

RWT420/440 Series Transducer CAN Bus Interface

**Revision 3 - November 2012
RWT420/440 MKIII (Firmware Revision: 4.3)**

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Introduction

The RWT420 series CAN bus interface is fully compliant with the CAN 2.0B protocol and uses standard 11bit message identifiers.

The data available on the CAN bus is limited to torque and speed, but also includes a transducer zero function.

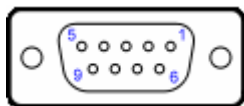
The baud rate, message identifiers and output rate can be customised by using the Transducer Control program which accompanies our digital based torque transducers. The customisation is done via the USB interface on the transducer.

Hardware Implementation

The CAN bus interface is implemented using an ARM Cortex M3 processor and its embedded CAN module.

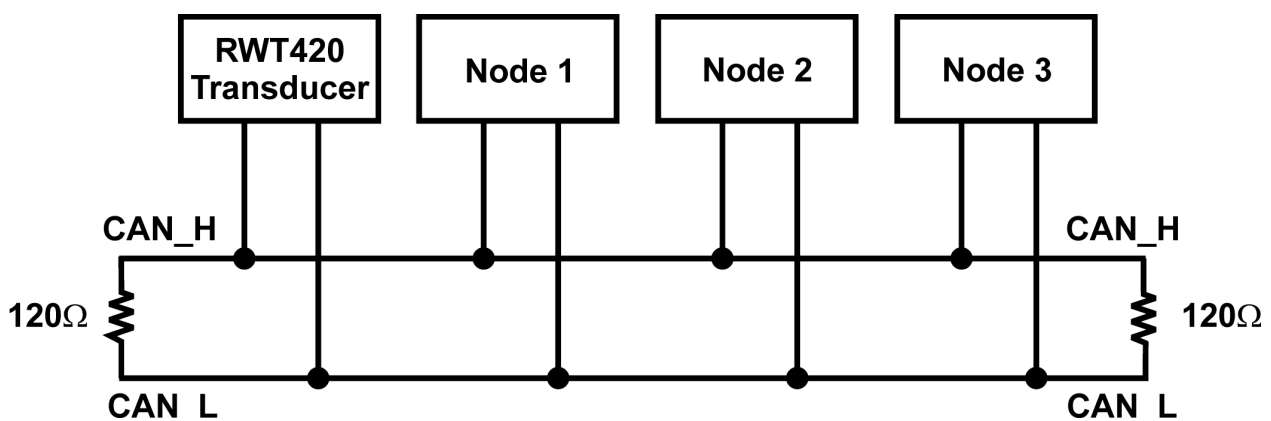
The CAN bus interface replaces the standard RS232 capability of the transducer. In order for the signals to be properly received the CAN bus needs to be correctly terminated. This can be accomplished by using a 120Ω resistor across the two data lines at both ends of the bus.

CAN bus 9 pin D connector pin out



Pin	Signal Name	Signal Description
2	CAN_L	Dominant Low
3	CAN_GND	Ground
7	CAN_H	Dominant High

Recommended CAN bus termination



Software Implementation

The CAN interface is configured with the settings detailed in Table 1.

Table 1:

Baud rate Selectable with Transducer Control	1 Mbps 500 Kbps 250 Kbps 100 Kbps
Sample point	75%
Sampling mode	3 samples per bit
Synchronisation jump width (SJW)	2
TSEG1 (PROP_SEG + PHASE_SEG1)	11
TSEG2 (PHASE_SEG2)	4

Transducer data is output on to the CAN bus automatically without application synchronisation. The output rate can be set by Transducer Control.

The CAN messages that are output from the transducer use standard 11bit identifiers, the identifiers can be set to anything between 1 and 2047, and can be configured using Transducer Control.

CAN Messages

Each data frame output from the transducer contains a four byte data field. The byte order of the data field is in the little-endian format, i.e. least significant byte first. Table 2 gives an overview of the data and functions available.

Table 2:

Transducer Data/Function	Default Identifier	Data Type	Bytes
Torque	50	IEEE-754 Float	4
Speed	111	Unsigned Integer	4
Zero Command	156	-	0

The CAN message output rate is either the internal capture rate for the data, or a fixed rate. If the fixed rate is greater than the internal capture rate, the last value will be resent. The output rate can be configured using Transducer Control.

When selecting the output rate it is important to consider the other devices on the CAN bus, if the rate is too high then the bus will become congested, overwhelming the receiver or blocking devices from transmission. If a high rate is important the message identifiers can be used to prioritise messages, lower numeric identifiers have bus priority.

Torque (Default Identifier 50)

Torque data is output as a floating point number using the IEEE-754 standard floating point number format.

Floating-point format:

SEEE EEEE EMMM MMMM MMMM MMMM MMMM MMMM
S – Sign Bit, E – Exponent, M – Mantissa.

