ATR Chassis

For Conduction-Cooled VME Boards

- Available in multiple ARINC 404A sizes: 1ATRLong, 1ATRShort, 3/4ATRShort, 1/2ATRShort
- Choice of cooling options:
  - Fan assisted with integral fan
  - Using air ducted through a rear plenum
  - Conduction through base or sidewall
  - Liquid
- Pluggable 28 VDC, 115 VAC and 270VDC power supplies
- Supplied as a low risk wired, integrated and tested subsystem or as an un-configured chassis
- Supported by a full obsolescence management service

Radstone ATR chassis provide the highest level of environmental protection combined with exceptional packing density and thermal performance. Boards are clamped in place using expanding screw driven wedgelock assemblies and cooling is entirely by conduction through internal chassis walls. No cooling air passes over the boards themselves and as a result they are completely protected from airborne contaminants. Heat is extracted from the chassis by air or liquid being passed through sidewall heat exchangers or by conduction to a suitable cold-plate.

Radstone's level 4 and 5 conduction-cooled boards meet IEEE 1101.2-1992. The ATRs will accept boards from any vendor meeting this international standard.

All Radstone chassis products are backed up by a range of integration services. During the early design phase these include thermal modelling, mechanical adaptation and electronic interface design. Then, as the program moves on, software engineering is on hand to support development, provide system level Built-In-Test (BIT) and where necessary integrate third party boards and peripherals. Finally dedicated teams of engineers provide ILS data, qualification support, obsolescence management and through life support. A one-stop shop for an out-of-the-box and ready-to-run solution.

RADSTONE
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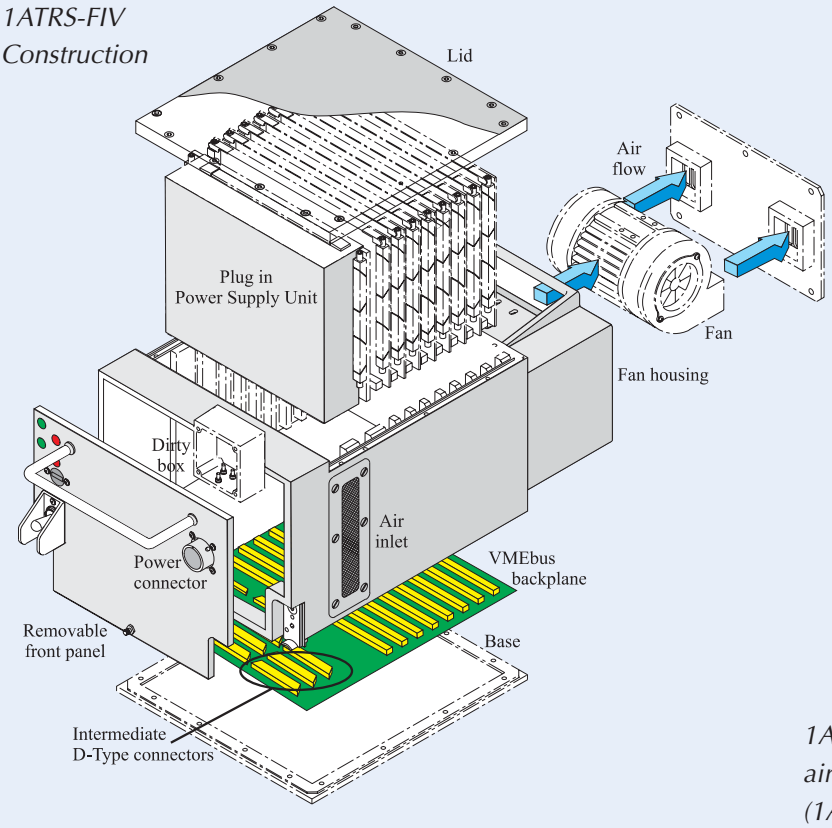
General Construction

1ATRS-FIV Construction



All Radstone ATR chassis provide unparalleled strength and protection for fragile internal electronics. The chassis meet the ARINC 404 profile with hold downs to ARINC 600, positioned to ARINC 404 in order to maximize front panel connector area.

Feed-through filters and a "dirty box" arrangement contain primary power transients and prevent transmission to internal electronics or the "461" compliant PSU.

