



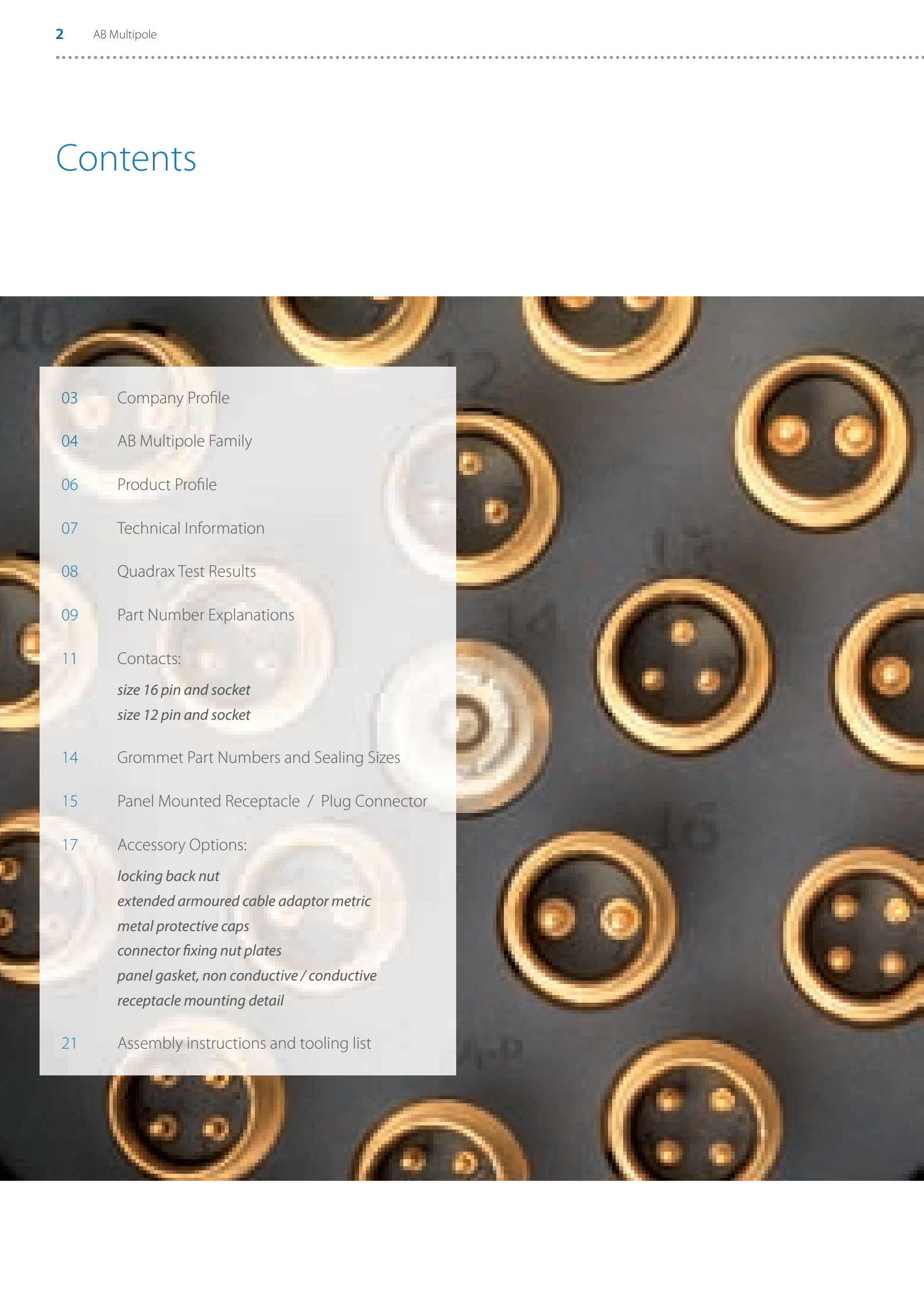
Connectors

AB Multipole:
high speed & signal data connector



.....
Belief in Technology

Contents

- 
- | | |
|----|---|
| 03 | Company Profile |
| 04 | AB Multipole Family |
| 06 | Product Profile |
| 07 | Technical Information |
| 08 | Quadrax Test Results |
| 09 | Part Number Explanations |
| 11 | Contacts:
<i>size 16 pin and socket</i>
<i>size 12 pin and socket</i> |
| 14 | Grommet Part Numbers and Sealing Sizes |
| 15 | Panel Mounted Receptacle / Plug Connector |
| 17 | Accessory Options:
<i>locking back nut</i>
<i>extended armoured cable adaptor metric</i>
<i>metal protective caps</i>
<i>connector fixing nut plates</i>
<i>panel gasket, non conductive / conductive</i>
<i>receptacle mounting detail</i> |
| 21 | Assembly instructions and tooling list |

Company Profile



When safety matters the world's leading rail manufacturer's turn to TT electronics for exceptional design support

TT electronics plc is a global electronics company that has been supplying innovative high reliability components and assemblies to the world's rail transport manufacturers for more than 30 years. The knowledge and experience gained in that time has resulted in a dedicated team of industry experts who are available to advise and guide customers through even the most complex component requirements. Our industry experience and agile approach to business has given us a pre-eminent position in the supply of connectors and other components for rail network infrastructures and rolling stock.

Modern rail transport applications present a harsh and unforgiving environment, where systems are subjected to vibration and temperature fluctuations. TT electronics' relentless focus on quality and compliance helps rail manufacturers focus on core activities, improving their time-to-market, lowering manufacturing costs and mitigating risk. Working closely on site with our OEM and ODM customers has given our engineering team a deep understanding of the changing market trends and regulations of the rail sector, enabling them to engineer the best possible component solution.

