



WMATA CRCS Redundant Antenna System General Overview Handbook

For
GPD Telecom Inc.

AWL Works Order Q119862
AWL Product Part Nos.:

- 60-228801 - WMATA Jackson Graham Building CRAS System
- 60-228701 - WMATA Carmen Turner Facility CRAS System
- 60-228901 - WMATA Gallery Place Station CRAS System

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Table of Contents

1.	Introduction	5
1.1.	Scope and Purpose of Document.....	5
1.2.	Limitation of Liability Notice.....	5
2.	Safety Considerations	6
2.1.	Earthing of Equipment.....	6
2.2.	Electric Shock Hazard.....	6
2.3.	RF Radiation Hazard.....	6
2.4.	Lifting and other Health and Safety Recommendations.....	6
2.5.	Chemical Hazard	7
2.6.	Laser Safety.....	7
2.7.	Emergency Contact Numbers	7
3.	60-228801 - WMATA Jackson Graham Building CRAS System.....	8
3.1.	60-228801 List of Major Sub-Components	8
3.2.	60-228801 System Diagram.....	9
3.3.	Dual Fiber Optic Unit 60-228703.....	10
3.3.1.	Dual Fiber Optic Unit 60-228703 List of Major Sub-Components	11
3.3.2.	Dual Fiber Optic Unit 60-228703 Specification	11
3.3.3.	Dual Fiber Optic Unit 60-228703 System Diagram	12
3.3.3.1.	Dual Fiber Optic Unit 60-228703 Alarm Outputs.....	13
3.3.4.	Dual Fiber Optic Unit 60-228703 Front View	14
3.3.5.	Dual Fiber Optic Unit 60-228703 Rear View.....	15
3.3.6.	Dual Fiber Optic Unit 60-228703 DC Inlet	16
3.3.6.1.	Free Socket for 60-228703 DC Inlet.....	16
3.4.	Dual Redundant PSU 60-091705.....	17
3.4.1.	Dual Redundant PSU 60-091705 List of Major Sub-Components	17
3.4.2.	Dual Redundant PSU 60-091705 Specification	17
3.4.3.	Dual Redundant PSU 60-091705 System Diagram	18
3.4.4.	Dual Redundant PSU 60-091705 Front View	19
3.4.5.	Dual Redundant PSU 60-091705 Rear View.....	19
4.	60-228701 - WMATA Carmen Turner Facility CRAS System.....	20
4.1.	60-228701 List of Major Sub-Components	21
4.2.	60-228701 System Diagram.....	22
4.3.	60-228701 Rack Elevations	23
4.3.1.	Rack Front View.....	23
4.3.2.	Rack Rear View	24
4.3.3.	Ports on the Rack Lid.....	25
4.3.4.	60-228701 Alarm Wiring Schematic	26
4.4.	Quadplexer (Base) 60-228706	27
4.4.1.	Quadplexer (Base) 60-228706 Major Sub-Components	28
4.4.2.	Quadplexer (Base) 60-228706 Specification	28
4.4.3.	Quadplexer (Base) 60-228706 System Diagram	29
4.4.4.	Quadplexer (Base) 60-228706 Front View	30
4.4.5.	Quadplexer (Base) 60-228706 Rear View	30
4.5.	8 Channel Squelch Gated BDA 60-228704	31
4.5.1.	8 Ch. Squelch Gated BDA 60-228704 List of Major Sub-Components	32
4.5.2.	8 Ch. Squelch Gated BDA 60-228704 Specification.....	32
4.5.3.	8 Ch. Squelch Gated BDA 60-228704 System Diagram.....	34
4.5.3.1.	8 Ch. Squelch Gated BDA 60-228704 Alarm Wiring Diagram.....	35
4.5.4.	8 Ch. Squelch Gated BDA 60-228704 Front View	36
4.5.5.	8 Ch. Squelch Gated BDA 60-228704 Rear View.....	37
4.6.	8 Ch. Squelch Gated BDA 60-228705.....	38
4.6.1.	8 Ch. Squelch Gated BDA 60-228705 List of Major Sub Components	39

4.6.2.	8 Ch. Squelch Gated BDA 60-228705 Specification	39
4.6.3.	8 Ch. Squelch Gated BDA 60-228705 System Diagram.....	41
4.6.3.1.	8 Ch. Squelch Gated BDA 60-228705 Alarm Wiring Diagram.....	42
4.6.4.	8 Ch. Squelch Gated BDA 60-228705 Front View	43
4.6.5.	8 Ch. Squelch Gated BDA 60-228705 Rear View.....	44
4.7.	Splitter/Combiner Unit 60-228702	45
4.7.1.	Splitter/Combiner Unit 60-228702 List of Major Sub-Components.....	45
4.7.2.	Splitter/Combiner Unit 60-228702 Specification	45
4.7.3.	Splitter/Combiner Unit 60-228702 System Diagram	46
4.7.4.	Splitter/Combiner Unit 60-228702 Front View	47
4.7.5.	Splitter/Combiner Unit 60-228702 Rear View	47
4.8.	Dual Fiber Optic Unit 60-228703.....	48
4.8.1.	Dual Fiber Optic Unit 60-228703 List of Major Sub-Components	49
4.8.2.	Dual Fiber Optic Unit 60-228703 Specification	49
4.8.3.	Dual Fiber Optic Unit 60-228703 System Diagram.....	50
4.8.3.1.	Dual Fiber Optic Unit 60-228703 Alarm Outputs.....	51
4.8.4.	Dual Fiber Optic Unit 60-228703 Front View	52
4.8.5.	Dual Fiber Optic Unit 60-228703 Rear View.....	53
4.9.	Quadplexer (DAS) 60-228706.....	54
4.9.1.	Quadplexer (DAS) 60-228706 List of Major Sub-Components	55
4.9.2.	Quadplexer (DAS) 60-228706 Specification	55
4.9.3.	Quadplexer (DAS) 60-228706 System Diagram.....	56
4.9.4.	Quadplexer (DAS) 60-228706 Front View	57
4.9.5.	Quadplexer (DAS) 60-228706 Rear View.....	57
4.10.	PSU Housing Shelf 96-300090	58
4.10.1.	PSU module 96-300091 Specification	58
4.10.2.	PSU Module Chassis 96-300090 Rear View	59
4.10.3.	PSU Module Chassis 96-300090 Alarm Wiring	59
4.10.4.	DC Connector Details.....	60
4.10.4.1.	DC Inlet Free Socket.....	60
5.10.4.2.	Typical DC Inlet Panel Plug.....	60
5.	60-228901 - WMATA Gallery Place Station CRAS System.....	61
5.1.	Simplified System Sketch.....	62
5.2.	Rack 1 Equipment Layout	63
5.3.	Rack 2 Equipment Layout	64
5.4.	Rack 1 Front View.....	65
5.5.	Rack 1 Rear View	66
5.6.	Rack 1 elevations showing RF connections	67
5.7.	Rack 2 Front View.....	68
5.8.	Rack 2 Rear View	69
5.9.	Rack 2 elevations showing RF connections	70
5.10.	Rack Alarm Wiring Diagrams	71
5.10.1.	Rack 1 Alarm Wiring.....	71
5.10.2.	Rack 2 Alarm Wiring.....	72
5.11.	Dual Fiber Optic Unit 60-228703 (Gallery Place Station).....	73
5.11.1.	Dual Fiber Optic Unit 60-228703 List of Major Sub-Components.....	74
5.11.2.	Dual Fiber Optic Unit 60-228703 Specification	74
5.11.3.	Dual Fiber Optic Unit 60-228703 System Diagram	75
5.11.3.1.	Dual Fiber Optic Unit 60-228703 Alarm Outputs.....	76
5.11.4.	Dual Fiber Optic Unit 60-228703 Front View	77
5.11.5.	Dual Fiber Optic Unit 60-228703 Rear View	78
5.12.	RF Failover Switch Unit 60-228905.....	79
5.12.1.	RF Failover Switch Unit 60-228905 List of Major Sub-Components.....	80
5.12.2.	RF Failover Switch Unit 60-228905 Specification	81
5.12.3.	RF Failover Switch Unit 60-228905 System Diagram	82
5.12.4.	RF Failover Switch Unit 60-228905 Alarm Wiring Diagram.....	83

5.12.4.1.	RF Failover Switch Unit 60-228905 Alarm Outputs.....	84
5.12.5.	RF Failover Switch Unit 60-228905 Front View	85
5.12.6.	RF Failover Switch Unit 60-228905 Rear View.....	86
5.13.	Combiner Unit 60-228906	87
5.13.1.	Combiner Unit 60-228906 List of Major Sub-Components.....	87
5.13.2.	Combiner Unit 60-228906 System Diagram	88
5.13.3.	Combiner Unit 60-228906 Front and Rear Views	89
5.14.	Combiner Unit 60-228908	90
5.14.1.	Combiner Unit 60-228908 List of Major Sub-Components.....	90
5.14.2.	Combiner Unit 60-228908 System Diagram	91
5.14.3.	Combiner Unit 60-228908 Front and Rear Views	92
5.15.	Combiner Unit 60-228909	93
5.15.1.	Combiner Unit 60-228909 List of Major Sub-Components.....	93
5.15.2.	Combiner Unit 60-228909 System Diagram	94
5.15.3.	Combiner Unit 60-228909 Front and Rear Views	95
5.16.	Combiner Unit 60-228907	96
5.16.1.	Combiner Unit 60-228907 List of Major Sub-Components.....	96
5.16.2.	Combiner Unit 60-228907 System Diagram	97
5.16.3.	Combiner Unit 60-228907 Front and Rear Views	98
5.17.	16 Ch. DSP U/L Squelch Gate 60-228904	99
5.17.1.	16 Ch. DSP U/L Squelch Gate 60-228904 List of Major Sub-Components.....	100
5.17.2.	16 Ch. DSP U/L Squelch Gate 60-228904 Specification.....	101
5.17.3.	16 Ch. DSP U/L Squelch Gate 60-228904 System Diagram	102
5.17.3.1.	16 Ch. DSP U/L Squelch Gate 60-228904 Alarm Output.....	103
5.17.4.	16 Ch. DSP U/L Squelch Gate 60-228904 Front View.....	104
5.17.5.	16 Ch. DSP U/L Squelch Gate 60-228904 Rear View	105
5.18.	PSU Housing Shelf 96-300090	106
5.18.1.	PSU module 96-300091 Specification	106
5.18.2.	PSU Module Chassis 96-300090 Rear View	107
5.18.3.	PSU Module Chassis 96-300090 Alarm Wiring	107
5.18.4.	DC Connector Details.....	108
5.18.4.1.	DC Inlet Free Socket.....	108
5.18.4.2.	Typical DC Inlet Panel Plug.....	108
Appendix A.....		110
A.1.	Glossary of Terms used in this document	110
A.2.	Key to Drawing Symbols used in this document.....	111
A.3.	EC Declaration of Conformity.....	112
A.4.	Waste Electrical and Electronic Equipment (WEEE) Notice	113
A.5.	Document Amendment Record	114

1. Introduction

1.1. Scope and Purpose of Document

This handbook is for use solely with the equipment identified by the Axell Wireless Limited (AWL) Part Number shown on the front page. It is not to be used with any other equipment unless specifically authorized by AWL. This is a controlled release document and, as such, becomes a part of the Axell Wireless Total Quality Management System. Alterations and modification may therefore only be performed by Axell Wireless.

AWL recommends that the installer of this equipment familiarize themselves with the safety and installation procedures contained within this document before installation commences.

The purpose of this handbook is to provide the user/maintainer with sufficient information to service and repair the equipment to the level agreed. Maintenance and adjustments to any deeper level must be performed by AWL, normally at the company's repair facility in Chesham, England.

This handbook has been prepared in accordance with BS 4884, and AWL's Quality procedures, which maintain the company's registration to BS EN ISO 9001:2000 and to the R&TTE Directive of the European Parliament. Copies of the relevant certificates and the company Quality Manual can be supplied on application to the Operations Support Director (see section 2.7.).

This document fulfils the relevant requirements of Article 6 of the R&TTE Directive.

1.2. Limitation of Liability Notice

This manual is written for the use of technically competent operators/service persons. No liability is accepted by AWL for use or misuse of this manual, the information contained therein, or the consequences of any actions resulting from the use of the said information, including, but not limited to, descriptive, procedural, typographical, arithmetical, or listing errors.

Furthermore, AWL does not warrant the absolute accuracy of the information contained within this manual, or its completeness, fitness for purpose, or scope.

AWL has a policy of continuous product development and enhancement, and as such, reserves the right to amend, alter, update and generally change the contents, appearance and pertinence of this document without notice.

Unless specified otherwise, all AWL products carry a twelve month warranty from date of shipment. The warranty is expressly on a return-to-base repair or exchange basis and the warranty cover does not extend to on-site repair or complete unit exchange.

2. Safety Considerations

2.1. Earthing of Equipment



Equipment supplied from the mains must be connected to grounded outlets and earthed in conformity with appropriate local, national and international electricity supply and safety regulations.

2.2. Electric Shock Hazard



The risk of electrical shocks due to faulty mains driven power supplies While potentially ever present in any electrical equipment, would be minimized by adherence to good installation practice and thorough testing at the following stages:

- a) Original assembly.
- b) Commissioning.
- c) Regular intervals, thereafter.

All test equipment must be in good working order prior to its use. High current power supplies can be dangerous because of the possibility of substantial arcing. Always switch off during disconnection and reconnection.

2.3. RF Radiation Hazard



RF radiation, (especially at UHF frequencies) arising from transmitter outputs connected to AWL's equipment, must be considered a safety hazard.

This condition might only occur in the event of cable disconnection, or because a 'spare' output has been left un-terminated. Either of these conditions would impair the system's efficiency. No investigation should be carried out until all RF power sources have been removed. This would always be a wise precaution, despite the severe mismatch between the impedance of an N type connector at 50Ω , and that of free space at 377Ω , which would severely compromise the efficient radiation of RF power. Radio frequency burns could also be a hazard, if any RF power carrying components were to be carelessly touched!

Antenna positions should be chosen to comply with requirements (both local & statutory) regarding exposure of personnel to RF radiation. When connected to an antenna, the unit is capable of producing RF field strengths, which may exceed guideline safe values especially if used with antennas having appreciable gain. In this regard the use of directional antennas with backscreens and a strict site rule that personnel must remain behind the screen while the RF power is on, is strongly recommended.

Where the equipment is used near power lines or in association with temporary masts not having lightning protection, the use of a safety earth connected to the case-earthing bolt is strongly advised.

2.4. Lifting and other Health and Safety Recommendations



Certain items of AWL equipment are heavy and care should be taken when lifting them by hand. Ensure that a suitable number of personnel, appropriate lifting apparatus and appropriate personal protective equipment is used especially when installing Equipment above ground e.g. on a mast or pole and manual handling precautions relevant to items of the weight of the equipment being worked on must be observed at all times when handling, installing or dismantling this equipment.

2.5. Chemical Hazard



Beryllium Oxide, also known as Beryllium Monoxide, or Thermalox™, is sometimes used in devices within equipment produced by Axell Wireless Ltd. Beryllium oxide dust can be toxic if inhaled, leading to chronic respiratory problems. It is harmless if ingested or by contact.

Products that contain beryllium are load terminations (dummy loads) and some power amplifiers. These products can be identified by a yellow and black “skull and crossbones” danger symbol (shown above). They are marked as hazardous in line with international regulations, but pose no threat under normal circumstances. Only if a component containing beryllium oxide has suffered catastrophic failure, or exploded, will there be any danger of the formation of dust. Any dust that has been created will be contained within the equipment module as long as the module remains sealed. For this reason, any module carrying the yellow and black danger sign should not be opened. If the equipment is suspected of failure, or is at the end of its life-cycle, it must be returned to Axell Wireless Ltd. for disposal.

To return such equipment, please contact the Operations Support Department, who will give you a Returned Materials Authorization (RMA) number. Please quote this number on the packing documents, and on all correspondence relating to the shipment.

Polytetrafluoroethylene, (P.T.F.E.) and P.T.F.E. Composite Materials

Many modules/components in AWL equipment contain P.T.F.E. as part of the RF insulation barrier.

This material should never be heated to the point where smoke or fumes are evolved. Any person feeling drowsy after coming into contact with P.T.F.E., especially dust or fumes should seek medical attention.

2.6. Laser Safety



General good working practices adapted from
EN60825-2: 2004/ EC 60825-2:2004

Do not stare with unprotected eyes or with any unapproved optical device at the fiber ends or connector faces or point them at other people, Use only approved filtered or attenuating viewing aids.

Any single or multiple fiber end or ends found not to be terminated (for example, matched, spliced) shall be individually or collectively covered when not being worked on. They shall not be readily visible and sharp ends shall not be exposed.

When using test cords, the optical power source shall be the last connected and the first disconnected; use only approved methods for cleaning and preparing optical fibers and optical connectors.

Always keep optical connectors covered to avoid physical damage and do not allow any dirt/foreign material ingress on the optical connector bulkheads.

The optical fiber jumper cable minimum bend radius is 3cm; bending to a smaller radius may result in optical cable breakage and excessive transmission losses.

Caution: The F/O units are NOT weather proof.

2.7. Emergency Contact Numbers



The AWL Operations Support Department can be contacted on:

Telephone +44 (0)1494 777000

Fax. +44 (0)1494 777002

e-mail qa@axellwireless.com

3. 60-228801 - WMATA Jackson Graham Building CRAS System

The WMATA Jackson Graham Building CRAS System consists of the following equipment:

Part No. 60-228703 Dual Fiber Optic Unit
Part No. 60-091705 Dual Redundant PSU

The Jackson Graham Building CRAS System provides the Primary Downlink to and receives the Primary Uplink signal from the Gallery Place Station CRAS System.

The Downlink signal is received from a BTS via a direct connection and is modulated onto an optical signal which is then fed to the Gallery Place Station CRAS System via fiber optic cables. This Downlink is the Primary Downlink from the Jackson Graham Building CRAS System to the Gallery Place Station CRAS System.

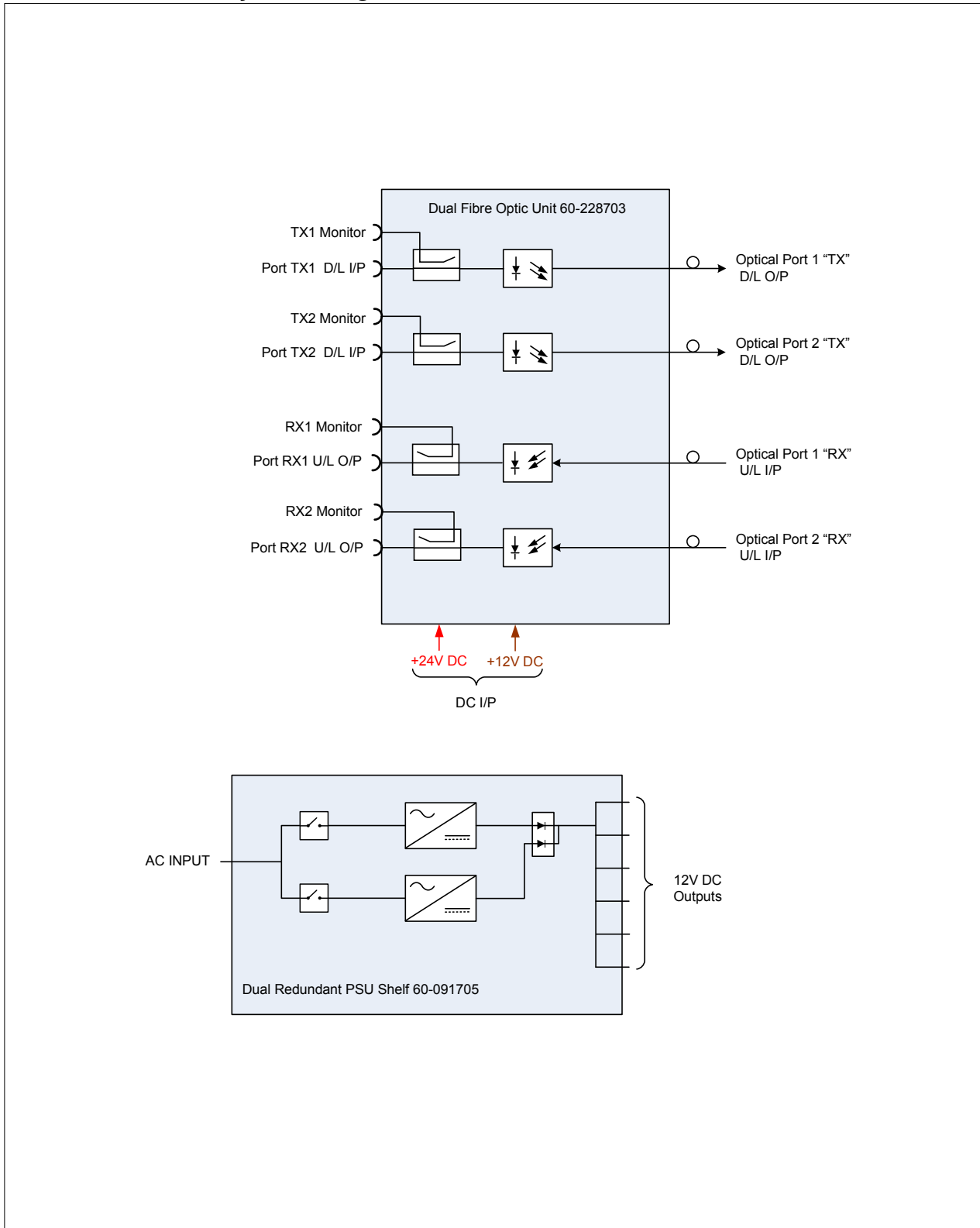
Uplink optical signals from the Gallery Place Station CRAS System are received via fiber optic cables, demodulated to RF and fed to the BTS. This Uplink is the Primary Uplink from the Gallery Place Station CRAS System to the Jackson Graham Building CRAS System.