If required the chassis can also be supplied with hermetic sealing

1ATRS with rear air plenum (1ATRS-IV)

The Design Process

Radstone has privileged access to board level design data and this combined with a library of proven system components, makes Radstone a cost effective choice when it comes to ATR configuration and board level integration.

Following architecture definition, the ATR design process normally begins with a thermal analysis. This will provide optimum board level slot positions and confirm that card edge temperatures remain within design limits. Mechanical design will then follow. This will include front panel connector cut-outs but it may also include provision for peripherals and any other specific chassis adaptation.

For portability, the chassis wiring schedule will take the form of a Microsoft Excel spreadsheet and even though this may suggest particular front panel connector positions, specific configurations can be accommodated.

Initial fast turn around prototypes and small production runs will normally utilize discretely wired backplanes and front panels. This initial build will be used for functional design proving. Following this and before the formal qualification program begins, there is scope to invest in a number of measures designed to reduce future production costs.

Tracked Backplanes

A "tracked" backplane integrates the majority of I/O signals in order to produce a single Line Replaceable Unit. Design time will depend upon complexity but as the cost of a "tracked" backplane approximates to that of a bare, unconfigured, standard backplane, then each configured system will benefit from a reduced labor overhead.

Video and high speed digital traces are not normally integrated during this process and will normally be routed directly from the rear of the backplane to front panel connectors by means of discrete wires.

Front Panel Flexi-Connections

For significant production runs it is often cost effective to design specific flexi-circuits to link the "tracked" system backplane to front panel connectors. In such cases the front panel layout may have to change in order to accommodate the new assemblies.

Note: For 1ATR chassis, I/O signals are routed to the front panel through D-Type intermediate connectors OR by discrete wires. For 3/4ATR and 1/2ATR chassis all signals are routed directly from the backplane to the front panel – there are no intermediate connectors.