Byte order:

LSB Byte 0	Byte 1	Byte 2	MSB Byte 3
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The internal capture rate for torque varies from transducer to transducer and is defined during build. The output rate is between 8 KHz and 11 KHz.

Speed (Default Identifier 111)

Speed data is output as a four byte integer (unsigned long); with the LSB transmit first, as illustrated below:

Byte order:

LSB Byte 0	Byte 1	Byte 2	MSB Byte 3
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The speed output is based on the fast capture system which uses a period count. The period count works by measuring the time between pulses from a speed grating. In this mode the internal capture rate is dependant on the rotational speed of the transducer, the capture rate will increase and decrease as the transducer speed increases and decreases.

The output rate can be calculated from Table 3.

Table 3:

Rotational Speed (RPM)		Update Rate (Hz)
From	To	
0		1 Hz
1	2000	RPM
2000	4000	$((\text{RPM} - 2000) \times 0.5) + 1004$
4000	6000	$((\text{RPM} - 4000) \times 0.334) + 1336$
6000	8000	$((\text{RPM} - 6000) \times 0.25) + 1502$
8000	10000	$((\text{RPM} - 8000) \times 0.2) + 1602$
10000	12000	$((\text{RPM} - 10000) \times 0.166) + 1670$
12000	14000	$((\text{RPM} - 12000) \times 0.144) + 1714$
14000	16000	$((\text{RPM} - 14000) \times 0.126) + 1750$

Zero Command (Default Identifier 156)

The zero command zero's the transducer torque value; making all subsequent torque readings offset by the torque amount present when zeroed.

To request this command send a data frame with the zero command identifier and 0 bytes in the data field.

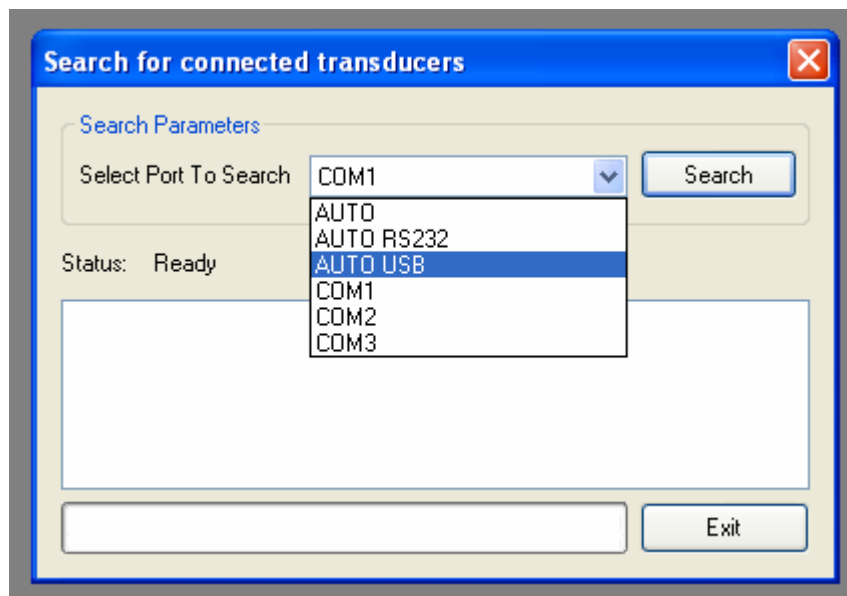
Transducer Control

Transducer Control can be used to customise the identifiers, baud rate and output rate of the CAN interface on the transducer.

To customise the settings power on the transducer and connect the USB lead to a PC.

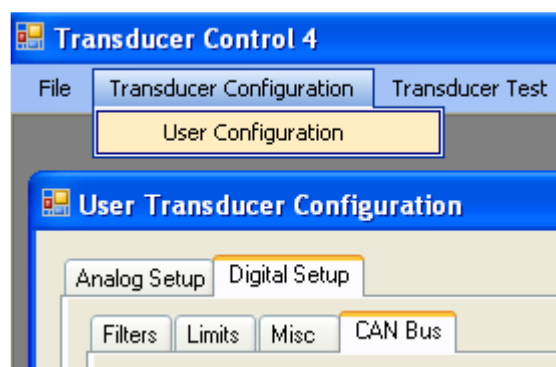
Run Transducer Control by clicking Start > Programs > Sensor Technology > Transducer Control 4 > Transducer Control 4.

Once the program has loaded, a “Search for connected transducers” dialog box will be shown. Select “AUTO USB” from the “Select port to search” combo box and click “Search”.



