

M0 SIGNAL CABLING

Execution Documentation

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A. M0 Cables Manufacturing

A1. Signal cable structure

A2. Connectors

A3. Twisted pair flat cable

A4. Geometry of a cable

A5. Cable length

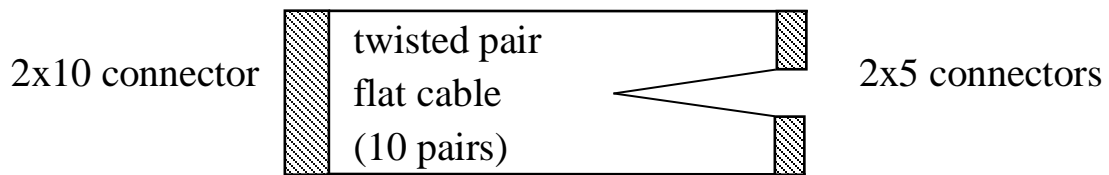
A6. Cable code

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A8. Cable label

A9. Quantity of FFC for M0 signal cables manufacturing

A1. Signal cable structure



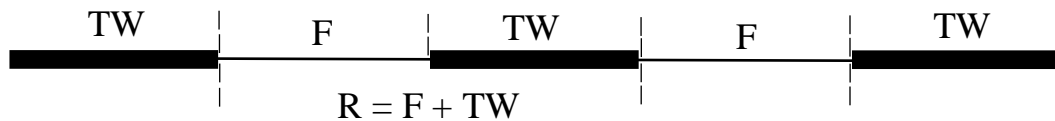
A2. Connectors

2x10 connector : ID20 - DH

2x5 connector : ID10 - DH

A3. Twisted pair flat cable

Cable code (3M factory)	Repeat (mm)	Flat (mm)	TWist (mm)	No. of pairs
1700/20 - TB	190.5	25.4	165.1	25
1700/20 - BA	266.7	50.8	215.9	10



A4. Geometry of a cable

Defined by:

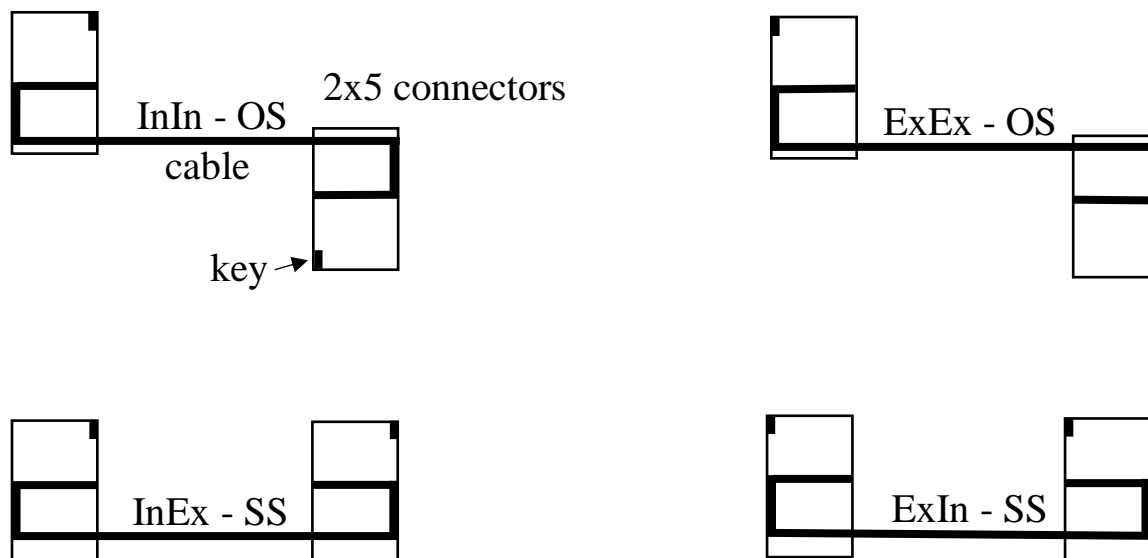
-the connector key position in relation to the cable:

Intern - In / Extern - Ex

-both connectors position in relation to the cable:

Same Side - SS / Opposite Side - OS

2x10 connector



A5. Cable length

Cable code (3M factory)	Cutting length (mm)	Connector to connector distance L (mm)	Cutout
1700/20- TB	215	180	
1700/20- BA	267	230	
1700/20- BA	317	280	

A6. Cable code

Connector to connector distance L (mm)	Connector key position in relation to cable		Both connectors position in relation to cable
	2 x 10 conn.	2 x 5 conn.	
180 / 230 / 280	In / Ex	In / Ex	SS / OS

Code structure:

L - In/Ex In/Ex - SS/OS

Exemple:

230 - InEx - SS

A7. Cable manufacturing

List of cables for M0: see B8

List of cables for S1÷S7 (M0): see B1÷B7

List of steps for cable manufacturing:

- a) Selecting the cable to manufacture (cable code). See B1÷B7.
- b) Cutting the cable for specified length L. See A5 (Cable length).
- c) Mounting 2x10 connector on one side of the cable with the key In/Ex in relation to the cable. See A4 (Geometry of a cable) and A6 (Cable code).