As a major plc listed on the London stock exchange, TT electronics plc has the financial resources to continually invest in up-to-the-minute manufacturing facilities to address our customer's needs and provide them with the correct solution. With design and manufacturing plants in Europe and the USA, we are able to help rail manufacturers globally accelerate their design through to on-time market entry by supplying innovative rugged connectors and assemblies to the IRIS standard.

AB Multipole Family

TT electronics' components division has multiple facilities for the design and manufacture of interconnection systems with engineering teams providing custom solutions.

Rail

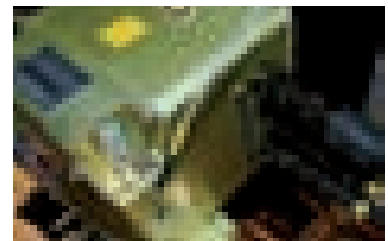
Rolling stock

Design, development and supply of interconnection solutions direct to major OEM partners.



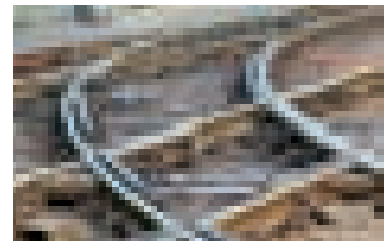
Equipment

Comprehensive product portfolio for all electrical interfaces on all rail vehicles.



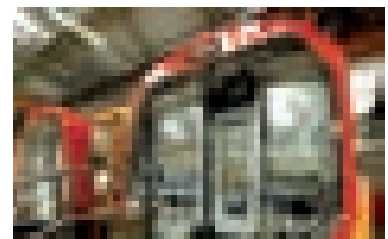
Infrastructure & signalling

Trackside and signalling cables and connectors.



Services

Innovative product solutions for upgrades and vehicle overhaul programmes, supporting the vehicle life cycle.



Military and Defence

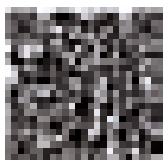
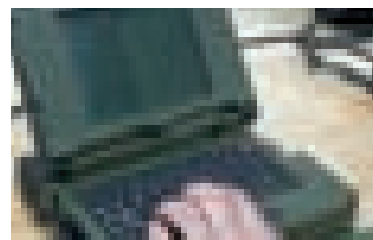
Land Based Vehicles

Consult our Engineering department for further details.

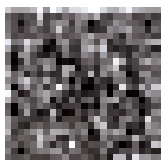


Battle Field Support

Consult our Engineering department for further details.



Scan QR Code to view our
Land Based Vehicles Brochure
<http://www.ttabconnectors.com/e-catalogues/LBV>



Scan QR Code to view our
Rail Vehicles Brochure
http://www.ttabconnectors.com/e-catalogues/Rail_Vehicles_Brochure

AB Multipole

product profile

TT electronics AB Connectors has used the experience it gained in military and aerospace connector design to bring innovation into its family of connectors for industrial, automotive and general rail applications. The new range of modular bayonet-lock connectors has undergone rigorous environmental and stress testing to enable reliable signal and high-speed data interconnects up to 100Mbit/s in the most demanding applications.

The MIL-DTL-5015 and VG95234 style connectors are available in a range of sizes to accept various multi-pole contacts. Any combination of co-ax, twin-ax, tri-ax or quadrax modules can be specified, delivering a highly versatile connector system capable of consolidating up to seven high-speed Ethernet connections or many combinations of signal and data links.

The contacts feature industry-standard crimp terminations, enabling rapid connection to multi-core cables. Also, the insulator design eliminates the need for insertion or extraction tooling. The sealing system employs a stepped wire sealing grommet, which provides a water-tight seal to the cables to meet IP67 specifications.

The modular contacts are housed in a removable thermoplastic insulator, which can be positioned in a number of orientations and features a polarising keyway to maintain correct orientation with the outer shell. The insulator is engineered to present a low fire hazard. Gold-plated copper contacts display low contact resistance, better than 5m Ω nominal and 10m Ω after conditioning. Maximum operating voltage is 500Vpeak (DC or AC), and the connectors are rated for operation from -55°C to +125°C.



AB Multipole

technical information

Materials & Finishes

Shell: Aluminium alloy, cadmium free plated, black passivation

Insulators: Low fire hazard thermo plastic

Contacts:

Twin-ax, tri-ax, quadrax - copper alloy, gold plated

Co-ax - silver or gold plated

Mechanical Features

Coupling: Three pin bayonet lock

Polarisation: Shell key/keyway in removable insulator

Contact type: Crimp, multi-pole signal, sandwich retention

Contact arrangements: 1 to 12 way

Endurance: Minimum 2000 mating/unmating operations in any connector

Shock & vibration: BSEN61373 Cat 1. Class A.

Contact retention: Minimum 200N

Electrical Data

Voltage proof: 500v DC/AC peak

Contact resistance: <5m ohms, less than 10 ohms after conditioning

Dielectric withstanding voltage: Sea level = 500 Vrms between signal contacts and signal contact/body

Insulation resistance: at ambient temperature >5000m ohms, at high temperature >1000m ohms

Note: Suitable for data transmission @ 100 Base-Tx on Cat 5e: Single Quadax

Suitable for data transmission @ 1000 Base-T on Cat 5e: 2 x Quadax

Environmental Features

Temperature rating: -55°C to +125°C

Sealing: IP67

NOTE: The company reserves the right and may change or vary specification without prior written notice.

