User Guide

Multi-Channel Time Distribution Unit

Model TDU-310

P/N 01800000X

Revision J

July 2022

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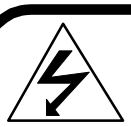
Revision History

REVISION	DATE	COMMENTS
NC	12-08-03	Initial release of TDU-310 user guide.
A	12-06-04	Revision of entire TDU-310 user guide.
B	02-21-06	Customer's comments incorporated into TDU-310 user guide.
C	02-01-08	Revised input and output configuration tables to reflect correct factory jumper settings. Outline drawing updated to Rev B, showing rounded corners on front panel.
D	01-21-2011	Clarified Calibration requirements
E	12-12-2012	Corrected connector voltages
F	07-05-2016	Corrected pin errors in 1.3.1 Inputs.
G	10-30-2018	Corrected timecode inputs, updated outline drawing to Rev D
H	07-29-2022	Added support for additional variations
J	09-29-2023	Modification 10volt 1PPS to 15volt 1PPS

Safety Warnings

WARNING:
To prevent fire and electric shock, do not expose this unit to rain or moisture.



WARNING:
The lightning flash with an arrowhead inside of an equilateral triangle is intended to alert the user to the presence of un-insulated "dangerous voltage" within the product's enclosure. The "dangerous voltage" may be of sufficient magnitude to constitute as a risk of electrical shock to people.

CAUTION:
The exclamation point inside of an equilateral triangle is intended to alert the user to the presence of important operation and maintenance instructions in the user guide.

Table of Contents

1 Introduction

1.1 Scope of Section

Section 1 provides a general description of the Brandywine Communications Multi-Channel Time Distribution Unit (Model TDU-310). The introduction is divided into three parts, purpose of the equipment, physical and electrical specification, and an identification of the external controls, indicators, and connectors.

1.2 Purpose of Equipment

The TDU-310 accepts various inputs from external timing units, chooses between these input sources, and buffers the outputs of the selected source to the user. The selection is essentially a 2 x 1 switch for all inputs. The input chosen is user-programmed to be either user selectable or automatic. Primary to secondary switching is based on amplitude faults of the 1 PPS input, Time Code 1 input (HaveQuick), Time Code 2 input (50 bit/second BCD), and the state change of the Time Fault Discrete input.

The TDU-310 is designed to provide dual redundant timing signals for use in telecommunications, power utilities, and military communication applications.

1.3 Specification

1.3.1 Inputs

Table 1. Inputs

INPUT	SIGNAL	LEVEL	IMPEDANCE	CONNECTOR
Reference A Inputs	1 PPS	0 V to +5 VDC or 0 VDC to 10 VDC and positive on time	50 ohms	J1
	Time Code 1 (HaveQuick)	0 V to +5 VDC	50 ohms	J3
	Time Code 2 (BCD)	RS232 or RS422 compatible	DS14C232 and DS8922	J5 Pin 4 (GND) J5 Pin 8 (–) J5 Pin 9 (+)
	Time Fault Discrete	5 V logic and fault active low	74 ACT logic	J5 Pin 1
	Isolation	All signal inputs are optically isolated		
Reference B Inputs	1 PPS	0 V to +5 VDC or 0 VDC to 10 VDC and positive on time	50 ohms	J2
	Time Code 1 (HaveQuick)	0 V to +5 VDC	50 ohms	J4
	Time Code 2 (BCD)	RS232 or RS422 compatible	DS14C232 and DS8922	J6 Pin 4 (GND) J6 Pin 8 (+) J6 Pin 9 (-)
	Time Fault Discrete	5 V logic and fault active low	74 ACT logic	J6 Pin 1
	Isolation	All signal inputs are optically isolated		
Power		115/230 VAC selectable, 47Hz to 70 Hz, and 10 W		IEC-320 receptacle
Size	Width	Standard 19” rack mounting		
	Height	1U (1.72”)		
	Depth	6.15” excluding the connectors		
Weight		Approximately 10 lbs		