Provision is made for a redundant standby path in both the Downlink and Uplink, these are referred to as the "Main Primary" and "Standby Redundant" paths.

3.1. 60-228801 List of Major Sub-Components

Component Part	Component Part Description	Qty Per Assembly
60-228703	Dual Fiber Optic Unit	1
60-091705	Dual Redundant PSU	1

3.2. 60-228801 System Diagram



Date: 15/02/2010	Jackson Graham Building CRAS System Diagram	Not to Scale
© AWL 2010		Drawn by: EW/AJS
 <p>Aerial House Asheridge Road Chesham Buckinghamshire HP5 2QD United Kingdom Telephone: +44 (0) 1494 777000 Facsimile: +44 (0) 1494 777002 E-Mail: info@axellwireless.com www.axellwireless.com</p>	Issue: 2	
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	Page 1 of 1	

3.3. Dual Fiber Optic Unit 60-228703

Dual Fiber Optic Unit 60-228703 is built into a 2U, 19" rack-mount case.

The Main Primary Downlink RF path from the BTS enters the Dual Fiber Optic Unit via the N type port labeled "TX 1" (annotated "A" in section 3.3.4.) and then passes through a 20dB Directional Coupler 90-852420 which couples off a small portion of the signal and feeds it to the N type port labeled "MON -20dB TX 1" (annotated "B" in section 3.3.4.) which provides a 20dB test/monitor port for the Main Primary Downlink input.

The Main Primary Downlink path then passes into a Fiber Optic Transmitter Module 20-005401 where the RF signal is modulated onto a laser and the optical signal thus produced then exits the Dual Fiber Optic Unit via the SC/APC optical port 1 "TX" (annotated "C" in section 3.3.4.) and is transmitted to the Gallery Place Station CRAS System via a fiber optic cable link.

The N type port labeled "TX 2" (annotated "D" in section 3.3.4..) is a Downlink input to a separate, parallel, Standby Redundant Downlink path with its own Directional Coupler, test monitor port (annotated "E" in section 3.3.4.) and Fiber Optic Transmitter Module. The Optical output from the Standby Redundant Downlink path exits the Dual Fiber Optic Unit via the SC/APC optical port 2 "TX" (annotated "F" in section 3.3.4.)

Switching between the Main and Standby Redundant Downlink paths is accomplished manually by disconnecting the Downlink RF input from the "TX 1" port and connecting it to the "TX 2" port, and by disconnecting the optical Downlink output cable from the SC/APC optical port 1 "TX" and connecting it to the SC/APC optical port 2 "TX" N.B. The safety precautions noted in section 2 must be observed when changing from main to standby.

The Main Primary Uplink optical signal from the Gallery Place Station CRAS System enters the Dual Fiber Optic Unit via the SC/APC optical port 1 "RX" (annotated "G" in section 3.3.4.) and passes into a Fiber Optic Receiver Module 20-005501 which demodulates the Uplink signal to RF and the Uplink RF signal then passes through a 20dB Directional Coupler 90-852420 which couples off a small portion of the signal and feeds it to the N type port labeled "MON -20dB RX 1" (annotated "I" in section 3.3.4.) which provides a 20dB test/monitor port for the Main Primary Uplink output. The Main Primary Uplink path then exits the Dual Fiber Optic Unit for the BTS via the N type port labeled "RX 1" (annotated "H" in section 3.3.4.)

The SC/APC optical port 2 "RX" (annotated "J" in section 3.3.4.) is an Uplink input to a separate, parallel, Standby Redundant Uplink path with its own Fiber Optic Receiver Module, Directional Coupler and test/monitor port (annotated "L" in section 3.3.4.) The RF output from the standby Uplink path exits the Dual Fiber Optic Unit for the BTS via the N type port labeled "RX 2" (annotated "K" in section 3.3.4.)

Switching between the Main and Standby Redundant Uplink paths is accomplished manually by disconnecting the optical Uplink input cable from the SC/APC optical port 1 "RX" and connecting it to the SC/APC optical port 2 "RX", and by disconnecting the Uplink RF output from the "RX 1" port and connecting it to the "RX 2" port. N.B. The safety precautions noted in section 2 must be observed when changing from main to standby.

Dual Fiber Optic Unit 60-228703 is powered by a 12V DC supply from Dual Redundant PSU 60-091705, which powers the fiber optic modules within the unit

An alarm system is fitted to Dual Fiber Optic Unit 60-228703, each of the fiber optic modules carries its own voltage-free contact alarm relay output which are summed at the 15 way "D" panel plug labeled "ALARM" (annotated "EE" in section 3.3.4.)

3.3.1. Dual Fiber Optic Unit 60-228703 List of Major Sub-Components

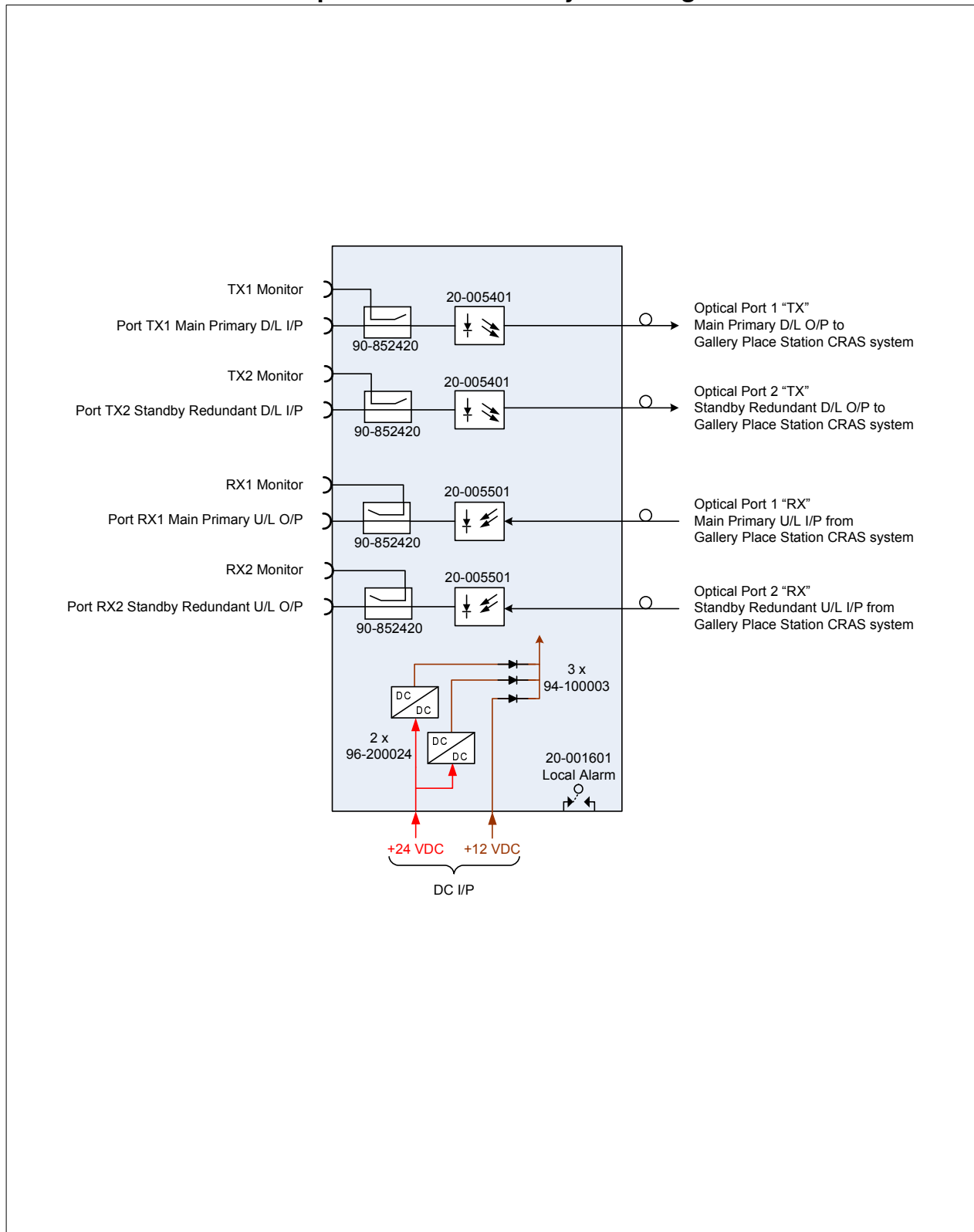
Component Part	Part Description	Qty Per Assembly
20-001601	12V Dual Relay Board	1
20-005401	Fiber Optic Transmitter Module	2
20-005501	Fiber Optic Receiver Module	2
96-110013	3.15 A Fuse	2
96-200024	DC/DC Converter	2
90-852420	20dB Directional Coupler	4
94-100003	Power Diode	3


3.3.2. Dual Fiber Optic Unit 60-228703 Specification

PARAMETER	SPECIFICATION
RF Downlink	
Frequency range	489.5MHz to 491.0MHz 496.3MHz to 496.7MHz
Coupling TX1 to Mon TX1	20 dB±1
Coupling TX2 to Mon TX2	20 dB±1
Optical Downlink	
Wavelength	1310nm
TX(A) Optical TX Power	1-3 dBm
TX(B) Optical TX Power	1-3 dBm
Optical Uplink	
Wavelength	1550nm
RX(A) Gain	>+15 dB
RX(A) Gain Set To	0 dB±0.5
RX(A) Alarm Threshold	< -10dBm
RX(B) Gain	>+15 dB
RX(A) Gain Set To	0 dB±0.5
RX(B) Alarm Threshold	< -10dBm
RF Uplink	
Frequency range	499.3MHz to 499.7MHz 492.5MHz to 494.0MHz
Coupling RX1 to Mon RX1	20 dB±1
Coupling RX2 to Mon RX2	20 dB±1
General	
Supply Voltage	12V DC or 24V DC
Current consumption	< 1.0A @ 24V DC input < 1.5A @ 12V DC input
Alarm output Summary volts free dry contact output (Closed = Normal / Open = Alarm)	F/O TX1 contact output Pin 1 & 2
	F/O TX2 contact output Pin 3 & 4
	F/O RX1 contact output Pin 5 & 6
	F/O RX1 contact output Pin 7 & 8
	24V DC-DC contact output Pin 9 & 10**

**This alarm is not operational when the unit is powered from 12V DC

3.3.3. Dual Fiber Optic Unit 60-228703 System Diagram



Date: 15/02/2010	Dual Fibre Optic Unit 60-228703 System Diagram (Jackson Graham Building CRAS System)	Not to Scale
© AWL 2010		Drawn by: EW/AJS
 Aerial House Asheridge Road Chesham Buckinghamshire HP5 2QD United Kingdom		Issue: 3
	Telephone: +44 (0) 1494 777000 Facsimile: +44 (0) 1494 777002 E-Mail: info@axellwireless.com www.axellwireless.com	
		Page 1 of 1

3.3.3.1. Dual Fiber Optic Unit 60-228703 Alarm Outputs

15 pin “D” panel plug “ALARM”, local alarm output to Krone terminal block on rack (annotated “EE” in section 3.3.3.)

Dry Contact Outputs (Closed = Normal / Open = Alarm)

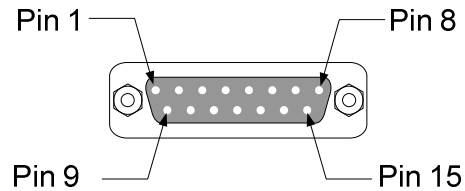
F/O TX 1 (main), contact output Pin 1 & 2

F/O TX 2 (standby), contact output Pin 3 & 4

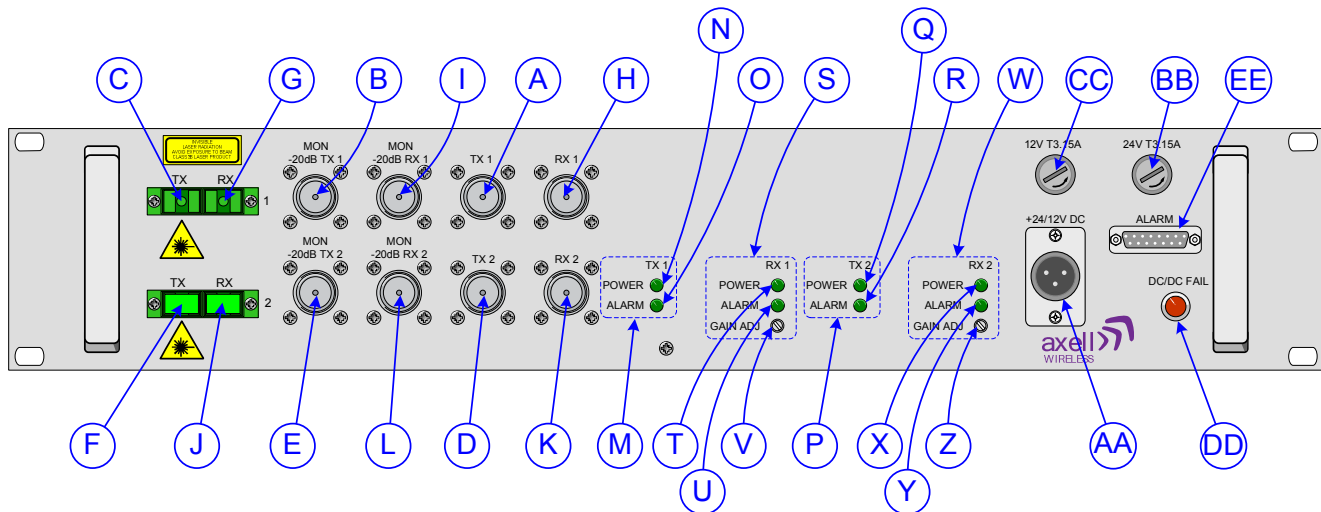
F/O RX 1 (main), contact output Pin 5 & 6

F/O RX 2 (standby), contact output Pin 7 & 8

24V DC>DC contact output Pin 9 & 10

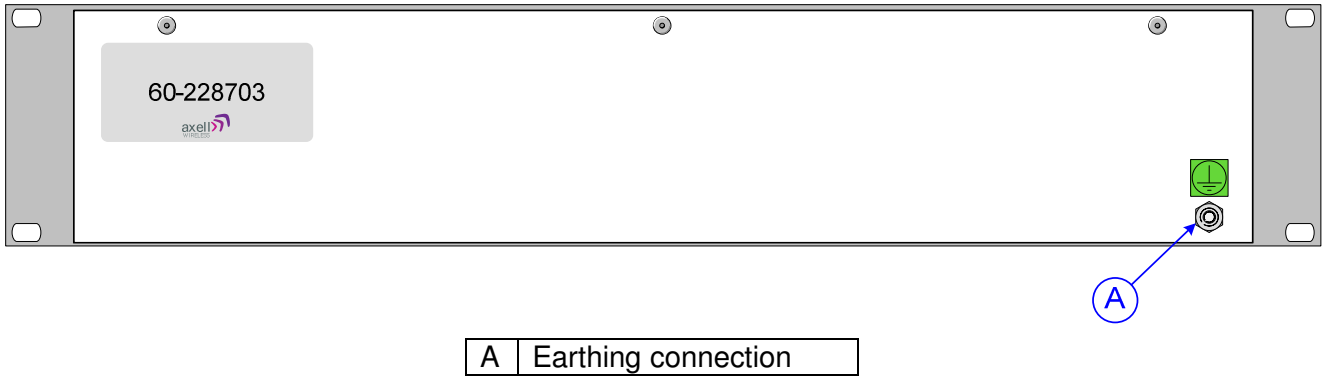


3.3.4. Dual Fiber Optic Unit 60-228703 Front View



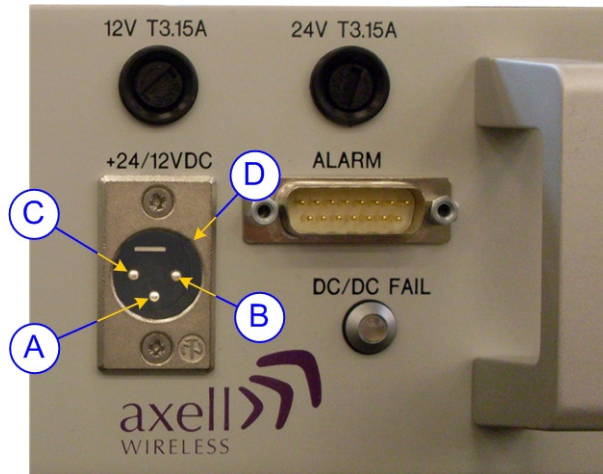
A	N type port "TX1", Main Primary RF D/L I/P from BTS
B	N type port "MON -20dB TX 1", 20dB test/monitor port coupled from D/L input to port "TX1"
C	SC/APC optical port 1 "TX", Main Primary optical D/L O/P to Gallery Place Station CRAS System
D	N type port "TX2", Standby Redundant RF D/L I/P from BTS
E	N type port "MON -20dB TX 2", 20dB test/monitor port coupled from D/L input to port "TX2"
F	SC/APC optical port 2 "TX", Standby Redundant optical D/L O/P to Gallery Place Station CRAS System
G	SC/APC optical port 1 "RX", Main Primary optical U/L I/P from Gallery Place Station CRAS System
H	N type port "RX1", Main Primary RF U/L O/P to BTS
I	N type port "MON -20dB RX 1", 20dB test/monitor port coupled from U/L output to port "RX1"
J	SC/APC optical port 2 "RX", standby optical U/L I/P from Gallery Place Station CRAS System
K	N type port "RX2", Standby Redundant RF U/L O/P to BTS
L	N type port "MON -20dB RX 2", 20dB test/monitor port coupled from U/L output to port "RX2"
M	Status Indicators for F/O TX Module 1 (Main Primary D/L to Gallery Place Station CRAS System)
N	Green LED "POWER", Fiber Optic TX Power On indicator illuminated during normal operation
O	Green LED "ALARM", Fiber Optic TX Alarm indicator extinguished during alarm state
P	Status Indicators for F/O TX Module 2 (Standby Redundant D/L to Gallery Place Station CRAS System)
Q	Green LED "POWER", Fiber Optic TX Power On indicator illuminated during normal operation
R	Green LED "ALARM", Fiber Optic TX Alarm indicator extinguished during alarm state
S	Status Indicators for F/O RX Module 1 (Main Primary U/L from Gallery Place Station CRAS System)
T	Green LED "POWER", Fiber Optic RX Power On indicator illuminated during normal operation
U	Green LED "ALARM", Fiber Optic RX Alarm indicator extinguished during alarm state
V	Fiber Optic RX RF gain adjustment
W	Status Indicators for F/O RX Module 2 (Standby Redundant U/L from Gallery Place Station CRAS System)
X	Green LED "POWER", Fiber Optic RX Power On indicator illuminated during normal operation
Y	Green LED "ALARM", Fiber Optic RX Alarm indicator extinguished during alarm state
Z	Fiber Optic RX RF gain adjustment
AA	DC input (12V or 24V)
BB	3.15A Fuse for 24V DC input
CC	3.15A Fuse for 12V DC input
DD	Red LED "DC/DC FAIL" illuminated in alarm state (DC/DC convertor failure)
EE	15 pin "D" panel plug "ALARM" local alarm output

3.3.5. Dual Fiber Optic Unit 60-228703 Rear View



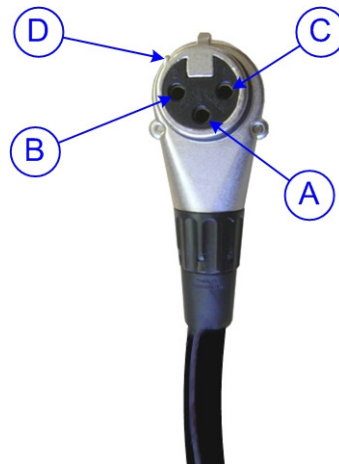
3.3.6. Dual Fiber Optic Unit 60-228703 DC Inlet

The Dual Fiber Optic Unit 60-228703 is a standard module used in three different locations: the Jackson Graham Building, the Carmen Turner Facility and the Gallery Place Station. The DC supply voltage available at the Carmen Turner Facility and the Gallery Place Station locations is 24V While the DC supply at the Jackson Graham Building is 12V so to enable the provision of a standardized unit the Dual Fiber Optic Unit 60-228703 is configured to operate from both 24V and 12V DC supplies



A	Pin 3, 12V, (Red Wire)
B	Pin 2, 0V, (Black wire)
C	Pin 1, not connected (used for 24V I/P)
D	Guide keyway
E	Fuse access

3.3.6.1. Free Socket for 60-228703 DC Inlet



A	Pin 3, 12V (Red Wire)
B	Pin 2, 0V (Black wire)
C	Pin 1, not connected
D	Guide key
E	Locking/release lug

3.4. Dual Redundant PSU 60-091705

Dual Redundant PSU 60-091705 is built into a 4U, 19" rack-mount case.