AB Multipole

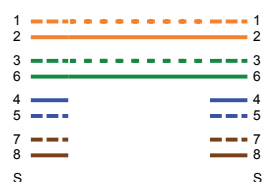
quadrax test results

Quadrax test results for 100 Base-Tx @85m

Results	Measured Values	Pairs
Length (ft), Limit 328	286	3, 6
Prop. Delay (ns)	440	1, 2
Delay Skew (ns)	18	1, 2
Resistance (ohms)	14.1	1, 2
Impedance (ohms)	100	3, 6
Insertion Loss Margin (dB)	1.1	1, 2
Frequency (MHz)	100	1, 2
Limit (dB)	24	1, 2

Wire Map (Ethernet Two-Pair)

PASS



	Worst Case Margin		Worst Case Value	
PASS	MAIN	SR	MAIN	SR
Worst Pair	12-36	12-36	12-36	12-36
NEXT (dB)	3.5	3.1	6.2	4.9
Freq. (MHz)	11.6	29.1	90.8	82.5
Limit (dB)	42.8	36.1	27.8	28.5

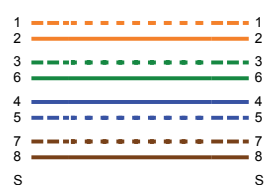
PASS	MAIN	SR	MAIN	SR
Worst Pair	36	12	36	36
NEXT (dB)	11.5	10.5	11.5	12.9
Freq. (MHz)	91.0	2.8	91.0	100.0
Limit (dB)	8.4	15.0	8.4	8.0

Quadrax test results for 1000 Base-T @85m

Results	Measured Values	Pairs
Length (ft), Limit 328	286	3, 6
Prop. Delay (ns)	440	1, 2
Delay Skew (ns)	18	1, 2
Resistance (ohms)	14.1	1, 2
Impedance (ohms)	100	3, 6
Insertion Loss Margin (dB)	0.5	1, 2
Frequency (MHz)	100	1, 2
Limit (dB)	24	1, 2

Wire Map (T568B)

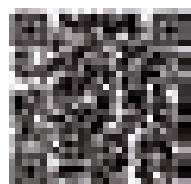
PASS



	Worst Case Margin		Worst Case Value	
PASS	MAIN	SR	MAIN	SR
Worst Pair	12-36	45-78	45-78	45-78
NEXT (dB)	4.7	4.0	5.1	4.1
Freq. (MHz)	6.9	83.0	97.3	97.3
Limit (dB)	46.6	28.5	27.3	27.3

PASS	MAIN	SR	MAIN	SR
Worst Pair	45	36	36	36
RL (dB)	11.8	10.2	12.3	10.2
Freq. (MHz)	3.8	89.0	86.3	89.0
Limit (dB)	15.0	8.5	8.7	8.5

PASS	MAIN	SR	MAIN	SR
Worst Pair	45-78	45-78	36-45	45-36
ACR-F (dB)	8.2	8.2	12.8	12.2
Freq. (MHz)	10.5	10.5	91.8	91.8
Limit (dB)	36.6	36.6	15.1	17.7
Worst Pair	78	78	45	45
PS ACR-F (dB)	9.8	10.1	14.2	13.9
Freq. (MHz)	10.1	9.4	91.8	88.3
Limit (dB)	34.3	35.0	15.1	15.5



Scan QR Code to view data sheet

http://www.ttabconnectors.com/pdf/abcirp_sigcon.pdf

AB Multipole

insert arrangements

views from front face of pin insert

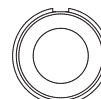
Shell size 18

18-M3 1 Multipole contact



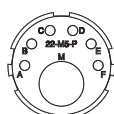
Shell size 20

20-M8 1 Coax contact
ABMPC#003
or ABMPC#004



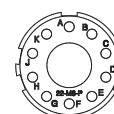
Shell size 22

22-M5 1 Multipole contact
6 #16 contacts



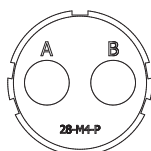
Shell size 22

22-M6 1 Multipole contact
10 #16 contacts



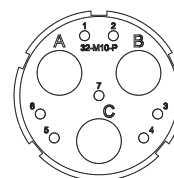
Shell size 28

28-M4 2 Multipole contacts



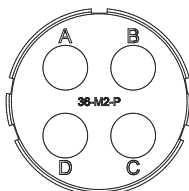
Shell size 32

32-M10 3 Multipole contacts
7 #16 contacts



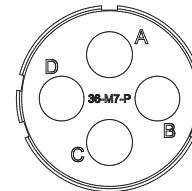
Shell size 36

36-M2 4 Multipole contacts



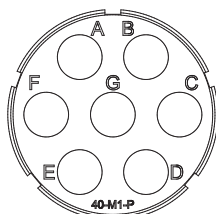
Shell size 36

36-M7 2 Multipole contacts
2 Coax contacts
ABMPC#002



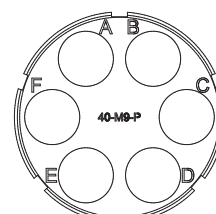
Shell size 40

40-M1 7 Multipole contacts



Shell size 40

40-M9 6 Coax contacts
ABMPC#003
or ABMPC#004



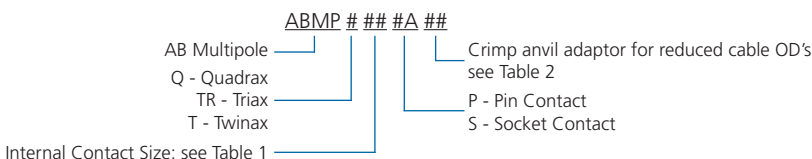
All multiple cavities can also accept Coax contacts ABMPC#001
Replace # with P = Pin or S = Socket

NOTES:

See contact-planform compatibility chart on page 12
Custom insert arrangements available on request
Multipole inserts are not SNCF approved

AB Multipole

multipole contacts



NOTE: Crimp anvil adaptor for use on Quadrax and Twinax assemblies only.