1.3.2 Outputs

Table 2. Outputs

OUTPUT	SIGNAL	LEVEL	IMPEDANCE	RISE TIME	QTY	CONNECTOR
GROUP 1	PULSE TIME CODE 1 (HQ) TIME CODE 2 (BCD) LINK SELECTABLE	0-10 $V_{0\text{-}pk}$	LOW Z OR 50 OHMS LINK SELECTABLE PER OUTPUT	< 10 ns	5	J9, J11, J13, J15, AND J17
GROUP 2	PULSE TIME CODE 1 (HQ) TIME CODE 2 (BCD) LINK SELECTABLE	0-10 $V_{0\text{-}pk}$	LOW Z OR 50 OHMS LINK SELECTABLE PER OUTPUT	< 10 ns	5	J19, J21, J23, J25, AND J27
GROUP 3	PULSE TIME CODE 1 (HQ) TIME CODE 2 (BCD) LINK SELECTABLE	0-05 $V_{0\text{-}pk}$	LOW Z OR 50 OHMS LINK SELECTABLE PER OUTPUT	< 10 ns	5	J10, J12, J14, J16, AND J18
GROUP 4	PULSE TIME CODE 1 (HQ) TIME CODE 2 (BCD) LINK SELECTABLE	0-05 $V_{0\text{-}pk}$	LOW Z OR 50 OHMS LINK SELECTABLE PER OUTPUT	< 10 ns	5	J20, J22, J24, J26, AND J28
GROUP 5 AND GROUP 6	PULSE TIME CODE 1 (HQ) TIME CODE 2 (BCD) LINK SELECTABLE	PER EIA RS232	PER EIA RS232	4.5 V/µs PROP. DELAY OF 1µs	10	J7 SIGNAL: 11, 13, 15, 17, 28, 30, 32, 44, 46, 48 GROUND: 12, 14, 16, -, 29, 31, 33, 45, 47, 49
GROUP 7 AND GROUP 8	PULSE TIME CODE 1 (HQ) TIME CODE 2 (BCD) LINK SELECTABLE	PER EIA RS422	PER EIA RS422	< 20 ns	10	J7 +: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 –: 18, 19, 20, 21, 22, 23, 24, 25, 26, 27 GROUND: 34, 35, 36, 37, 38, 39, 40, 41, 42, 43
1 PPS	PULSE WIDTH	20 µs REGARDLESS OF THE 1 PPS INPUT PULSE WIDTH				

1.4 Controls and Indicators

All operating controls excluding the power control are located on the front panel of the TDU-310.

Table 3. Controls

CONTROL	FUNCTION
Reference Select	Manual selection of the input source. Either Reference A, Reference B, or automatic selection.
Power	Located on the rear panel of the unit.

Table 4. Indicators

INDICATOR	DESCRIPTION
A Online	Indicator shows Reference A is the source of the outputs.
A Available	Indicator shows all Reference A signals are present.
B Online	Indicator shows Reference B is the source of the outputs.
B Available	Indicator shows all Reference B signals are present.
Auto	Indicator shows Reference Select is in automatic mode.
Power	Indicator shows power is available.

2 Installation

2.1 Scope of Section

Section 2 provides installation instructions for the Brandywine Communications Multi-Channel Time Distribution Unit (Model TDU-310).

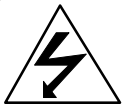
2.2 Unpacking and Inspection

Remove the TDU-310 from its shipping container. Visually inspect the unit for any damage and loose hardware. If any shipping damage is observed, immediately notify the carrier and Brandywine Communications.

The TDU-310 occupies 1U (1.75 inches) of vertical cabinet space.

2.3 TDU-310 Configuration

Refer to Figure 6.4 for the locations of the push on jumper links. The TDU-310 is extremely flexible with respect to the input and output configurations. Setup is done using the push on jumpers on the main printed circuit board assembly.



WARNING:
Remove the AC power cord before removing the top cover of the TDU-310.