The PSU case houses two mains driven PSU modules whose outputs are parallel combined using high power, low volt-drop diodes. This means that if either supply fails the other will seamlessly take over all power provision until the fault is rectified. Both supplies' outputs are monitored and an alarm will become active should either module fail.

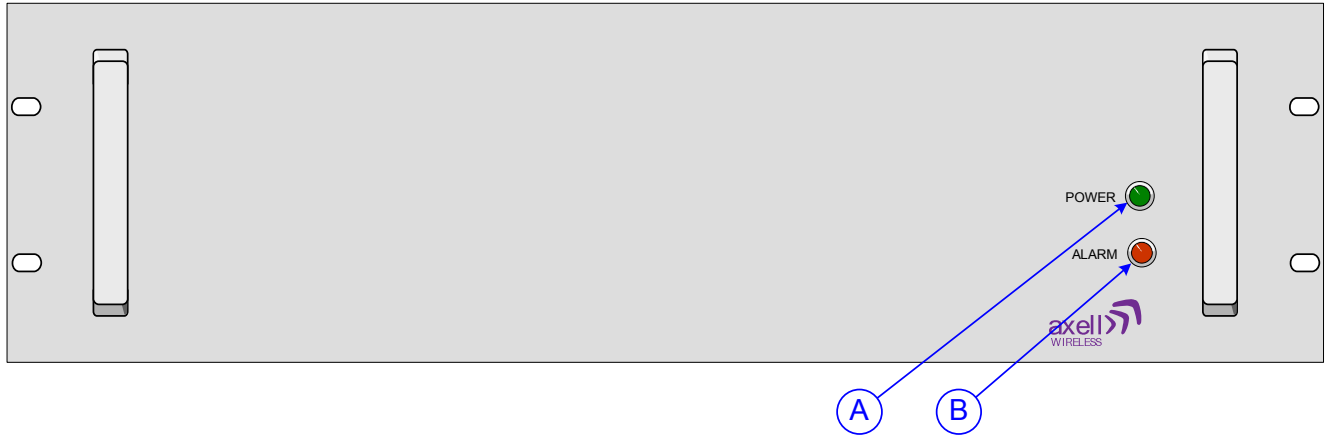
3.4.1. Dual Redundant PSU 60-091705 List of Major Sub-Components

Component Part	Part Description	Qty Per Assembly
20-001601	12V Dual Relay Board	1
94-100004	Dual Diode Assembly	1
96-300051	100W PSU Module	2
96-920022	3A Circuit Breaker	2

3.4.2. Dual Redundant PSU 60-091705 Specification

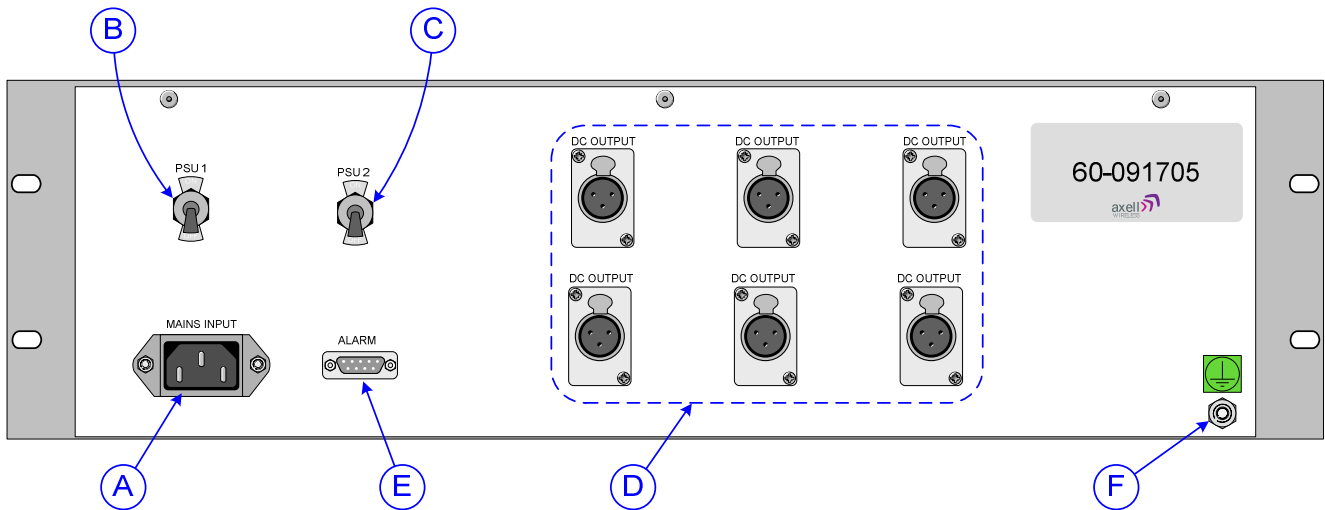
PARAMETER	SPECIFICATION
Input	115/230V AC 50/60Hz (nominal, single port)
Outputs	6 x 12V DC at 16A (max. total)
Indicators	Green 'DC on' LED
	Red LED (alarm1)
Alarm Interface	9-way 'D' connector
PSU1 alarm	pins 1 & 2
PSU2 alarm	Pins 1 & 4

3.4.4. Dual Redundant PSU 60-091705 Front View



A	Green LED "POWER", illuminated during normal operation
B	Red LED "ALARM", illuminated during alarm condition

3.4.5. Dual Redundant PSU 60-091705 Rear View



A	AC Mains input
B	Trip switch for PSU module 1
C	Trip switch for PSU module 2
D	12V DC outputs
E	9 way "D" panel plug, alarm output
F	Earthing connection

4. 60-228701 - WMATA Carmen Turner Facility CRAS System

The WMATA Carmen Turner Facility CRAS System consists of the following equipment mounted in a 41U, 19" equipment housing rack

- Part No. 96-300090 PSU Housing Shelf
Contains Qty. 2, Part No. 96-300091 PSU Modules
- Part No. 60-228703 Dual Fiber Optic Unit
- Part No. 60-228702 Splitter/Combiner Unit
- Part No. 60-228706 Quadplexer (Base)
- Part No. 60-228706 Quadplexer (DAS)
- Part No. 60-228704 8 Ch. Squelch Gated BDA (Band 1)
- Part No. 60-228705 8 Ch. Squelch Gated BDA (band 2)

The Carmen Turner Facility CRAS System provides the Redundant Downlink to and receives the Redundant Uplink signal from the Gallery Place Station CRAS System. In addition, the Carmen Turner Facility CRAS System also provides a Downlink to and receives an Uplink from a local Distributed Antenna System within the Carmen Turner Facility building

Downlink RF from a remote off-air BTS is received and the signal is split into two paths; each path consists of a pair of frequencies, Downlink and Uplink, within the overall operating passband which can be processed together While allowing the easy rejection of opposing frequencies. For the sake of convention, within the Carmen Turner Facility CRAS System, the descriptions "Band 1" and "Band 2" will be used to refer to the two Downlink and Uplink pairs according to the following table:

Band 1	Downlink	489.5MHz to 491.0MHz
	Uplink	492.5MHz to 494.0MHz
Band 2	Downlink	496.3MHz to 496.7MHz
	Uplink	499.3MHz to 499.7MHz

The Downlink signals are then processes utilizing SDR technology to define the eight operating channels. and then amplified. The two paths are re-combined and then fed to the distributed antenna system.

RF Uplink from the distributed antenna system is split into two paths, for the reasons outlined above, which are processed utilizing SDR technology to define the eight operating channels and amplified. The two paths are then re-combined and then fed to the BTS.

In the Downlink path the signal is split by means of a directional coupler and fed to a fiber optic transmitter which modulates the RF signal on to an optical signal which is then fed to the Gallery Place Station CRAS System.

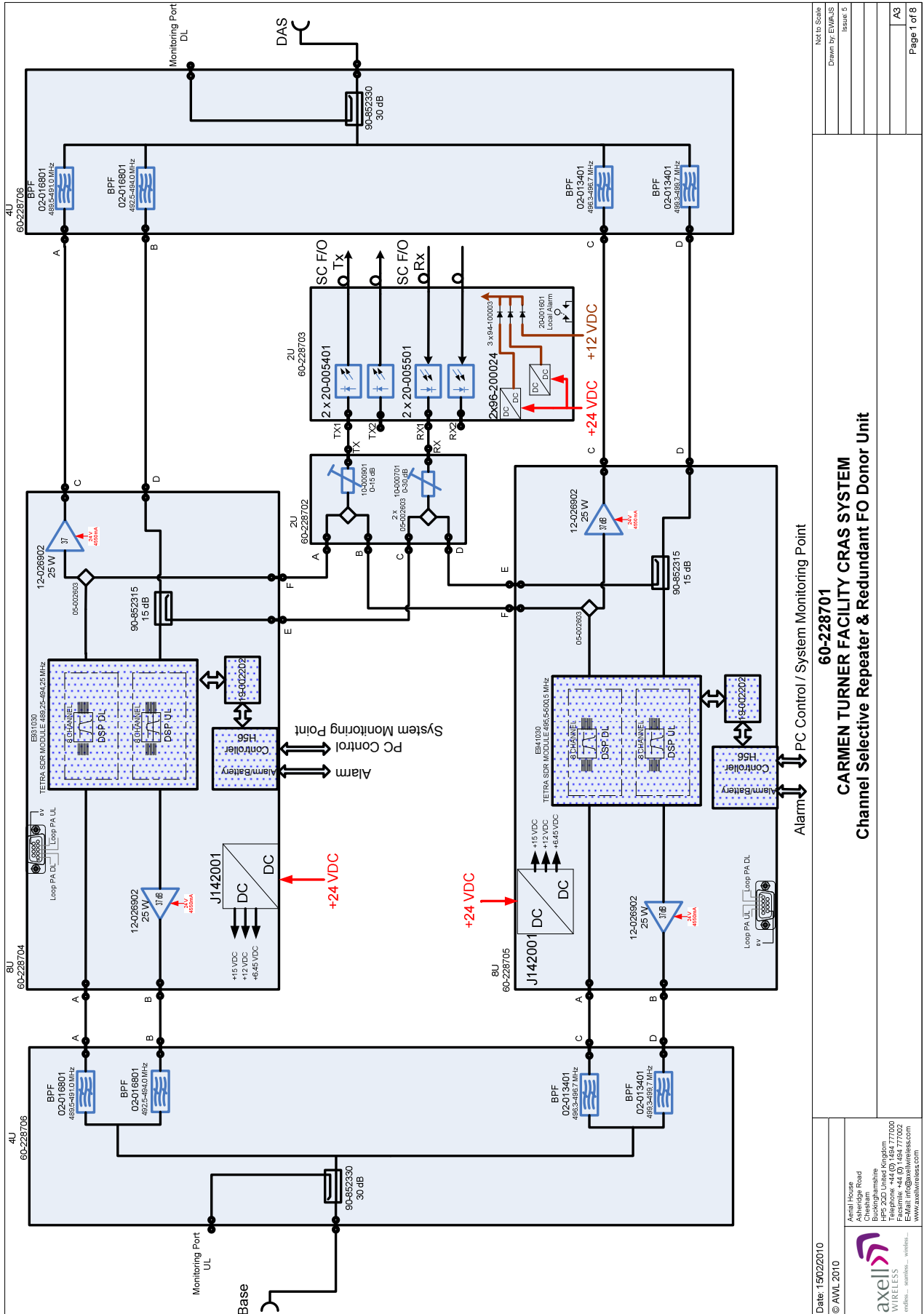
Optical Uplink signals from the Gallery Place Station CRAS System are received and demodulated to RF and coupled onto the Uplink path to the remote off-air BTS.

Provision is made for a redundant standby path in both the Downlink and Uplink to and from the Gallery Place Station CRAS System; these are referred to as the "Main Redundant" and "Standby Redundant" paths.

4.1. 60-228701 List of Major Sub-Components

Component Part	Component Part Description	Qty Per Assembly
60-228706	Quadplexer (Base)	1
60-228704	8 Ch. Squelch Gated BDA (Band 1)	1
60-228705	8 Ch. Squelch Gated BDA (band 2)	1
60-228702	Splitter/Combiner Unit	1
60-228703	Dual Fiber Optic Unit	2
60-228706	Quadplexer (DAS)	1
96-300090	PSU Housing Shelf	1
96-300091	PSU Module	2
97-500424	41U 19" Equipment Rack	1

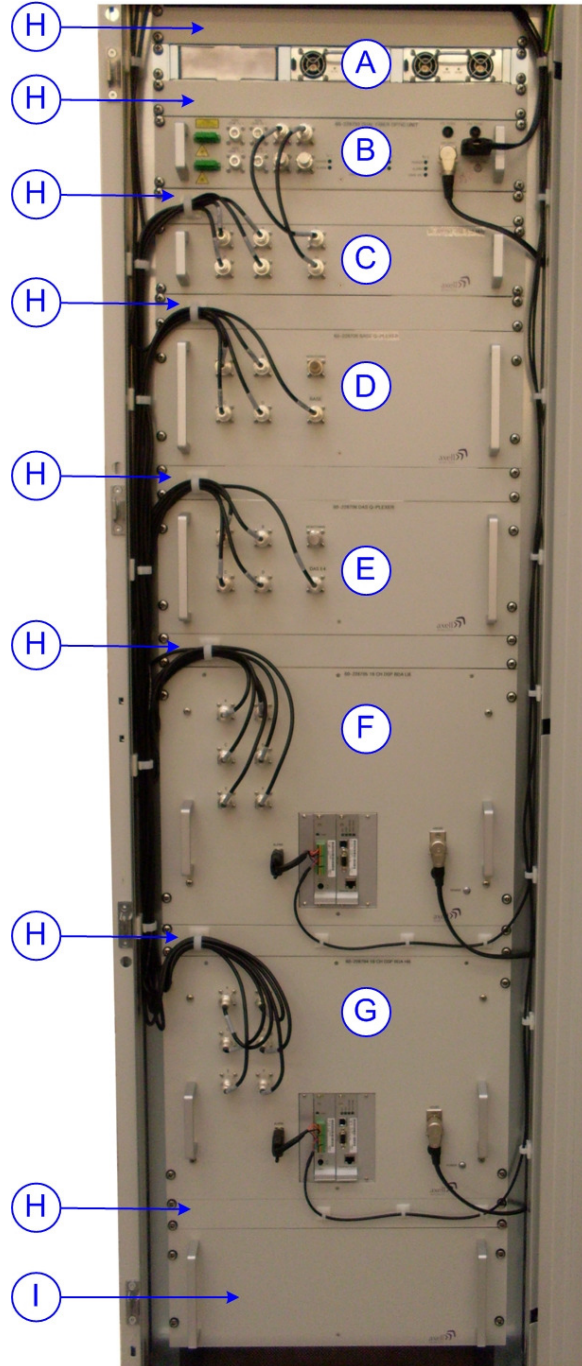
4.2. 60-228701 System Diagram



Date: 15/02/2010	© AVL 2010	<p>axell WIRELESS</p> <p>enrich... smart... wireless... www.axellwireless.com</p>	<p>Annal House Cherwell Road Birmingham B15 2JD United Kingdom Tel: +44 (0) 121 777000 Fax: +44 (0) 121 777002 E-Mail: info@axellwireless.com</p>	<p>Not to Scale Drawn by: EJVWJLS Issue 5</p>
<p>60-228701 CARMEN TURNER FACILITY CRAS SYSTEM Channel Selective Repeater & Redundant FO Donor Unit</p>		<p>Alarm / System Monitoring Point</p>		
<p>PC Control / System Monitoring Point</p>		<p>Alarm / System Monitoring Point</p>		
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<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port DL</p>		<p>Monitoring Port UL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port UL</p>		<p>Monitoring Port DL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port DL</p>		<p>Monitoring Port UL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port UL</p>		<p>Monitoring Port DL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port DL</p>		<p>Monitoring Port UL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port UL</p>		<p>Monitoring Port DL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port DL</p>		<p>Monitoring Port UL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port UL</p>		<p>Monitoring Port DL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port DL</p>		<p>Monitoring Port UL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port UL</p>		<p>Monitoring Port DL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port DL</p>		<p>Monitoring Port UL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port UL</p>		<p>Monitoring Port DL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port DL</p>		<p>Monitoring Port UL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port UL</p>		<p>Monitoring Port DL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port DL</p>		<p>Monitoring Port UL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port UL</p>		<p>Monitoring Port DL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port DL</p>		<p>Monitoring Port UL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port UL</p>		<p>Monitoring Port DL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port DL</p>		<p>Monitoring Port UL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port UL</p>		<p>Monitoring Port DL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port DL</p>		<p>Monitoring Port UL</p>		
<p>Base</p>		<p>DAS</p>		
<p>Monitoring Port UL</p>		<p>Monitoring Port DL</p>		
<p>Base</p>				

