ARINC 573/717 Analyser Type 080515

Hardware Information

1. INTRODUCTION

This document sets out details of the hardware of Airflair Limited's 808515 ARINC 573 and ARINC 571 Analyser.

The 080515 connects to a standard PC (which provides the user interface) via a standard USB 1 interface. It provides two ARINC 573/717 Receiver (Rx) and two Transmitter (Tx) channels. Each of the Tx and Rx channels may be used for interface testing using Harvard Bi-Phase (Bi-Phase) or Return to Zero (RZ) data .

The 080515 takes its power entirely from the USB interface which connects it to its Host PC. It is powered whenever the Host PC is powered and the USB cable is connected.

For brevity, the ARINC 573/717 interfaces will be referred to in this document as ARINC 717 (A717).

2. PHYSICAL

The 080515 is supplied in two enclosure types, as follows:

A compact aluminium alloy enclosure, ideally suited to field use, measuring approximately 185 x 113 x 30mm.

A 1U high 19” rack mountable module. This in turn may be ordered with connectors located to best suit the application.

In either form the 080515 is provided with two connectors:

A standard `female' 37 way D type connector for the A717 inputs and outputs and for the external clock signals

A standard USB connector for the link to the Host PC.

Provision is made for the fitting of a 9 way `male' D Type connector, to carry the external clock signals, and synchronisation outputs for diagnostic purposes.

3. CONNECTORS AND PIN ALLOCATIONS

USB Connector

The USB connector is an industry standard item, for use wither with the supplied USB cable or with an equivalent cable sourced separately.

D Type Connectors

Connector type (on the box) is a
37 way female D Type

J2 Pin	Use
1	Tx1 Bi-Phase A
2	Tx1 Bi-Phase B
3	0v
4	Tx2 Bi-Phase A
5	Tx2 Bi-Phase B
6	0v
7	0v
8	NC
9	NC
10	NC
11	0v
12	Tx2 Ext Clock
13	Tx1 Ext Clock
14	0v
15	Rx2 Bi-Phase B
16	Rx2 Bi-Phase A
17	0v
18	Rx1 Bi-Phase B
19	Rx1 Bi-Phase A
20	0v
21	Tx2 RZ A
22	Tx2 RZ B
23	0v
24	Tx1 RZ A
25	Tx1 RZ B
26	0v
27	NC
28	NC
29	NC
30	0v
31	0v
32	Rx2 RZ B
33	Rx2 RZ A
34	0v
35	Rx1 RZ B
36	Rx1 RZ A
37	0v

Connector type (on the box) is a
9 way male D Type

J4 Pin	Use
1	Tx2 Sync (Test purposes only)
2	Tx1 Sync (Test purposes only)
3	0v
4	Power Ind (LED to 0v if required)
5	NC
6	Tx2 Ext Clock (Link required)
7	0v
8	0v
9	Tx1 Ext Clock (Link required)

Note that the D Connector shells are not formally bonded to the enclosure (which is constructed of anodised parts, but may make contact in places with conductive machined features. The connector shells are also isolated from the internal 0 v rail, although the shell of the D37 can be connected to 0v by making the link marked “Shell” and “0v” at the bottom left hand corner of the board.

4. HARVARD BI-PHASE AND RETURN TO ZERO I/O

Both Tx channels create simultaneous outputs of the data in both Bi-Phase and RZ forms. Either, or both, may be used according to the connections made to the unit.

Both Rx channels can accept inputs in either Bi-Phase or RZ form. The unit will automatically detect which form of input is being received and adapt accordingly. The source of the input data (Bi-Phase or RZ) is reported by to the controlling PC with the received data.

Connecting both Bi-Phase and RZ inputs to a channel simultaneously will cause unpredictable (but almost certainly incorrect) operation. **Do not do this.**

Note that the Rx channels must be set for operation at the frequency of the received signal. Failure to do this will result in a failure to synchronise correctly with the received data and consequently to incorrect data.

5. Tx AMPLITUDE SETTING

Both Tx outputs may be set independently to user controlled amplitudes. The same settings control the amplitude of both the Bi-Phase and RZ output forms.

The amplitudes are set in terms of a percentage of full scale. The absolute values are not precisely determined, but may be established by `parking' the outputs (see later). The output voltages at the 100% setting are approximately:

Bi-Phase, line to ground	8.6 volts
RZ, line to line	13.6 volts

These values were chosen to ensure that the outputs can cover the entire legitimate range of the associated receiver.

The mechanism used to vary the output amplitude will not span the 4 : 1 range required for the Bi-Phase signals. To cope with this, a gain change occurs when the output is reduced to (or below) 45% of full scale. This is not obvious to the user on the Bi-Phase version of the output, as there is a corresponding gain adjustment elsewhere to compensate. On the RZ output, though, the signal amplitude for settings of 45% or less will be double that which is expected (for example, setting 40% will achieve the same result as 80%). This `feature' should not compromise normal RZ testing, as the 45 % value is less that the lower level of the signal specification for RZ input channels.

