05/21/2004

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CSC-DT Data Exchanging Transition Board Upgrade

The CSC Track Finder accepts up to 2 track segments from MB2/1 per 30^0 sector; however, when two segments exist, the DT Trigger serializes the data across 2 BX. The CSC Track Finder accepts just one segment per BX to reduce the number of connections. A flag must be sent to denote if a sent segment actually belongs to the previous BX as the second of two segments.

The CSC Track Finder sends all track segments from ME1/3 to the DT Track Finder along with a flag bit to denote whether a segment satisfies $|\eta| < 1.04$. Thus up to 6 stubs can be delivered to DT Track Finder.

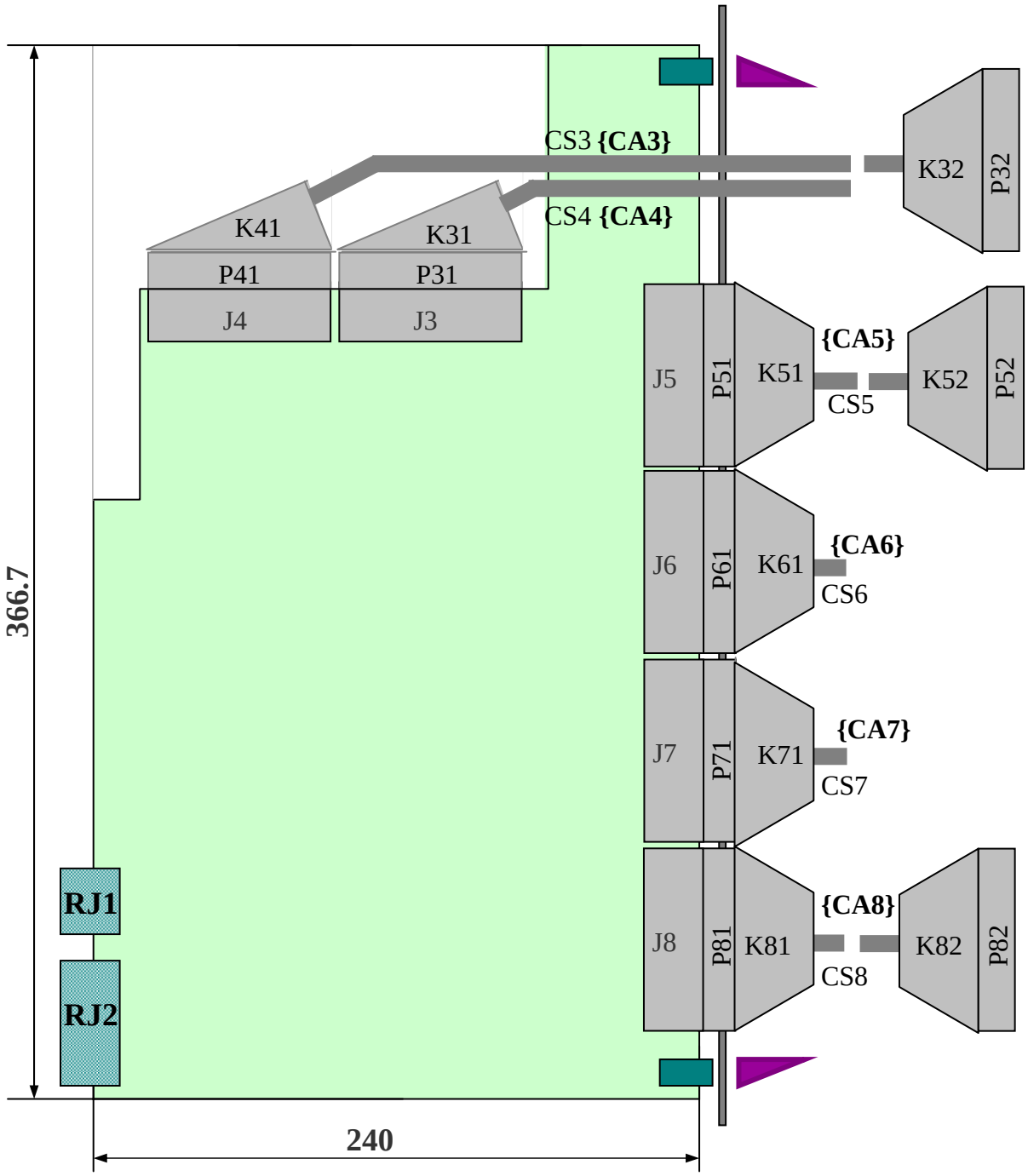
The data words exchanged between the DT and CSC Track Finders are summarized in Tables 1 and 2.