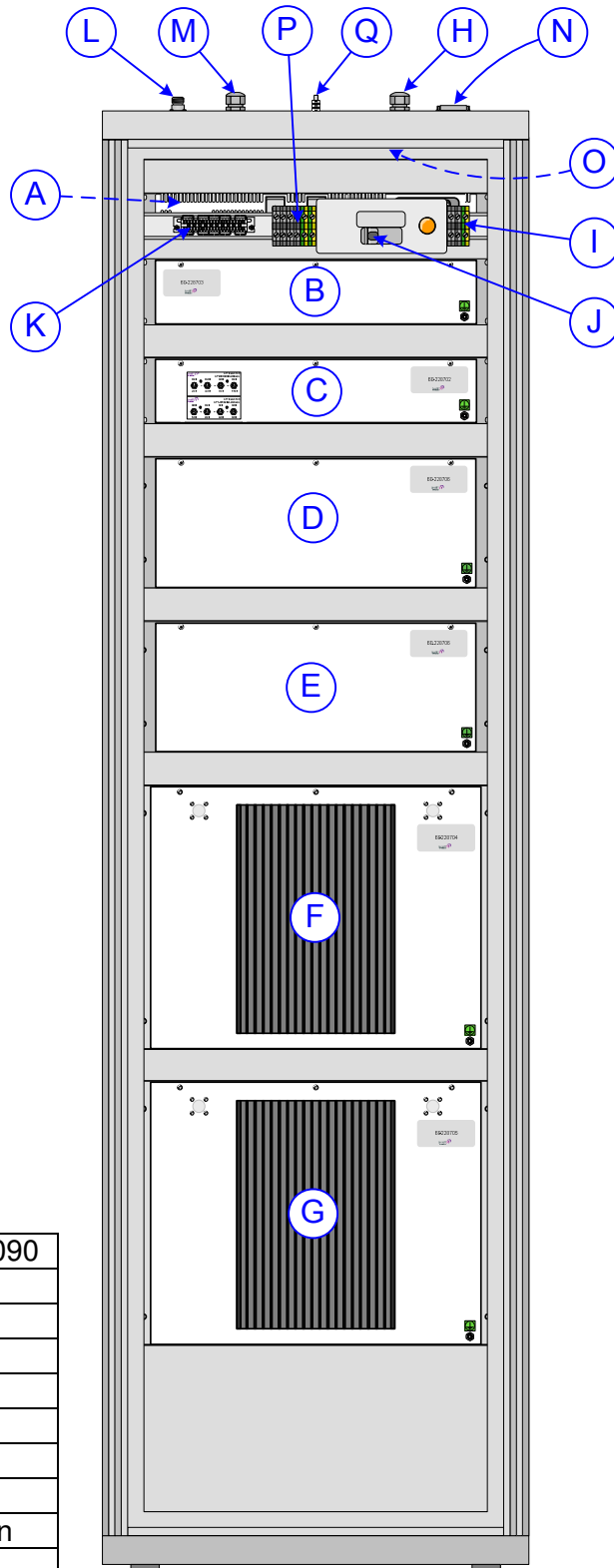
4.3. 60-228701 Rack Elevations

4.3.1 Rack Front View



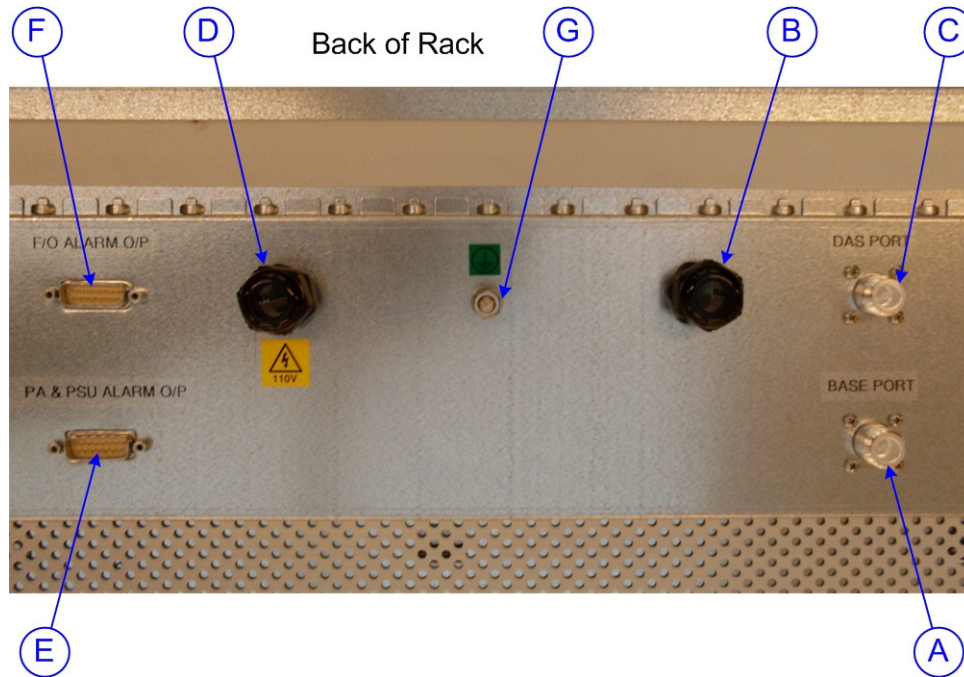
A	PSU Housing Shelf 96-300090
B	Dual Fiber Optic Unit 60-228703
C	Splitter/Combiner Unit 60-228702
D	Quadplexer (Base) 60-228706
E	Quadplexer (DAS) 60-228706
F	8 Ch. Squelch Gated BDA 60-228704
G	8 Ch. Squelch Gated BDA 60-228705
H	1U Blanking Panels
I	5U Blanking Panel

4.3.2. Rack Rear View



A	Position of PSU Housing Shelf 96-300090
B	Dual Fiber Optic Unit 60-228703
C	Splitter/Combiner Unit 60-228702
D	Quadplexer (Base) 60-228706
E	Quadplexer (DAS) 60-228706
F	8 Ch. Squelch Gated BDA 60-228704
G	8 Ch. Squelch Gated BDA 60-228705
H	Cable gland for AC mains wiring
I	Terminal blocks for AC input connection
J	AC circuit breaker
K	Krone terminal block for alarm outputs from components shelves
L	N type ports connections to/from BTS and DAS
M	Cable gland for optical fiber links to/from Gallery Place Station CRAS System
N	15 way "D" panel plugs for alarm outputs
O	Position of rack cooling fans
P	Terminal blocks for AC distribution
Q	Rack earthing connection

4.3.3. Ports on the Rack Lid



A	N type port "BASE PORT", D/L I/P from and U/L O/P to BTS
B	Cable gland for optical fiber links to/from Gallery Place Station CRAS System
C	N type port "DAS PORT", D/L O/P to and U/L I/P from DAS
D	Cable gland for AC mains wiring
E	15 way "D" panel plug "PA & PSU ALARM O/P" alarm output from system amplifiers and PSU modules
F	15 way "D" panel plug "F/O ALARM O/P" alarm output from fiber optic modules
G	Rack earthing connection

4.4. Quadplexer (Base) 60-228706

Quadplexer (Base) 60-228706 is built into a 4U, 19" rack-mount case

Downlink RF from the BTS enters the rack via the N type connector labeled "BASE PORT" on the rack lid (annotated "A" in section 4.3.3.) and the signal is fed to the N type port on the Quadplexer front panel labeled "BASE" (annotated "A" in section 4.4.4.). The signal path passes through 30dB Directional Coupler 90-852330 which is used to provide a test/monitor port for the Uplink signal and then the signal path is split into two branches, Band 1 and Band 2, by means of critical harness.

The Band 1 branch is then further split by critical harness into Uplink and Downlink paths and the Band 1 Downlink path passes through a Bandpass Filter 02-016801 which is tuned to pass the Band 1 Downlink passband of 489.5MHz to 491.0MHz and to reject out-of-band signals and noise.

The Band 2 branch is also further split by critical harness into Uplink and Downlink paths and the Band 2 Downlink path passes through a Bandpass Filter 02-013401 which is tuned to pass the Band 2 Downlink passband of 496.3MHz to 496.7MHz and to reject out-of-band signals and noise.

The two Downlink paths, Band 1 and Band 2 then exit the Quadplexer for their respective BDAs; the Band 1 Downlink exits the shelf for 8 Ch. Squelch Gated BDA 60-228704 via the N type port labeled "A" (annotated "B" in section 4.4.4.) and the Band 2 Downlink exits the shelf for 8 Ch. Squelch Gated BDA 60-228705 via the N type port labeled "C" (annotated "C" in section 4.4.4.)

The Band 1 Uplink from 8 Ch. Squelch Gated BDA 60-228704 enters the shelf via the N type port labeled "B" (annotated "D" in section 4.4.4.) and passes through a Bandpass Filter 02-013401 which is tuned to pass the Band 1 Uplink passband of 492.5MHz to 494.0MHz and to reject out-of-band signals and noise. The Band 1 Uplink path is then combined with that of the Band 1 Downlink path by means of critical harness.

The Band 2 Uplink from 8 Ch. Squelch Gated BDA 60-228705 enters the shelf via the N type port labeled "D" (annotated "E" in section 4.4.4.) and passes through a Bandpass Filter 02-013401 which is tuned to pass the Band 2 Uplink passband of 499.3MHz to 499.7MHz and to reject out-of-band signals and noise.

The Band 2 Uplink path is then combined with that of the Band 2 Downlink path by means of critical harness and the Band 1 and Band 2 Uplink paths are then combined again by means of critical harness and the combined Uplink path passes through the 30dB Directional Coupler 90-852330 which couples off a small portion of the Uplink signal and feeds it to the N type port labeled "MONITORING" (annotated "F" in section 4.4.4.) providing a 30dB test/monitor port for the Uplink signal. The main Uplink signal then exits the shelf via the N type port labeled "BASE" (annotated "A" in section 4.4.4.) and the signal is fed to the N type connector labeled "BASE PORT" on the rack lid (annotated "A" in section 4.3.3.).

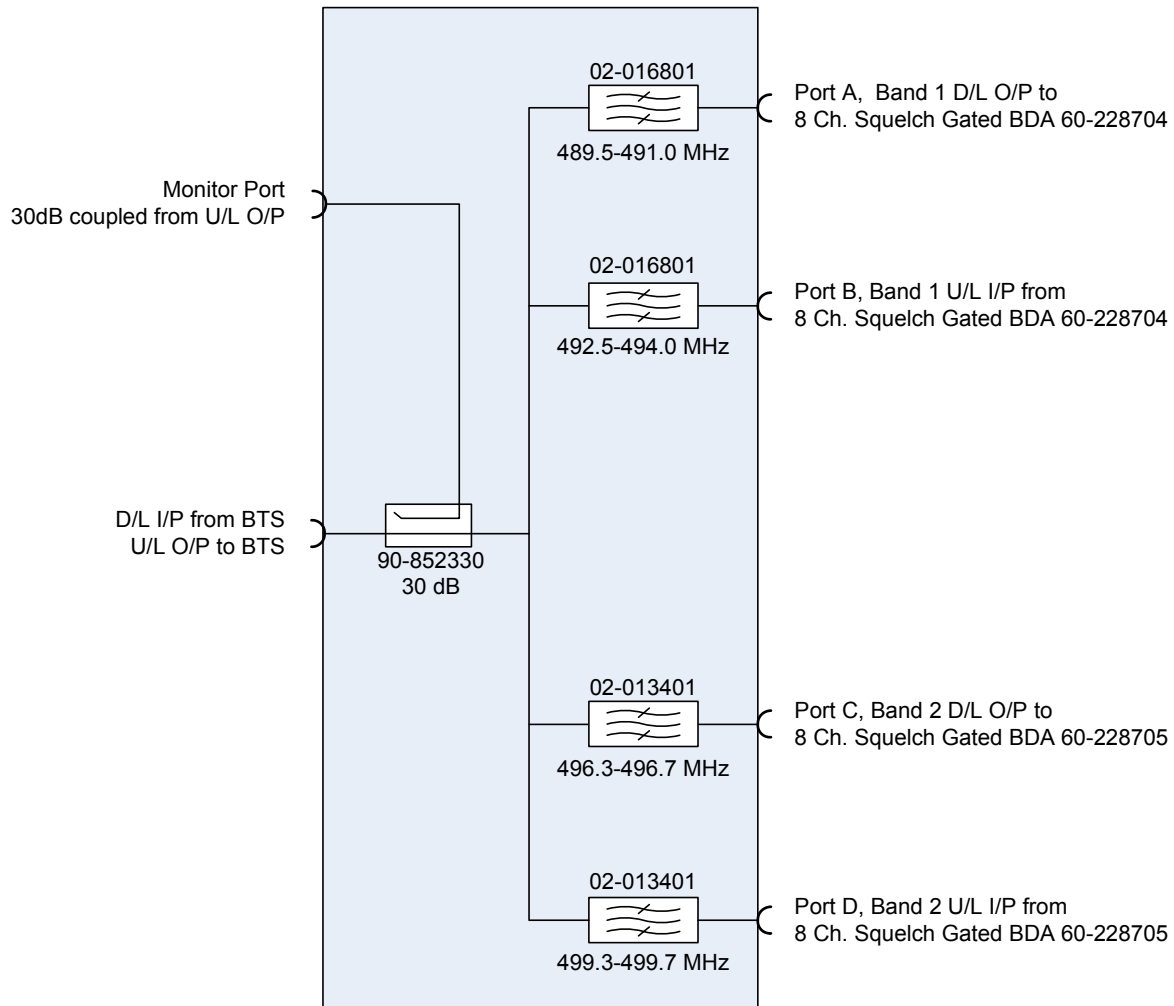
4.4.1. Quadplexer (Base) 60-228706 Major Sub-Components


Component Part	Part Description	Qty Per Assembly
02-013401	Bandpass Filter	2
02-016801	Bandpass Filter	2
90-852330	30dB Directional Coupler	1

4.4.2. Quadplexer (Base) 60-228706 Specification

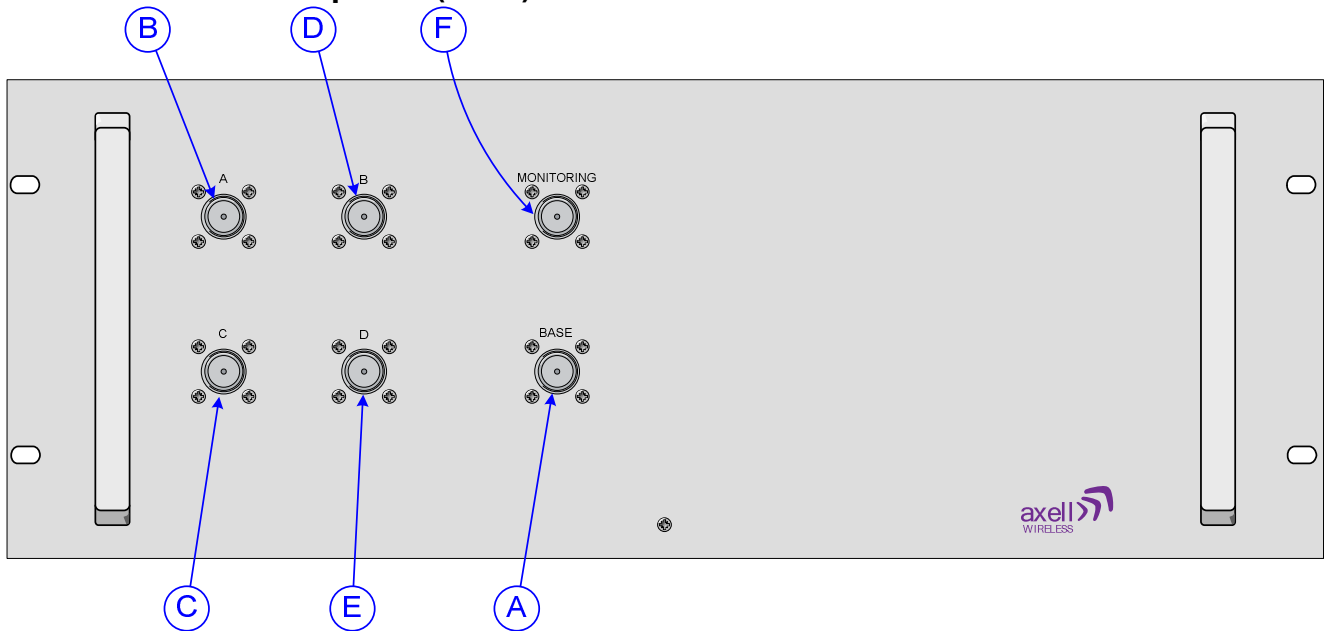
PARAMETER	SPECIFICATION
Band 1 D/L (Base port to port A)	
Frequency Range	489.5-491.0 MHz
Rejection	492.5-494.0 MHz > 65 dB
Insertion Loss	≤ 3.0 dB
Band 1 U/L (port B to Base port)	
Frequency Range	492.5-494.0 MHz
Rejection	489.5-491.0 MHz > 40 dB 496.3-496.7 MHz > 65 dB
Insertion Loss	≤ 3.0 dB
Port B to Monitoring port	33dB ±1 dB
Band 2 D/L (Base port to port C)	
Frequency Range	496.3-496.7 MHz
Rejection	492.5-494.0 MHz > 65 dB 499.3-499.7 MHz > 60 dB
Insertion Loss	≤ 3.0 dB
Band 2 U/L (port D to Base port)	
Frequency Range	499.3-499.7 MHz
Rejection	496.3-496.7 MHz > 75 dB
Insertion Loss	≤ 3.0 dB
Port D to Monitoring port	33dB ±1 dB

4.4.3. Quadplexer (Base) 60-228706 System Diagram



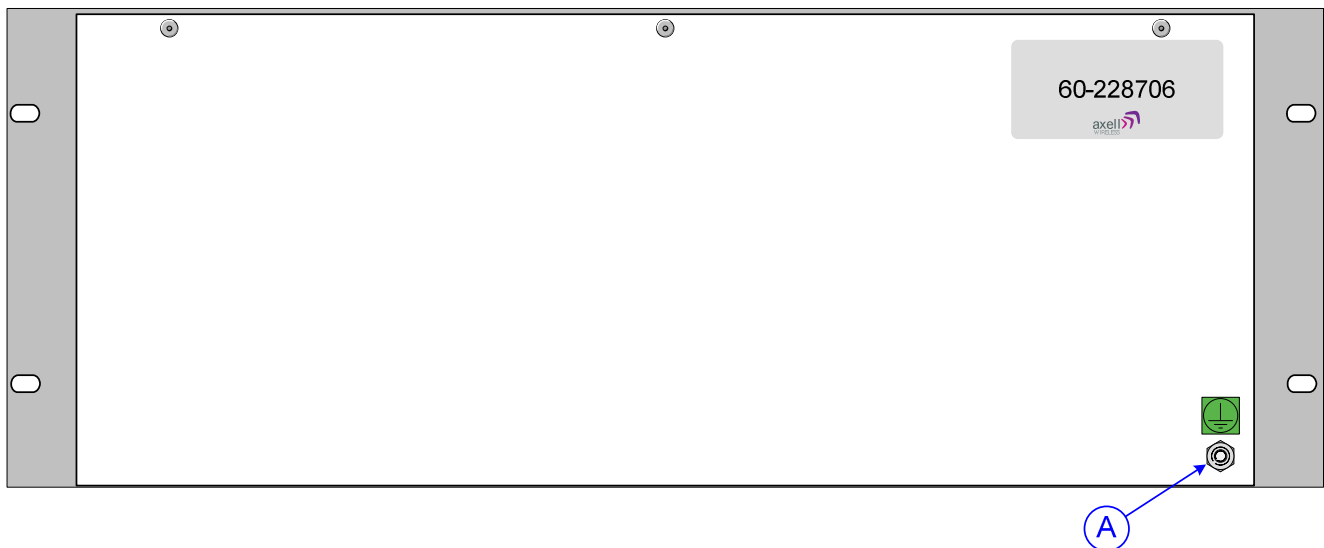
Date: 19/11/2009	Quadplexer (Base) 60-228706 System Diagram	Not to Scale
© AWL 2009		Drawn by: EW/AJS
 <p> Aerial House Asheridge Road Chesham Buckinghamshire HP5 2QD United Kingdom Telephone: +44 (0) 1494 777000 Facsimile: +44 (0) 1494 777002 E-Mail: info@axellwireless.com www.axellwireless.com </p>		Issue: 1
		A4
		Page 1 of 1

4.4.4. Quadplexer (Base) 60-228706 Front View



A	N type port "BASE", Downlink input from and Uplink output to BTS
B	N type port "A", Band 1 Downlink output to 8 Ch. Squelch Gated BDA 60-228704
C	N type port "C", Band 2 Downlink output to 8 Ch. Squelch Gated BDA 60-228705
D	N type port "B", Band 1 Uplink input from 8 Ch. Squelch Gated BDA 60-228704
E	N type port "D", Band 2 Uplink input from 8 Ch. Squelch Gated BDA 60-228705
F	N type port "MONITORING", 30dB test/monitor port coupled from the Uplink O/P path

4.4.5. Quadplexer (Base) 60-228706 Rear View



A	Earthing connection
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4.5. 8 Channel Squelch Gated BDA 60-228704

8 Ch. Squelch Gated BDA 60-228704 is built into an 8U, 19" rack-mount case

60-228704 utilizes Software Defined Radio (SDR) technology to digitally process the signal to define the required channel frequencies and bandwidth (eight channels in the Downlink path and eight in the Uplink path). As part of the digital signal processing function the signal amplitude is monitored to apply squelch functionality to the signal path to attenuate unwanted noise when the input signal level is low. The unit is pre-programmed with the 8 required duplex frequencies and channel bandwidths as indicated in section 4.5.2., these can be modified by the use of RMC software.

