User Manual

# USBCAN-2I Industrial CAN-bus Module

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User Manual

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|---|---|
| Keywords | USBCAN, PC-CAN, CAN Interface Module |
| Summary | |

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# 1 Introduction

## 1.1 Description

USBCAN-2I intelligent module integrates two isolate CAN-bus interfaces. With USB interface, it can transfers data from PC and CAN-bus. The CAN-bus interfaces accord with the CAN Specification 2.0A/B, and it supports the any baud rate from 5Kbps to 1Mbps. It has perfect protection function and high reliability as a CAN-bus node.

## 1.2 Features

- CAN: Supports CAN Specification 2.0A/B, Conforms to ISO/DIS11898；
- USB: Supports USB2.0, Compatible with USB1.1;
- Baud Rate：From 5K bps To 1Mbps；
- Power: USB port or an external power supply（DC5V and ≥500mA）.

## 1.3 External interfaces

- USB：Connector of USB-B；
- CAN：The 3 Pin open Connector；
- Terminal Resistance：With the dip switch.

## 1.4 Applications

- CAN-bus Data Analysis；
- Adjustment of CAN-bus Equipment；
- Expanding the CAN-bus Nodes.

### 1.5 Supporting Operating System

- Windows98/Me/2000/XP/2003；
- Linux 2.4、Linux 2.6.

### 1.6 Using Environment

- Operating Temperature: -25°C ～ +85°C；
- Storage Temperature: -40°C ～ +85°C.

## 2 Technical Support

If you want get technical support or the latest information about this product, please access the website: http:/www.itek.net.cn.

## 3 About Function

### 3.1 Summary

USBCAN-2I intelligent CAN interface module made in iTEK. It is convenient to Using it for collecting data, and analysing data, and processing data in building CAN-bus laboratory, or industrial control, or intelligent community, or automotive electronics. USBCAN-2I has these characteristics, such as compact design and beautiful appearance and plug-and-play etc, and it is dependable assistant in matching equipment and debugging equipment and developing equipment.

### 3.2 Parameters

- Adopts electrical isolation, the isolation voltage is : 2500Vrms;
- Max data flow for a single channel: 3000 fps (standard frame);
- Power consumption: ≤2W.
- Physical size: (length) 100mm * (width) 65mm * (height) 25mm.

- Supports iTEK CANalyst software.

### 3.3 Appearance


# 4 Using Product

## 4.1 Power supply

It can be powered by either PC USB port or an external DC5V power supply.

**Using USB port power supply:**

Connecting the USBCAN-2I module to the PC with the attached cable can provide the module with a +5V voltage. Firstly, the LED POWER becomes to green, indicating the power supply works normally.

**External DC5V Power Supply:**

External power supply is used in case that the USB port is unable to provide enough current for USBCAN-2I interface when the PC is using an USB hub or connected with many USB terminal devices.

When the external power supply (DC5V@500mA, Inner pin is positive and outside is negative) is connected to the POWER jack of the USBCAN-2I module,

the LED POWER becomes to green. Now, user only need to connect the USBCAN-2I module to the PC with the attached USB cable to start the module.

## 4.2 CAN-bus connector

USBCAN-2I module integrates two independent CAN-bus channels, and they are can be connected with two different CAN network. The pin signal definitions for CAN port, please see Table 1.

**Table 1 Pin Signal Definitions for CAN**

| Pin | Channel | Definition | Function |
|---|---|---|---|
| 1 | CAN0 | H | CAN_H signal cable |
| 2 | | G | Shield cable |
| 3 | | L | CAN_L signal cable |
| 1 | CAN1 | H | CAN_H signal cable |
| 2 | | G | Shield cable |
| 3 | | L | CAN_L signal cable |

## 4. 3 Signal Indicator LED

USBCAN-2I module integrates three signal indicator LEDs, they are PWR and ERR and CAN0/CAN1. Detailed function, please see Table 2. When USBCAN-2I module is power up, the PWR LED becomes green, indicating that the power supply is working. Then the ERR LED and the CAN0/CAN1 LED flashes red with same frequency, indicating that the inner MCU is working and waiting for starting. When the software starts the any CAN channel, the ERR LED and the CAN0/CAN1 LED stops flashing and in turn off status. Indicating

that the USBCAN-2I module is ready for data transmission .