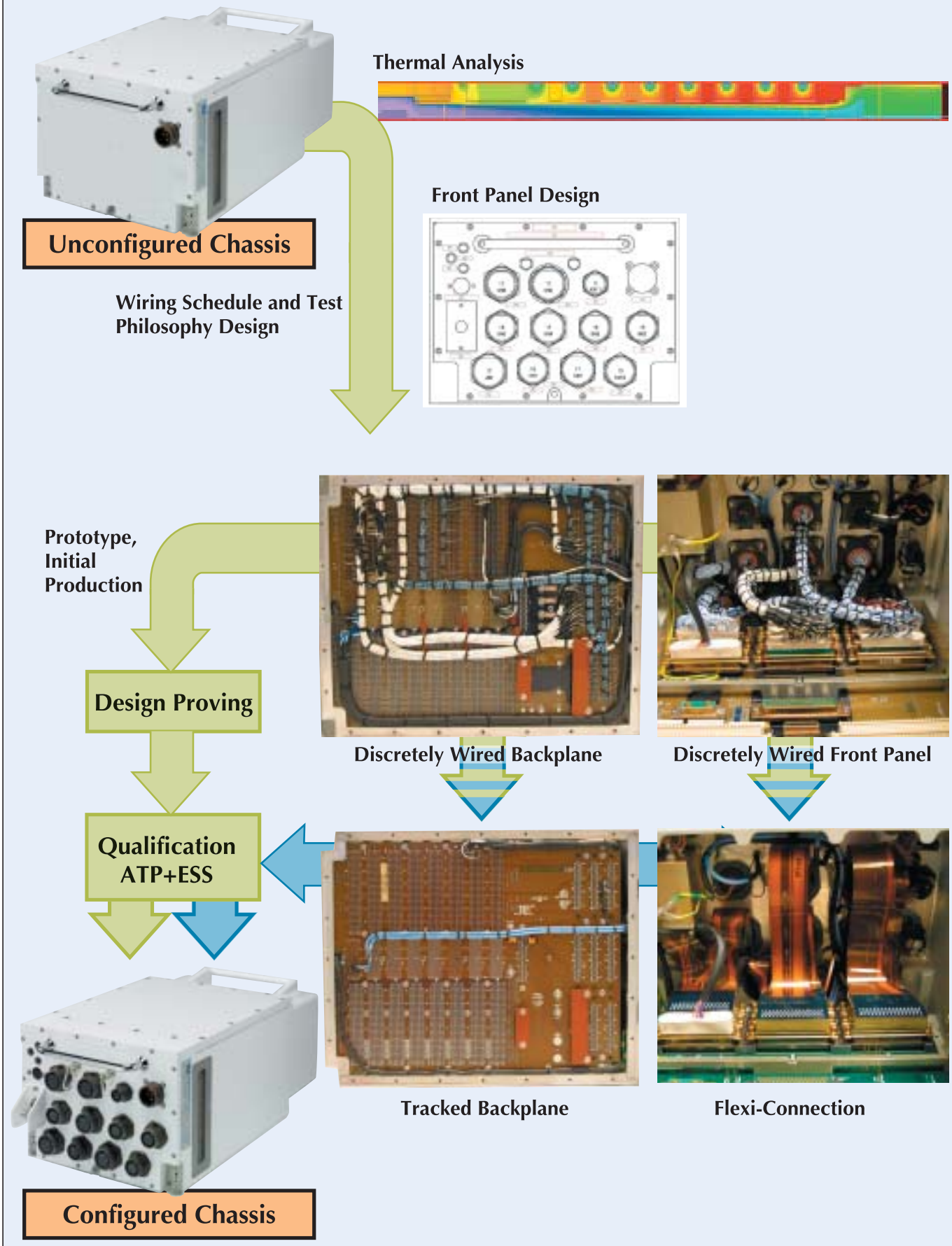


Figure 1: The Design Process

Conduction-Cooled Chassis

1/2ATRS-BBIV

- Heat is dissipated through an integral baseplate or sideplate which also supports mechanical attachment to a suitable cold-plate
- Baseplate (BBIV) or sideplate (SIV) cooled
- Ideal for vetronic and naval applications where weight is less important and a suitable cold-plate is available
- Supports high power levels
- For use where mechanical noise from fans is unacceptable

	W1	W2	L1	L3	H	Weight §	I/O area
1ATRL-BBIV	284 mm	348 mm	532 mm	39 mm	194 mm	23 Kg	304.8 cm^2
	11.18 in	13.7 in	20.94 in	1.14 in	7.63 in	50.6 lbs	47.24 in^2
1ATRS-BBIV	284 mm	348 mm	348 mm	39 mm	194 mm	15.2 Kg	304.8 cm^2
	11.18 in	13.7 in	13.7 in	1.14 in	7.63 in	33.4 lbs	47.24 in^2
1/2ATRS-BBIV	124 mm	190 mm	336 mm	39 mm	194.5 mm	6.8 Kg	118.77 cm^2
	4.88 in	7.48 in	13.23 in	1.14 in	7.66 in	15 lbs	18.41 in^2
1/2ATRS-SIV	124 mm	135 mm	336 mm	39 mm	193.5 mm	6.3 Kg	118.77 cm^2
	4.88 in	5.31 in	13.23 in	1.14 in	7.62 in	13.9 lbs	18.41in^2

Table 1: Conduction-Cooled Chassis Detail

NOTE: § Weight figure is for the basic chassis and backplane. It does not include the PSU, I/O connectors or I/O cabling

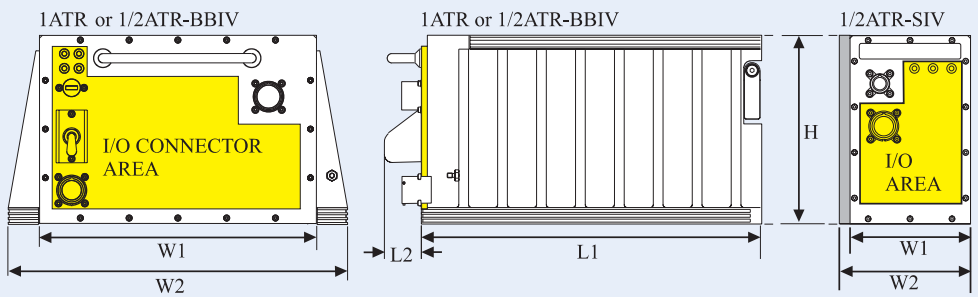


Figure 2: Conduction-Cooled Chassis Outline Drawing

Blown Sidewalls

1ATRS-FIV

- Heat generated by VMEbus modules and power supplies is transferred by conduction to hollow sidewall heat exchangers and hence to cooling air
- Integral fan option for stand alone operation
- Plenum option to duct aircraft supplied air
- Lowest weight penalty for avionic applications
- Fan supports vetronic and avionic applications where a cold-plate is not available