Band 1 Downlink RF from Quadplexer (Base) 60-228706 enters the BDA via the N type port labeled "A" (annotated "A" in section 4.5.4.) and the Downlink signal passes through the Downlink path of UHF SDR Module E931030 to define the 8 required Downlink channels.

After passing through the SDR module the Band 1 Downlink signal is split into two equal paths by 3dB Splitter/Combiner 05-002603; The first path passes through the Downlink 25W Power Amplifier 12-026902 which provides 37dB of signal gain and then the signal exits the BDA via the N type port labeled "C" (annotated "B" in section 4.5.4.) on its way to the local DAS by way of Quadplexer (DAS) 60-228706.

The second path from 3dB Splitter/Combiner 05-002603 exits the BDA for Splitter/Combiner Unit 60-228702 (and ultimately the Gallery Place Station CRAS System) via the N type port labeled "F" (annotated "C" in section 4.5.4.)

Band 1 Uplink RF from the local DAS (by way of Quadplexer (DAS) 60-228706) enters the BDA via the N type port labeled "D" (annotated "D" in section 4.5.4.) and passes through 15dB Directional Coupler 90-852315 before entering UHF SDR Module E931030.

Band 1 Uplink RF from Splitter/Combiner Unit 60-228702 (from the Gallery Place Station CRAS System) enters the BDA via the N type port labeled "E" (annotated "E" in section 4.5.4.) and also passes through 15dB Directional Coupler 90-852315 where it is coupled onto the main Uplink signal path which passes through the Uplink path of UHF SDR Module E931030 which utilizes SDR technology to digitally process the signal to define the 8 required Uplink channels. After passing through the SDR module the Band 1 Uplink signal passes through the Uplink 25W Power Amplifier 12-026902 which provides 37dB of signal gain and then the signal exits the BDA via the N type port labeled "B" (annotated "F" in section 4.5.4.) on its way to the BTS by way of Quadplexer (Base) 60-228706.

8 Ch. Squelch Gated BDA 60-228704 is powered by a 24V DC supply from the Redundant PSU Modules 96-300091 in PSU Housing Shelf 96-300090, The 24V DC supply powers the Power Amplifiers and an on-board DC/DC converter J1421001 steps down the 24V supply to provide 6.45v and 15v DC to power the SDR, Controller and Ext. Alarm/battery modules within the BDA.

Each Power Amplifiers have alarm outputs which are summed at the 9 way "D" panel plug labeled "ALARM" on the front panel (annotated "J" in section 4.5.4.), the alarm data is connected to the External Alarm and Battery Module J1161030 (annotated "K" in section 3.6.3.), from where the summary alarm data is fed to the Krone terminal block located near the top of the rack (see section 4.3.2.).

The SDR controller module H561003 is used to control and supervise the SDR functionality, two ports are provided where an operator may connect into the system, a local serial port, (a 9 way "D" panel socket annotated "N" in section 4.6.4.) is used with a laptop PC running suitable terminal-emulation software to interrogate and control the equipment using GET and SET commands. Alternatively the equipment can be configured using RMC software via the RJ45 ethernet port (annotated "O" in section 4.6.4.) To ensure synchronous communications between the SDR and the H56 controller, a high stability 10MHz reference generator, R031002 is incorporated in the equipment backplane.

4.5.1. 8 Ch. Squelch Gated BDA 60-228704 List of Major Sub-Components

Component Part	Part Description	Qty Per Assembly
05-002603	3dB Splitter/Combiner	1
12-026902	25W Power Amplifier	2
19-002202	Interconnection Assembly	1
90-852315	15dB Directional Coupler	1
96-110015	15A Fuse	1
E931030	UHF SDR Module (489.25MHz to 494.25MHz)	1
H561003	Control Module	1
J1161030	External Alarm and Battery Module	1
J1421001	DC/DC Converter	1
R031002	Reference Generator	1

4.5.2. 8 Ch. Squelch Gated BDA 60-228704 Specification

PARAMETER	SPECIFICATION
Downlink	
Frequency Range	489.5MHz to 491.0MHz
No of Channels	8 ⁽¹⁾
Maximum Gain	>+95 dB
Passband ripple	≤ ±1.5 dB
ALC Setting (all channels on)	+28 ±1 dBm
ALC Dynamic Range	>30 dB
Switched attenuator	0dB to 30 dB in 2dB steps ± 1dB
Noise Figure	≤ 4.5 dB (at maximum gain)
In Band Spurious Noise (30kHz B/W)	< -36 dBm (at maximum gain)
Squelch Level	-95dBm ±2 dBm
Uplink	
Frequency Range	492.5MHz to 494.0MHz
No of Channels	8 ⁽²⁾
Maximum Gain	>+95
Passband ripple	≤ ±1.5 dB
ALC Setting (all channels on)	+23 ±1 dBm
ALC Dynamic Range	>30 dB
Switched attenuator	0dB to 30 dB in 2dB steps ± 1dB
Noise Figure	≤ 4.5 dB (at maximum gain)
In Band Spurious Noise (30kHz B/W)	< -36 dBm (at maximum gain)
Squelch Level	-95 ±2 dBm
General	
Supply Voltage	24V DC
Current consumption	< 12 A
Alarm output Summary volts free dry contact output (Closed = Normal / Open = Alarm)	pins 7 & 8 - Alarm connector terminal on External Alarm and Battery Module J1161030

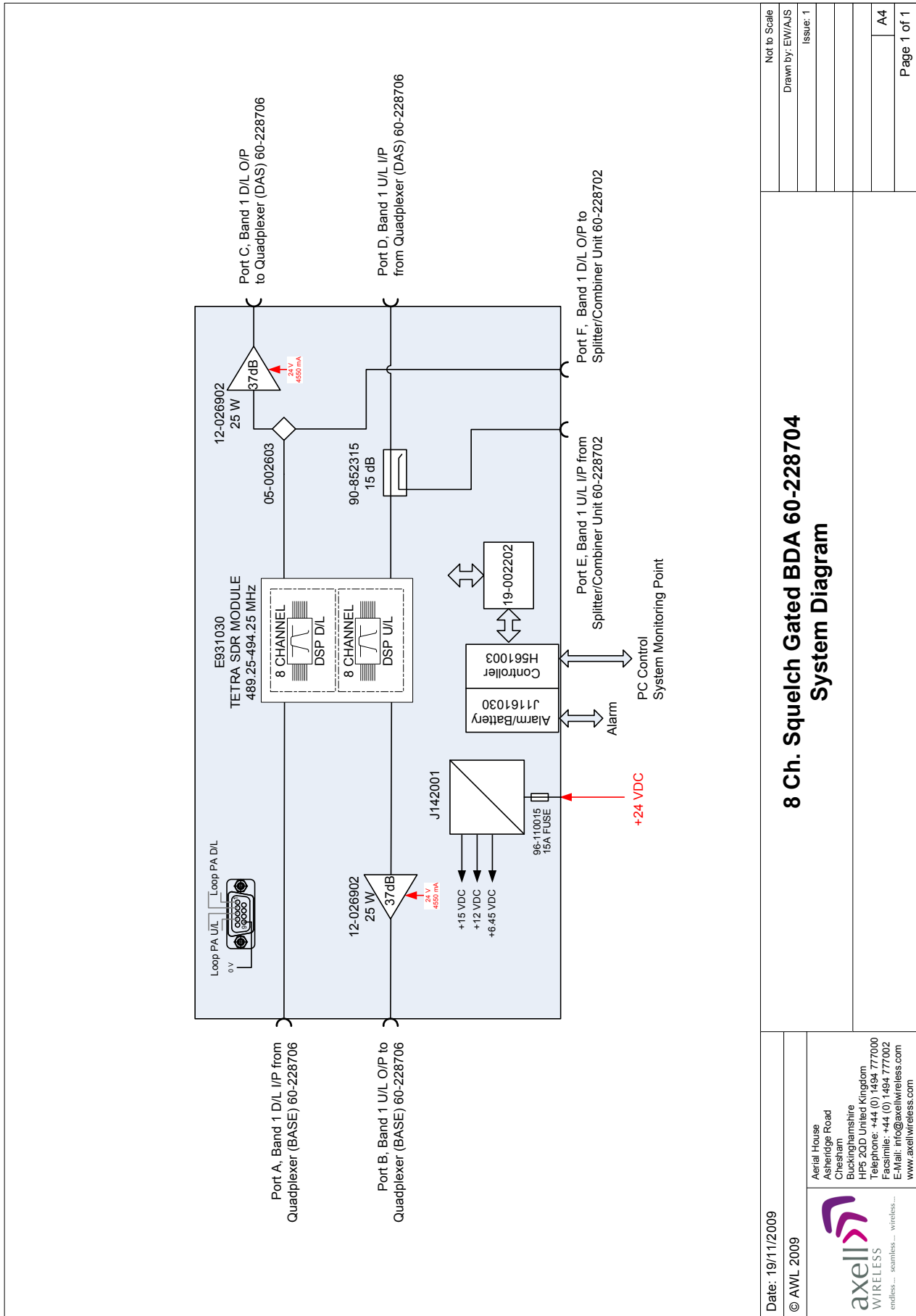
⁽¹⁾Downlink Channels


Channel Number	Channel Frequency	Channel Bandwidth
14	489.5125 MHz	12.5 kHz
13	489.5375 MHz	12.5 kHz
2	490.7875 MHz	25.0 kHz
12	490.8375 MHz	12.5 kHz
1	490.8625 MHz	12.5 kHz
11	490.8875 MHz	12.5 kHz
10	490.9125 MHz	12.5 kHz
9	490.9625 MHz	25.0 kHz

⁽²⁾Uplink Channels

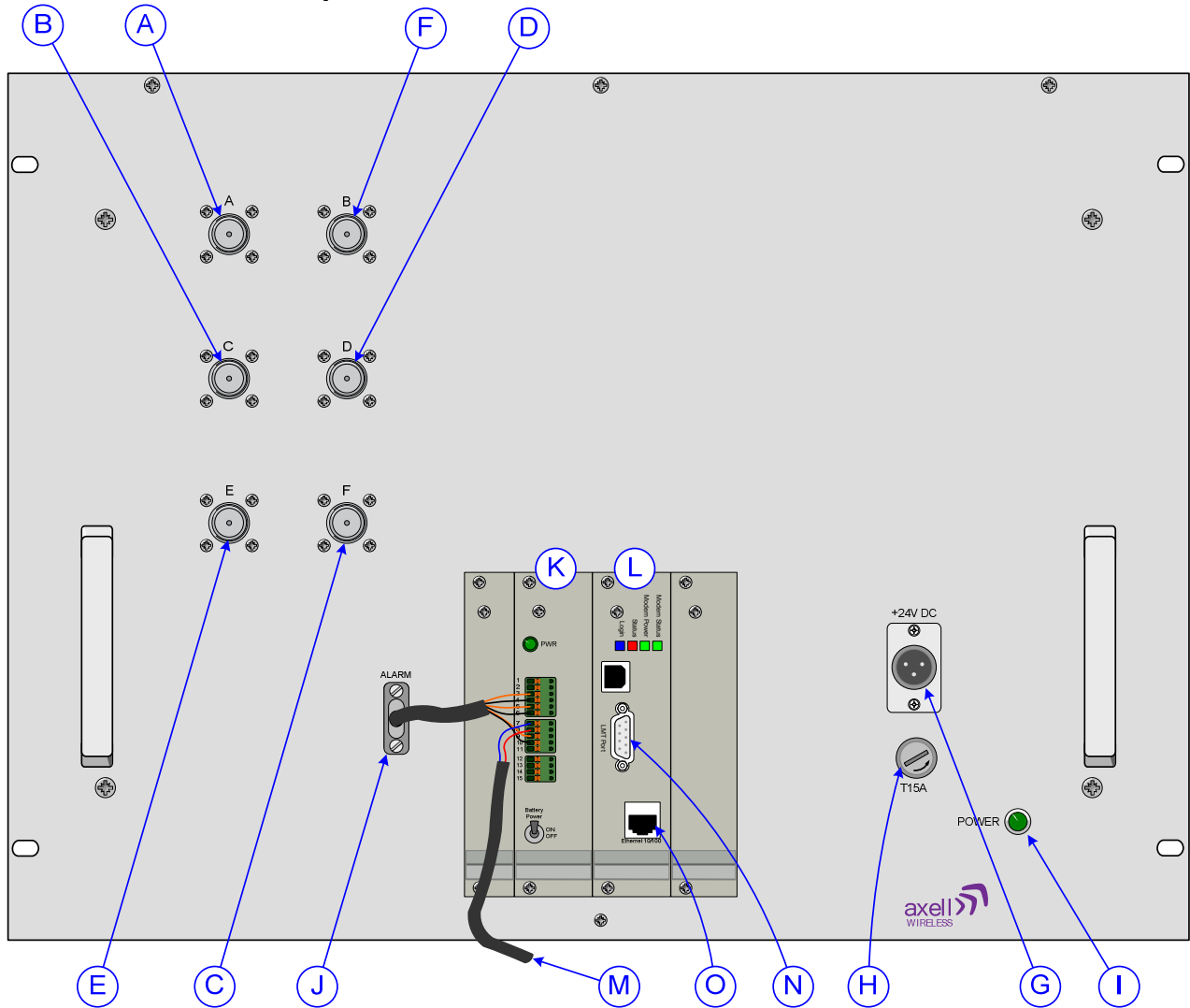
Channel Number	Channel Frequency	Channel Bandwidth
14	492.5125 MHz	12.5 kHz
13	492.5375 MHz	12.5 kHz
2	493.7875 MHz	25.0 kHz
12	493.8375 MHz	12.5 kHz
1	493.8625 MHz	12.5 kHz
11	493.8875 MHz	12.5 kHz
10	493.9125 MHz	12.5 kHz
9	493.9625 MHz	25.0 kHz

4.5.3. 8 Ch. Squelch Gated BDA 60-228704 System Diagram



Date: 19/11/2009	Not to Scale
© AWL 2009	Drawn by: EW/AJS
 endless... seamless... wireless...	Issue: 1
8 Ch. Squelch Gated BDA 60-228704 System Diagram	
Aerial House Ashridge Road Chesham Buckinghamshire HP5 2QD United Kingdom Telephone: +44 (0) 1494 777000 Facsimile: +44 (0) 1494 777002 E-Mail: info@axellwireless.com www.axellwireless.com	
	Page 1 of 1

4.5.4. 8 Ch. Squelch Gated BDA 60-228704 Front View



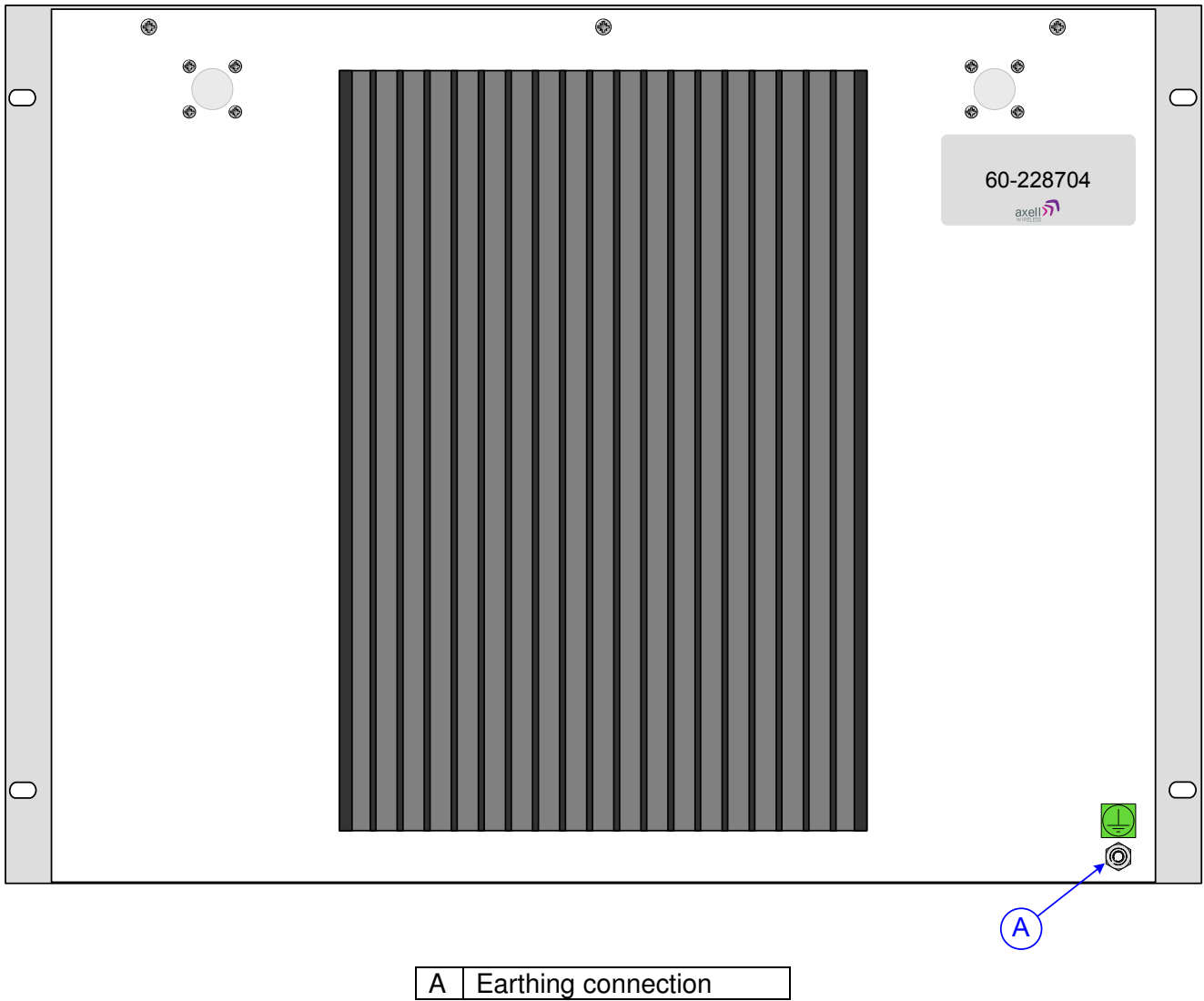
A	N type port "A", Band 1 D/L I/P from Quadplexer (Base) 60-228706
B	N type port "C", Band 1 D/L O/P to Quadplexer (DAS) 60-228706
C	N type port "F", Band 1 D/L O/P to Splitter/Combiner Unit 60-228702 ⁽¹⁾
D	N type port "D", Band 1 U/L I/P from Quadplexer (DAS) 60-228706
E	N type port "E", Band 1 U/L I/P from Splitter/Combiner Unit 60-228702 ⁽²⁾
F	N type port "B", Band 1 U/L O/P to Quadplexer (Base) 60-228706
G	24V DC input from PSU module 96-300091 in PSU shelf 96-300090
H	15A fuse for DC input
I	Green LED "POWER", illuminated during normal operation
J	9 pin "D" panel plug "ALARM" local alarm output
K	External Alarm and Battery Module J1161030 ⁽³⁾
L	Control Module H561003 ⁽³⁾
M	Alarm to Krone Terminal Block on rack
N	9 pin "D" panel socket "LMT Port", A local serial port enabling interrogation of alarm data by PC/laptop
O	RJ45 Ethernet socket enabling interrogation of alarm data by PC/laptop

⁽¹⁾ Coupled from the D/L O/P to port "C"

⁽²⁾ Coupled to the U/L O/P to port "B"

⁽³⁾ For more information on the Control Module H561003 and External Alarm and Battery Module J1161030, see document A1829300.

