TECH TIME Helpful Tips for the Avionics Technician

BY AL INGLE

This month we continue our series on serial busses. With the ever-increasing complexity of information being made available to pilots through technological advances in high-resolution displays, another databus was needed. ARINC 708 was developed for the task.

ARINC 708

ARINC 708 describes the characteristics of airborne weather radar systems used in our industry. The ARINC standard actually specifies two independent busses: ARINC 429 (low speed) and ARINC 453, a second databus with a 1 million bit per second data rate and the electrical characteristics of MIL-STD-1553.

The ARINC 429 message originates in the indicator and consists of three control words with labels 270, 271 and 273 (not used). These words contain information such as the pilot's gain, range settings, tilt, etc. The receiver-transmitter (RT) receives these instructions and configures its operation to match. The resultant display data is transmitted back to the indicator over the ARINC 453 databus, along with a duplicate set of instructions previously received from the indicator. In this way, the indicator compares the settings of the RT with its present configuration and, if they match, accepts the data. If they do not match, a fault is generated to notify the pilot of a problem. This "target" databus consists of 1,600 bit messages (words) that are Manchester encoded, preceded and followed by a sync (3 bits wide). *See Figure 1 below:*

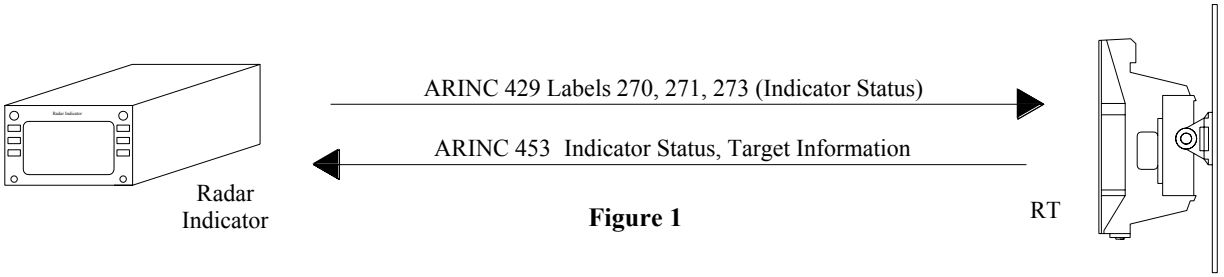


Figure 1

The ARINC 429 bus uses control words as defined by ARINC 708 below:

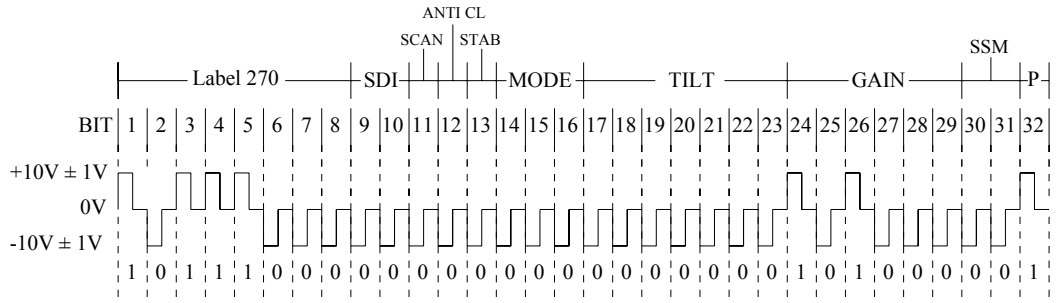


Figure 2 Control Word 1 (Label 270)

- Label: 8 bits
- SDI (Source/Destination Identifier): 2 bits
- Sector Scan Angle: 1 bit
- Anticlutter: 1 bit
- Stabilization: 1 bit
- Mode: 3 bits
- Tilt: 7 bits
- Gain: 6 bits
- Sign Status Matrix (2 bits): Reports error codes, tests functions, sign
- Parity (P): Usually odd but can be even (1 bit)

