CAN-RS An interface module between CBUS and Serial RS-232

Introduction

CAN-RS is one of a number of modules for use with the CBUS system. This is a general purpose layout control bus (LCB) using the industry standard CAN bus. For more information on CBUS, see the introductory article on this website.

CAN-RS is unique amongst the CBUS modules in that it is neither a producer nor consumer of events but a simple interface between CBUS and a standard serial port. Its primary function is to link CBUS with a computer (PC) or other device using RS-232 serial protocol. It acts as a two way message passing node.

Please refer to the schematic CAN_RS_sch.pdf

Power supply.

CAN-RS is a very basic node which requires an external 5 volt supply. This may be taken from other CBUS modules via the CBUS connector pins 1 and 4 or supplied directly to the two pin terminal block on the board. When such an external 5 volt supply is used, it may be connected to the CBUS terminal bock for use by other modules by fitting a link across R1 on the PCB. Pads are available for this. Care must be taken not to fit this link if the CBUS is already powered from other modules or it will result in two 5 volt supplies being wired in parallel.

The serial interface.

The connection is via a standard 9 way D socket requiring a ‘one to one’ cable to the PC. The BAUD rate is fixed at 115.2Kbps. This is the highest common rate available on PCs although even this rate does not allow continual transmission of the CBUS frames which use a CAN bit rate of 125 Kbps. At present, no handshake is used although the PCB layout allows for this facility in the future.

The serial protocol.

There are several published CAN to serial protocols but we adopted the one by ‘Gridconnect’ to whom full acknowledgement is made. The full protocol is available from

http://site.gridconnect.com/docs/CAN/can-rs232.pdf

although we have only used the basic message format. This is described below.

The information on the serial side uses ASCII characters. This simplifies message parsing by the PC and is compatible with most software, e.g. Visual Basic. However, the structure of the ASCII string follows that of a CAN frame so there is direct correspondence between the CAN frame and the serial string.

The header.

Following the 'Gridconnect' scheme, the ASCII string starts with a ":" followed by an "S" to indicate a Standard CAN frame or an "X" for an extended frame. CBUS only uses Standard frames but the CAN_RS module allows for both types of frame. The next 4 chars are the ASCII version of the two header bytes in HEX for a standard frame or 8 chars for the four bytes of an extended header. This is departure from the Gridconnect format as CBUS uses a 7 bit node ID and 4 priority bits rather than just an 11 bit number. These two bytes map directly into the bytes sent and received by the CAN processor as SIDH and SIDL. (Standard IDentifier High byte and Standard IDentifier Low byte) For an extended header, the four bytes map directly to the SIDH, SIDL, EIDH and EIDL.

An example would be where the CBUS priority bits are 1011 and the CAN ID number is 0000001. These bits become the two bytes of the CAN header as follows

10110000 00100000 or in HEX form, B020. SIDH is B0 and SIDL is 20. This gives the string so far as :SB020 or in ASCII,

3A 53 42 30 32 30

The frame type

The next character is either "N" or "R" signifying a Normal or a RTR frame (RTR is Remote Transfer Request). Except during the self enumeration process, CBUS only uses Normal frames.

The data segment

A CBUS frame has up to 8 data bytes and the remainder of the string is the data bytes in ASCII (HEX) form. The string is concluded by a ";" Note, there is no value indicating the number of data bytes. This is worked out by the firmware in the CAN-RS module. If a frame has all 8 data bytes then the format for a normal frame is as follows.

:ShhhhNd0d1d2d3d4d5d6d7;

Where hhhh is the two byte header and d0 to d7 are the 8 data bytes. If the header is B020 as above and the data is 1,2,3,4,5,6,7,8 then the ASCII string becomes

3A 53 42 30 32 30 4E 30 31 30 32 30 33 30 34 30 35 30 36 30 37 30 38 3B

Exactly the same format is used for data to or from the CAN-RS module.

A PC oftware program is available which allows entry of the various bytes in either HEX or binary and then sends the appropriate ASCII string. The same software also displays incoming CBUS frames in HEX and binary and also whether the frame is N or R and the number of data bytes. This program is written in Visual Basic 5 but a compiled (installable) version is also available. See the MERG website. The CAN_RS module can also be used with the JMRI (JAVA Model Railroad Interface) package.

Notes.

While the CAN-RS module can buffer two successive CBUS frames, it cannot keep up with a continuous stream of CBUS frames without any gaps. It is not a true 'sniffer' but is satisfactory for all normal layout control activities.

The PC used must be capable of supporting a BAUD rate of 115.2Kbps. A reasonably fast PC is also recommended. The PC should also have a genuine serial port. Attempts to use USB to RS-232 adapters have not always proved reliable as some of these cannot run at 115.2 Kbps.

The pushbutton S1 on the PCB is not presently used on the CAN_RS module. The green LED (LD2) indicates correct operation.

The CAN ID number is included in the ASCII string sent to the CAN-RS module by the PC. This allows for multiple CAN_RS modules with multiple PCs. The PC program should ensure that the CAN_ID is different for each CAN_RS module as well as different from any other 'producer' module.

The priority bits are also sent so the PC can determine the priority of the outgoing message. (The CAN ID is not part of the CBUS message). However, for received CBUS messages, the CAN ID sent to the PC is that of the received frame. This allows for monitoring other node CAN IDs as well as their message priority.

The PCBs include provision for in-circuit serial programming and debugging (ICSP).

The alteration with rev d of the firmware to allow both standard and extended frames makes this module suitable for any CAN system. It can also be used with the CBUS bootloader which uses extended frames.

Mike Bolton and Gil Fuchs 25th July 2010 ©