4.5.5. 8 Ch. Squelch Gated BDA 60-228704 Rear View



4.6. 8 Ch. Squelch Gated BDA 60-228705

8 Ch. Squelch Gated BDA 60-228705 is built into an 8U, 19" rack-mount case.

60-228705 utilizes Software Defined Radio technology to digitally process the signal to define the required channel frequencies and bandwidth (eight channels in the Downlink path and eight in the Uplink path). As part of the digital signal processing function the signal amplitude is monitored to apply squelch functionality to the signal path to attenuate unwanted noise when the input signal level is low. The unit is pre-programmed with the 8 required duplex frequencies and channel bandwidths as indicated in section 4.6.2, these can be modified by the use of RMC software.

Band 2 Downlink RF from Quadplexer (Base) 60-228706 enters the BDA via the N type port labeled "A" (annotated "A" in section 4.6.4.) and the Downlink signal passes through the Downlink path of UHF SDR Module E941030 to define the 8 required Downlink channels.

After passing through the SDR module the Band 2 Downlink signal is split into two equal paths by 3dB Splitter/Combiner 05-002603; The first path passes through the Downlink 25W Power Amplifier 12-026902 which provides 37dB of signal gain and then the signal exits the BDA via the N type port labeled "C" (annotated "B" in section 4.6.4.) on its way to the local DAS by way of Quadplexer (DAS) 60-228706.

The second path from 3dB Splitter/Combiner 05-002603 exits the BDA for Splitter/Combiner Unit 60-228702 (and ultimately the Gallery Place Station CRAS System) via the N type port labeled "F" (annotated "C" in section 4.6.4.)

Band 2 Uplink RF from the local DAS (by way of Quadplexer (DAS) 60-228706) enters the BDA via the N type port labeled "D" (annotated "D" in section 4.6.4.) and passes through 15dB Directional Coupler 90-852315 before entering UHF SDR Module E941030.

Band 2 Uplink RF from Splitter/Combiner Unit 60-228702 (from the Gallery Place Station CRAS System) enters the BDA via the N type port labeled "E" (annotated "E" in section 4.6.4.) and also passes through 15dB Directional Coupler 90-852315 where it is coupled onto the main Uplink signal path which passes through the Uplink path of UHF SDR Module E941030 which utilizes SDR technology to digitally process the signal to define the 8 required Uplink channels. After passing through the SDR module the Band 2 Uplink signal passes through the Uplink 25W Power Amplifier 12-026902 which provides 37dB of signal gain and then the signal exits the BDA via the N type port labeled "B" (annotated "F" in section 4.6.4.) on its way to the BTS by way of Quadplexer (Base) 60-228706.

8 Ch. Squelch Gated BDA 60-228705 is powered by a 24V DC supply from the Redundant PSU Modules 96-300091 in PSU Housing Shelf 96-300090, The 24V DC supply powers the Power Amplifiers and an on-board DC/DC converter J1421001 steps down the 24V supply to provide 6.45v and 15v DC to power the SDR, Controller and Ext. Alarm/battery modules within the BDA.

Each of the Power Amplifiers have alarm outputs which are summed at the 9 way "D" panel plug labeled "ALARM" on the front panel (annotated "J" in section 4.6.4.), the alarm data is connected to the External Alarm and Battery Module J1161030 (annotated "K" in section 4.6.4.), from where the summary alarm data is fed to the Krone terminal block located near the top of the rack (see section 4.3.2.).

The SDR controller module H561003 is used to control and supervise the SDR functionality, two ports are provided where an operator may connect into the system, a local serial port, (a 9 way "D" panel socket annotated "N" in section 4.6.4.) is used with a laptop PC running suitable terminal-emulation software to interrogate and control the equipment using GET and SET commands. Alternatively the equipment can be configured using RMC software via the RJ45 ethernet port (annotated "O" in section 4.6.4.) To ensure synchronous communications between the SDR and the H56 controller, a high stability 10MHz reference generator, R031002 is incorporated in the equipment backplane.

4.6.1 8 Ch. Squelch Gated BDA 60-228705 List of Major Sub Components

Component Part	Part Description	Qty Per Assembly
05-002603	3dB Splitter/Combiner	1
12-026902	25W Power Amplifier	2
19-002202	Interconnection Assembly	1
90-852315	15dB Directional Coupler	1
96-110015	15A Fuse	1
E941030	UHF SDR Module (495.5 - 500.5MHz)	1
H561003	Control Module	1
J1161030	External Alarm and Battery Module	1
J1421001	DC/DC Converter	1
R031002	Reference Generator	1

4.6.2. 8 Ch. Squelch Gated BDA 60-228705 Specification

PARAMETER	SPECIFICATION
Downlink	
Frequency Range	496.3MHz to 496.7MHz
No of Channels	8 ⁽¹⁾
Maximum Gain	>+95 dB
Passband ripple	≤ ±1.5 dB
ALC Setting (all channels on)	+28 ±1 dBm
ALC Dynamic Range	>30 dB
Switched attenuator	0dB to 30 dB in 2dB steps ± 1dB
Noise Figure	≤ 4.5 dB (at maximum gain)
In Band Spurious Noise (30kHz B/W)	< -36 dBm (at maximum gain)
Squelch Level	-95dBm ± 2 dBm
Uplink	
Frequency Range	499.3MHz to 499.7MHz
No of Channels	8 ⁽²⁾
Maximum Gain	>+95
Passband ripple	≤ ±1.5 dB
ALC Setting (all channels on)	+23 ±1 dBm
ALC Dynamic Range	>30 dB
Switched attenuator	0dB to 30 dB in 2dB steps ± 1dB
Noise Figure	≤ 4.5 dB (at maximum gain)
In Band Spurious Noise (30kHz B/W)	< -36 dBm (at maximum gain)
Squelch Level	-95 ± 2 dBm
General	
Supply Voltage	24V DC
Current consumption	< 12 A
Alarm output Summary volts free dry contact output (Closed = Normal / Open = Alarm)	pins 7 & 8 - Alarm connector terminal on External Alarm and Battery Module J1161030

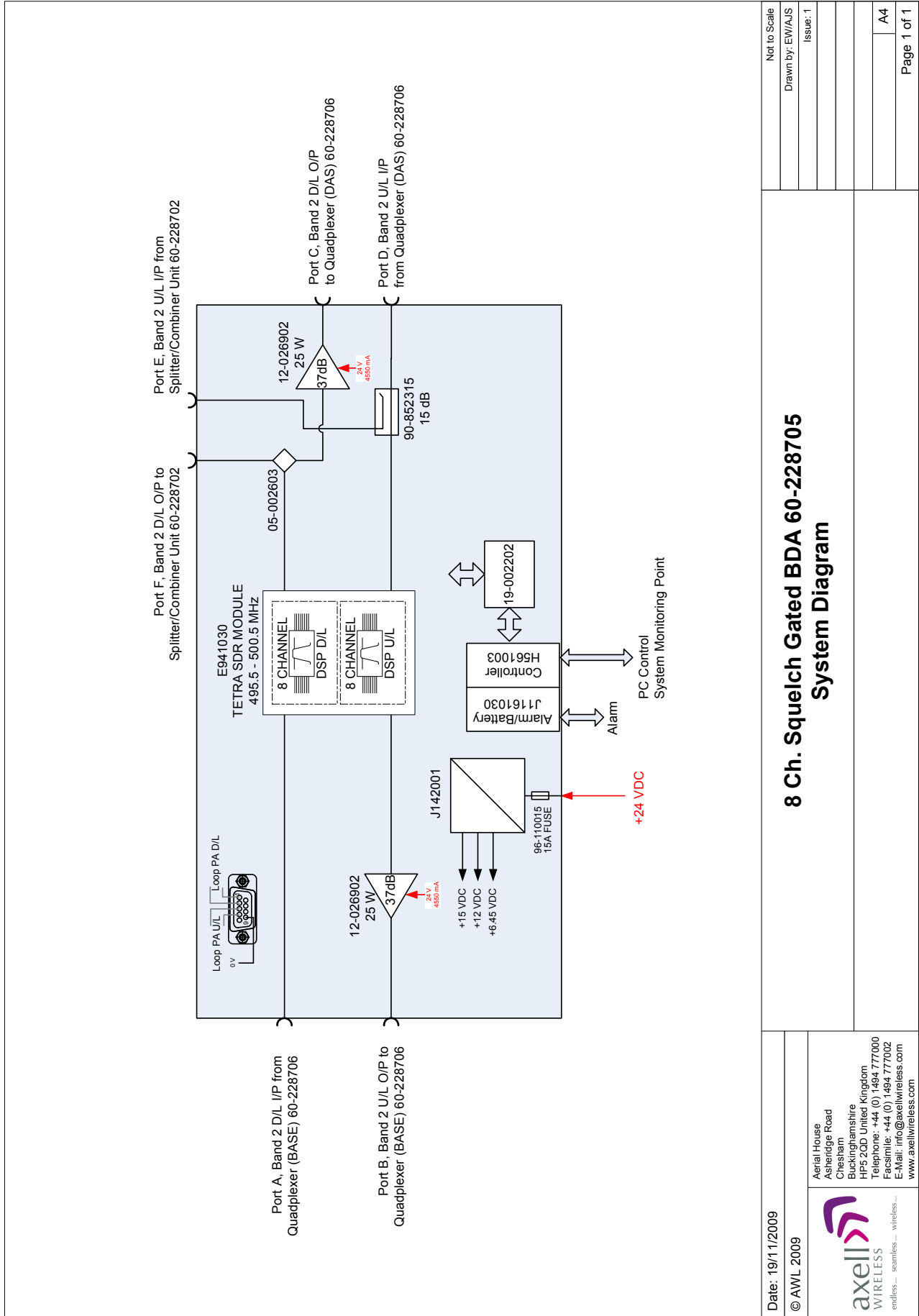
⁽¹⁾Downlink Channels

Channel Number	Channel Frequency	Channel Bandwidth
8	496.3375 MHz	25.0 kHz
3	496.4375 MHz	25.0 kHz
7	496.4875 MHz	12.5 kHz
Paging	496.5125 MHz	12.5 kHz
4	496.5375 MHz	12.5 kHz
6	496.5626 MHz	12.5 kHz
15	496.5875 MHz	12.5 kHz
5	496.6125 MHz	12.5 kHz

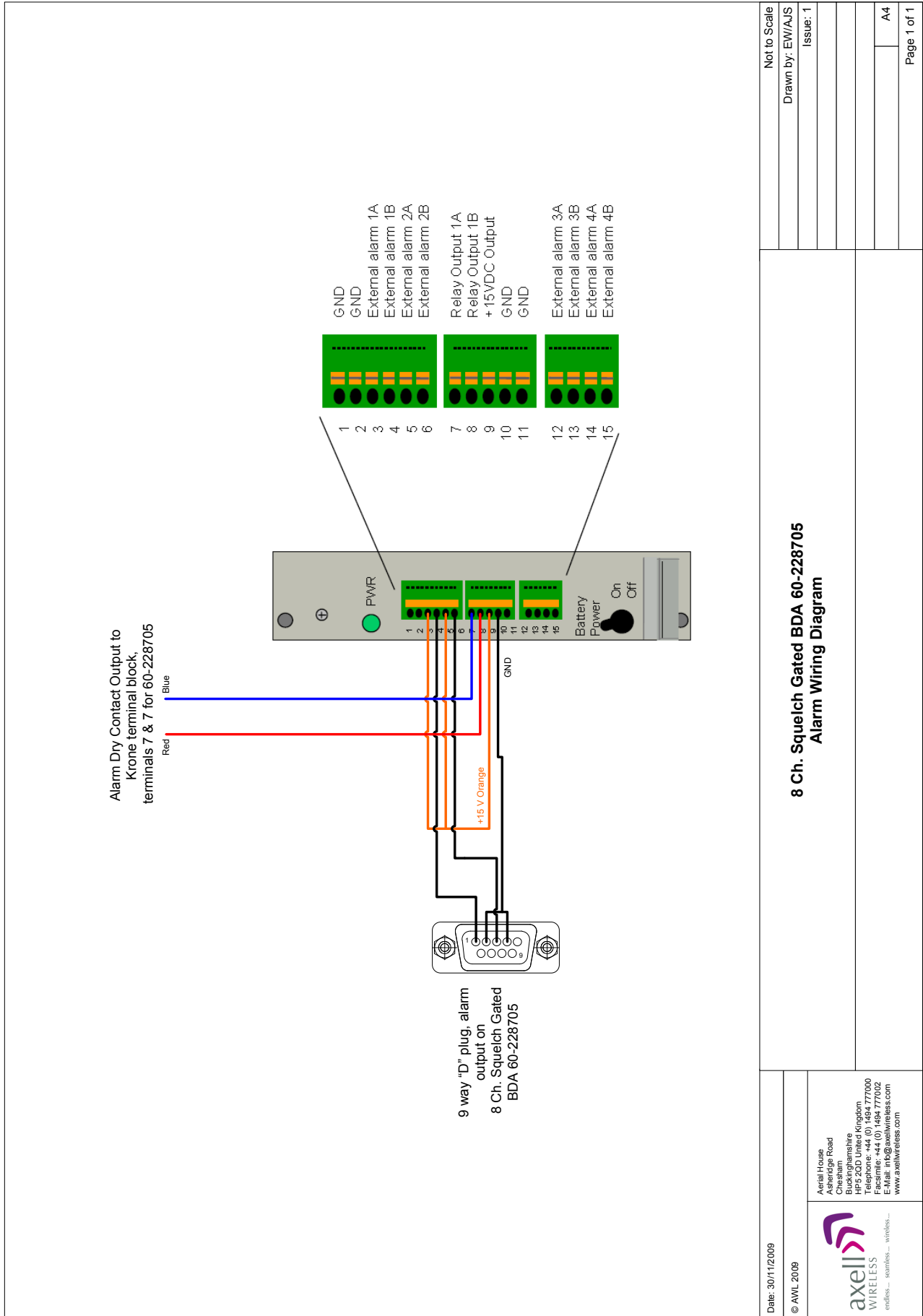
⁽²⁾Uplink Channels

Channel Number	Channel Frequency	Channel Bandwidth
8	499.3375 MHz	25.0 kHz
3	499.4375 MHz	25.0 kHz
7	499.4875 MHz	12.5 kHz
Paging	499.5125 MHz	12.5 kHz
4	499.5375 MHz	12.5 kHz
6	499.5626 MHz	12.5 kHz
15	499.5875 MHz	12.5 kHz
5	499.6125 MHz	12.5 kHz

4.6.3. 8 Ch. Squelch Gated BDA 60-228705 System Diagram

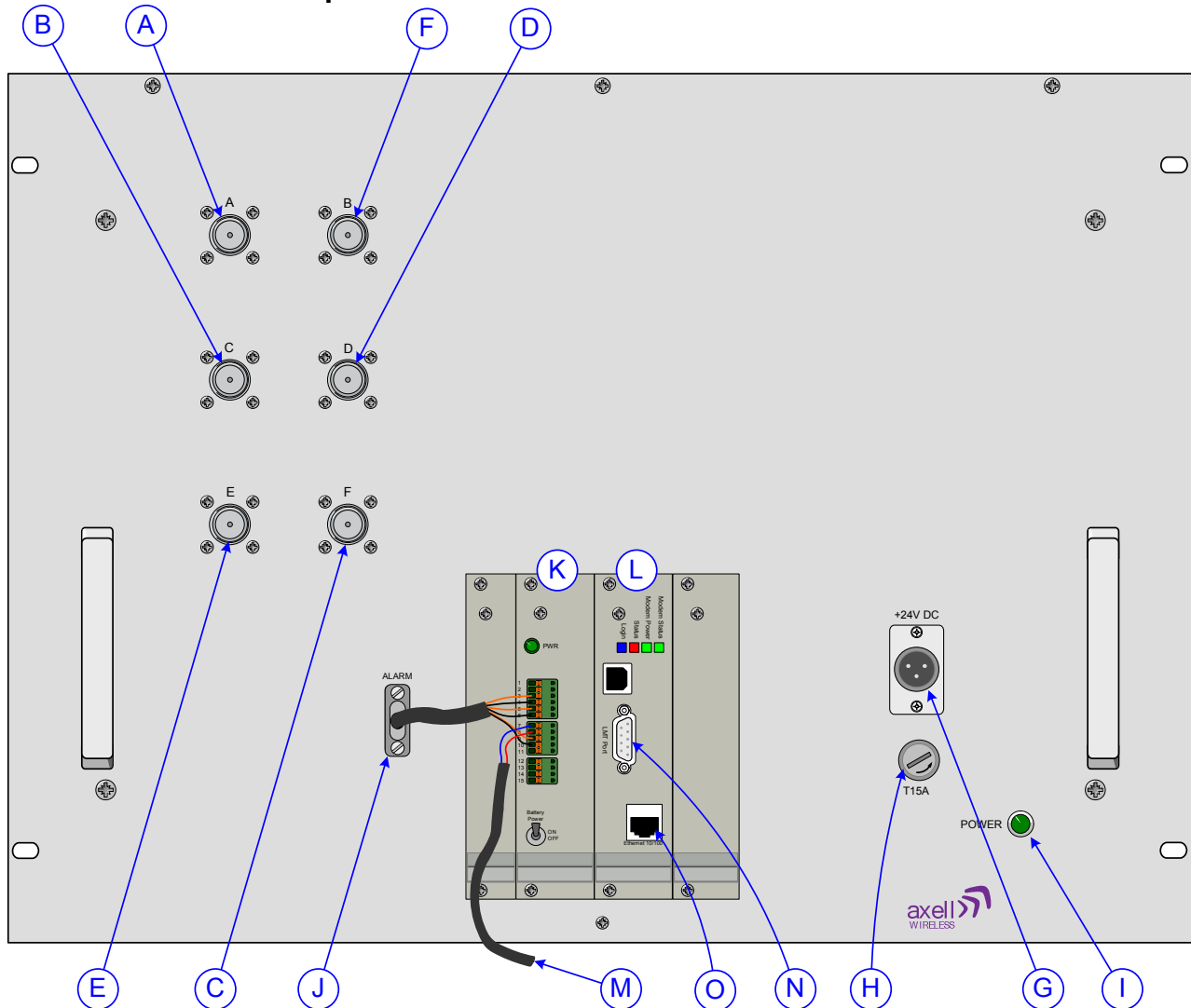


4.6.3.1. 8 Ch. Squelch Gated BDA 60-228705 Alarm Wiring Diagram



Not to Scale	
Drawn by: EW/AJS	Issue: 1
8 Ch. Squelch Gated BDA 60-228705 Alarm Wiring Diagram	
<p>Aerial House Asheridge Road Chesham Buckinghamshire HP5 2GD United Kingdom Telephone: +44 (0) 1494 77009 Facsimile: +44 (0) 1494 77002 E-Mail: info@axellwireless.com www.axellwireless.com</p>	
Date: 30/11/2009	© AWL 2009
<p>endless... seamless... wireless...</p>	
Page 1 of 1	