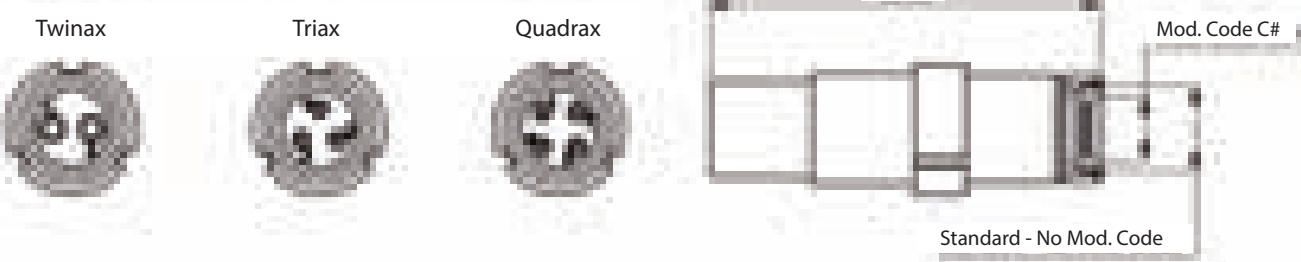
Table 1: Internal contact size availability

		CONTACT SIZE (AWG)		
		16	20	22
ABMPQ	QUADRAX	✗	✓	✓
ABMPTR	TRIAX	✗	✓	✓
ABMPT	TWINAX	✓	✓	✓

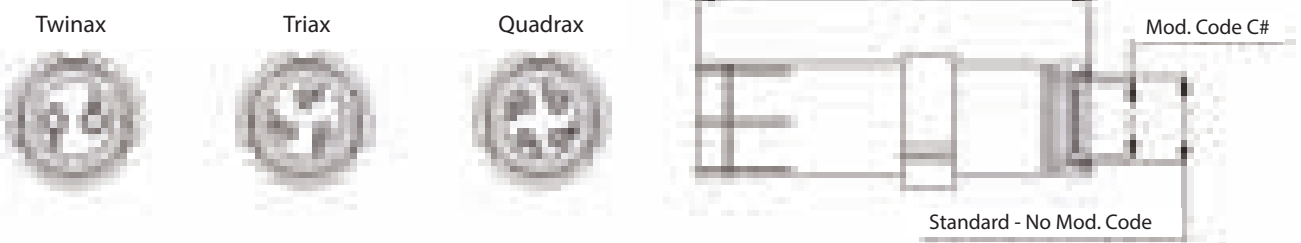
Table 2: Crimp modification codes

OUTSIDE CABLE DIAMETER	CODE
7.00 - 8.10	none
6.00 - 7.00	C1
5.00 - 6.00	C2
4.00 - 5.00	C3

Multipole pin contact



Multipole socket contact



Hand Crimp Tool

Contact sizes 12 and 16

AB Part No: ABBFT8

Supplier DMC part no. FT8

Pneumatic Crimp Tool

Contact sizes 12 and 16

AB Part No: ABWA27F

Supplier DMC part no: WA27F

Turret Locator

Contact sizes 12 and 16

(to locate contacts within a crimp tool)

AB Part No: ABBUH2-5

Supplier DMC part no: UH2-5

Hand Crimp Tool

External Multipole Contacts

AB Part No: ABBD51

Supplier Dubuis part no: D51

Electric Crimp Tool

External Multipole Contacts

AB Part No: ABBD55E

Supplier Dubius part no: D55E

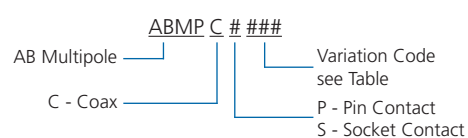
Die Sets

External Multipole Contacts

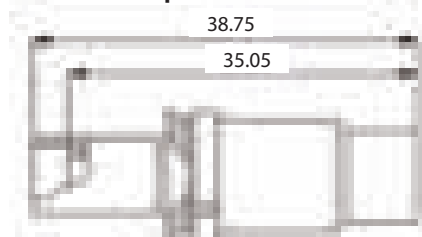
AB Part No: ABT00004

AB Multipole

coax contacts



Coax socket and pin



ABMP C S 001

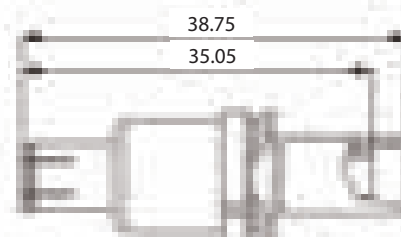
Coax Socket



Coax Pin



(for illustration purposes)



ABMP C P 001

Contact - Planform compatability chart

Code	001	002	004
Impendence (omhs)	50	50	75
Cable type	LMR 240	GX_07272_D & GX_07272_D-04	G_04273-12
18-M3	✓	✗	✗
20-M8	✗	✗	✓
22-M5	✓	✗	✗
22-M6	✓	✗	✗
28-M4	✓	✗	✗
32-M10	✓	✗	✗
36-M2	✓	✗	✗
36-M7	✓ +	✓ *	✗
40-M1	✓	✗	✗
40-M9	✗	✗	✓

Tooling

INNER CONTACT	ABBFT8 ABBUH2-5	Solder	Solder
BAND STRAP	—	ABB600057	ABB600057
BAND TOOL	—	ABB600061	ABB600061
CRIMP TOOL	D51 or D55	—	—
DIE SET	ABT00004	—	—

