TB3069

Use of Auto-Baud for Reception of LIN Serial Communications Devices: Mid-Range and Enhanced Mid-Range

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BACKGROUND

The Baud Rate Generator (BRG) is an 8-bit or 16-bit timer that is dedicated to the support of asynchronous EUSART operation. By default, the BRG operates in 8-Bit mode. Setting the BRG16 bit of the BAUDxCON register selects the 16-Bit mode. The SPxBRGH:SPxBRGL register pair determines the period of the free running baud rate timer.

In Asynchronous mode, the multiplier of the baud rate period is determined by both the BRGH bit of the TXxSTA register and the BRG16 bit of the BAUDxCON register.

The baud rate is determined as follows (Table 1):

TABLE 1: BAUD RATE CALCULATION FORMULAS

Configuration Bits			BRG/EUSART Mode	Baud Rate Formula
SYNC	BRG16	BRGH		
0	0	0	8-bit/Asynchronous	FOSC/[64(n+1)]
0	0	1	8-bit/Asynchronous	FOSC/[16(n+1)]
0	1	0	16-bit/Asynchronous	
0	1	1	16-bit/Asynchronous	FOSC/[4(n+1)]
1	0	x	8-bit/Synchronous	
1	1	x	16-bit/Synchronous	

Legend: x = Don't care, n = value of SPxBRGH, SPxBRGL register pair

The above formulas are used to set the nominal (or default) baud rate for the LIN system.

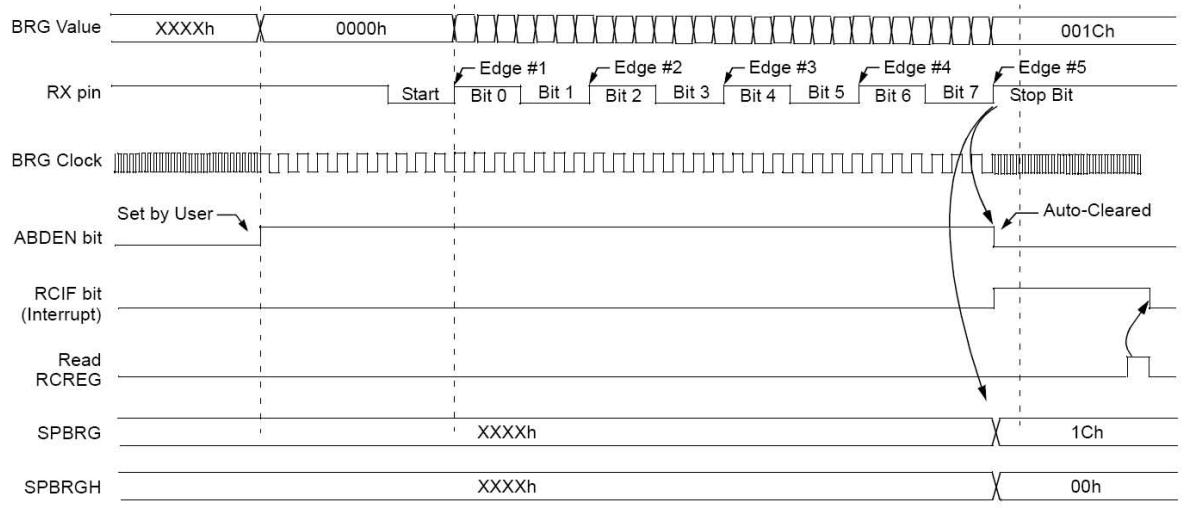
USE OF AUTO-BAUD

In LIN communication, as well as other communications protocols, the master baud rate may vary due to various factors in the application (temperature, voltage, etc.), resulting in small variations in the incoming signal timing. LIN specification defines a maximum allowable deviation from the typical baud rate. In this case, it becomes useful to use the auto-baud feature of the EUSART module to correct any variation of the incoming Rx signal.

The auto-baud feature is an automatic detection and calibration of the baud rate. In the Auto-Baud Detect mode (ABDEN = 1), the clock to the Baud Rate Generator (BRG) is reversed. The incoming Rx signal is timing the BRG. The BRG is used to time the period of a received 55h (ASCII "U"), which is used as the Sync character for LIN bus. The auto-baud detection circuit counts the five rising edges of the incoming Sync character to determine the correct value of the BRG.

During Auto-Baud Detect, the SPBRG registers (high and low) are used as a 16-bit counter. The resulting byte measurement is the average bit time.

FIGURE 1: AUTO-BAUD SEQUENCE



Note 1: The ABD sequence requires the EUSART module to be configured in Asynchronous mode.

Note that the ABDEN bit, which is set by the user, is automatically cleared after the 5th edge is received.

IMPLEMENTATION

The following reflects the implementation of auto-baud for LIN communication. To effectively implement an auto-baud the following steps must be taken:

Break Character Detection

In LIN communication, a Break character is sent by the LIN Master node. This is identified by the Slave node as a x00 or x80 received, followed by a Framing Error. This is the indication to the Slave node that a synchronization byte (usually a 0x55) is about to be received.

ABDEN On

At this point the Slave state machine will turn the auto-baud enable on. Upon receiving the fifth rising edge (shown in Figure 1 above), the ABDEN bit will clear signaling that a valid value is now in the SPBRG register.

It is good practice to validate the value of SPBRG generated by auto-baud. Noise or glitches within the system can cause rare, but significant errors in SPBRG. So, in addition to having a default SPBRG value used to initiate communication, a minimum and maximum allowable SPBRG must be specified.

Baud min = Baud – 5%

Baud max = Baud + 5%

If the baud rate falls out of this window, then the default SPBRG is to be used. This process will ensure that the incoming message is received and responded to.

Constraints

The minimum and maximum baud rate values must be selected according to the system specifications and according to the maximum bit error. Please refer to application note AN864, "*Implementing a LIN Slave Node on a PIC18F1320*", for information on LIN error calculations.

Attached to this technical brief are example code files implementing the auto-baud techniques described.

CONCLUSION

LIN communication with auto-baud needs to have a way of checking the maximum and minimum allowable values of SPBRG; this will ensure that the message will always be received and responded to as long as the designer takes into consideration the maximum error allowed by the system.

For additional information on LIN communication products, data sheets, development tools and application notes, go to www.microchip.com/lin.

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