	W1	L1	L2	L3	L4	H	Weight §	I/O area
1ATRL-FIV	257.05mm	498.5mm	16.5mm	55.5mm	114mm	193.5mm	17.2 Kg *	280.5 cm^2
	10.12in	19.62in	0.65in	2.18in	4.49in	7.62in	37.8 lbs *	43.48 in^2
1ATRL-IV	257.05mm	498.5mm	16.5mm	55.5mm	38mm	193.5mm	14.7 Kg	280.5 cm^2
	10.12in	19.62	0.65in	2.18in	1.5in	7.62in	32.3 lbs	43.48 in^2
1ATRS-FIV	257.05mm	320.5mm	16.5mm	55.5mm	114mm	193.5mm	14.2 Kg *	280.5 cm^2
	10.12in	12.62	0.65in	2.18in	4.49in	7.62in	31.2 lbs *	43.48 in^2
1ATRS-IV	257.05mm	320.5mm	16.5mm	55.5mm	38mm	193.5mm	11.7 Kg	280.5 cm^2
	10.12in	12.62inß	0.65in	2.18in	1.5in	7.62in	25.7 lbs	43.48 in^2
3/4ATRS-IV	191.7mm	320.5mm	35mm	107.39mm	N/A	193.5mm	5 Kg	135 cm^2
	7.55in	12.62in	1.38in	4.22in	N/A	7.62in	11 lbs	20.93 in^2
1/2ATRS-FIV	124mm	320.5mm	16.5mm	55.5mm	56mm	193.5mm	6.7 Kg	118.77 cm^2
	4.88in	12.62in	0.65in	2.18in	2.2in	7.62in	14.8 lbs	18.41 in^2

Table 2: Blown Air Chassis Detail

NOTE: § Weight figure is for the basic chassis, fan and backplane. It does not include the PSU, I/O connectors or I/O cabling
* Figure is for DC input chassis & fan. For AC input & fan (1 or 3 phase, 400 Hz) subtract 1.6 Kg / 3.5 lbs

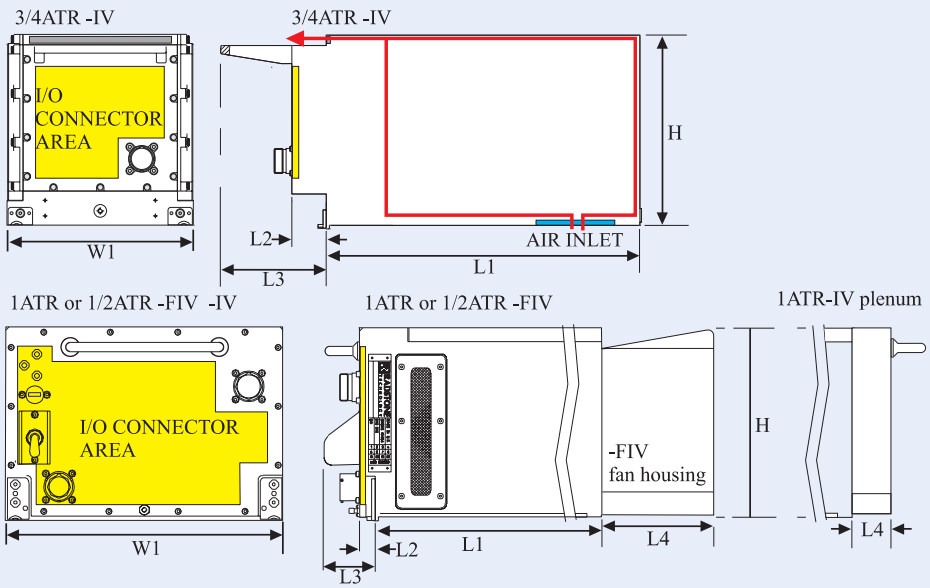
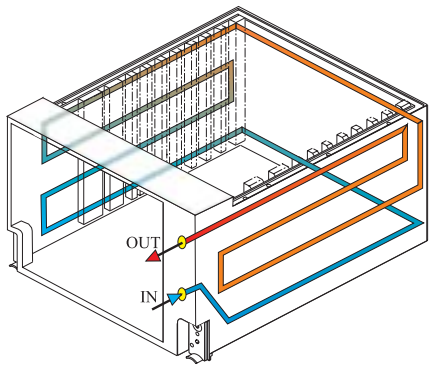