+ cavities B and C only

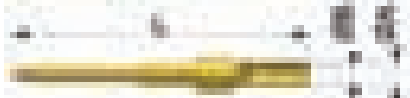
* cavities A and C only

AB Multipole

contacts



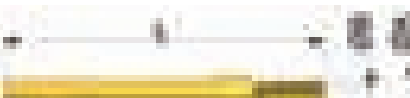
size 16 pin and socket

Part Number	ØA	ØB	Conductor CSA mm ²	L	Pin
ABMP 16 22 KPK P3	2.30	0.90	0.25/0.34	31.65	
ABMP 16 20 KPK P3	2.65	1.07	0.50/0.60		
ABMP 16 18 KPK P3	2.30	1.25	0.75/0.93		
ABMP 16 KPK P3	2.75	1.75	0.93/1.50		
ABMP 16 14 KPK P3	2.90	1.80	1.68		

Part Number	ØA	ØB	Conductor CSA mm ²	L	Socket
ABMP 16 22 KLK P3	2.30	0.90	0.25/0.34	35.00	
ABMP 16 20 KLK P3	2.65	1.07	0.50/0.60		
ABMP 16 18 KLK P3	2.30	1.25	0.75/0.93		
ABMP 16 KLK P3	2.75	1.75	0.93/1.50		
ABMP 16 14 KLK P3	2.90	1.80	1.68		

size 12 pin and socket

Part Number	ØA	ØB	Conductor CSA mm ²	L	Pin
ABMP 12 20 KPK P3	2.65	1.10	0.50/0.60	31.65	
ABMP 12 18 KPK P3	2.30	1.25	0.75/0.93		
ABMP 12 16 KPK P3	2.75	1.75	0.93/1.50		
ABMP 12 14 KPK P3	2.90	1.80	1.68		
ABMP 12 KPK P3	3.80	2.50	2.50/3.00		
ABMP 12 10 KPK P3	4.40	3.00	5.53		
ABMP 12 (40) KPK P3	4.00	2.70	4		

Part Number	ØA	ØB	Conductor CSA mm ²	L	Socket
ABMP 12 20 KLK P3	2.65	1.10	0.50/0.60	35.00	
ABMP 12 18 KLK P3	2.30	1.25	0.75/0.93		
ABMP 12 16 KLK P3	2.75	1.75	0.93/1.50		
ABMP 12 14 KLK P3	2.90	1.80	1.68		
ABMP 12 KLK P3	3.80	2.50	2.50/3.00		
ABMP 12 10 KLK P3	4.40	3.00	5.53		
ABMP 12 (40) KLK P3	4.00	2.70	4		

AB Multipole

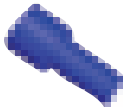
grommet part numbers and sealing sizes

Part Number	Contact Arrangement	Wire Insulation O/D Min. (mm)	Wire Insulation O/D Max. (mm)
ABCIRP 18 M3 G#	1 Multipole contact	6.00	8.50
ABCIRP 20 M8 G#	1 Coax contact	6.00	8.50
ABCIRP 22 M5 G#	1 Multipole contact 6 #16 contacts	6.00 0.80	8.50 2.30
ABCIRP 22 M6 G#	1 Multipole contact 10 #16 contacts	6.00 0.80	8.50 2.30
ABCIRP 28 M4 G#	2 Multipole contacts	6.00	8.50
ABCIRP 32 M10 G#	3 Multipole contacts 7 #16 contacts	6.00 0.80	8.50 2.30
ABCIRP 36 M2 G#	4 Multipole contacts	6.00	8.50
ABCIRP 36 M7 G#	2 Multipole contacts 2 Coax contacts	6.00 0.80	8.50 2.30
ABCIRP 40 M1 G#	7 Multipole contacts	6.00	8.50
ABCIRP 40 M9 G#	6 Coax contacts	6.00	8.50

to be replaced by gender - P or S

grommet filler

Part Number ABMP6GFP

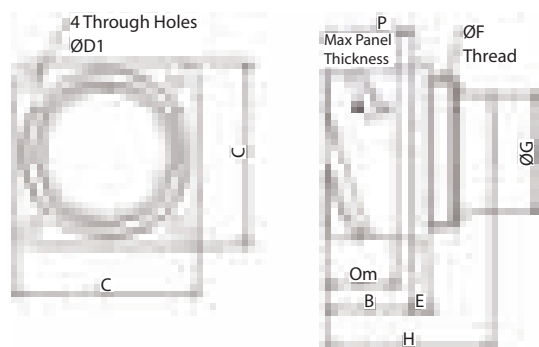
Large grommet filler plug	Grommet filler plug	Sealed using filler plugs
		

Part No.	Colour
ABB16KFP	Blue
ABB12KFPF80	Orange

To be used if grommet is pierced incorrectly

AB Multipole

panel mounted receptacle- rear mounting



ABMP03T

Shell Size	ØF Thread Class 2A	B Max	C Max	ØD1 +0,2-0	Threaded Holes (MOD CODE M6)	E Max	ØG	H	P see note	Om Min Overlap Mated
18	1" x 20 UNEF	23.45	35.30	3.20	M3	4.20	18.30	46.25	3.30	15.85
20	1 1/8" x 18 UNEF		38.30				20.50			
22	1 1/4" x 18 UNEF		41.30				24.60			
24	1 3/8" x 18 UNEF		44.80	3.70	M4		27.00			15.75
28	1 5/8" x 18 UNEF	24.45	51.10	M5	32.50					
32	1 7/8" x 16 UN		57.30		35.80					
36	2 1/16" x 16 UNS		63.80		42.50					
40	2 5/16" x 16 UN		70.20		48.50					