**Table 2 LEDs Status**

| Definition | Color | Status | Function |
|---|---|---|---|
| PWR | GREEN | LIGHT | Power supply is OK. |
| ERR | RED | FLASH | CAN-bus ERR |
| CAN0/CAN1 | RED | FLASH | Data transmission in CAN0 channel. |
| | GREEN | FLASH | Data transmission in CAN1 channel. |

# 5 System Connection

## 5. 1 CAN-bus Connection

To connect USBCAN-2I module to the CAN-bus, user only need to connect CAN_L and CAN_L, CAN_H and CAN_H. CAN-bus network adopts straight-line topology, and two terminal 120Ω resistances need to be installed on the two bus terminals. If the number of nodes larger than 2, the 120Ω resistance is not necessary to be installed on the middle node. The module integrates two terminal 120Ω resistances for two CAN channels. You can enable them with the dip switch. The usage, please see Table 3.

**Table 3 Dip Switch Status definition**

| Switch | Channel | Status | Function |
|---|---|---|---|
| R0 | CAN0 | ON | Enable the 120Ω resistance. |
| | | OFF | Disable the 120Ω resistance. |
| R1 | CAN1 | ON | Enable the 120Ω resistance. |
| | | OFF | Disable the 120Ω resistance. |

**Note:** CAN-bus cable can be either ordinary twisted-pair or shield twisted-pair. If the communication distance is longer than 1Km, then the area of section for the twisted-pair should be larger than Φ1.0mm$^2$. The particular specification depends upon the communication distance, and a longer distance usually requires a larger area.

## 5.2 USB Connection

The USB port of USBCAN-2I supports USB1.1 protocol specification, and can be used to connect PCs that support USB1.1 and USB2.0 standards. There are two modes for USBCAN-2I interface connecting to PC:

**Bus power supply:**

Directly connects to USB port on the PC by using the attached USB cable. This USB port provides +5V voltage to USBCAN-2I module.

**External power supply:**

USBCAN-2I interface module connects to the PC USB hub. If this USB hub is powered by bus, USBCAN-2I module should use external power supply. Then connects to USB port on the USB hub by using the attached USB cable.

# 6 Version Information

| Version | Add/Del/Rev | Data |
|---|---|---|
| V1.00 | Initial Version | 2012-11-15 |

# Appendix 1: The Frame Format of CAN2.0

## CAN2.0B standard frame:

The length for CAN standard frame message is 11 bytes, including two parts: message and data. The first 3 bytes are used for message.。

| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| **Byte 1** | FF | RTR | × | × | DLC(Data Length) | | | |
| **Byte 2** | ID.10 | ID.9 | ID.8 | ID.7 | ID.6 | ID.5 | ID.4 | ID.3 |
| **Byte 3** | ID.2 | ID.1 | ID.0 | × | × | × | × | × |
| **Byte 4** | Data1 | | | | | | | |
| **Byte 5** | Data 2 | | | | | | | |
| **Byte 6** | Data 3 | | | | | | | |
| **Byte 7** | Data 4 | | | | | | | |
| **Byte 8** | Data 5 | | | | | | | |
| **Byte 9** | Data 6 | | | | | | | |
| **Byte 10** | Data 7 | | | | | | | |
| **Byte 11** | Data 8 | | | | | | | |

Notes

1、Byte 1 is frame information. Bit 7 (FF) denotes frame format, FF=0 in the standard frame. Bit 6 (RTR) denotes the frame type, 0 for data frame and 1 for remote frame. DLC stands for the data length in data frame mode.

3、Byte 2 and 3 are message identifiers, 11 bits are effective.

4、Byte 4 to 11 is the data for data frame, invalid for remote frame.