Figure 3: Blown Sidewalls Chassis Outline Drawing

Liquid-Cooled Chassis

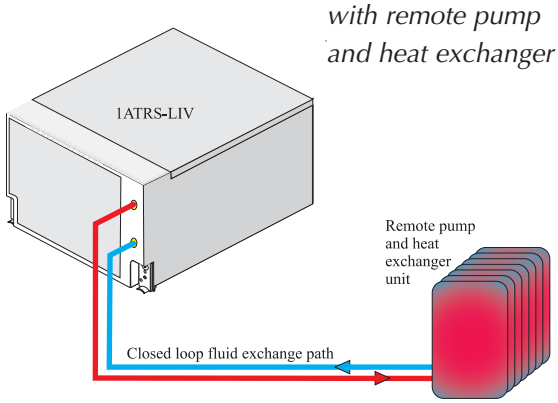
1ATRL-LIV

- Heat generated by VMEbus modules and power supplies is transferred by conduction to sidewall heat exchangers and hence to cooling liquid
- Handles up to 1KW of power
- Low internal temperature gradients support higher system level operating temperatures
- Front panel mounted CEJN series 324 quick disconnect couplings (alternative couplings available)
- Suitable for use in aircraft/vehicle loop or stand alone closed loop system with remote heat exchanger
- Coolants supported include water, 60/40 ethylene glycol/water and Polyalphaolefin (PAO)



1ATRL-LIV Coolant Flow

Closed loop system with remote pump and heat exchanger



	W1	L1	L2	H	Weight §	I/O area
1ATRL-LIV	257.05 mm	515 mm max	36 mm	193.5 mm	13.1 Kg	227.57 cm^2
	10.12 in	20.27 in max	1.42 in max	7.62 in	28.8 lbs	35.28 in^2
1ATRS-LIV	257.05 mm	337 mm max	36 mm	193.5 mm	10.3 Kg	227.57 cm^2
	10.12 in	13.27 in max	1.42 in max	7.62 in	22.7 lbs	35.28 in^2

Table 3: Conduction-Cooled Detail

NOTE: § Weight figure is for the basic chassis. It does not include the PSU, I/O connectors or cabling

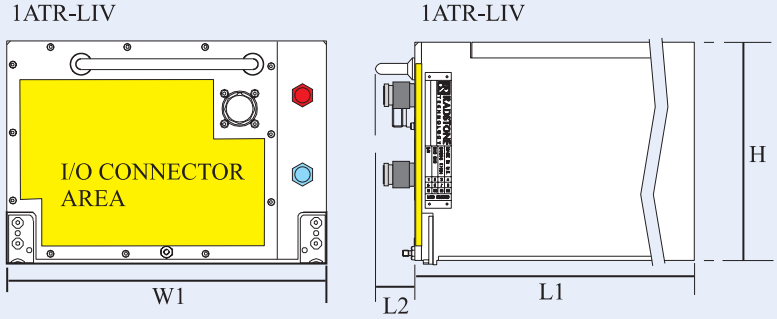


Figure 4: Liquid-Cooled Chassis Outline Drawing

Adaptation

Platform requirements often dictate a degree of I/O interface conditioning or the incorporation of specific peripherals and it is normally more cost effective to realize such "adapted COTS" at the chassis level. For this reason Radstone ATRs are backed up by a range of proven mechanical sub-assemblies and peripheral options that can be used to allow standard COTS board level assemblies to be used in even the most demanding of applications.

Generally such measures include:

Power Supply configuration changes in response to specific input voltage specifications, transient tolerance, EMC requirements, hold-up specifications or simply output voltage and current ratings.