- d) Splitting the cable to the other side in two branches of 2x5 pairs each of them.
- e) Mounting a thermotube on each branch.
See A8 (Cable label) and Annex D4 (Notation explanation).
- f) Mounting 2x5 connectors on each branch
-with the key In/Ex in relation to the cable
-and assuring the position of both connectors (2x5 and 2x10) on SS/OS in relation to the cable. See A4 (Geometry of a cable) and A6 (Cable code).
- g) Attaching the corresponding label on each branch thermotube. See A8 (Cable label) and Annex D4 (Notation explanation).

A8. Cable label

a) Materials:

-thermotube: HST-12-WT-4 (AdamTech)

-label: TZE-241 (white colour) or
TZE-641 (yellow colour) (Brother)

b)Printer: PT-E300VP (Brother)

c)Dimensions:

-thermotube: $l = 14$ mm

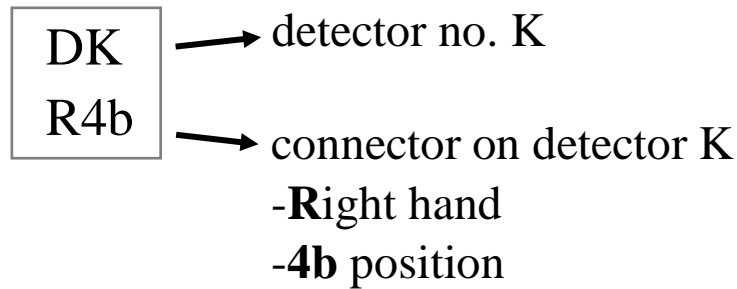
-label: 38x12 mm

d)Label inscription:

-two rows

-character height: 12 pts.

-content:



See Annex D4 (Notation explanation).

See B1 ÷ B7 (for label content).

A9. Quantity of FFC for M0 signal cables manufacturing

Cable length L (mm)	FFC type (3M factory)	Cutout (mm)	FFC per M0 cable (mm)	Number of cables	FFC total length (m)
180	1700/20-TB	2F + 2TW	381	68	25.9
230	1700/20-BA	F + TW	266.7	140	37.4
280	1700/20-BA	2F + TW	533.4	96	51.2

B. M0 Cabling Tables

- B1. M0-S1 Cabling table
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- B5. M0-S5 Cabling table
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- B8. M0 Cable list

B1. M0-S1 Cabling table / I

Detector No.	Cable position		Cable code	Cable label	
	Feedthru connector	Detector connector		Cable branch a	Cable branch b
D1	G1 - L1 L2 L3 L4	D1 - L1ab L2ab L3ab L4ab	280 -InEx- SS	D1 - L1a L2a L3a L4a	D1 - L1b L2b L3b L4b
	G1 - R1 R2 R3 R4	D1 - R1ab R2ab R3ab R4ab	180 -InEx- SS	D1 - R1a R2a R3a R4a	D1 - R1b R2b R3b R4b
D2	G2 - L1 L2 L3 L4	D2 - L1ab L2ab L3ab L4ab	280 -InEx- SS	D2 - L1a L2a L3a L4a	D2 - L1b L2b L3b L4b
	G2 - R1 R2 R3 R4	D2 - R1ab R2ab R3ab R4ab	280 -InIn- OS	D2 - R1a R2a R3a R4a	D2 - R1b R2b R3b R4b
D3	G3 - L1 L2 L3 L4	D3 - L1ab L2ab L3ab L4ab	280 -InEx- SS	D3 - L1a L2a L3a L4a	D3 - L1b L2b L3b L4b
	G3 - R1 R2 R3 R4	D3 - R1ab R2ab R3ab R4ab	180 -InEx- SS	D3 - R1a R2a R3a R4a	D3 - R1b R2b R3b R4b
D4	G4 - L1 L2 L3 L4	D4 - L1ab L2ab L3ab L4ab	230 -InEx- SS	D4 - L1a L2a L3a L4a	D4 - L1b L2b L3b L4b
	G4 - R1 R2 R3 R4	D4 - R1ab R2ab R3ab R4ab	230 -InIn- OS	D4 - R1a R2a R3a R4a	D4 - R1b R2b R3b R4b