To remove the top cover of the TDU-310, remove the four side screws and the center front panel screw. This will expose the main printed circuit board assembly. Install the jumper links as required. Note that the 5/10 V pulse outputs typically used for the 1 PPS may be configured to be either a 50 ohm source impedance or a low source impedance. The 50 ohm source impedance is recommended when driving a 50 ohm terminated coaxial cable for correct impedance matching to prevent pulse reflections. The load will see a 5 V pulse in this configuration. When all link installations are correct, replace the top cover using the five screws. ***Please note that the factory default settings are shown in BOLD font.***

2.3.1 Internal Jumper Settings

Table 5. Internal Jumper Settings

Jumper	Connector	Printed Circuit Card Jumper Function	Top or Left	Bottom or Right
LK1	NA	No 1PPS Channel A	**Std**	No 1PPS
LK2	NA	No 1PPS Channel B	**Std**	No 1PPS
LK3	NA	No Have Quick Channel A	**Std**	No HQ
LK4	NA	No Have Quick Channel B	**Std**	No HQ
LK5	NA	RS422 or RS232	**RS232**	RS422
LK6	NA	No BCD Channel A	**Std**	No BCD
LK7	NA	RS422 or RS232	**RS232**	RS422
LK8	NA	No BCD Channel B	**Std**	No BCD
LK9	NA	No /TFD Channel A	/TFD	**No /TFD**
LK10	NA	No /TFD Channel B	/TFD	**No /TFD**
LK11	J9, J11, J13, J15, J17	Ch 1-5: 0-15V 1PPS or HQ	HQ	**1PPS**
LK12	J9, J11, J13, J15, J17	Ch 1-5: 0-10V BCD		BCD
LK13	J19, J21, J23, J25, J27	Ch 6-10: 0-15V 1PPS or HQ	HQ	**1PPS**
LK14	J19, J21, J23, J25, J27	Ch 6-10: 0-10V BCD		BCD
LK15	J10, J12, J14, J16, J18	Ch 1-5: 0-5V 1PPS or HQ	**HQ**	1PPS
LK16	J10, J12, J14, J16, J18	Ch 1-5: 0-5V BCD		BCD
LK17	J20, J22, J24, J26, J28	Ch 6-10: 0-5V 1PPS or HQ	**HQ**	1PPS
LK18	J20, J22, J24, J26, J28	Ch 6-10: 0-5V BCD		BCD
LK19	J7	Ch 1-5: RS232 1PPS or HQ	HQ	1PPS
LK20	J7	Ch 1-5: RS232 BCD		**BCD**
LK21	J7	Ch 6-10: RS232 1PPS or HQ	HQ	1PPS
LK22	J7	Ch 6-10: RS232 BCD		**BCD**
LK23	J7	Ch 1-5: RS422 1PPS or HQ	HQ	1PPS
LK24	J7	Ch 1-5: RS422 BCD		**BCD**
LK25	J7	Ch 6-10: RS422 1PPS or HQ	HQ	1PPS
LK26	J7	Ch 6-10: RS422 BCD		**BCD**

2.3.2 Output Jumper Settings

Table 6. Output Settings

Link	Connector	Output 1 Level (Typical)	Impedance
		Link in/out	Link in/out
LK27	J9	10V/5V	LoZ/50Ω
LK28	J11	10V/5V	LoZ/50Ω
LK29	J13	10V/5V	LoZ/50Ω
LK30	J15	10V/5V	LoZ/50Ω
LK31	J17	10V/5V	LoZ/50Ω
LK32	J19	10V/5V	LoZ/50Ω
LK33	J21	10V/5V	LoZ/50Ω
LK34	J23	10V/5V	LoZ/50Ω
LK35	J25	10V/5V	LoZ/50Ω
LK36	J27	10V/5V	LoZ/50Ω
LK38	J10	5V/2.5V	LoZ/50Ω
LK39	J12	5V/2.5V	LoZ/50Ω
LK40	J14	5V/2.5V	LoZ/50Ω
LK41	J16	5V/2.5V	LoZ/50Ω
LK42	J18	5V/2.5V	LoZ/50Ω
LK43	J20	5V/2.5V	LoZ/50Ω
LK44	J22	5V/2.5V	LoZ/50Ω
LK45	J24	5V/2.5V	LoZ/50Ω
LK46	J26	5V/2.5V	LoZ/50Ω
LK47	J28	5V/2.5V	LoZ/50Ω