## CAN2.0B extended frame

The length for CAN extended frame message is 13 bytes, including two parts: message and data. The first 5 bytes are used for message.

| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| **Byte 1** | FF | RTR | × | × | DLC(Data Length) | | | |
| **Byte 2** | ID.28 | ID.27 | ID.26 | ID.25 | ID.24 | ID.23 | ID.22 | ID.21 |
| **Byte 3** | ID.20 | ID.19 | ID.18 | ID.17 | ID.16 | ID.15 | ID.14 | ID.13 |
| **Byte 4** | ID.12 | ID.11 | ID.10 | ID.9 | ID.8 | ID.7 | ID.6 | ID.5 |
| **Byte 5** | ID.4 | ID.3 | ID.2 | ID.1 | ID.0 | × | × | × |
| **Byte 6** | Data 1 | | | | | | | |
| **Byte 7** | Data 2 | | | | | | | |
| **Byte 8** | Data 3 | | | | | | | |
| **Byte 9** | Data 4 | | | | | | | |
| **Byte 10** | Data 5 | | | | | | | |
| **Byte 11** | Data 6 | | | | | | | |
| **Byte 12** | Data 7 | | | | | | | |
| **Byte 13** | Data 8 | | | | | | | |

Notes

1、Byte 1 is frame information. Bite 7 (FF) denotes the frame format, FF=1 for extended frame. Bite 6 (RTR) denotes the frame type, 0 for data frame and 1 for remote frame.DLC stands for the data length in the data frame.

2、Byte 2 and 5 are message identifiers, the higher 29 bits are effective.

3、Byte 6 to 13 is the data for data frame, invalid for remote frame.

# Appendix 2: SJA1000 Standard Baud Rate

| | Baud Rate(Kbps) | BTR0(Hex) | BTR1(Hex) |
|---|---|---|---|
| **1** | 5 | BF | FF |
| **2** | 10* | 31 | 1C |
| **3** | 20* | 18 | 1C |
| **4** | 40 | 87 | FF |
| **5** | 50* | 09 | 1C |
| **6** | 80 | 83 | FF |
| **7** | 100* | 04 | 1C |
| **8** | 125* | 03 | 1C |
| **9** | 200 | 81 | FA |
| **10** | 250* | 01 | 1C |
| **11** | 400 | 80 | FA |
| **12** | 500* | 00 | 1C |
| **13** | 666 | 80 | B6 |
| **14** | 800* | 00 | 16 |
| **15** | 1000* | 00 | 14 |

Note: Those with "*" are the Baud rates that recommended by CIA union.

# Appendix 3: Configuration for CAN Message Filter

The CAN message filter of the converter is designed based on the PeliCAN mode of the CAN controller SJA1000 (made by PHILIPS). SJA1000 filter is composed of 4 sets (4 Bytes) of acceptance code registers (ACR) and 4 sets (4 Bytes) of acceptance mask registers (AMR). The value of ACR is the preset acceptance code, and the value of AMR indicates that if the corresponding value of ACR is used for acceptance filtering. When SJA1000 is in some certain modes, part of registers in the filter will be left unused. For convenience, we only care about the actual value for the filter and discard the unnecessary value.

The general rules for filtering are: Every acceptance mask bit is corresponding to each acceptance code bit respectively. When the mask bit is 1 (namely set to irrelative), then no matter if the corresponding acceptance frame ID bit is the same to the corresponding acceptance code bit or not, it will denotes an acceptance. But when the mask bit is 0(namely set to relative), it will not indicate an acceptance unless the two correspond bits above have the same value. And CAN controller receives this frame message only when all the bits denote acceptance.

There are two filter configuration modes: single filter and dual filter. And the filtering for standard frame and extended frame is a little different. Open all the filter functions under “customize filter mask code” in the configuration software.