panel mounted receptacle- front mounting

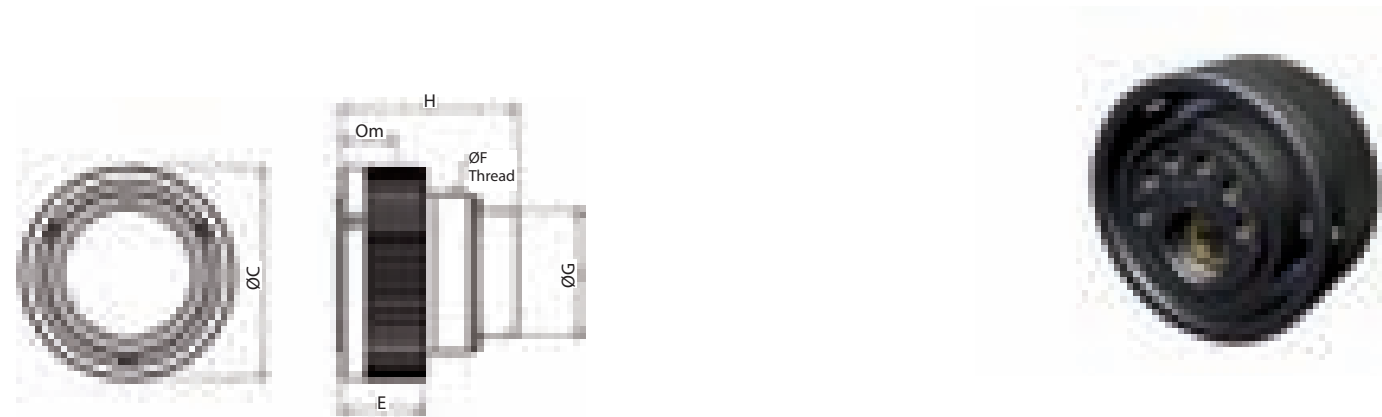


ABMP00T

Shell Size	ØF Thread Class 2A	B Max	C Max	ØD1 +0,2-0	Threaded Holes (MOD CODE M6)	E Max	ØG	H	P see note	Om Min Overlap Mated
18	1" x 20 UNEF	23.60	35.30	3.20	M3	4.20	18.30	46.25	3.30	15.85
20	1 1/8" x 18 UNEF		38.30				20.50			
22	1 1/4" x 18 UNEF		41.30				24.60			
24	1 3/8" x 18 UNEF	25.20	44.80	3.70	M4		27.00			15.75
28	1 5/8" x 18 UNEF		51.10		M5		32.50			
32	1 7/8" x 16 UN		57.30	4.30			35.80			
36	2 1/16" x 16 UNS		63.80				42.50			
40	2 5/16" x 16 UN		70.20				48.50			

AB Multipole

plug connector (style 'T' less accessories)

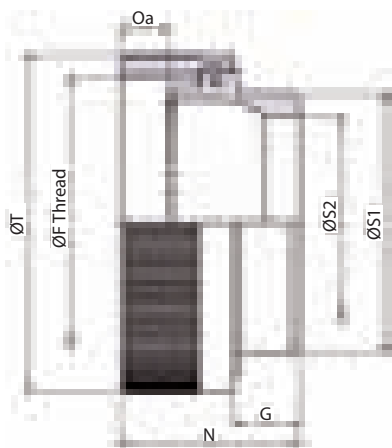


ABMPSE06T

Shell Size	C Max	E Max	ØF Thread Class 2A	ØG	H	Om Min Overlap Mated
18	37.30	24.00	1" x 20 UNEF	18.30	46.25	15.85
20	40.70		1 1/8" x 18 UNEF	20.50		
22	44.20		1 1/4" x 18 UNEF	24.60		
24	47.70		1 3/8" x 18 UNEF	27.00		
28	54.50		1 5/8" x 18 UNEF	32.50		
32	61.40	27.00	1 7/8" x 16 UN	35.80		15.75
36	68.00		2 1/16" x 16 UNS	42.50		
40	74.00		2 5/16" x 16 UN	48.50		

AB Multipole - accessory options

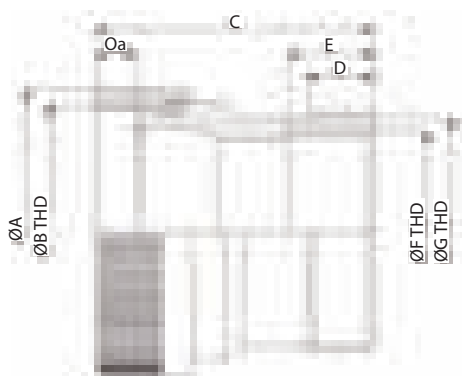
locking backnut for grommet sealing only - LBN



ABBP ## LBN
 Series prefix ———
 Shell size ——— Locking back nut

Shell Size	ØF Thread Class 2B	G Max	N Max	ØS1 Max	ØS2 Min	ØT Max	Oa Min Overlap Accessory
18	1" x 20 UNEF	8.70	25.65	25.50	16.70	31.00	7.00
20	1 1/8" x 18 UNEF			30.20	19.80	35.00	
22	1 1/4" x 18 UNEF					38.00	
24	1 3/8" x 18 UNEF		24.65	36.60	25.40	41.00	
28	1 5/8" x 18 UNEF				27.00	48.00	
32	1 7/8" x 16 UN			44.50	32.50	54.00	
36	2 1/16" x 16 UNS			50.90	35.70	61.00	
40	2 5/16" x 16 UN			57.20	45.00	67.00	

extended armoured cable adaptor metric - EACAM



ABBP ## EACAM
 Series prefix ———
 Shell size ——— Extended armoured cable adaptor metric