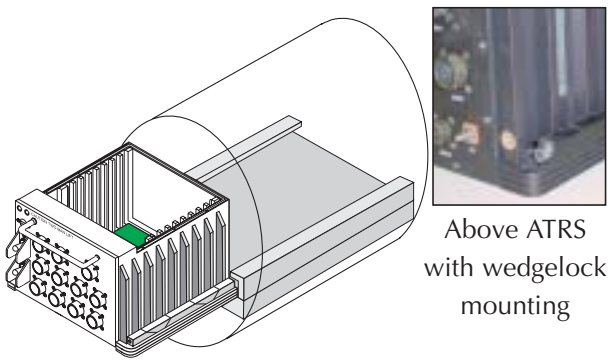
Mounting Provisions. Sometimes ARINC hold downs can not be used and alternatives have to be considered. For example consider a Baseplate-cooled 1ATRS mounted in a tube by means of expanding wedgelocks illustrated in figure 5.

Color and paint finishes to application requirements.

Raised lids for cable routing above VME front panels, peripheral mounting or additional connector positions (figure 6).

Peripherals such as FLASH disks, rotating disks, hubs and media converters.

Contact Radstone for specific requirements



Above ATRS with wedgelock mounting

Figure 5: Wedgelock Mounted ATR

Figure 6: 1ATRL with a raised lid

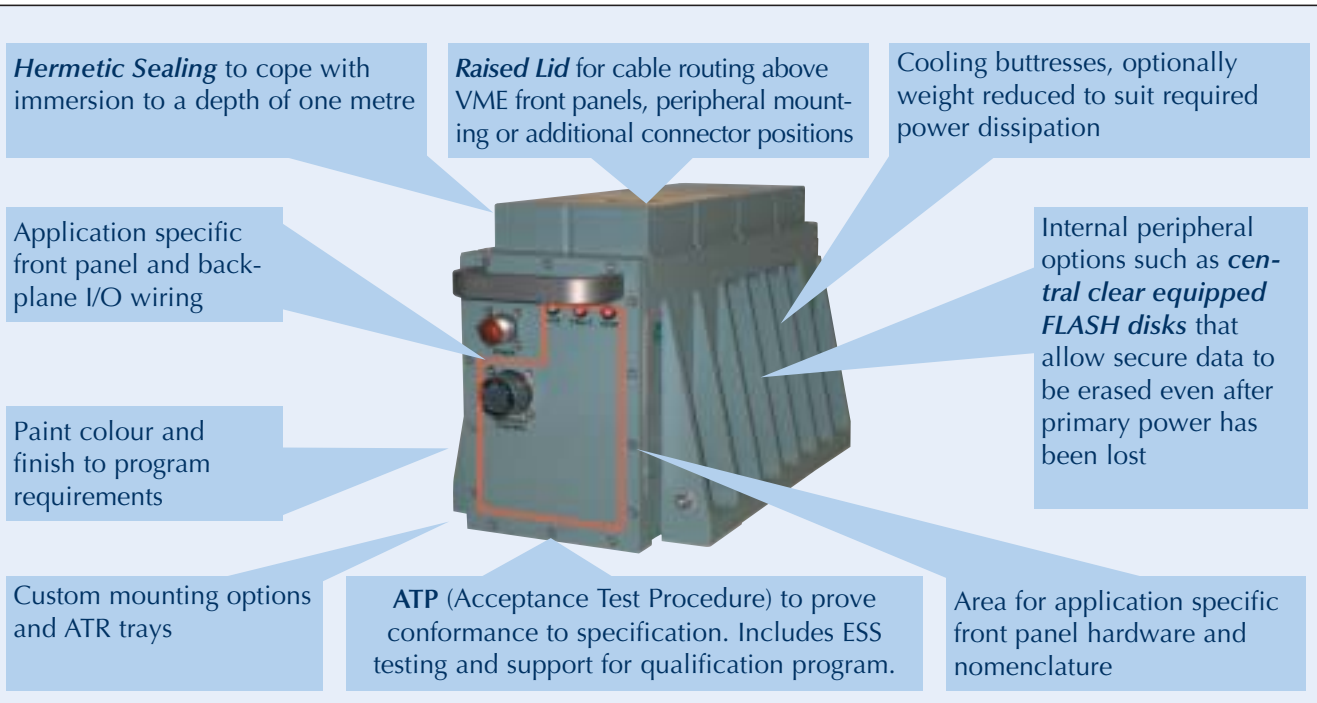


Figure 7: Chassis Adaptation, showing the 1/2ATRS-BBIV

Power Supplies

	Nominal Input	+5V DC	+3.3V DC	+12V DC	-12V DC	Internal Power	Weight Kg	Weight lbs	Part Number
1ATR	28VDC	40A	-	-	-	200W	1.49	3.3	001PSU-001000 *
	28VDC	40A	10A	0.42A	0.42A	243W	1.65	3.6	001PSU-001300
1ATR	115VAC, 3 Phase	40A	-	-	-	200W	1.57	3.5	001PSU-002000 *
	115VAC, 3 Phase	40A	10A	3.6A	0.42A	281W	1.8	4.0	001PSU-002300
1ATR	115VAC, 1 Phase	40A	-	-	-	200W	1.67	3.7	001PSU-003000 *
	115VAC, 1 Phase	40A	10A	3.6A	0.42A	281W	1.9	4.2	001PSU-003300
3/4ATR	28VDC	40A	-	-	-	200W	1.19	2.6	3/4PSU-001000 *
	28VDC	40A	10A	0.42A	0.42A	243W	1.35	3.0	3/4PSU-001300
3/4ATR	115VAC, 3 Phase	40A	-	-	-	200W	1.27	2.8	3/4PSU-002000 *
	115VAC, 3 Phase	40A	10A	3.6A	0.42A	281W	1.50	3.3	3/4PSU-002300
3/4ATR	115VAC, 1 Phase	40A	-	-	-	200W	1.37	3.0	3/4PSU-003000 *
	115VAC, 1 Phase	40A	10A	3.6A	0.42A	281W	1.60	3.5	3/4PSU-003300
1/2ATR	28VDC	20A	-	-	-	100W	0.69	1.5	1/2PSU-001000 *
	28VDC	20A	10A	0.42A	0.42A	143W	0.85	1.9	1/2PSU-001300
1/2ATR	115VAC, 1 Phase	20A	-	-	-	100W	0.67	1.5	1/2PSU-003000 *
	115VAC, 1 Phase	20A	10A	3.6A	0.42A	181W	0.9	2.0	1/2PSU-003300

Table 4: Power Supply Configurations

NOTE: * Denotes PSU fitted unless otherwise agreed. All PSUs meet MIL-STD-704E. Other options such as alternative "704" standards and MIL-STD-1275A/B are available by special order. Additionally and again by special order, PSUs can be supplied with a "hold-up" capability.

Radstone boards normally use only a +5VDC rail. Other voltage rails are derived locally on each board to match individual IC and I/O requirements. As a result, the standard PSU provides only +5VDC. Additional voltage rails are added when required. For illustration, the maximum configuration is also defined.