Table 1. Data delivered from the CSC to the DT. Two connections are needed, each of which delivers 3 stubs. Data should be sent at 40 MHz using LVDS

Signal	Bits/ stub	Bits/ 3 Stubs (ME1: 30^0)	Bits/ 6 Stubs (ME1: 60^0)	Description
PHI	12	36	72	Azimuth Coordinate
ETA	1	3	6	DT/CSC Region Flag
QTY	3	9	18	Derived from 4 bit Quality
BXN	-	2	4	2 LSB of Bunch Crossing Number
CLK	-	1	2	Clock for Data
BC0	-	1	2	Bunch Crossing 0
Total	16	52	104	

Table 2. Data delivered from the DT to the CSC. Two stubs from one chamber in the same bunch crossing are transmitted on consecutive bunch crossings. Two connections from two different DT Sector Processors are implemented using LVDS at 40 MHz.

Signal	Bits/ stub	Bits/ 2 stubs (MB1:60^0)	Description
PHI	12	24	Azimuth Coordinate
PHIb	5	10	PHI Bend Angle
QTY	3	6	Quality
FL	1	2	2^{nd} Muon of Previous BX
BXN	2	4	2 LSB of Bunch crossing Number
CLK	1	2	Clock for Data
BC0	1	2	Bunch Crossing 0
CAL	1	2	Special DT mode
Total	26	52	

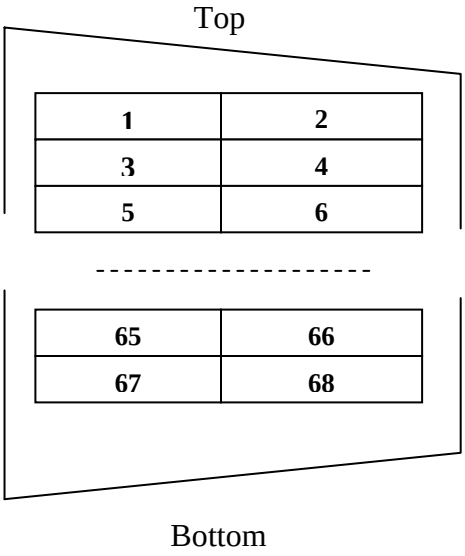


J3÷J8: AMP787190-7 – Amplimite Connector, 68 Cont
{CA3}, {CA4}: P31 ÷ P42 - P4AMP749621-7 –Amplimite Plug Assembly, 68 Pin
K31, K41 - AMP749204-2 – Amplimite Backshell Kit, 68 Pos.
K32, K42 – AMP749195-2 – Amplimite Backshell Kit, 68 Pos.
CS3, CS4 – Belden 1403A – 34 Pairs SCSI2 Cable, Non halogen
{CA5} ÷ {CA8}: P51 ÷ P82 - P4AMP749621-7 –Amplimite Plug Assembly, 68 Pin
K51 ÷ K82 - AMP749195-2 – Amplimite Backshell Kit, 68 Pos.
CS5 ÷CS8 – Belden 1403A – 34 Pairs SCSI2 Cable, Non halogen

Fig.1. CSC/DT Transition Board Connections

Pin's Numbering

Front view of J3-J8:

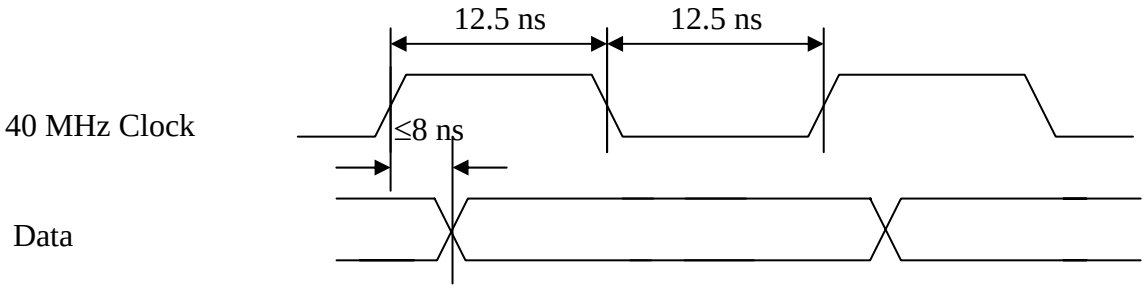


Cable Assembly, Stub and Bit definition

Cable Assembly: CA3 ÷ CA8
Stub definition: S1÷S6
Bit definition:
- According to Table 1 and Table 2 above.
- RES – Reserved pin
- S_DATIN, S_DATOUT, S_READY, S_CK - serial verification bits, not realized at CSC

Timing Diagram

The data communication between CSC and DT is providing over ~ 10 m long cables.
The timing diagram for data pass from CSC to DT is the following:



The valid data are appeared not late than 8 ns follow the grow edge of the 40 MHz clock.

Pin	Bit	Pin	Bit
1	PHI0-	2	PHI0+
3	PHI1-	4	PHI1+
5	PHI2-	6	PHI2+
7	PHI3-	8	PHI3+
9	PHI4-	10	PHI4-
11	PHI5-	12	PHI5+
13	PHI6-	14	PHI6+
15	PHI7-	16	PHI7+
17	PHI8-	18	PHI8+
19	PHI9-	20	PHI9+
21	PHI10-	22	PHI10+
23	PHI11-	24	PHI11+
25	PHIB0-	26	PHIB0+
27	PHIB1-	28	PHIB1+
29	PHIB2-	30	PHIB2+
31	PHIB3-	32	PHIB3+
33	PHIB4-	34	PHIB4+
35	QTY0-	36	QTY0+
37	QTY1-	38	QTY1+
39	QTY2-	40	QTY2+
41	FL-	42	FL+
43	CAL-	44	CAL+
45	BXN0-	46	BXN0+
47	BXN1-	48	BXN1+
49	BC0-	50	BC0+
51	GND	52	GND
53	CLK-	54	CLK+
55	GND	56	GND
57	RES0-	58	RES0+
59	RES1-	60	RES1+
61	RES2-	62	RES2+
63	RES3-	64	RES3+
65	GND	66	RES (SDATIN_CON1)
67	GND	68	RES (SDAT2

Table 3. DT to CSC Connection 1 (J3)

Note: DT to CSC Connection 2 (J4) is the same

Pin	Bit	Pin	Bit
1	S1_PHI0-	2	S1_PHI0+
3	S1_PHI1-	4	S1_PHI1+
5	S1_PHI2-	6	S1_PHI2+
7	S1_PHI3-	8	S1_PHI3+
9	S1_PHI4-	10	S1_PHI4-
11	S1_PHI5-	12	S1_PHI5+
13	S1_PHI6-	14	S1_PHI6+
15	S1_PHI7-	16	S1_PHI7+
17	S1_PHI8-	18	S1_PHI8+
19	S1_PHI9-	20	S1_PHI9+
21	S1_PHI10-	22	S1_PHI10+
23	S1_PHI11-	24	S1_PHI11+
25	S1_ETA--	26	S1_ETA+
27	S1_QTY0-	28	S1_QTY0+
29	S1_QTY1-	30	S1_QTY1+
31	S1_QTY2-	32	S1_QTY2+
33	S2_PHI0-	34	S2_PHI0+
35	S2_PHI1-	36	S2_PHI1+
37	S2_PHI2-	38	S2_PHI2+
39	S2_PHI3-	40	S2_PHI3+
41	S2_PHI4-	42	S2_PHI4+
43	S2_PHI5-	44	S2_PHI5+
45	S2_PHI6-	46	S2_PHI6+
47	S2_PHI7-	48	S2_PHI7+
49	S2_PHI8-	50	S2_PHI8+
51	S2_PHI9-	52	S2_PHI9+
53	S2_PHI10-	54	S2_PHI10+
55	S2_PHI11-	56	S2_PHI11+
57	S2_ETA--	58	S2_ETA-+
59	S2_QTY0-	60	S2_QTY0+
61	S2_QTY1-	62	S2_QTY1+
63	S2_QTY2-	64	S2_QTY2+
65	GND	66	GND
67	GND	68	RES (S_DATOUT_CON1))