2.4 Installation and Testing

Install the TDU-310 in the desired cabinet location. Fabricate the input/output cables and connect them to the TDU-310.

CAUTION:
Verify that the input voltage range selection on the rear panel of the unit is set to match the local line AC voltage (115/230 VAC).

If the input voltage range selection is incorrect, lift the red cover on the power entry module and remove the fuse holder. Rotate the fuse holder 180 degrees and reinstall the fuse holder so that the correct line voltage is shown through the rear window. Connect the AC power source to the TDU-310. Apply power to the unit by switching on the power switch located on the rear panel of the unit.

3 Operating Instructions

3.1 Scope of Section

Section 3 provides operating instructions for the Multi-Channel Time Distribution Unit (Model TDU-310).

3.2 Operation

To operate the unit, apply power to the unit and the Power indicator should illuminate.

3.2.1 Automatic Selection of Signal Sources

Set the ‘Reference Select’ switch to ‘Auto’. The following LEDS should illuminate:

- Reference A Available
- Reference B Available
- Auto
- Reference A Online

In this mode, Reference A is selected unless the TDU-310 detects a missing signal on *ANY* of the three reference signal inputs (1 PPS, Time Code 1 (HQ), and Time Code 2 (BCD)) *OR* the Time Fault Discrete line is pulled low. If any of these conditions is met, the TDU-310 will switch *ALL* outputs to be driven from the Reference B input. If both Reference A *AND* Reference B are faulty, the outputs will be switched to Reference A.

3.2.2 Manual Selection of Reference A as Signal Source

Set the ‘Reference Select’ switch to ‘A’. The following LEDS should illuminate:

- Reference A Available
- Reference B Available
- Reference A Online

3.2.3 Manual Selection of Reference B as Signal Source

Set the ‘Reference Select’ switch to ‘B’. The following LEDS should illuminate:

- Reference A Available
- Reference B Available
- Reference B Online

4 Link Locations and Pin Assignments

4.1 Scope of Section

Section 4 provides the link locations and the input/output pin assignments for the TDU-310.

4.2 Link Locations

Refer to Figure 6.4 for the locations of the push on jumper links.

4.3 Pin Assignments

4.3.1 Input Connectors

Table 7. Input Connectors

CONNECTOR	SIGNAL	CONNECTOR TYPE
J1	Reference A 1 PPS In	BNC
J2	Reference B 1 PPS In	BNC
J3	Reference A TC1 (HaveQuick)	BNC
J4	Reference B TC1 (HaveQuick)	BNC
J5	Reference A TC2 (BCD)	Multi-Pin
	Reference A Time Fault Discrete	Multi-Pin
J6	Reference B TC2 (BCD)	Multi-Pin
	Reference B Time Fault Discrete	Multi-Pin

4.3.2 Output Connectors

Table 8. Output Connectors

CONNECTOR	SIGNAL	CONNECTOR TYPE
J9 – J28	5/10/15 V Pulse and Logic Level	BNC
J7	RS232 and RS422	Multi-Pin