Chassis Power Dissipation

For forced air-cooled chassis, the heat dissipation at a given altitude is proportional to the temperature and volumetric flow rate of the cooling air. The total chassis figures given, detail operation using Level 5 cards at 50000 feet with inlet air at 55ºC and using the standard fan or equivalent airflow from the aircraft supply.

	Baseplate or Sideplate-cooled	**Blown Sidewalls (Forced Air-cooled)**	**Liquid-Cooled**
1ATR Long	450 Watts	220 Watts	1000 Watts
1ATR Short	300 Watts	150 Watts	600 Watts
3/4ATR Short	-	150 Watts	-
1/2ATR Short	150 Watts	75 Watts	-

Table 5: Power Supply Dissipation

Note: Allowance must be made for PSU inefficiency

Low pressure (altitude)	Storage and operation generally to MIL-E-5400 (50 000ft) for fan-cooled chassis. Higher altitudes with reduced power levels or conduction-cooling. Also rapid decompression to maximum altitude
Operating temperature	-40ºC to +55ºC (level 4 boards). OR as determined by thermal analysis of configuration
Storage temp	-50ºC to +100ºC (level 4 or 5 boards)
Temperature shock	Two chamber shock test consisting of 3 cycles of transfer between max and min storage temperatures with a maximum transfer time of 5 minutes
Rain	Simulated dripping water through leakage or condensation
Humidity	Up to 95% RH with varying temperature. 10 cycles 240 hrs minimum
Salt fog	Continuous exposure to mist with 5% salt solution 48 hrs
Sand and dust	Blowing sand up to 95 ft/sec (29 m/sec)
Acceleration	Structural & operational tests. Acceleration levels up to 13.5g.
Vibration	Category 5 equipment of MIL-STD-810E vibration spectrum fig 514.4-8 15 to 2000 Hz at 0.1g2/Hz (RMS 12g approximately)
Shock	Terminal peak saw tooth test pulse of fig 516.4-4 of MIL-STD-810E at the level of 20g for 11ms for fan assisted chassis and 40g for 11ms for baseplate/sideplate chassis. Bench handling in accordance with procedure VI of method 516.4 of MIL-STD-810E.
EMC to MIL-STD-461C MIL-C-38999 connectors fitted	Conducted emissions CE01, CE03 and CE07 Conducted susceptibility CS01, CS02 and CS06 Radiated emissions RE01 and RE02 Radiated susceptibility RS01, RS02 and RS03