Table 4. CSC to DT1 Connection A (S1, S2, J5)

Note: CSC to DT2 Connection A (S4, S5, J7) is the same

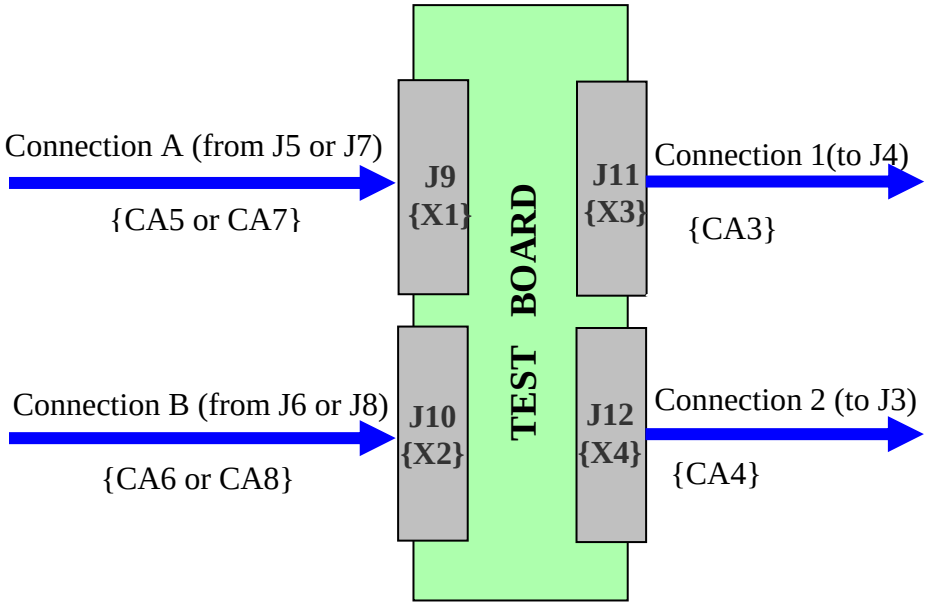
Pin	Bit	Pin	Bit
1	S3_PHI0-	2	S3_PHI0+
3	S3_PHI1-	4	S3_PHI1+
5	S3_PHI2-	6	S3_PHI2+
7	S3_PHI3-	8	S3_PHI3+
9	S3_PHI4-	10	S3_PHI4-
11	S3_PHI5-	12	S3_PHI5+
13	S3_PHI6-	14	S3_PHI6+
15	S3_PHI7-	16	S3_PHI7+
17	S3_PHI8-	18	S3_PHI8+
19	S3_PHI9-	20	S3_PHI9+
21	S3_PHI10-	22	S3_PHI10+
23	S3_PHI11-	24	S3_PHI11+
25	S3_ETA--	26	S3_ETA+
27	S3_QTY0-	28	S3_QTY0+
29	S3_QTY1-	30	S3_QTY1+
31	S3_QTY2-	32	S3_QTY2+
33	S1-3_BXN0-	34	S1-3_BXN0+
35	S1-3_BXN1-	36	S1-3_BXN1+
37	S1-3_BC0-	38	S1-3_BC0+
39	GND	40	GND
41	S1-3_CLK-	42	S1-3_CLK+
43	GND	44	GND
45	RES0-	46	RES0+
47	RES1-	48	RES1+
49	RES2-	50	RES2+
51	RES3-	52	RES3+
53	RES4-	54	RES4+
55	RES5-	56	RES5+
57	RES6-	58	RES6+
59	RES7-	60	RES7+
61	RES8-	62	RES8+
63	RES9-	64	RES9+
65	RES (S_CK_CON2)	66	RES (S_READY_CON2)
67	GND	68	RES (S_DATOUT_CON2)

Table 5. CSC to DT1 Connection B (S3, J6)

Note: CSC to DT2 Connection B (S6, J8) is the same

Test Board

The Test Board allows SP02 DT Interface stand alone test using connection between TB outputs and inputs. It is necessary to provide a preliminary testing just before the real DT Transition Board is delivered. The Test Board adapts two output connectors J5 (J7) and J6 (J8) to be pin-to-pin compatible with the input connectors J3 and J4 according to the pin assignment listed in Tables 3, 4, 5.



