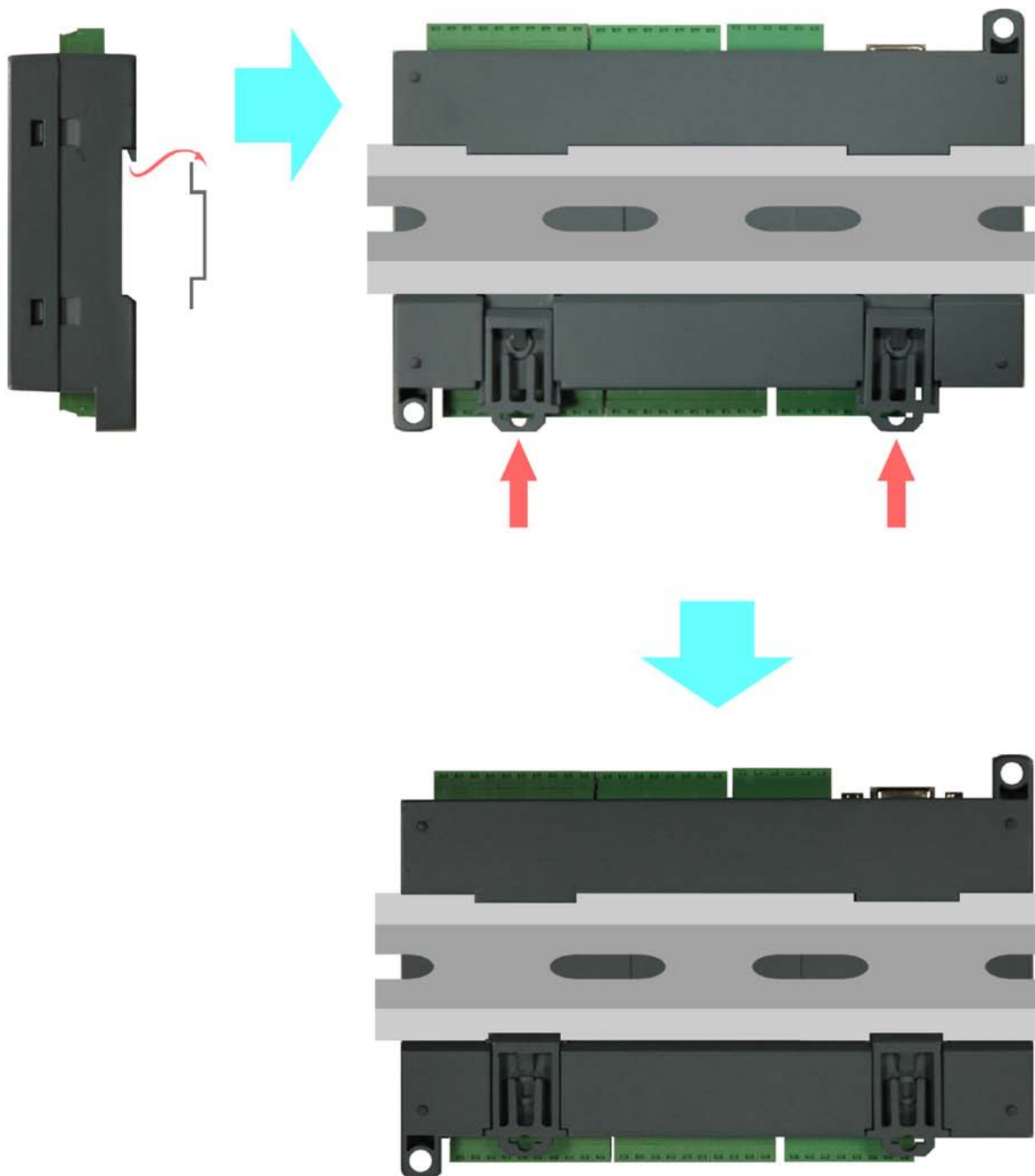
RX: 5AA5 LEN 82 ADR\_DGUS DATA CRC

To avoid data collision, all devices on RS485 will answer 0x8F command by Timing, the range of acknowledged data will be decided by ACK\_ADR\_START and ACK\_ADR\_END set by 0x80 command via RS232.