4.3.3 Pin Assignments

Table 9. Pin Assignments

CONNECTOR REFERENCE	CONNECTOR TYPE	CONNECTOR PIN	SIGNAL
J5	DB-9 MALE	1	REFERENCE A TIME FAULT DISCRETE
		2	GROUND
		3	N/C
		4	GROUND
		5	TIME CODE 2 INPUT RS232
		6	N/C
		7	N/C
		8	TIME CODE 2 INPUT RS422 (–)
		9	TIME CODE 2 INPUT RS422 (+)
J6	DB-9 MALE	1	REFERENCE B TIME FAULT DISCRETE
		2	GROUND
		3	N/C
		4	GROUND
		5	TIME CODE 2 INPUT RS232
		6	N/C
		7	N/C
		8	TIME CODE 2 INPUT RS422 (+)
		9	TIME CODE 2 INPUT RS422 (–)
J7	DB-50 FEMALE	1	RS422 01 +
		2	RS422 02 +
		3	RS422 03 +
		4	RS422 04 +
		5	RS422 05 +
		6	RS422 06 +
		7	RS422 07 +
		8	RS422 08 +
		9	RS422 09 +
		10	RS422 10 +
		11	RS232 1
		12	GROUND
		13	RS232 2
		14	GROUND
		15	RS232 3
		16	GROUND
		17	RS232 4
		18	RS422 01 -
		19	RS422 02 -
		20	RS422 03 -
		21	RS422 04 -
		22	RS422 05 -
		23	RS422 06 -
		24	RS422 07 -
		25	RS422 08 -
		26	RS422 09 -
		27	RS422 10 -
		28	RS232 5
		29	GROUND
		30	RS232 6
		31	GROUND
		32	RS232 7
		33	GROUND
		34	GROUND
		35	GROUND
		36	GROUND
		37	GROUND
		38	GROUND
		39	GROUND
		40	GROUND
		41	GROUND
		42	GROUND
		43	GROUND
		44	RS232 8
		45	GROUND
		46	RS232 9
		47	GROUND
		48	RS232 10
		49	GROUND
		50	N/C

5 Maintenance and Calibration

5.1 Scope of Section

Section 5 describes the recommended maintenance checks for the TDU-310 and outlines a general approach to fault finding and repair.

5.2 Routine Maintenance

During normal operation the TDU-310 functions automatically and does not require continuous manual intervention. Preventative maintenance can therefore be restricted to a regular inspection of the status indicators.

WARNING:
Before removing the TDU-310 cover make sure that the power cord has been detached from the rear panel of the unit.

5.3 Fault Finding

CAUTION:
In case of equipment malfunction or failure, Brandywine Communications strongly recommends that the TDU-310 be returned to the factory for repair. If this is not practical, fault finding and repair must only be undertaken by a qualified test engineer. Brandywine Communications will not accept any liability for injury or damage caused during fault finding and repair by the user.

5.4 Calibration

The Model TDU310 has no calibration requirements.

6 Drawings

Table 10. TDU-310 Drawings

FIGURE	DESCRIPTION
6.1	TDU-310 Front Panel
6.2	TDU-310 Rear Panel
6.3	TDU-310 Mechanical Outline
6.4	TDU-310 Link Location