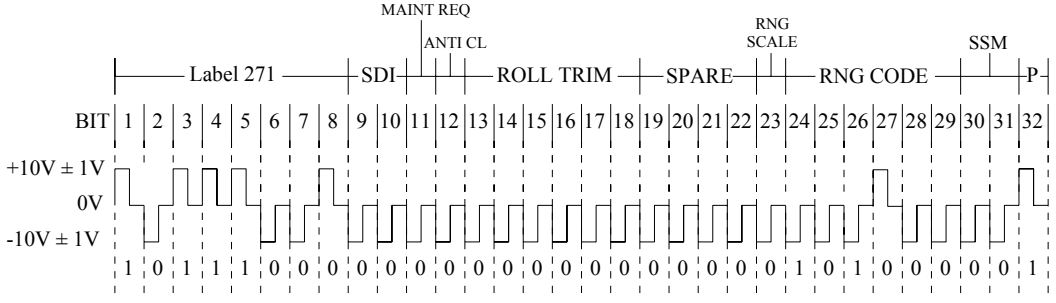
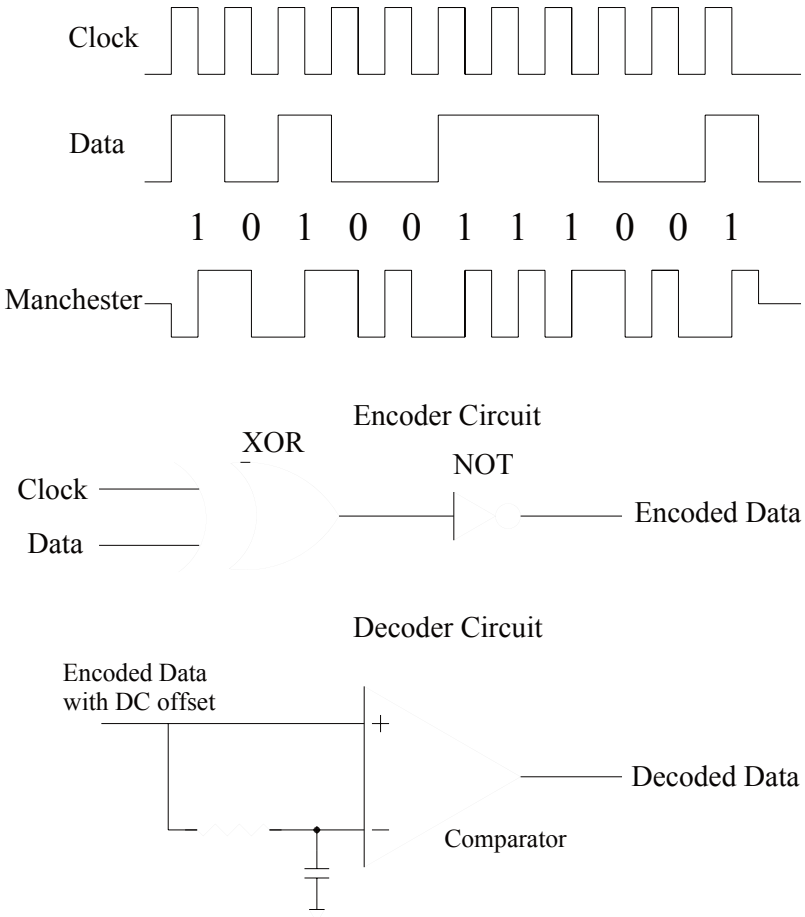


Figure 3 Control Word 2 (Label 271)

- Label: 8 bits
- SDI: 2 bits
- Maintenance Request: 1 bit
- Anticlutter: 1 bit
- Roll Trim Data: 6 bits
- Spares: 4 bits
- Range Scale: 1 bit
- Range Code: 6 bits
- Status Matrix: 2 bits
- Parity: 1 bit

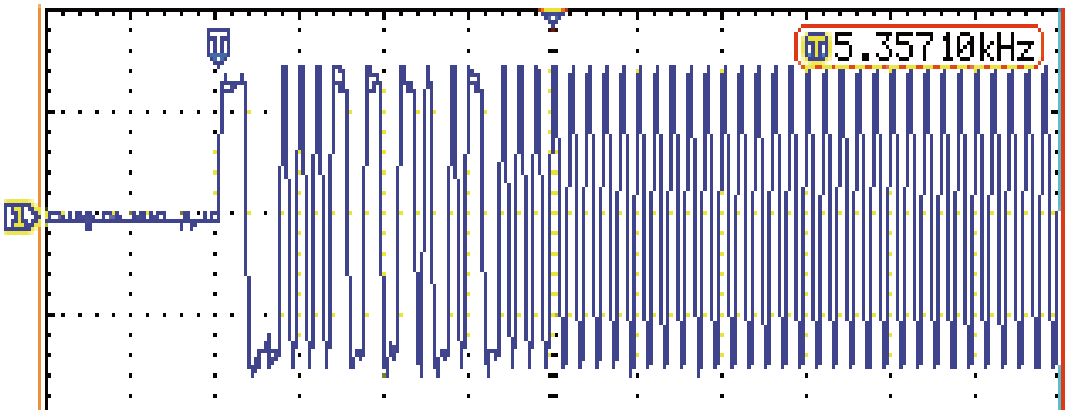
ARINC 453 uses asynchronous Manchester encoding where the clock is embedded into the data.
See Figure 4 below:



- Level transition in the middle of a bit period indicates the data
- Clock is embedded into the signal, recoverable at the destination
- Low-to-high indicates a "1" — high-to-low indicates a "0"
- Two formats: IEEE 802.3 and "GE Thomas"
- Similar to Ethernet

Figure 4 ARINC-708 Wx Bus Manchester Encoding/Decoding

An oscilloscope depiction of the Wx bus is seen in Figure 5 below:



- Sync Pulse: 3 bit width
- Label: 8 bits
- Control: 53 bits: Mode, Faults, Tilt, Gain, Range, Scan Angle
- Data: 1536 bits (512 3-bit Range Bins, 360 degrees of coverage)
- Entire 1600 bit word is Manchester encoded on a 1MHz clock signal
- Unidirectional
- Bus termination is critical

Figure 5 ARINC-708 Wx Bus

The ARINC 708 standard has proven to be a reliable, robust method of transferring information. It is part of a collection of standards that have arisen in response to needs within the aviation community. The reward for following good installation techniques will be avionics systems with fewer maintenance problems.