Table 6: Generic ATR Specifications

Ordering Information

XXX	ATR	X	-	XXX	X	X	X	X	X
									0= no air filter 1= with air filter
								0= I/O wiring uses wirewrap pins 1= I/O through intermediate D-types (1ATR) 2= I/O wired directly (1/2ATR and 3/4ATR)	
							0= +5V only PSU 1= +5V and ±12V PSU 2= +5V and +3V3 PSU 3= +5V and ±12V and +3V3 PSU		
						0= chassis not Hermetic H= Hermetic sealing			
					0= blown sidewalls, no fan (IV design) F= blown sidewalls with fan (FIV design) B= Baseplate-cooled (BBIV design) S= Sideplate-cooled (SIV design) L= Liquid-cooled (LIV design)				
				001= 28 VDC primary power 002= 115 VAC, 3 phase, 400 Hz primary power 003= 115 VAC, 1 phase, 400 Hz primary power 005= 270 VDC Note:- Consult factory for 60Hz option					
		S= Short L= Long							
001= 1ATR 3/4= 3/4ATR 1/2= 1/2ATR									

Example: 1/2ATRS-001B0320

1/2ATR Short, 28VDC primary power, baseplate conduction-cooled, non hermetic. Internal power +5V at 20A, +3.3V at 10A, +12V at 1.25A, -12V at 0.42A. I/O wiring taken directly from backplane to front panel. No air filter. Fitted with blank front panel (except for power connector, handle and earth stud). No J0 connectors fitted.

Configured Chassis Variant Allocation

Please consult Radstone for specific adaptation or customization. The addition of configuration options such as I/O wiring, PO connection or PSU hold up capacitance will convert the 1/2ATRS-001B0320 chassis into a "900" series variant (1/2ATRS-9XXBBIV). If VME boards are added this will then become a configured system level product 1/2ATRS-S-9XXBBIV.

SYSCONFIG	System configuration, the installation of I/O wiring, connectors and peripherals as required. A per system charge
ESS	Environmental Stress Screening. The configured chassis or system will be exercised using system level Built-In-Test while it is subjected to thermal cycling and vibration testing. Specification available on demand. A per system charge
ATP	Functional testing of a configured system according to an agreed Acceptance Test Program. A per system charge
THERMAL ANALYSIS	Fluent Icepak modeling software will be used to predict system level temperature gradients
SYSTEM-MTBF	System level MTBF calculation using COTS board level and peripheral data
SYSTEM-DOC	System level documentation to support contractual requirements

Table 7: Services

Publication RT290 03/2004

UK
Radstone Technology
Tove Valley Business Park
Towcester
Northants NN12 6PF
Telephone: +44 (0) 1327 359444
Facsimile: +44 (0) 1327 322800
E-mail: sales@radstone.co.uk

USA
Radstone Technology Corporation
50 Tice Boulevard
Woodcliff Lake, NJ 07677-7645
Telephone: +1 (800) 368-2738
Facsimile: +1 (201) 391-2899
E-mail: sales@radstone.com

Eastern Region: +1 (201) 391-2700
North Central Region: +1 (978) 399-0195
Central Region: +1 (480) 964 5407
Western Region: +1 (909) 974-1141

Helpdesk: +44 (0) 1327 322760
E-mail: support@radstone.co.uk

http://www.radstone.com

CANADA
Interactive Circuits and Systems Ltd
5430 Canotek Road
Ottawa, Ontario
K1J 9G2
Telephone: + 1 (613) 749-9241
Facsimile: + 1 (613) 749-9461
Toll Free: (US Only) 800 267-9794
E-mail: info@ics-ltd.com

http://www.ics-ltd.com

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