J9 … J12: AMP787190-7 – Amplimite Connector, 68 Cont.
X1 …X4: Connectors numbering on the Test PCB

Fig. 2. Test Board Connections

Test 1: Connection J5 to J9 {X1}, Connection J6 to J10 {X2}
Connection J11 {X3} to J4, Connection J12 {X4} to J3

Connector J5 to Connector X3 to Connector J4

Pin	Bit	Pin	Bit	Pin	Bit
1	S1_PHI0-	1	S1_PHI0-	1	1A_PHI0-
3	S1_PHI1-	3	S1_PHI1-	3	1A_PHI1-
5	S1_PHI2-	5	S1_PHI2-	5	1A_PHI2-
7	S1_PHI3-	7	S1_PHI3-	7	1A_PHI3-
9	S1_PHI4-	9	S1_PHI4-	9	1A_PHI4-
11	S1_PHI5-	11	S1_PHI5-	11	1A_PHI5-
13	S1_PHI6-	13	S1_PHI6-	13	1A_PHI6-
15	S1_PHI7-	15	S1_PHI7-	15	1A_PHI7-
17	S1_PHI8-	17	S1_PHI8-	17	1A_PHI8-
19	S1_PHI9-	19	S1_PHI9-	19	1A_PHI9-
21	S1_PHI10-	21	S1_PHI10-	21	1A_PHI10-
23	S1_PHI11-	23	S1_PHI11-	23	1A_PHI11-
25	S1_ETA--	25	S1_ETA--	25	1A_PHIB0-
27	S1_QTY0-	27	S1_QTY0-	27	1A_PHIB1-
29	S1_QTY1-	29	S1_QTY1-	29	1A_PHIB2-
31	S1_QTY2-	31	S1_QTY2-	31	1A_PHIB3-
33	S2_PHI0-	33	S2_PHI0-	33	1A_PHIB4-
35	S2_PHI1-	35	S2_PHI1-	35	1A_QTY0-
37	S2_PHI2-	37	S2_PHI2-	37	1A_QTY1-
39	S2_PHI3-	39	S2_PHI3-	39	1A_QTY2-
41	S2_PHI4-	41	S2_PHI4-	41	1A_FL-
43	S2_PHI5-	43	S2_PHI5-	43	1A_CAL-
45	S2_PHI6-	45	S2_PHI6-	45	1A_BXN0-
47	S2_PHI7-	47	S2_PHI7-	47	1A_BXN1-
49	S2_PHI8-	49	S2_PHI8-	49	1A_BC0-
51	S2_PHI9-	51	GND	51	GND
		53	S2_PHI9-	53	1A_CLK-
		55	GND	55	GND
65	GND	65	GND	65	
67	GND	67	GND	67	

Connector J5 to Connector X4 to Connector J3

53	S2_PHI10-	1	S2_PHI10-	1	1D_PHI0-
55	S2_PHI11-	3	S2_PHI11-	3	1D_PHI1-
57	S2_ETA--	5	S2_ETA--	5	1D_PHI2-
59	S2_QTY0-	7	S2_QTY0-	7	1D_PHI3-
61	S2_QTY1-	9	S2_QTY1-	9	1D_PHI4-
63	S2_QTY2-	11	S2_QTY2-	11	1D_PHI5-