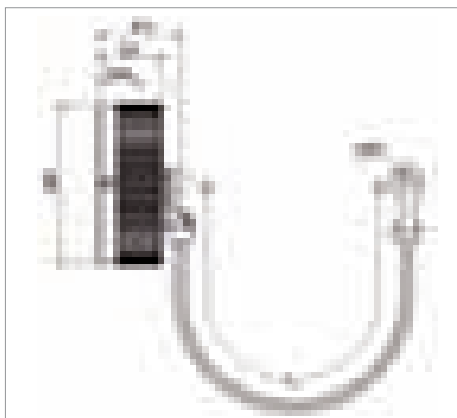
Shell Size	ØA	ØB THD	C	D	E	ØF THD	ØG THD	Oa
18	31	1 x 20 UNEF	53	9.5	14.5	M16 x 1.5	M25 x 1.5	7
20	35	1 1/8 X 18 UNEF	53	9.5	14.5	M16 x 1.5	M25 x 1.5	7
22	38	1 1/4 X 18 UNEF	53	10.5	14.5	M25 x 1.5	M32 x 1.5	7
24	41	1 3/8 X 18 UNEF	53	10.5	14.5	M25 x 1.5	M32 x 1.5	7
28	48	1 5/8 X 18 UNEF	53	11.5	14.5	M32 x 1.5	M40 x 1.5	7
32	54	1 7/8 X 18 UNEF	53	11.5	14.5	M32 x 1.5	M40 x 1.5	7
36	61	2 1/16 x 18 UNS	53	12.5	14.5	M40 x 1.5	M50 x 1.5	7
40	67	2 5/16 x 18 UNS	53	12.5	14.5	M40 x 1.5	M50 x 1.5	7

AB Multipole - accessory options

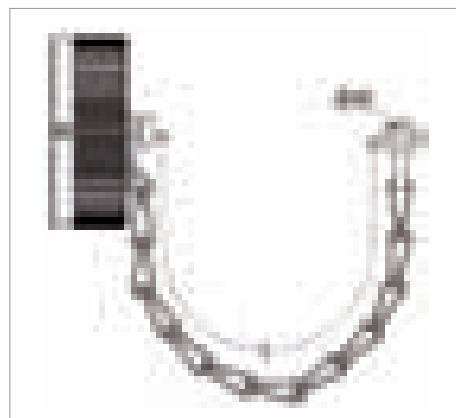
metal protective caps



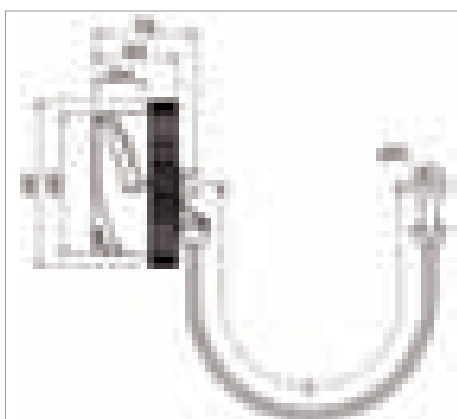
ABBE**XPCA M32 (with nylon cord)



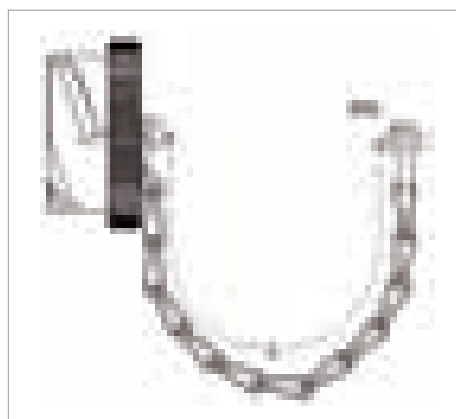
ABBE**XPCAK M32 (with sash chain)



ABB**EPCA M32 (with nylon cord)



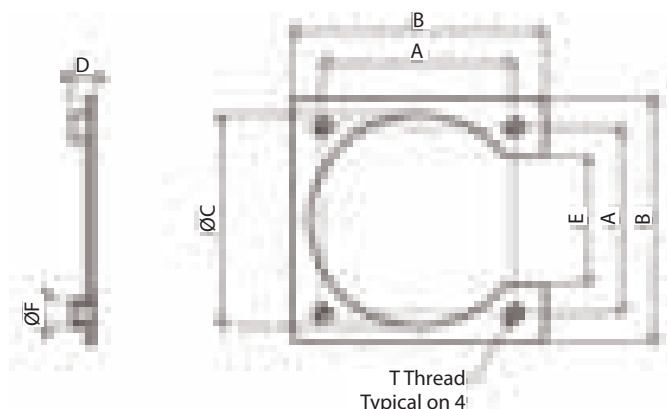
ABB**EPCAK M32 (with sash chain)



Shell Size	B Max	ØC Max	ØD Max	E1 Max	E2 Max	F1 Max	F2 Max	L (approx)	Ød1 Min	Ød2 +0.5, -0 +0.02, -0	Om Min Overlap Mated
18	36.50	38.70	30.80	24.00	27.30	29.80	33.90	100	4.85	4.30	15.85
20	39.90	42.10	34.20					130			15.75
22	43.10	45.30	37.40							160	
24	46.60	48.80	40.90								
28	53.40	54.60	46.70	27.00							
32	60.10	61.30	53.40		5.50						
36	66.30	67.50	59.60								
40	72.10	73.40	65.50								