4.6.4. 8 Ch. Squelch Gated BDA 60-228705 Front View



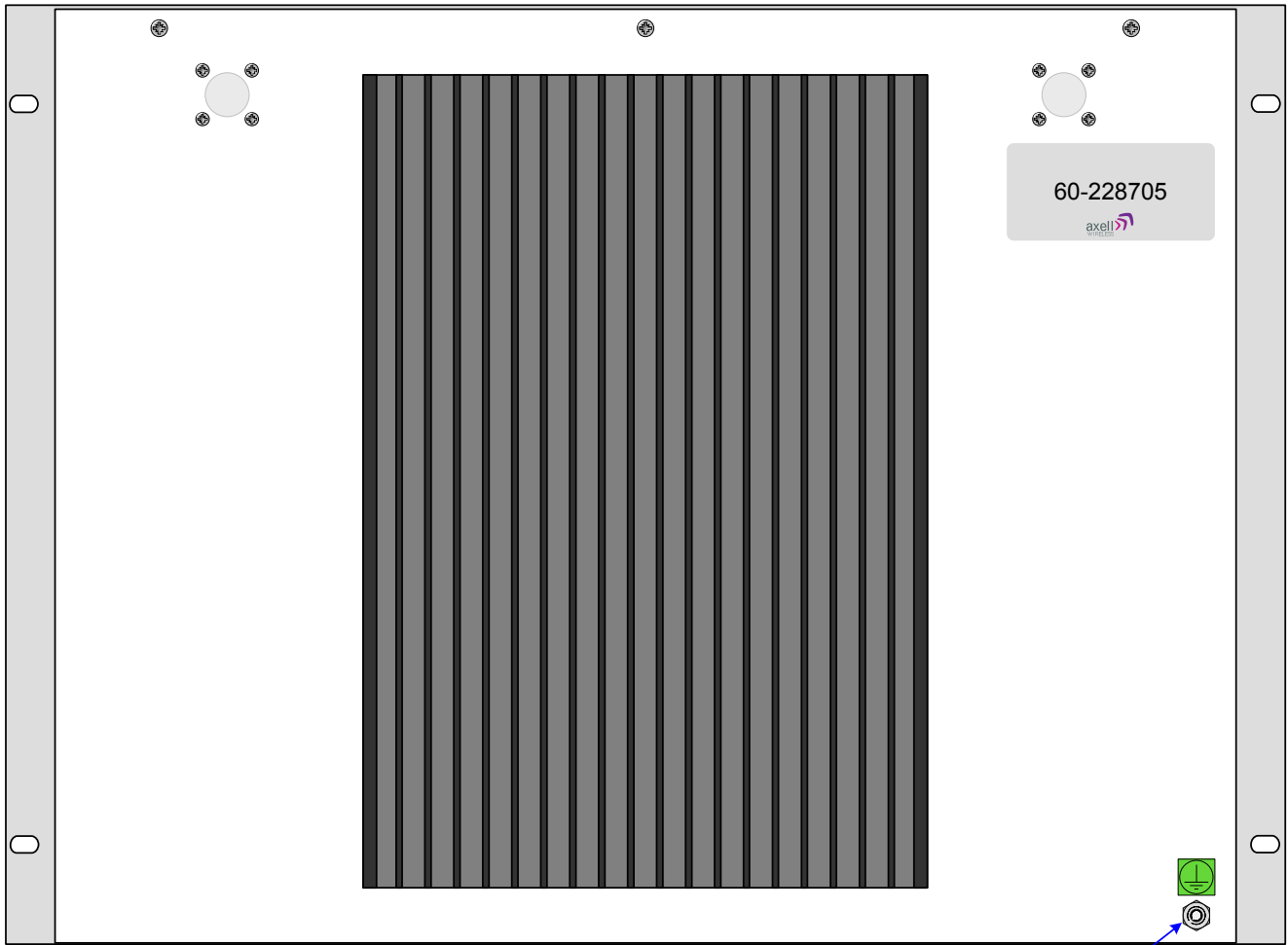
A	N type port "A", Band 2 D/L I/P from Quadplexer (Base) 60-228706
B	N type port "C", Band 2 D/L O/P to Quadplexer (DAS) 60-228706
C	N type port "F", Band 2 D/L O/P to Splitter/Combiner Unit 60-228702 ⁽¹⁾
D	N type port "D", Band 2 U/L I/P from Quadplexer (DAS) 60-228706
E	N type port "E", Band 2 U/L I/P from Splitter/Combiner Unit 60-228702 ⁽²⁾
F	N type port "B", Band 2 U/L O/P to Quadplexer (Base) 60-228706
G	24V DC input from PSU module 96-300091 in PSU shelf 96-300090
H	15A fuse for DC input
I	Green LED "POWER", illuminated during normal operation
J	9 pin "D" panel plug "ALARM" local alarm output
K	External Alarm and Battery Module J1161030 ⁽³⁾
L	Control Module H561003 ⁽³⁾
M	Alarm to Krone Terminal Block on rack
N	9 pin "D" panel socket "LMT Port", A local serial port enabling interrogation of alarm data by PC/laptop
O	RJ45 Ethernet socket enabling interrogation of alarm data by PC/laptop

⁽¹⁾ Coupled from D/L O/P to port "C"

⁽²⁾ Coupled to U/L O/P to port "B"

⁽³⁾ For more information on the Control Module H561003 and External Alarm and Battery Module J1161030, see document A1829300.

4.6.5. 8 Ch. Squelch Gated BDA 60-228705 Rear View



A | Earthing connection

4.7. Splitter/Combiner Unit 60-228702

Splitter/Combiner Unit 60-228702 is built into a 2U, 19" rack-mount case.

Band 1 Downlink RF from 8 Ch. Squelch Gated BDA 60-228704 enters the Splitter/Combiner Unit via the N type port labeled "A" (annotated "A" in section 4.7.4.) and passes into the Downlink 3dB Splitter/Combiner 05-002603.

Band 2 Downlink RF from 8 Ch. Squelch Gated BDA 60-228705 enters the Splitter/Combiner Unit via the N type port labeled "B" (annotated "B" in section 4.7.4.) and also passes into the Downlink 3dB Splitter/Combiner 05-002603 which combines the two Downlink paths and the combined path then passes through the Downlink Variable Switched Attenuator 10-000901 (annotated "A" in section 4.7.5.) which can provide up to 15dB of signal gain (in 1dB steps) if required; the attenuation value is controlled by the four toggle switches on the attenuator body; each switch is clearly marked with the attenuation it provides, and the total attenuation in-line is the sum of the values switched in.

After passing through the Downlink attenuator the Downlink signal exits the Splitter/Combiner for Dual Fiber Optic Unit 60-228703 via the N type port labeled "TX" (annotated "C" in section 4.7.4.).

Uplink RF from Dual Fiber Optic Unit 60-228703 enters the Splitter/Combiner via the N type port labeled "RX" (annotated "D" in section 4.7.4.) and the Uplink signal passes through the Uplink Variable Switched Attenuator 10-000701 (annotated "B" in section 4.7.5.) which can provide up to 30dB of signal gain (in 2dB steps) if required; the attenuation value is controlled by the four toggle switches on the attenuator body; each switch is clearly marked with the attenuation it provides, and the total attenuation in-line is the sum of the values switched in.

After passing through the Uplink attenuator the signal path passes into the Uplink 3dB Splitter/Combiner 05-002603 which splits the signal into two equal paths, One path (Band 1) exits Splitter/Combiner Unit 60-228702 for 8 Ch. Squelch Gated BDA 60-228704 via the N type port labeled "C" (annotated "E" in section 4.7.4.) and the second path (Band 2) exits Splitter/Combiner Unit 60-228702 for 8 Ch. Squelch Gated BDA 60-228705 via the N type port labeled "D" (annotated "F" in section 4.7.4.).

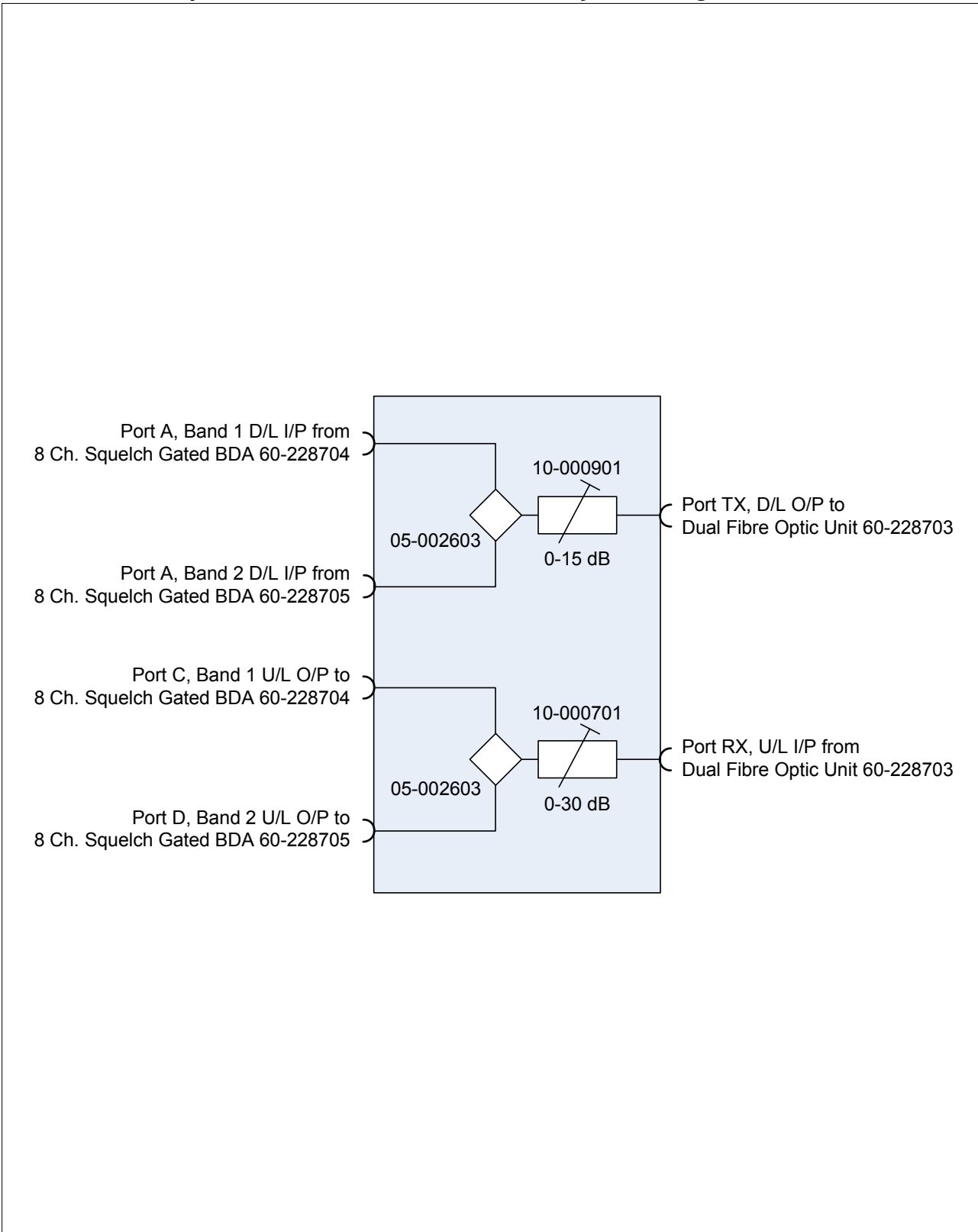
4.7.1. Splitter/Combiner Unit 60-228702 List of Major Sub-Components

Component Part	Part Description	Qty Per Assembly
05-002603	3dB Splitter/Combiner	2
10-000701	Variable Switched Attenuator 0-30dB	1
10-000901	Variable Switched Attenuator 0-15dB	1

4.7.2. Splitter/Combiner Unit 60-228702 Specification

PARAMETER	SPECIFICATION
Downlink	
Frequency range	Band 1, 489.5MHz to 491.0MHz Band 2, 496.3MHz to 496.7MHz
Switched attenuator	0dB to 15 dB in 1dB steps
Uplink	
Frequency range	Band 1, 492.5MHz to 494.0MHz Band 2, 499.3MHz to 499.7MHz
Switched attenuator	0dB to 30 dB in 2 dB steps

4.7.3. Splitter/Combiner Unit 60-228702 System Diagram



Date: 26/11/2009
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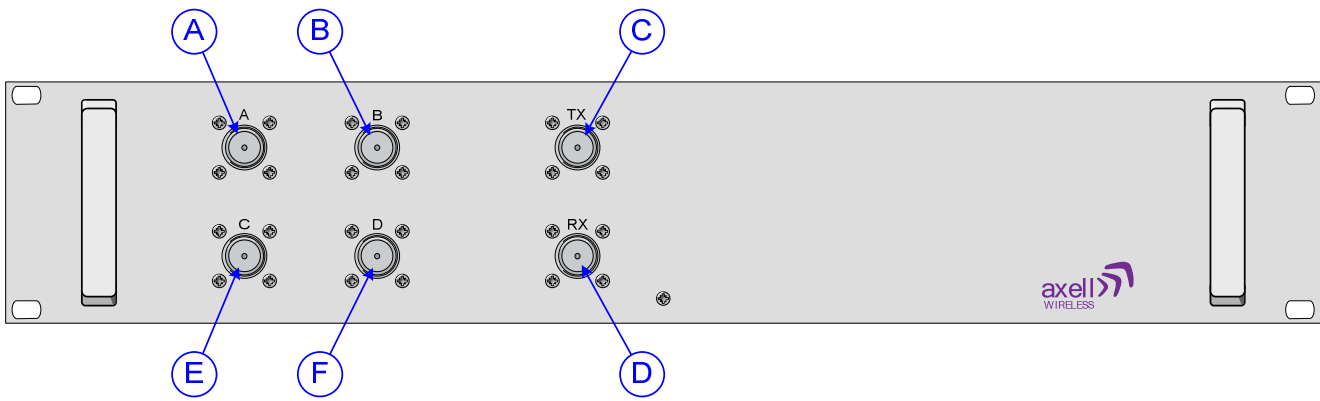
axell
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**Splitter/Combiner Unit 60-228702
 System Diagram**

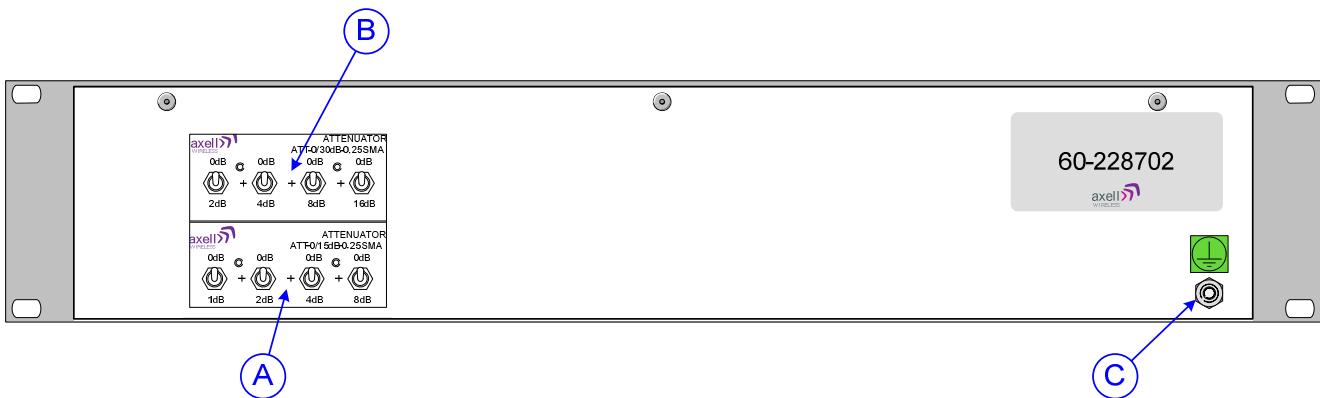
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 Drawn by: EW/AJS
 Issue: 1
 A4
 Page 1 of 1

4.7.4. Splitter/Combiner Unit 60-228702 Front View



A	N type port "A", D/L I/P from 8 Ch. Squelch Gated BDA 60-228704
B	N type port "B", D/L I/P from 8 Ch. Squelch Gated BDA 60-228705
C	N type port "TX" D/L O/P to Dual Fiber Optic Unit 60-228703
D	N type port "RX" U/L I/P from Dual Fiber Optic Unit 60-228703
E	N type port "C", U/L O/P to 8 Ch. Squelch Gated BDA 60-228704
F	N type port "D", U/L O/P to 8 Ch. Squelch Gated BDA 60-228705

4.7.5. Splitter/Combiner Unit 60-228702 Rear View



A	Downlink Variable Switched Attenuator 10-000901 (0-15dB)
B	Uplink Variable Switched Attenuator 10-000701 (0-30dB)
C	Earthing connection

4.8. Dual Fiber Optic Unit 60-228703

Dual Fiber Optic Unit 60-228703 is built into a 2U, 19" rack-mount case.

Downlink RF from Splitter/Combiner Unit 60-228702 enters the Dual Fiber Optic Unit via the N type port labeled "TX 1" (annotated "A" in section 4.8.4.) and passes through a 20dB Directional Coupler 90-852420 which couples off a small portion of the signal and feeds it to the N type port labeled "MON -20dB TX 1" (annotated "B" in section 4.8.4.) which provides a 20dB test/monitor port for the Downlink input.

The main Downlink path then passes into a Fiber Optic Transmitter Module 20-005401 where the RF signal is modulated onto a laser and the optical signal thus produced then exits the Dual Fiber Optic Unit via the SC/APC optical port 1 "TX" (annotated "C" in section 4.8.4.) and is transmitted to the Gallery Place Station CRAS System via a fiber optic cable link, this is the Main Redundant optical Downlink signal.

The N type port labeled "TX 2" (annotated "D" in section 4.8.4.) is a Downlink input to a separate, parallel, Standby Redundant Downlink path with its own Directional Coupler, test monitor port (annotated "E" in section 4.8.4.) and Fiber Optic Transmitter Module. The Optical output from the Standby Redundant Downlink path exits the Dual Fiber Optic Unit via the SC/APC optical port 2 "TX" (annotated "F" in section 4.8.4.) Switching between the Main Redundant and Standby Redundant Downlink paths is accomplished manually by disconnecting the Downlink RF input from the "TX 1" port and connecting it to the "TX 2" port, and by disconnecting the optical Downlink output cable from the SC/APC optical port 1 "TX" and connecting it to the SC/APC optical port 2 "TX". N.B. The safety precautions noted in section 2 must be observed when changing from Main to Standby Redundant.

The Main Redundant Uplink optical signal from the Gallery Place Station CRAS System enters the Dual Fiber Optic Unit via the SC/APC optical port 1 "RX" (annotated "G" in section 4.8.4.) and passes into a Fiber Optic Receiver Module 20-005501 which demodulates the Uplink signal to RF and the Uplink RF signal then passes through a 20dB Directional Coupler 90-852420 which couples off a small portion of the signal and feeds it to the N type port labeled "MON -20dB RX 1" (annotated "I" in section 4.8.4.) which provides a 20dB test/monitor port for the Main Redundant Uplink output. The Main Redundant Uplink path then exits the Dual Fiber Optic Unit for Splitter/Combiner Unit 60-228702 via the N type port labeled "RX 1" (annotated "H" in section 4.8.4.)

The SC/APC optical port 2 "RX" (annotated "J" in section 4.8.4.) is an Uplink input to a separate, parallel, Standby Redundant Uplink path with its own Fiber Optic Receiver Module, Directional Coupler and test/monitor port (annotated "L" in section 4.8.4.) The RF output from the Standby Redundant Uplink path exits the Dual Fiber Optic Unit for Splitter/Combiner Unit 60-228702 via the N type port labeled "RX 2" (annotated "K" in section 4.8.4.)

Switching between the Main Redundant and Standby Redundant Uplink paths is accomplished manually by disconnecting the optical Uplink input cable from the SC/APC optical port 1 "RX" and connecting it to the SC/APC optical port 2 "RX", and by disconnecting the Uplink RF output from the "RX 1" port and connecting it to the "RX 2" port. N.B. The safety precautions noted in section 2 must be observed when changing from Main to Standby Redundant.

Dual Fiber Optic Unit 60-228703 is powered by a 24V DC supply from one of the PSU Modules 96-300091 in PSU Housing Shelf 96-300090, The 24V DC supply powers two on-board DC/DC converters 96-200024 arranged in a parallel dual redundant configuration, the outputs of which are combined by power diodes to provide a 12V DC supply for the fiber optic modules within the unit

An alarm system is fitted to Dual Fiber Optic Unit 60-228703, each of the fiber optic modules carries its own voltage-free contact alarm relay output which are summed at the 15 way "D" panel plug labeled "ALARM" (annotated "EE" in section 4.8.4.) which connects to the Krone terminal block located near the top of the rack (see section 4.3.2.).