To facilitate the measurement of the output amplitude actually achieved (which will vary slightly with load) provision is made to `park' the outputs, This allows signal amplitudes to be measured using dc instruments. The outputs may be parked either high or low, the results of which are:

Park	BiPhase A	BiPhase B	RZ (Line A to Line B)
High	Vout	Zero	Vout
Low	Zero	Vout	-Vout
Off	Normal Operation on all lines		

This arrangement is intended to be used in a `closed loop' system, in which a first approximation to the required amplitude is set, followed by a series of iterations in which the outputs are `parked', measured, adjusted until exact and then `unparked'.

6. SYNCHRONISATION (BARKER CODES)

A717 signals contain no readily identifiable synchronisation information (such as, for example, the interword gaps in ARINC 429 data or the sync patterns for MIL-STD-1553). Synchronisation relies on the existence of predefined word values in the word positions (`time slots') at the beginning of every sub-frame.

It is essential that the receiver is given the correct values for these four words. In accordance with ARINC 717 Barker codes are used in these locations, so this term has been used as a `shorthand' for the values with occur in these locations (time slots 1, 65, 129 and 193 in the frame). The value of these words is fully controllable from the PC software. It is **essential** that the Barker Codes used for the Rx match those being use in the transmitting equipment. If this is not the case then synchronisation will not be achieved. (The converse is, naturally, true for the transmitter.)

When the receiver is first connected to an input signal it must be considered to have no synchronisation with it. It needs to synchronise at three levels:

With the correct transitions in the input signal (assuming it to be Bi-Phase). This will be a quite rapid process.

With the word boundaries

With the sub-frames and frames.

The receiver circuits used correlate the input data with the pre-set Barker Codes on a bit-by-bit basis until a perfect match is established. This simultaneously aligns the receive `process' with both the word and the frame boundaries. Once this is done the hardware reports synchronisation level `Full' to the PC.

If one or two Barker Codes fail to match in a subsequent frame period then the hardware detects a degraded synchronisation state and reports synchronisation as `Poor' to the PC. If the Barker Code(s) are missing from the next frame period the correlator assumes that synchronisation has been lost and reverts to looking for a new, full, Barker Code match. Until this occurs it reports synchronisation `Lost' to the PC.

If, when fully synchronised, the correlator detects a full Barker Code match but not at the time it was expected (with respect to the previous match) it concludes that synchronisation may well have ben lost. At this stage if reverts to looking for a further full match and reports synchronisation `lost'.

Data continues to be made available to the PC at all times. It is a user or user software application responsibility to establish and implement a policy regarding use of data when synchronisation is less than `full'. It should be noted that until the first full synchronisation is achieved there is almost complete certainty that the system is not synchronised and the data is therefore in all probability incorrect. Once synchronisation is lost, though, a `flywheel' keeps the word sampling phase unchanged. As a result, if the loss of synchronisation resulted from a loss (for whatever reason) of the Barker Codes then the data may well still be usable, but this is for the user/user application to determine.

7. TX EXTERNAL CLOCKS

Provision is made for either or both Tx channels to take its clock from an external source. The external clock inputs may be routed to either the designated pins on the 37 way D connector J2 or to pins on the 9 way D connector J3, if fitted (see Section 3. above).

The external clock inputs are taken to opto-couplers, which have been set to be TTL (or 74HCMOS) compatible. The opto-couplers are protected against reverse voltage inputs, so may be driven from an ac signal if required.

The external clock frequency should be set to 48 x word rate. Selection of the external clock is under software control.

If connector J3 is optionally fitted it may be advisable to disconnect these signals from J2. To do this, remove the circuit board from its case as follows:

At the end with the D37 connector, carefully prise off the two caps (`feet') on the underside of the plastic end piece. Remove the two screws which are revealed as a result.

Slide off the end piece and remove the four screws which attach the end panel to the main case.

Slide the end panel and circuit board from the case.

Remove the two wire wrapped links from the top left hand corner of the board (viewed with the D37 connector at the left).

Re-assembly is, as they say, the reverse of the procedure for dismantling.

8. THE SYNC OUTPUTS

Both the Bi-Phase and RZ outputs are such that they are extremely difficult to observe independently using, for example, an oscilloscope. With this difficulty in mind, a separate synchronisation output has been provided for each Tx channel. These signals are available at a number of test points on the circuit board and (if it is fitted) on the D9 connector (J3). Specifically, the signals may be found at:

Signal	**TP**	**J3 Pin**
Tx1 Sync#	6	NA
Tx1 Sync	7	2
Tx2 Sync#	8	NA
Tx2 Sync	9	1

A sync pattern may be associated with any word(s) on either Tx channel. Use of the sync pattern has no effect whatsoever on the `main' Bi-Phase and RZ outputs.

The nature of the sync pattern is determined by a four bit control field, which the hardware treats as follows:

0000	No sync associated with this word
1000	A long sync pattern, spanning the entire word period, is associated with this word.
0xxx	Where xxx <> 000. The sync patter will be output for a half bit period in each bit period where a `1' is included in the definition. The bits are transmitted MSB first, so that when seen on an oscilloscope the occur in the same order as they would normally be written.
1XXX	Where xxx <> 000. The half bit periods defined in xxx are XORed with the long pulse produced by the `1' in the MSB position.

A wide variety of sync outputs can therefore be produced, facilitating both visual recognition and oscilloscope triggering.