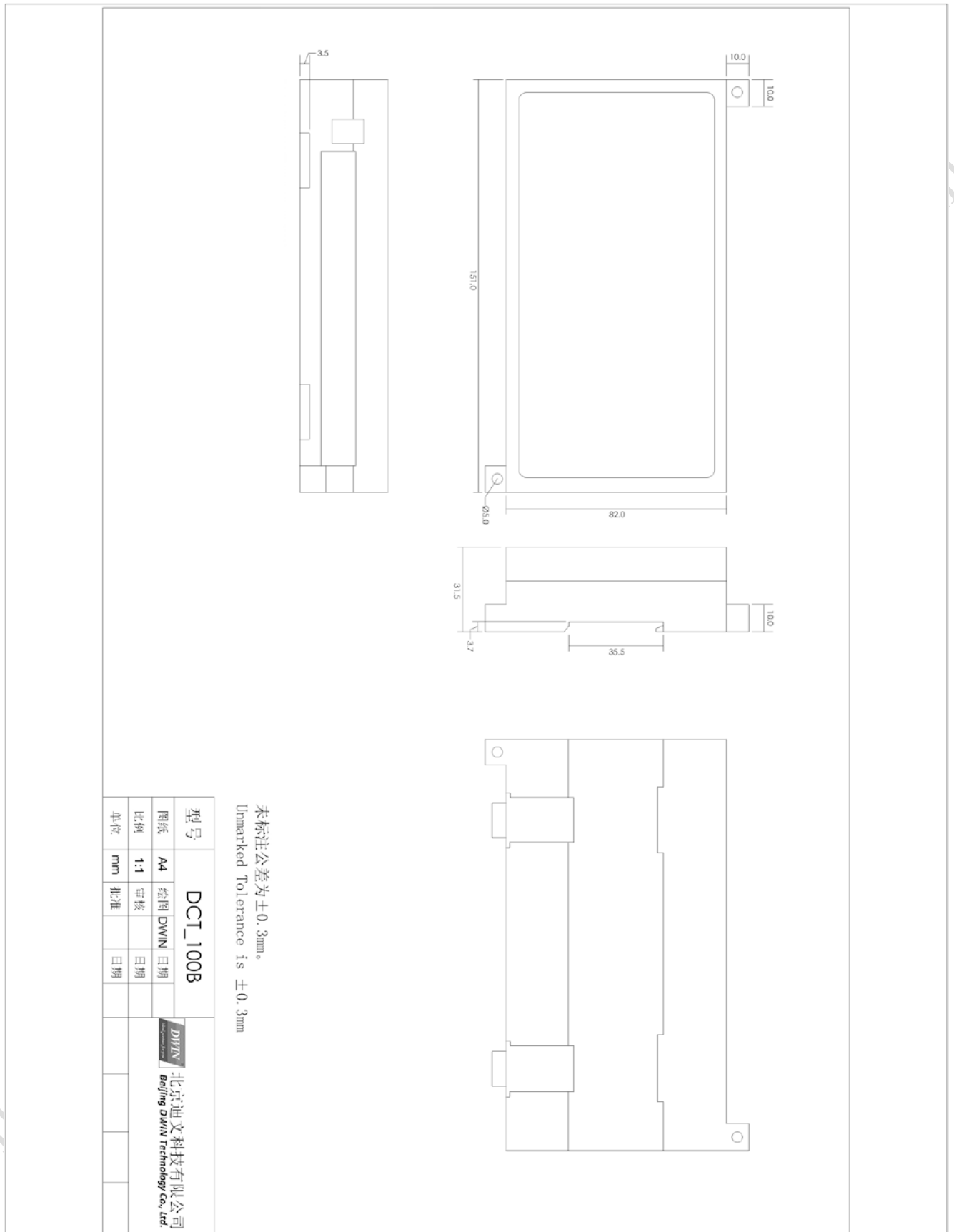


## 6 Installation:

DCT\_100B use rails to install as the diagram below:



## 7 Dimensions



## 8 Revision History

| Data       | Contents         | Version |
|------------|------------------|---------|
| 2012.12.11 | Initial released | V1.0    |

If you have any doubts, suggestions, or want the latest update for our industrial automation products, please contact us :

[info@ampdisplay.com](mailto:info@ampdisplay.com)

Thank you and your support will motivate us for further improvements!