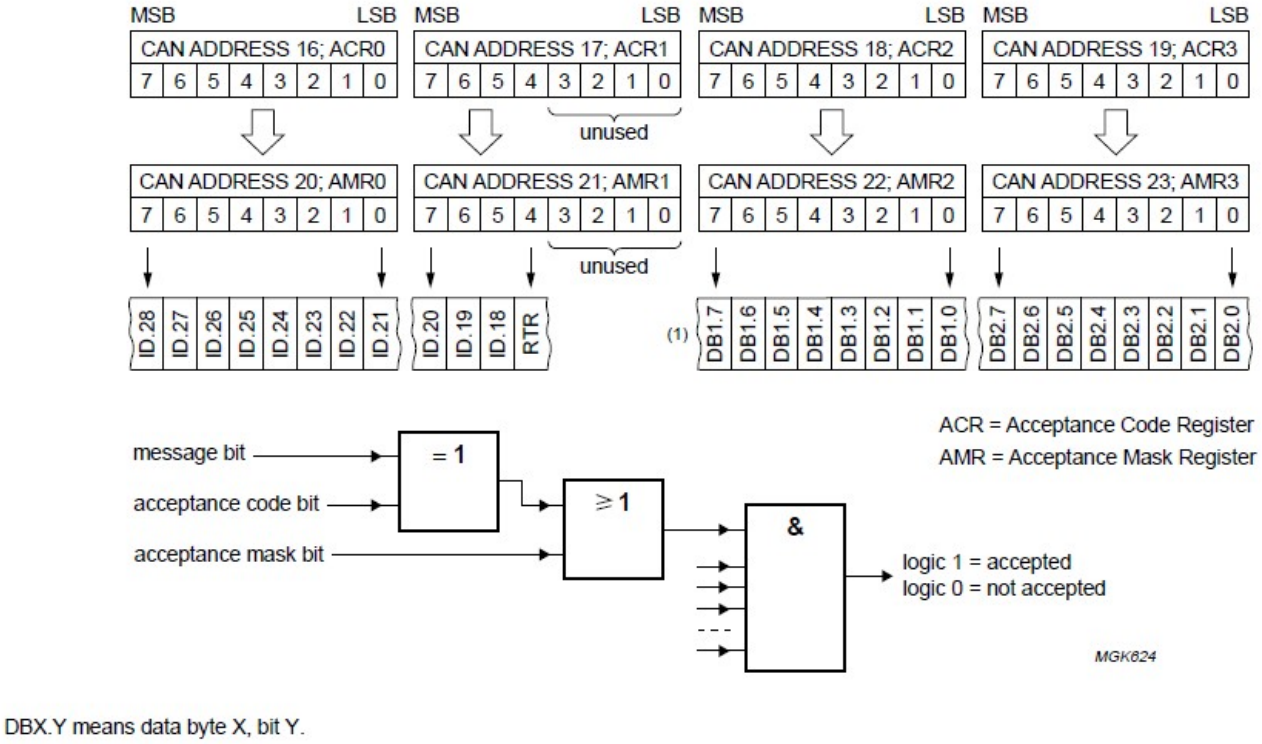
1. Single filter configuration

This kind of filter configuration can be defined as a long filter. The relationships for

the corresponding bits between the filter byte and the message byte are dependent on the current frame format.

**Standard frame:** When the frame format is standard, only part of the data bits (lower 11 bits) from the first two bytes in ACR (ACR3 and ACR4) will be used to store the filter acceptance code. Also, filter mask code only use the lower 11 bits from AMR3 and AMR4.

When the bits in AMR are 0 (relative), if the corresponding bits between ACR and acceptance frame ID (eg.ACR1.0 and AMR1.0 and ID.00) are the same, it indicates "acceptable" (logic 1), otherwise it indicates "unacceptable" (logic 0). When the bits in AMR are 1, it always indicates "acceptable" (logic) regardless of the discussions above.For a successfully received message, receiving signals must be sent after comparing each single bit. See Fig.1.




DBX.Y means data byte X, bit Y.

**Fig.1 Single filter configuration, receiving standard frame messages.**

**Extended frame:** When the frame format is extended, the length for the frame identifier is 29 bits,so the lower 29 bits of the four bytes of ACR are used to store the filter acceptance code. And it is similar to the AMR. The acceptance logic relationship is the same to that of standard frame. See Fig.2.