B1. M0-S1 Cabling table / II

Detector No.	Cable position		Cable code	Cable label	
	Feedthru connector	Detector connector		Cable branch a	Cable branch b
D5	G5 - L1 L2 L3 L4	D5 - L1ab L2ab L3ab L4ab	180 -InEx- SS	D1 - L1a L2a L3a L4a	D1 - L1b L2b L3b L4b
	G5 - R1 R2 R3 R4	D5 - R1ab R2ab R3ab R4ab	180 -InEx- SS	D1 - R1a R2a R3a R4a	D1 - R1b R2b R3b R4b
D6	G6 - L1 L2 L3 L4	D6 - L1ab L2ab L3ab L4ab	280 -ExEx- OS	D2 - L1a L2a L3a L4a	D2 - L1b L2b L3b L4b
	G6 - R1 R2 R3 R4	D6 - R1ab R2ab R3ab R4ab	280 -ExIn- SS	D2 - R1a R2a R3a R4a	D2 - R1b R2b R3b R4b
D7	G7 - L1 L2 L3 L4	D7 - L1ab L2ab L3ab L4ab	180 -ExEx- OS	D3 - L1a L2a L3a L4a	D3 - L1b L2b L3b L4b
	G7 - R1 R2 R3 R4	D7 - R1ab R2ab R3ab R4ab	180 -ExIn- SS	D3 - R1a R2a R3a R4a	D3 - R1b R2b R3b R4b
D8	G8 - L1 L2 L3 L4	D8 - L1ab L2ab L3ab L4ab	280 -ExEx- OS	D4 - L1a L2a L3a L4a	D4 - L1b L2b L3b L4b
	G8 - R1 R2 R3 R4	D8 - R1ab R2ab R3ab R4ab	280 -ExIn- SS	D4 - R1a R2a R3a R4a	D4 - R1b R2b R3b R4b

B1. M0-S1 Cabling table / III

Detector No.	Cable position		Cable code	Cable label	
	Feedthru connector	Detector connector		Cable branch a	Cable branch b
D9	G9 - L1	D9 - L1ab	230 -ExEx- OS	D9 - L1a	D9 - L1b
	L2	L2ab		L2a	L2b
	L3	L3ab		L3a	L3b
	L4	L4ab		L4a	L4b
	G9 - R1	D9 - R1ab	180 -ExEx- OS	D9 - R1a	D9 - R1b
	R2	R2ab		R2a	R2b
	R3	R3ab		R3a	R3b
	R4	R4ab		R4a	R4b
D10	G10 - L1	D10 - L1ab	280 -ExEx- OS	D10 - L1a	D10 - L1b
	L2	L2ab		L2a	L2b
	L3	L3ab		L3a	L3b
	L4	L4ab		L4a	L4b
	G10 - R1	D10 - R1ab	280 -ExIn- SS	D10 - R1a	D10 - R1b
	R2	R2ab		R2a	R2b
	R3	R3ab		R3a	R3b
	R4	R4ab		R4a	R4b

Cables for M0-S1:

180	SS	OS	230	SS	OS	280	SS	OS
InIn			InIn		4	InIn		4
InEx	16		InEx	4		InEx	12	
ExIn	4		ExIn			ExIn	12	
ExEx		8	ExEx		4	ExEx		12
Total	28		Total	12		Total	40	

B2. M0-S2 Cabling table / I

Detector No.	Cable position		Cable code	Cable label	
	Feedthru connector	Detector connector		Cable branch a	Cable branch b
D1	G1 - L1 L2 L3 L4	D1 - L1ab L2ab L3ab L4ab	230 -InIn- OS	D1 - L1a L2a L3a L4a	D1 - L1b L2b L3b L4b
	G1 - R1 R2 R3 R4	D1 - R1ab R2ab R3ab R4ab	230 -InEx- SS	D1 - R1a R2a R3a R4a	D1 - R1b R2b R3b R4b
D2	G2 - L1 L2 L3 L4	D2 - L1ab L2ab L3ab L4ab	280 -InIn- OS	D2 - L1a L2a L3a L4a	D2 - L1b L2b L3b L4b
	G2 - R1 R2 R3 R4	D2 - R1ab R2ab R3ab R4ab	280 -InEx- SS	D2 - R1a R2a R3a R4a	D2 - R1b R2b R3b R4b
D3	G3 - L1 L2 L3 L4	D3 - L1ab L2ab L3ab L4ab	230 -InIn- OS	D3 - L1a L2a L3a L4a	D3 - L1b L2b L3b L4b
	G3 - R1 R2 R3 R4	D3 - R1ab R2ab R3ab R4ab	230 -InEx- SS	D3 - R1a R2a R3a R4a	D3 - R1b R2b R3b R4b
D4	G4 - L1 L2 L3 L4	D4 - L1ab L2ab L3ab L4ab	280 -InIn- OS	D4 - L1a L2a L3a L4a	D4 - L1b L2b L3b L4b
	G4 - R1 R2 R3 R4	D4 - R1ab R2ab R3ab R4ab	280 -InEx- SS	D4 - R1a R2a R3a R4a	D4 - R1b R2b R3b R4b