Connector J6 to Connector X4 to Connector J3

Pin	Bit	Pin	Bit	Pin	Bit
1	S3_PHI0-	13	S3_PHI0-	13	1D_PHI6-
3	S3_PHI1-	15	S3_PHI1-	15	1D_PHI7-
5	S3_PHI2-	17	S3_PHI2-	17	1D_PHI8-
7	S3_PHI3-	19	S3_PHI3-	19	1D_PHI9-
9	S3_PHI4-	21	S3_PHI4-	21	1D_PHI10-
11	S3_PHI5-	23	S3_PHI5-	23	1D_PHI11-
13	S3_PHI6-	25	S3_PHI6-	25	1D_PHIB0-
15	S3_PHI7-	27	S3_PHI7-	27	1D_PHIB1-
17	S3_PHI8-	29	S3_PHI8-	29	1D_PHIB2-
19	S3_PHI9-	31	S3_PHI9-	31	1D_PHIB3-
21	S3_PHI10-	33	S3_PHI10-	33	1D_PHIB4-
23	S3_PHI11-	35	S3_PHI11-	35	1D_QTY0-
25	S3_ETA--	37	S3_ETA--	37	1D_QTY1-
27	S3_QTY0-	39	S3_QTY0-	39	1D_QTY2-
29	S3_QTY1-	41	S3_QTY1-	41	1D_FL-
31	S3_QTY2-	43	S3_QTY2-	43	CAL-
33	S1-3_BX0	45	S1-3_BX0-	45	1D_BXN0-
35	S1-3_BX1	47	S1-3_BX1	47	1D_BXN1-
37	S1-3_BC0	49	S1-3_BC0	49	1D_BC0-
39	GND	51	GND	51	GND
41	S1-3_CLK	53	S1-3_CLK	53	1D-CLK-
43	GND	55	GND	55	GND
45		57		57	
47		59		59	
49		61		61	
65	GND	65	GND	65	GND
67	GND	67	GND	67	GND

Tables 6. Table 7. Pin and bit definitions for Test 1.

Test 2: Connection J7 to J9 {X1}, Connection J8 to J10 {X2}
Connection J11 {X3} to J4, Connection X4 to {J3}

The pin and bit definitions are the same as mentioned above. The stubs are S4, S5 and S6 instead of S1, S2 and S3.

Appendix 1

Transition Board, Cable Assembly and Test Board Components are listed in the following tables.

Item	Reference	Manufacture Part #	Distributor Part #	1 PCB Qty	4 PCBs Qty	Part & Package
Capacitors						
1	C1…C4	Kemet T494C476K010AS	Digi-Key 399-1776-1-ND	4	16	Cap 47UF 10V Tant 6032
2	C5…C8	Kemet C0603C103K5RACTU	Digi-Key 399-1091-1-ND	48	192	Cap 0.01UF 50V Ceramic 0603
Connectors						
3	J1	AMP 100159-1	Digi-Key 100159-1-ND	1	4	2 mm Header 55 Pos Extn
4	J2	AMP 100141-1	Digi-Key 100141-1-ND	1	4	2 mm Z-Pack/ B Male Header 125 pos
5	J3 … J8	AMP 787190-7	Digi-Key A23736-ND	6	24	Conn 68 Pos .05 Ampl Pecp Rtagl
Test Points						
6	TP1 …TP162	Sullins Electronics PZC36SAAN	Digi-Key S1011-36-ND	162	648	ST Single Male Header 36 Pos
Semiconductors						
7	U1 … U14	Texas Instruments SN75LVDT390D	Digi-Key 296-6900-5-ND	14	56	Quad LVDS Line Receiver W/Term
8	U15 … U40	Texas Instruments SN75LVDS391D	Digi-Key 296-6929-5-ND	26	104	Quad LVDS Line Driver

Table 6. Transition Board Assembling Components

Item	Reference	Manufacture Part #	Distributor Part #	1 Item Qty	2 Items Qty	Part & Package
Plug Asembly						
1	P31…P81 P32…P82	AMP749621-7	Digi-Key A3304-ND	12	24	Amplimite Plug 68 Pos
Backshell Kit						
2	K31, K41	AMP 749204-2	Digi-Key A23586-ND	2	8	Amplimite Kit 68 Pos
3	K51…K81	AMP 749195-2	Digi-Key A3308-ND	6	12	Amplimite Kit 68 Pos
Cable						
4	CS3…CB8	Belden 1403A		6 x 5 m	12 x 5 m	34 Pairs SCSI Cable

Table 7. Cable Assembling Components

Item	Reference	Manufacture Part #	Distributor Part #	1 Item Qty	2 Items Qty	Part & Package
Connectors						
1	J9…J12	AMP787190-7	Digi-Key A23736-ND	4	8	Amplimite Conn. 68 Pos

Table8 . Test Board Assembling Components