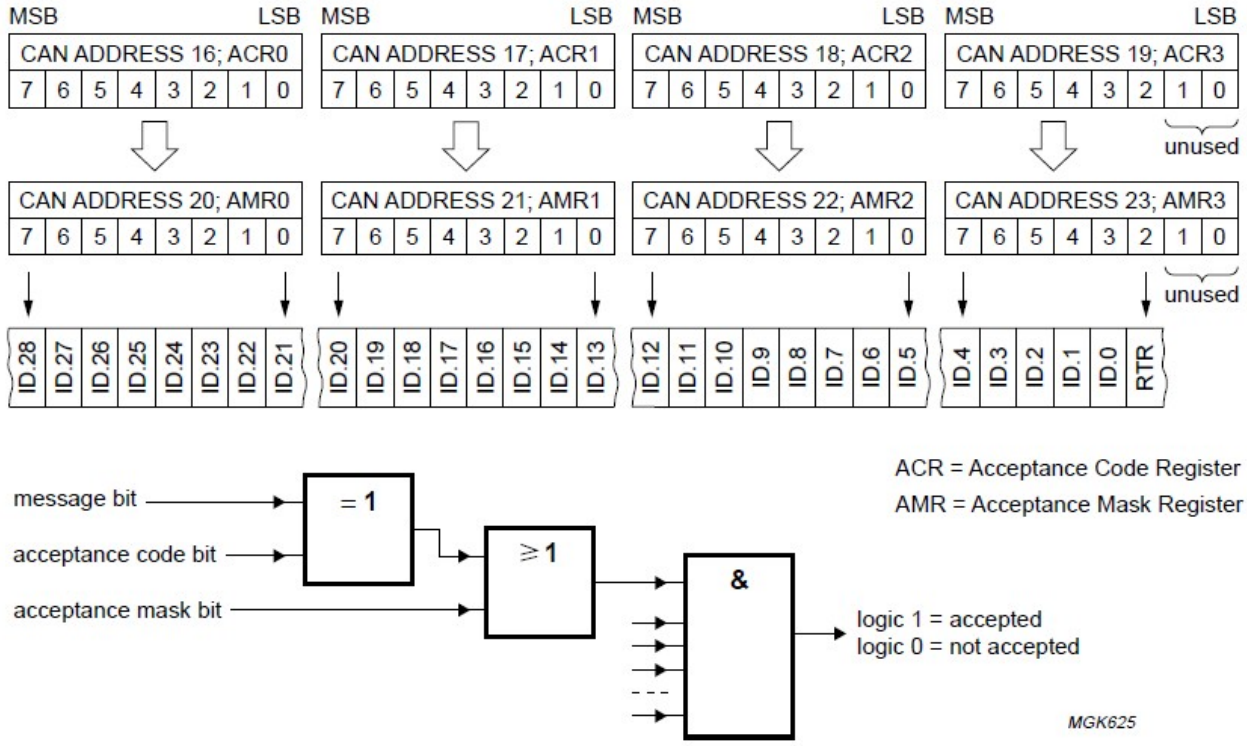



**Fig.2 Single filter configuration, receiving extended frame messages.**

## 2. Dual filter configuration.

This configuration mode is able to define two short filters. A message to be received has to compare with two filters before it can be stored into the receiving buffer. The message received is valid only when at least one filter sent out an acceptance signal. The relationships for the corresponding bits between the filter byte and the message byte are dependent on the current frame format.

**Standard frame:** For standard frame, it can be considered that the acceptance frame identifier is filtered with two single filters. See Fig.3.

To successfully receive message, all the bit comparisons should indicates “acceptable”. This frame can be received only when at least one filter of two indicates “acceptable”.