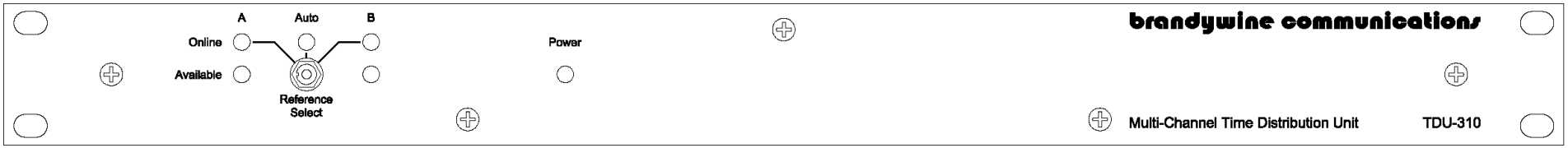


FIGURE 6.1
Front Panel

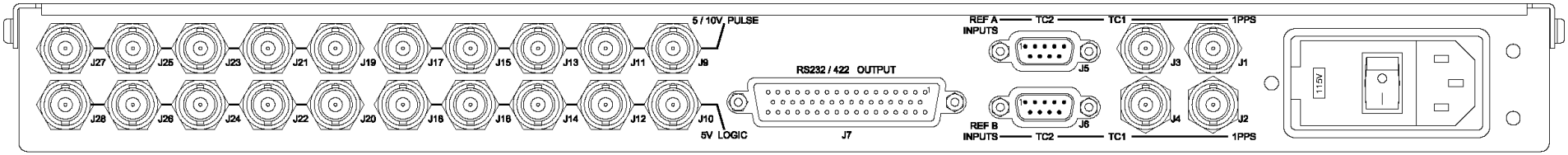


FIGURE 6.2
Rear Panel

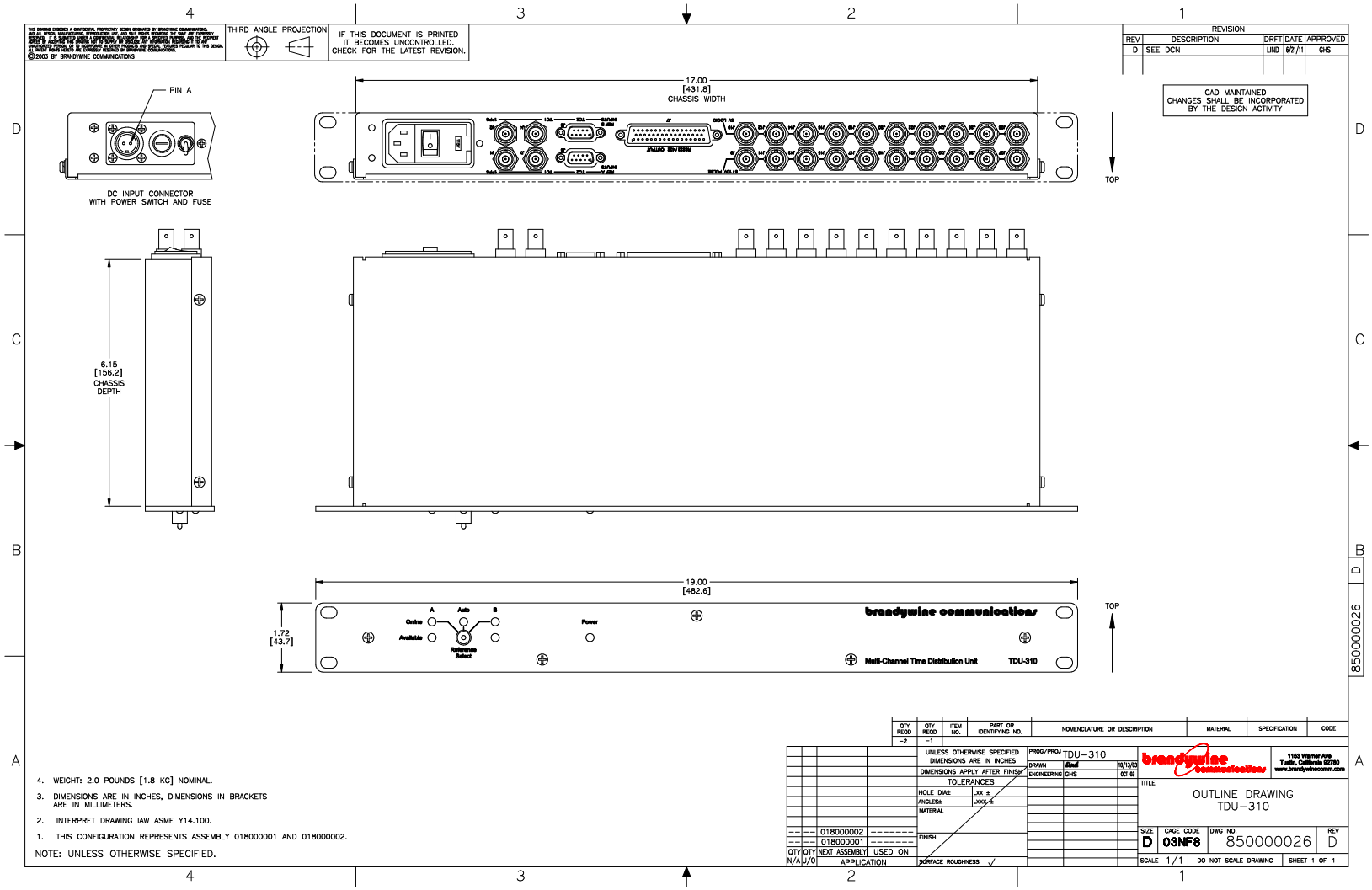