AB Multipole - accessory options

connector fixing nut plates



ABB**NP metric

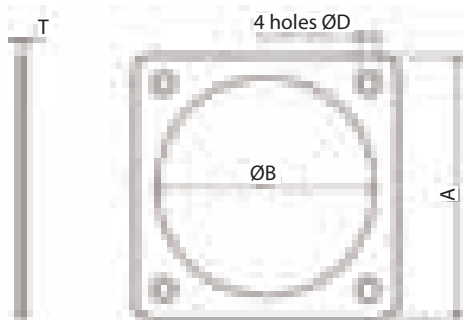
ABB**NP imperial

Shell Size	A	B Max	ØC Max	D	E Max	ØF Max	Part Number ABB**NP	T Thread (Metric)	Part Number ABB**NPA	T Thread (Imperial)
18	26.97	34.62	30.48	2.69/4.22	20.21	6.00	18	M3x0.5	18	4-40 UNC
20	29.36	38.48	33.53		22.47		20		20	
22	31.75	40.84	36.65		23.54	7.50	22		22	
24	34.93	44.83	40.00		25.90		24		24	
28	39.67	51.18	46.61	3.50/5.00	29.08	8.00	28	M4x0.7	28	8-32 UNC
32	44.45	59.10	52.75		30.68		32		32	
36	49.23	63.86	59.10		35.43		36		36	
40	55.58	74.68	68.33		38.60		40		40	

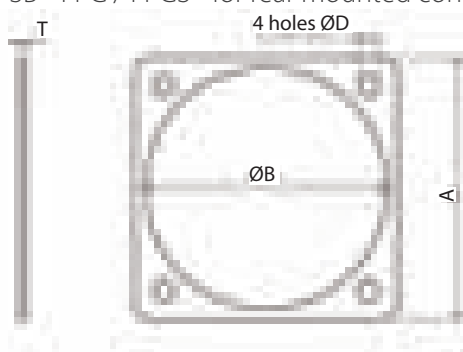
panel gasket, non-conductive / conductive

front & rear mounted connectors - RPG/S & FPG/S

SB**RPG / RPGS - for front mounted connectors



SB**FPG / FPGS - for rear mounted connectors

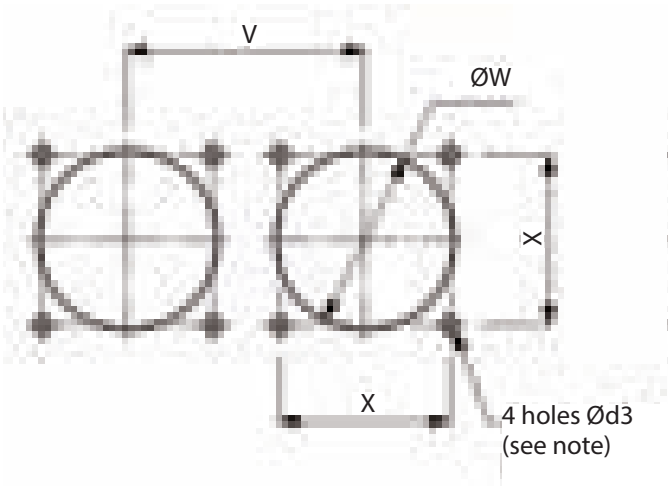


Shell Size	A Min	ØB Nominal	ØB1 Nominal	ØD Min	T Nominal
18	34.90	25.40	30.90	3.43	1.00
20	38.10	28.60	34.30		
22	41.30	31.70	37.50		
24	44.50	34.90	41.00	4.12	
28	50.80	41.30	46.80	4.78	
32	57.20	47.60	53.50		
36	63.50	52.60	59.70		
40	69.90	61.90	65.50	5.10	

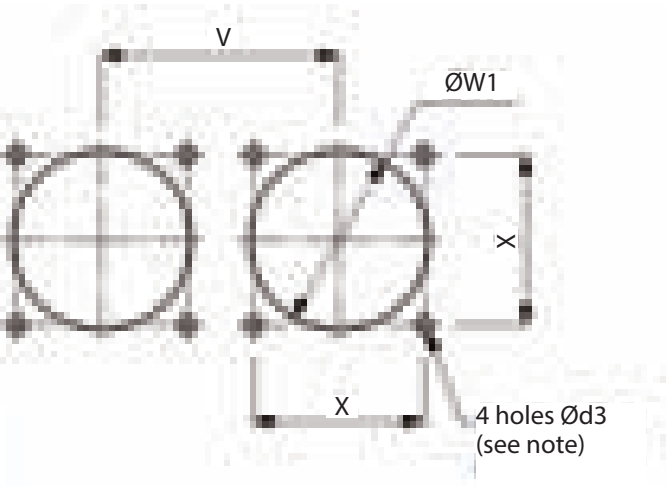
AB Multipole - accessory options

receptacle mounting detail

front mounting receptacle



rear mounting receptacle



Shell Size	Ød3	Ød4	V	ØW	ØW1	X
18	3.40	4.50	38.30	26.00	31.18	27.00
20			41.70	30.00	34.58	29.40
22			45.20	33.00	37.78	31.80
24	3.90		48.70	36.00	41.28	34.90
28			55.50	42.00	47.08	39.70
32	4.50	5.50	62.40	48.50	53.78	44.50
36			69.00	55.00	59.98	49.20
40			75.00	59.10	66.40	55.50

NOTE: When using threaded connectors use column Ød4

AB Multipole

assembly instructions & tooling list



To find our latest assembly instructions please scan the QR code or visit:

http://www.ttabconnectors.com/pdf/spec_595_issue_c.pdf

Global Sales Offices



North America

Email: sales@ttelectronics-na.com

Europe

Email: sales@ttelectronicseurope.com

Asia

Email: sales@ttelectronicasia.com



AB Connectors Limited Abercynon, Mountain Ash, Rhondda Cynon Taff, CF45 4SF
+44 (0) 1443 740331 www.ttabconnectors.com sales@ttabconnectors.com

www.ttelectronics.com