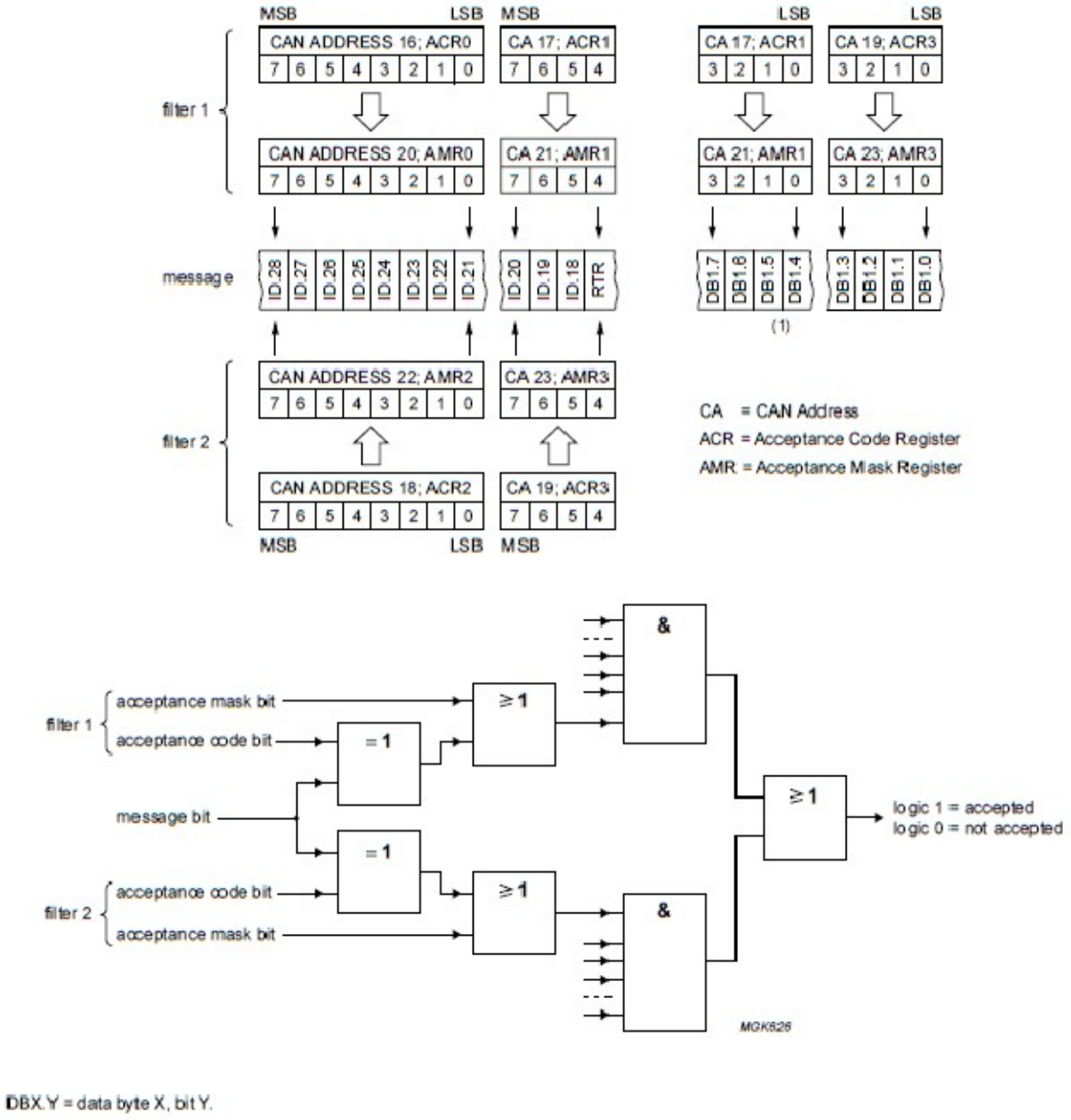



**Fig.3 Dual filter configuration, receiving standard frame messages.**

**Extended frame:** For extended frame, the two filters defined are the same. It only compares the first two bytes of the extended identifier (ID.28 to ID.13) for the two filters. See Fig.4. To successfully receive message, all the bit comparisons should indicates “acceptable”. This frame can be received only when at least one filter of two indicates “acceptable”.