B2. M0-S2 Cabling table / II

Detector No.	Cable position		Cable code	Cable label	
	Feedthru connector	Detector connector		Cable branch a	Cable branch b
D5	G5 - L1 L2 L3 L4	D5 - L1ab L2ab L3ab L4ab	230 -InIn- OS	D1 - L1a L2a L3a L4a	D1 - L1b L2b L3b L4b
	G5 - R1 R2 R3 R4	D5 - R1ab R2ab R3ab R4ab	230 -InEx- SS	D1 - R1a R2a R3a R4a	D1 - R1b R2b R3b R4b
D6	G6 - L1 L2 L3 L4	D6 - L1ab L2ab L3ab L4ab	280 -ExIn- SS	D2 - L1a L2a L3a L4a	D2 - L1b L2b L3b L4b
	G6 - R1 R2 R3 R4	D6 - R1ab R2ab R3ab R4ab	280 -ExEx- OS	D2 - R1a R2a R3a R4a	D2 - R1b R2b R3b R4b
D7	G7 - L1 L2 L3 L4	D7 - L1ab L2ab L3ab L4ab	230 -ExIn- SS	D3 - L1a L2a L3a L4a	D3 - L1b L2b L3b L4b
	G7 - R1 R2 R3 R4	D7 - R1ab R2ab R3ab R4ab	230 -ExEx- OS	D3 - R1a R2a R3a R4a	D3 - R1b R2b R3b R4b
D8	G8 - L1 L2 L3 L4	D8 - L1ab L2ab L3ab L4ab	280 -ExIn- SS	D4 - L1a L2a L3a L4a	D4 - L1b L2b L3b L4b
	G8 - R1 R2 R3 R4	D8 - R1ab R2ab R3ab R4ab	280 -ExEx- OS	D4 - R1a R2a R3a R4a	D4 - R1b R2b R3b R4b

B2. M0-S2 Cabling table / III

Detector No.	Cable position		Cable code	Cable label	
	Feedthru connector	Detector connector		Cable branch a	Cable branch b
D9	G9 - L1	D9 - L1ab	230 -ExIn- SS	D9 - L1a	D9 - L1b
	L2	L2ab		L2a	L2b
	L3	L3ab		L3a	L3b
	L4	L4ab		L4a	L4b
	G9 - R1	D9 - R1ab	230 -ExEx- OS	D9 - R1a	D9 - R1b
	R2	R2ab		R2a	R2b
	R3	R3ab		R3a	R3b
	R4	R4ab		R4a	R4b
D10	G10 - L1	D10 - L1ab	280 -ExIn- SS	D10 - L1a	D10 - L1b
	L2	L2ab		L2a	L2b
	L3	L3ab		L3a	L3b
	L4	L4ab		L4a	L4b
	G10 - R1	D10 - R1ab	280 -ExEx- OS	D10 - R1a	D10 - R1b
	R2	R2ab		R2a	R2b
	R3	R3ab		R3a	R3b
	R4	R4ab		R4a	R4b

Cables for M0-S2:

180	SS	OS	230	SS	OS	280	SS	OS
InIn			InIn		12	InIn		8
InEx			InEx	12		InEx	8	
ExIn			ExIn	8		ExIn	12	
ExEx			ExEx		8	ExEx		12
Total	0		Total	40		Total	40	