Figure 6.3 Outline Drawing

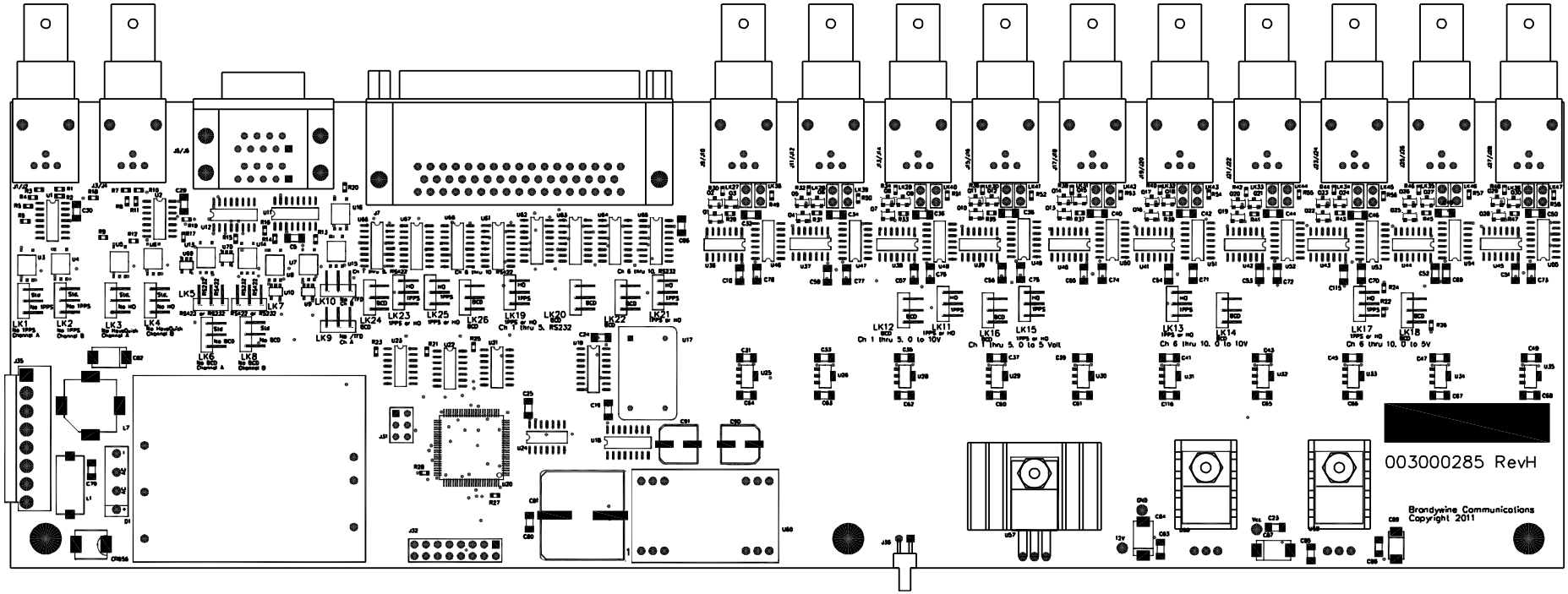


Figure 6.4 - Link Locations

Note: "Std." labels of LK1 to LK4 of 003000285 RevD (or older) were opposite than they're shown.