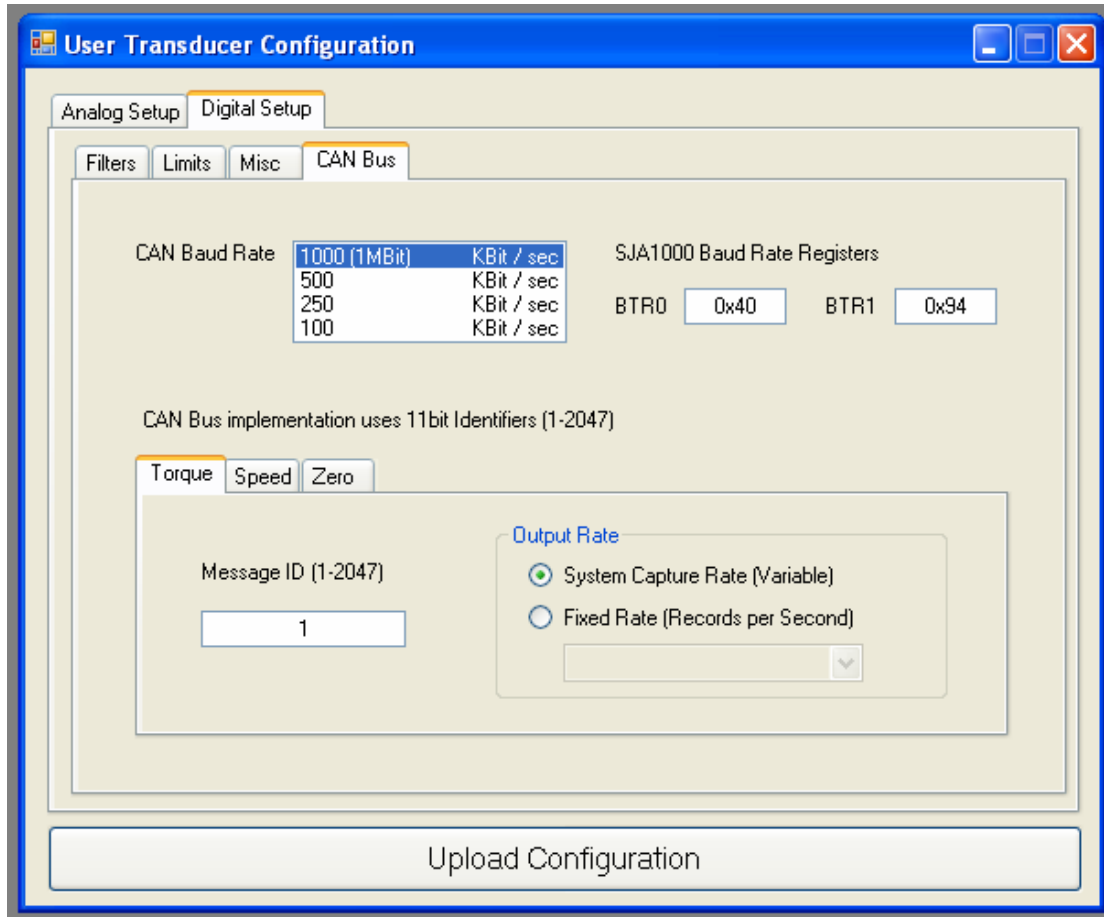
The purpose of this dialog box is to search for transducers for use with Transducer Control. Once the search is complete, the program will automatically load the discovered transducer, if more than one transducer is discovered a list will be shown for selection.

To load the CAN configuration page select Transducer Configuration > User Configuration from the menu bar. On the resulting window select the “Digital Setup” tab, followed by the “CAN Bus” tab.



CAN Configuration

Configure the CAN bus interface by selecting the baud rate, identifiers and output rate. Update the transducer by clicking the “Upload Configuration” button. A progress bar will be shown while the configuration update takes place, on completion close Transducer Control and power cycle the transducer.



CAN Baud Rate

The CAN Baud Rate list box selects the baud rate used by the CAN bus interface.

SJA1000 Baud Rate Registers

The BTR0 and BTR1 values show the equivalent register settings for a Philips/NXP SJA1000 - stand-alone CAN controller with a 16 MHz clock and operating in Intel mode.

This data is for information only and is provided as a guide to enable correct CAN bus synchronisation.

CAN Messages

Each of the CAN messages supported by the transducer are shown and configured on different tabs.

Messages

- **Torque** Torque value.
- **Speed** Speed value from the fast capture system.
- **Zero** Zero transducer.

For each CAN message enter a message identifier and select an appropriate output rate.

Message ID

Message identifiers must be unique and be between 1 and 2047.

Output Rate

- **System Capture Rate (Variable)**
CAN messages are output at the internal capture rate of the data value.
- **Fixed Rate (Records per Second)**
CAN messages are output at a fixed rate. If the output rate is greater than the capture rate, the last value will be resent.

The output rates available are based on the selected baud rate. Table 4 shows the output rates available for each baud rate.

Table 4

Records per Second	Baud Rate			
	1 Mbps	500 Kbps	250 Kbps	100 Kbps
1				
10				
100				
500				
1000				
2000				
3000				
4000				
5000				
6000				