B3. M0-S3 Cabling table / I

Detector No.	Cable position		Cable code	Cable label	
	Feedthru connector	Detector connector		Cable branch a	Cable branch b
D1	G1 - L1 L2 L3 L4	D1 - L1ab L2ab L3ab L4ab	180 -InIn- OS	D1 - L1a L2a L3a L4a	D1 - L1b L2b L3b L4b
	G1 - R1 R2 R3 R4	D1 - R1ab R2ab R3ab R4ab	180 -InEx- SS	D1 - R1a R2a R3a R4a	D1 - R1b R2b R3b R4b
D2	G2 - L1 L2 L3 L4	D2 - L1ab L2ab L3ab L4ab	180 -ExIn- SS	D2 - L1a L2a L3a L4a	D2 - L1b L2b L3b L4b
	G2 - R1 R2 R3 R4	D2 - R1ab R2ab R3ab R4ab	180 -ExEx- OS	D2 - R1a R2a R3a R4a	D2 - R1b R2b R3b R4b
D3	G3 - L1 L2 L3 L4	D3 - L1ab L2ab L3ab L4ab	180 -InIn- OS	D3 - L1a L2a L3a L4a	D3 - L1b L2b L3b L4b
	G3 - R1 R2 R3 R4	D3 - R1ab R2ab R3ab R4ab	180 -InEx- SS	D3 - R1a R2a R3a R4a	D3 - R1b R2b R3b R4b
D4	G4 - L1 L2 L3 L4	D4 - L1ab L2ab L3ab L4ab	180 -ExIn- SS	D4 - L1a L2a L3a L4a	D4 - L1b L2b L3b L4b
	G4 - R1 R2 R3 R4	D4 - R1ab R2ab R3ab R4ab	180 -ExEx- OS	D4 - R1a R2a R3a R4a	D4 - R1b R2b R3b R4b

B3. M0-S3 Cabling table / II

Detector No.	Cable position		Cable code	Cable label	
	Feedthru connector	Detector connector		Cable branch a	Cable branch b
D5	G5 - L1	D5 - L1ab	180 -InIn- OS	D1 - L1a	D1 - L1b
	L2	L2ab		L2a	L2b
	L3	L3ab		L3a	L3b
	L4	L4ab		L4a	L4b
	G5 - R1	D5 - R1ab	180 -InEx- SS	D1 - R1a	D1 - R1b
	R2	R2ab		R2a	R2b
	R3	R3ab		R3a	R3b
	R4	R4ab		R4a	R4b
D6	G6 - L1	D6 - L1ab	230 -ExIn- SS	D2 - L1a	D2 - L1b
	L2	L2ab		L2a	L2b
	L3	L3ab		L3a	L3b
	L4	L4ab		L4a	L4b
	G6 - R1	D6 - R1ab	230 -ExEx- OS	D2 - R1a	D2 - R1b
	R2	R2ab		R2a	R2b
	R3	R3ab		R3a	R3b
	R4	R4ab		R4a	R4b

Cables for M0-S3:

180	SS	OS	230	SS	OS	280	SS	OS
InIn		12	InIn			InIn		
InEx	12		InEx			InEx		
ExIn	8		ExIn	4		ExIn		
ExEx		8	ExEx		4	ExEx		
Total	40		Total	8		Total	0	

B4. M0-S4 Cabling table / I

Detector No.	Cable position		Cable code	Cable label	
	Feedthru connector	Detector connector		Cable branch a	Cable branch b
D1	G1 - L1 L2 L3 L4	D1 - L1ab L2ab L3ab L4ab	230 -InIn- OS	D1 - L1a L2a L3a L4a	D1 - L1b L2b L3b L4b
	G1 - R1 R2 R3 R4	D1 - R1ab R2ab R3ab R4ab	230 -ExEx- OS	D1 - R1a R2a R3a R4a	D1 - R1b R2b R3b R4b
D2	G2 - L1 L2 L3 L4	D2 - L1ab L2ab L3ab L4ab	280 -InIn- OS	D2 - L1a L2a L3a L4a	D2 - L1b L2b L3b L4b
	G2 - R1 R2 R3 R4	D2 - R1ab R2ab R3ab R4ab	280 -ExEx- OS	D2 - R1a R2a R3a R4a	D2 - R1b R2b R3b R4b
D3	G3 - L1 L2 L3 L4	D3 - L1ab L2ab L3ab L4ab	230 -InIn- OS	D3 - L1a L2a L3a L4a	D3 - L1b L2b L3b L4b
	G3 - R1 R2 R3 R4	D3 - R1ab R2ab R3ab R4ab	230 -ExEx- OS	D3 - R1a R2a R3a R4a	D3 - R1b R2b R3b R4b

Cables for M0-S4:

180	SS	OS	230	SS	OS	280	SS	OS
InIn			InIn		8	InIn		4
InEx			InEx			InEx		
ExIn			ExIn			ExIn		
ExEx			ExEx		8	ExEx		4
Total	0		Total	16		Total	8	