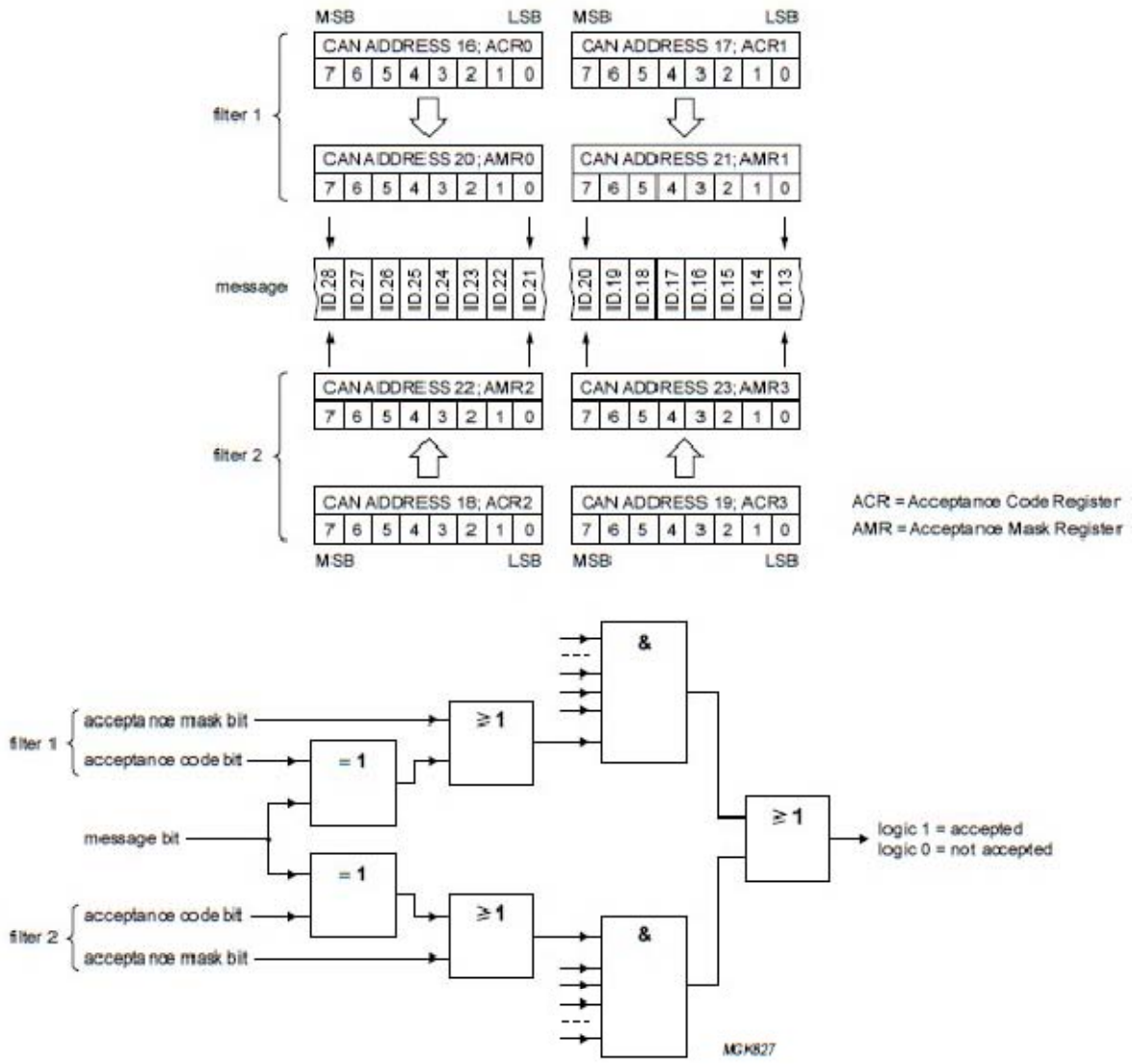



**Fig.4 Dual filter configuration, receiving extended frame messages.**

# Appendix 4: CAN-bus Communication distance （Reference Value）

| Baud Rate （kbps） | Max Distance （m） |
|---|---|
| 1000 | 40 |
| 500 | 130 |
| 250 | 270 |
| 125 | 530 |
| 100 | 620 |
| 50 | 1300 |
| 20 | 3300 |
| 10 | 6700 |
| 5 | 10000 |

# Appendix 5: list of CAN-bus products

| No. | PC Interface | Part number | CAN Channels | describe |
|---|---|---|---|---|
| 1 | PCI | PCICAN-9810 | 1 | Industrial PCI interface card. |
| 2 | | PCICAN-9820 | 2 | |
| 3 | | PCICAN-9840 | 4 | |
| 4 | USB | USBCAN-I | 1 | Intelligent industrial USB interface module. |
| 5 | | USBCAN-2I | 2 | |
| 6 | | CANalyst-II | 2 | Intelligent USB interface protocol analyzer. |
| 7 | LAN | iCANET-100T | 1 | Intelligent industrial Ethernet interface module |
| 8 | | iCANET-200T | 2 | |
| 9 | PCI-E | PCIECAN-9210 | 1 | Industrial PCI-E interface card |
| 10 | | PCIECAN-9220 | 2 | |
| 11 | PC104+ | 104plusCAN-I | 1 | Industrial PC104plus interface card |
| 12 | | 104plusCAN-II | 2 | |
| 13 | ExpressCard | iCANEC-I | 1 | Intelligent ExpressCard interface card |
| 14 | Serial Port | CAN232/485 | 1 | Intelligent industrial RS232 and RS485 interface |

| | | | | |
|---|---|---|---|---|
| | | | | protocol converter |
| 15 | | iCANBridge | 2 | Intelligent industrial CAN |
| 16 | | iCANHub-P4 | 4 | router and bridge |