B5. M0-S5 Cabling table / I

Detector No.	Cable position		Cable code	Cable label	
	Feedthru connector	Detector connector		Cable branch a	Cable branch b
D1	G1 - L1 L2 L3 L4	D1 - L1ab L2ab L3ab L4ab	230 -InIn- OS	D1 - L1a L2a L3a L4a	D1 - L1b L2b L3b L4b
	G1 - R1 R2 R3 R4	D1 - R1ab R2ab R3ab R4ab	230 -ExEx- OS	D1 - R1a R2a R3a R4a	D1 - R1b R2b R3b R4b
D2	G2 - L1 L2 L3 L4	D2 - L1ab L2ab L3ab L4ab	230 -InIn- OS	D2 - L1a L2a L3a L4a	D2 - L1b L2b L3b L4b
	G2 - R1 R2 R3 R4	D2 - R1ab R2ab R3ab R4ab	230 -ExEx- OS	D2 - R1a R2a R3a R4a	D2 - R1b R2b R3b R4b
D3	G3 - L1 L2 L3 L4	D3 - L1ab L2ab L3ab L4ab	230 -InIn- OS	D3 - L1a L2a L3a L4a	D3 - L1b L2b L3b L4b
	G3 - R1 R2 R3 R4	D3 - R1ab R2ab R3ab R4ab	230 -ExEx- OS	D3 - R1a R2a R3a R4a	D3 - R1b R2b R3b R4b

Cables for M0-S5:

180	SS	OS	230	SS	OS	280	SS	OS
InIn			InIn		12	InIn		
InEx			InEx			InEx		
ExIn			ExIn			ExIn		
ExEx			ExEx		12	ExEx		
Total	0		Total	24		Total	0	

B6. M0-S6 Cabling table / I

Detector No.	Cable position		Cable code	Cable label	
	Feedthru connector	Detector connector		Cable branch a	Cable branch b
D1	G1 - L1 L2 L3 L4	D1 - L1ab L2ab L3ab L4ab	230 -InIn- OS	D1 - L1a L2a L3a L4a	D1 - L1b L2b L3b L4b
	G1 - R1 R2 R3 R4	D1 - R1ab R2ab R3ab R4ab	230 -ExEx- OS	D1 - R1a R2a R3a R4a	D1 - R1b R2b R3b R4b
D2	G2 - L1 L2 L3 L4	D2 - L1ab L2ab L3ab L4ab	280 -InIn- OS	D2 - L1a L2a L3a L4a	D2 - L1b L2b L3b L4b
	G2 - R1 R2 R3 R4	D2 - R1ab R2ab R3ab R4ab	280 -ExEx- OS	D2 - R1a R2a R3a R4a	D2 - R1b R2b R3b R4b
D3	G3 - L1 L2 L3 L4	D3 - L1ab L2ab L3ab L4ab	230 -InIn- OS	D3 - L1a L2a L3a L4a	D3 - L1b L2b L3b L4b
	G3 - R1 R2 R3 R4	D3 - R1ab R2ab R3ab R4ab	230 -ExEx- OS	D3 - R1a R2a R3a R4a	D3 - R1b R2b R3b R4b

Cables for M0-S6:

180	SS	OS	230	SS	OS	280	SS	OS
InIn			InIn		8	InIn		4
InEx			InEx			InEx		
ExIn			ExIn			ExIn		
ExEx			ExEx		8	ExEx		4
Total	0		Total	16		Total	8	

B7. M0-S7 Cabling table / I

Detector No.	Cable position		Cable code	Cable label	
	Feedthru connector	Detector connector		Cable branch a	Cable branch b
D1	G1 - L1	D1 - L1ab	230 -InIn- OS	D1 - L1a	D1 - L1b
	L2	L2ab		L2a	L2b
	L3	L3ab		L3a	L3b
	L4	L4ab		L4a	L4b
	G1 - R1	D1 - R1ab	230 -ExEx- OS	D1 - R1a	D1 - R1b
	R2	R2ab		R2a	R2b
	R3	R3ab		R3a	R3b
	R4	R4ab		R4a	R4b
D2	G2 - L1	D2 - L1ab	230 -InIn- OS	D2 - L1a	D2 - L1b
	L2	L2ab		L2a	L2b
	L3	L3ab		L3a	L3b
	L4	L4ab		L4a	L4b
	G2 - R1	D2 - R1ab	230 -ExEx- OS	D2 - R1a	D2 - R1b
	R2	R2ab		R2a	R2b
	R3	R3ab		R3a	R3b
	R4	R4ab		R4a	R4b
D3	G3 - L1	D3 - L1ab	230 -InIn- OS	D3 - L1a	D3 - L1b
	L2	L2ab		L2a	L2b
	L3	L3ab		L3a	L3b
	L4	L4ab		L4a	L4b
	G3 - R1	D3 - R1ab	230 -ExEx- OS	D3 - R1a	D3 - R1b
	R2	R2ab		R2a	R2b
	R3	R3ab		R3a	R3b
	R4	R4ab		R4a	R4b

Cables for M0-S7:

180	SS	OS	230	SS	OS	280	SS	OS
InIn			InIn		12	InIn		
InEx			InEx			InEx		
ExIn			ExIn			ExIn		
ExEx			ExEx		12	ExEx		
Total	0		Total	24		Total	0	

B8. M0 Cables list

180	SS	OS	230	SS	OS	280	SS	OS
InIn		12	InIn		56	InIn		20
InEx	28		InEx	16		InEx	20	
ExIn	12		ExIn	12		ExIn	24	
ExEx		16	ExEx		56	ExEx		32
Total	68		Total	140		Total	96	

D. Annexes

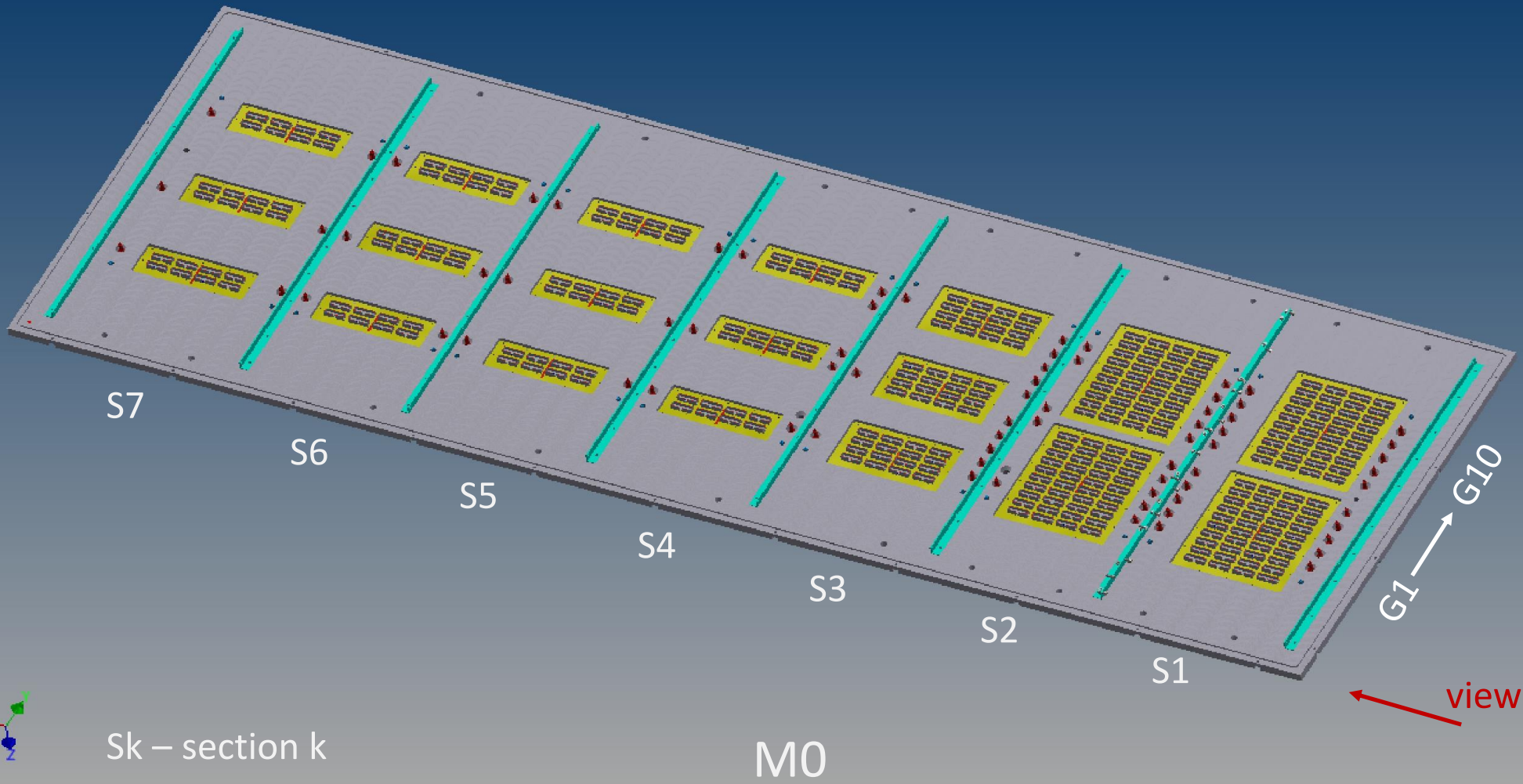
D1. ToF wall - inner zone: M0 position

D2. Feedthrough connectors PCBs on backplane

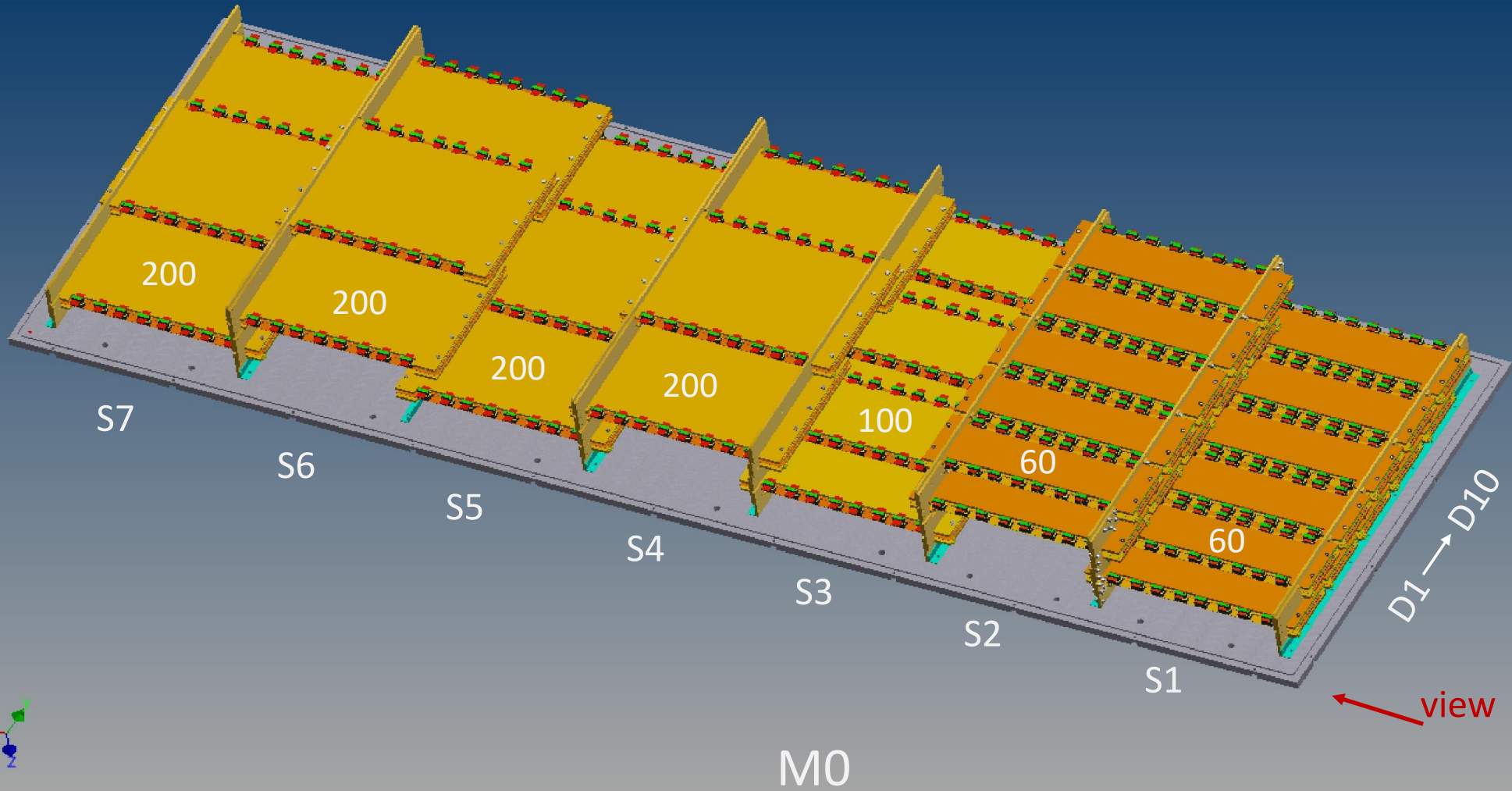
D3. RPC detectors disposal on backplane

D4. Notation explanation

D2. Feedthrough connectors PCBs on backplane



D3. RPC detectors disposal on backplane



D4. Notation explanation