4.8.1. Dual Fiber Optic Unit 60-228703 List of Major Sub-Components

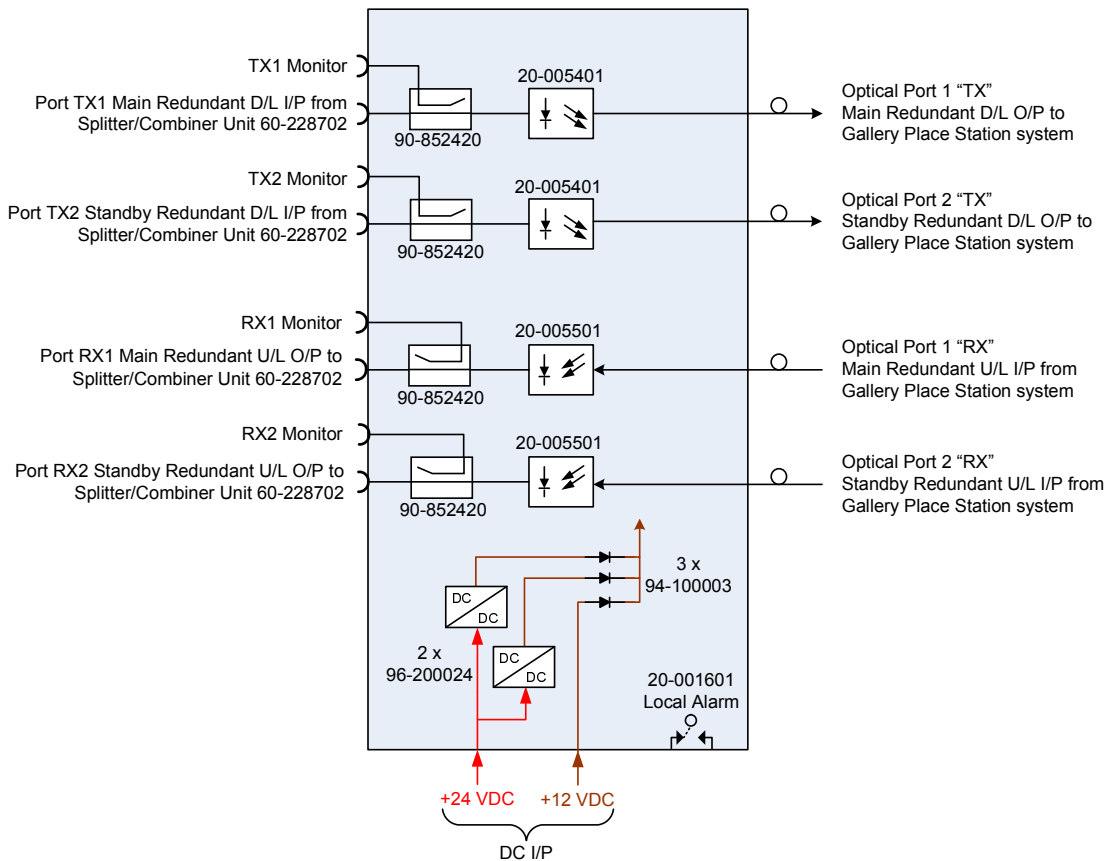
Component Part	Part Description	Qty Per Assembly
20-001601	12V Dual Relay Board	1
20-005401	Fiber Optic Transmitter Module	2
20-005501	Fiber Optic Receiver Module	2
96-110013	3.15 A Fuse	2
96-200024	DC/DC Converter	2
90-852420	20dB Directional Coupler	4
94-100003	Power Diode	3

4.8.2. Dual Fiber Optic Unit 60-228703 Specification

PARAMETER	SPECIFICATION
RF Downlink	
Frequency range	489.5MHz to 491.0MHz 496.3MHz to 496.7MHz
Coupling TX1 to Mon TX1	20 dB±1
Coupling TX2 to Mon TX2	20 dB±1
Optical Downlink	
Wavelength	1310nm
TX(A) Optical TX Power	1-3 dBm
TX(B) Optical TX Power	1-3 dBm
Optical Uplink	
Wavelength	1550nm
RX(A) Gain	>+15 dB
RX(A) Gain Set To	0 dB±0.5
RX(A) Alarm Threshold	< -10dBm
RX(B) Gain	>+15 dB
RX(A) Gain Set To	0 dB±0.5
RX(B) Alarm Threshold	< -10dBm
RF Uplink	
Frequency range	499.3MHz to 499.7MHz 492.5MHz to 494.0MHz
Coupling RX1 to Mon RX1	20 dB±1
Coupling RX2 to Mon RX2	20 dB±1
General	
Supply Voltage	12V DC or 24V DC
Current consumption	< 1.0A @ 24V DC input < 1.5A @ 12V DC input
Alarm output Summary volts free dry contact output (Closed = Normal / Open = Alarm)	F/O TX1 contact output Pin 1 & 2
	F/O TX2 contact output Pin 3 & 4
	F/O RX1 contact output Pin 5 & 6
	F/O RX1 contact output Pin 7 & 8
	24V DC-DC contact output Pin 9 & 10**

**This alarm is not operational when the unit is powered from 12V DC

4.8.3. Dual Fiber Optic Unit 60-228703 System Diagram



Date: 8/12/2009
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Dual Fibre Optic Unit 60-228703 System Diagram (Carmen Turner Facility System)

Not to Scale
 Drawn by: EW/AJS
 Issue: 2

A4
 Page 1 of 1

4.8.3.1. Dual Fiber Optic Unit 60-228703 Alarm Outputs

15 pin “D” panel plug “ALARM”, local alarm output to Krone terminal block on rack (annotated “EE” in section 3.8.4.)

Dry Contact Outputs (Closed = Normal / Open = Alarm)

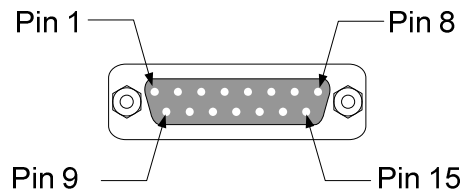
F/O TX1 contact output Pin 1 & 2

F/O TX2 contact output Pin 3 & 4

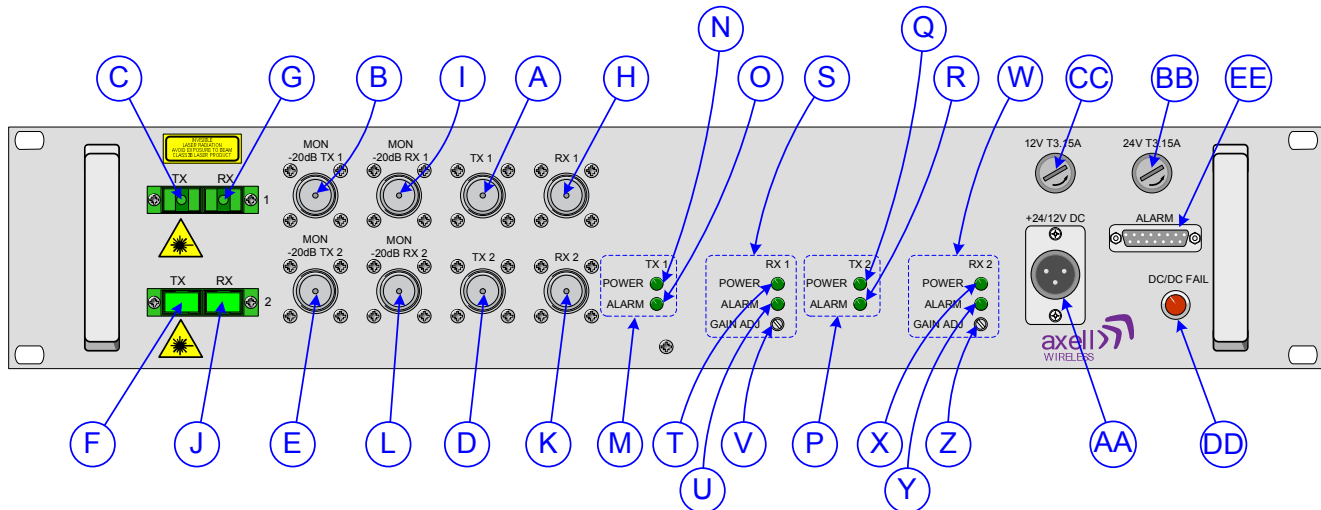
F/O RX1 contact output Pin 5 & 6

F/O RX1 contact output Pin 7 & 8

24V DC>DC contact output Pin 9 & 10

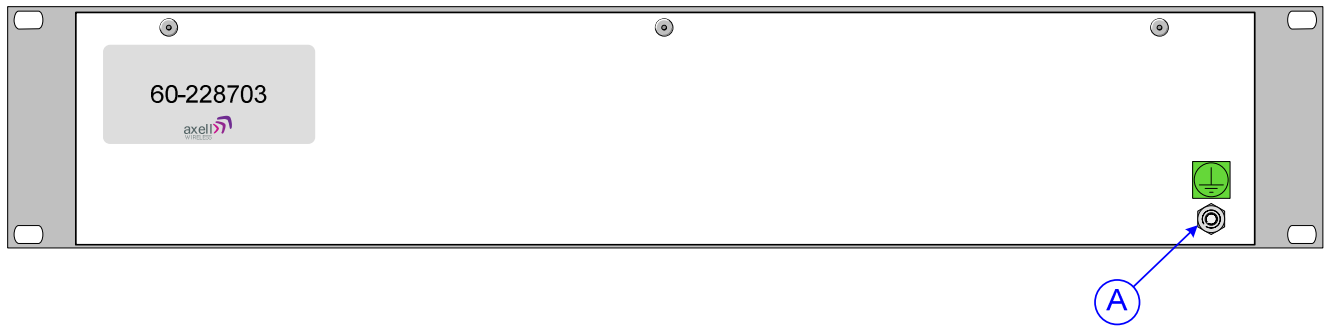


4.8.4. Dual Fiber Optic Unit 60-228703 Front View



A	N type port "TX1", Main Redundant D/L I/P from Splitter/Combiner Unit 60-228702
B	N type port "MON -20dB TX 1", 20dB test/monitor port coupled from D/L input to port "TX1"
C	SC/APC optical port 1 "TX", Main Redundant optical D/L O/P to Gallery Place Station CRAS System
D	N type port "TX2", Standby Redundant D/L I/P from Splitter/Combiner Unit 60-228702
E	N type port "MON -20dB TX 2", 20dB test/monitor port coupled from standby D/L input to port "TX2"
F	SC/APC optical port 2 "TX", Standby Redundant optical D/L O/P to Gallery Place Station CRAS System
G	SC/APC optical port 1 "RX", Main Redundant optical U/L I/P from Gallery Place Station CRAS System
H	N type port "RX1", Main Redundant U/L O/P to Splitter/Combiner Unit 60-228702
I	N type port "MON -20dB RX 1", 20dB test/monitor port coupled from U/L output to port "RX1"
J	SC/APC optical port 2 "RX", Standby Redundant optical U/L I/P from Gallery Place Station CRAS System
K	N type port "RX2", Standby Redundant U/L O/P to Splitter/Combiner Unit 60-228702
L	N type port "MON -20dB RX 2", 20dB test/monitor port coupled from standby U/L output to port "RX2"
M	Status Indicators for F/O TX Module 1 (Main Redundant D/L to Gallery Place Station CRAS System)
N	Green LED "POWER", Fiber Optic TX Power On indicator illuminated during normal operation
O	Green LED "ALARM", Fiber Optic TX Alarm indicator extinguished during alarm state
P	Status Indicators for F/O TX Module 2 (Standby Redundant D/L to Gallery Place Station CRAS System)
Q	Green LED "POWER", Fiber Optic TX Power On indicator illuminated during normal operation
R	Green LED "ALARM", Fiber Optic TX Alarm indicator extinguished during alarm state
S	Status Indicators for F/O RX Module 1 (Main Redundant U/L from Gallery Place Station CRAS System)
T	Green LED "POWER", Fiber Optic RX Power On indicator illuminated during normal operation
U	Green LED "ALARM", Fiber Optic RX Alarm indicator extinguished during alarm state
V	Fiber Optic RX RF gain adjustment
W	Status Indicators for F/O RX Module 2 (Standby Redundant U/L from Gallery Place Station CRAS System)
X	Green LED "POWER", Fiber Optic RX Power On indicator illuminated during normal operation
Y	Green LED "ALARM", Fiber Optic RX Alarm indicator extinguished during alarm state
Z	Fiber Optic RX RF gain adjustment
AA	DC input (12V or 24V)
BB	3.15A Fuse for 24V DC input
CC	3.15A Fuse for 12V DC input
DD	Red LED "DC/DC FAIL" illuminated in alarm state (DC/DC convertor failure)
EE	15 pin "D" panel plug "ALARM" local alarm output to Krone terminal block on rack

4.8.5. Dual Fiber Optic Unit 60-228703 Rear View



A | Earthing connection

4.9. Quadplexer (DAS) 60-228706

Quadplexer (DAS) 60-228706 is built into a 4U, 19" rack-mount case

Band 1 Downlink RF from the 8 Ch. Squelch Gated BDA 60-228704 enters the shelf via the N type port labeled "A" (annotated "A" in section 4.9.4.) and passes through a Bandpass Filter 02-016801 which is tuned to pass the Band 1 Downlink passband of 489.5MHz to 491.0MHz and to reject out-of-band signals and noise. The Band 1 Downlink link path is then combined with that of the Band 1 Uplink path by means of critical harness.

Band 2 Downlink RF from the 8 Ch. Squelch Gated BDA 60-228705 enters the shelf via the N type port labeled "C" (annotated "B" in section 4.9.4.) and passes through a Bandpass Filter 02-013401 which is tuned to pass the Band 2 Downlink passband of 496.3MHz to 496.7MHz and to reject out-of-band signals and noise.

The Band 2 Downlink link path is then combined with that of the Band 2 Uplink path by means of critical harness and the High and Band 1 Downlink paths are then combined again by means of critical harness and the combined Downlink path passes through 30dB Directional Coupler 90-852330 which couples off a small portion of the Downlink signal and feeds it to the N type port labeled "MONITORING" (annotated "D" in section 4.9.4.) providing a 30dB test/monitor port for the Downlink signal.

The main Downlink signal then exits the shelf via the N type port labeled "DAS" (annotated "C" in section 4.9.4.) and the signal is fed to the N type connector labeled "DAS PORT" on the rack lid (annotated "C" in section 4.3.3.).

Uplink RF from the DAS enters the rack via the N type connector labeled "DAS PORT" on the rack lid (annotated "C" in section 4.3.3.) and the signal is fed to the N type port on the Quadplexer front panel labeled "DAS" (annotated "C" in section 4.9.4.). The signal path passes through 30dB Directional Coupler 90-852330 which is used to provide a test/monitor port for the Downlink signal and then the signal path is split into two branches (Band 2 and Band 1) by means of critical harness.

The Band 1 branch is then further split by critical harness into Uplink and Downlink paths and the Band 1 Uplink path passes through a Bandpass Filter 02-016801 which is tuned to pass the Band 1 Uplink passband of 492.5MHz to 494.0MHz and to reject out-of-band signals and noise.

The Band 2 branch is also further split by critical harness into Uplink and Downlink paths and the Band 2 Uplink path passes through a Bandpass Filter 02-013401 which is tuned to pass the Band 2 Uplink passband of U/L 499.3MHz to 499.7MHz and to reject out-of-band signals and noise.

The two Uplink paths, High and Band 1 then exit the Quadplexer for their respective BDAs; the Band 1 Uplink exits the shelf for 8 Ch. Squelch Gated BDA 60-228704 via the N type port labeled "B" (annotated "E" in section 4.9.4.) and the Band 2 Uplink exits the shelf for 8 Ch. Squelch Gated BDA 60-228705 via the N type port labeled "D" (annotated "F" in section 4.9.4.)

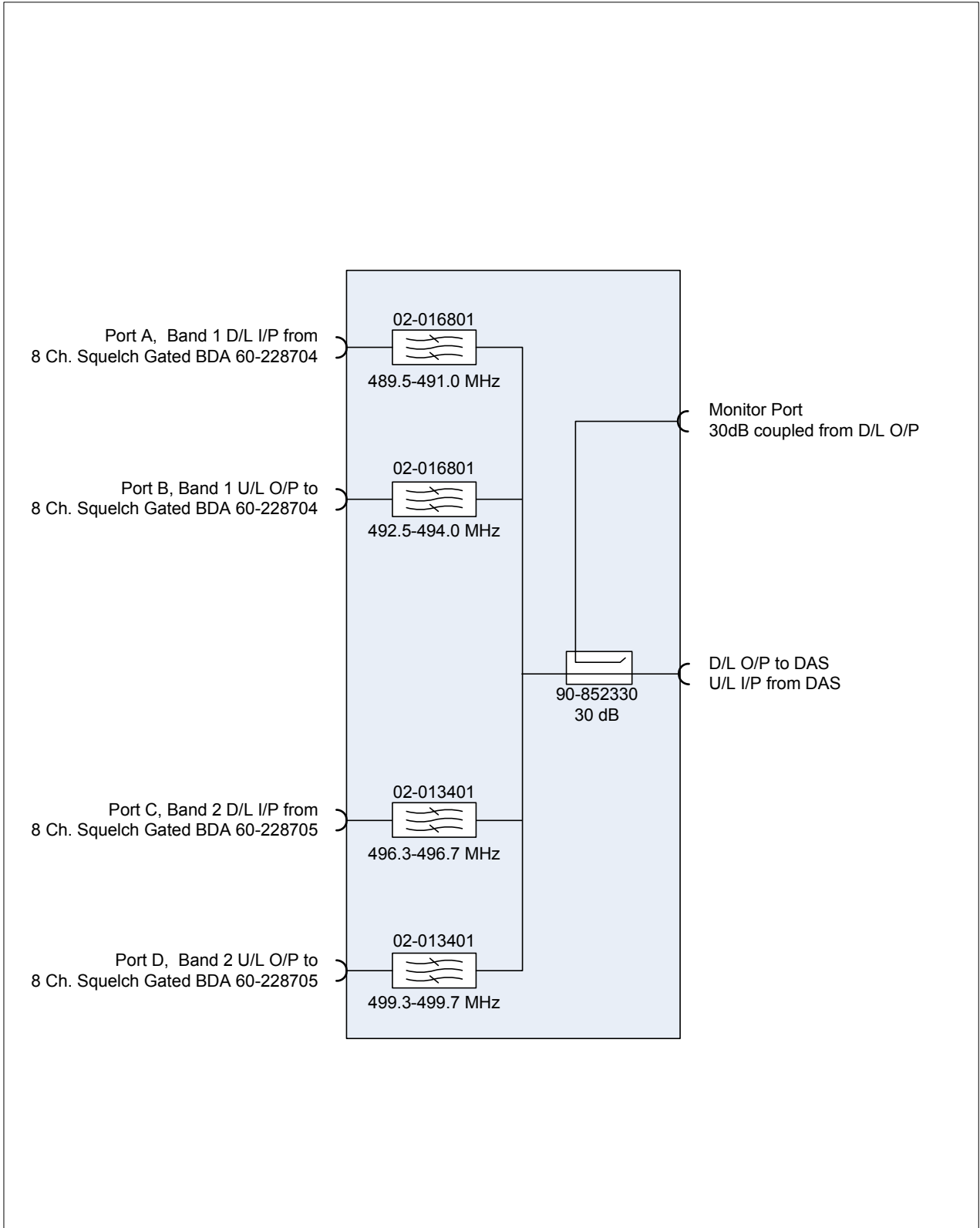
4.9.1. Quadplexer (DAS) 60-228706 List of Major Sub-Components


Component Part	Part Description	Qty Per Assembly
02-013401	Bandpass Filter	2
02-016801	Bandpass Filter	2
90-852330	30dB Directional Coupler	1

4.9.2. Quadplexer (DAS) 60-228706 Specification

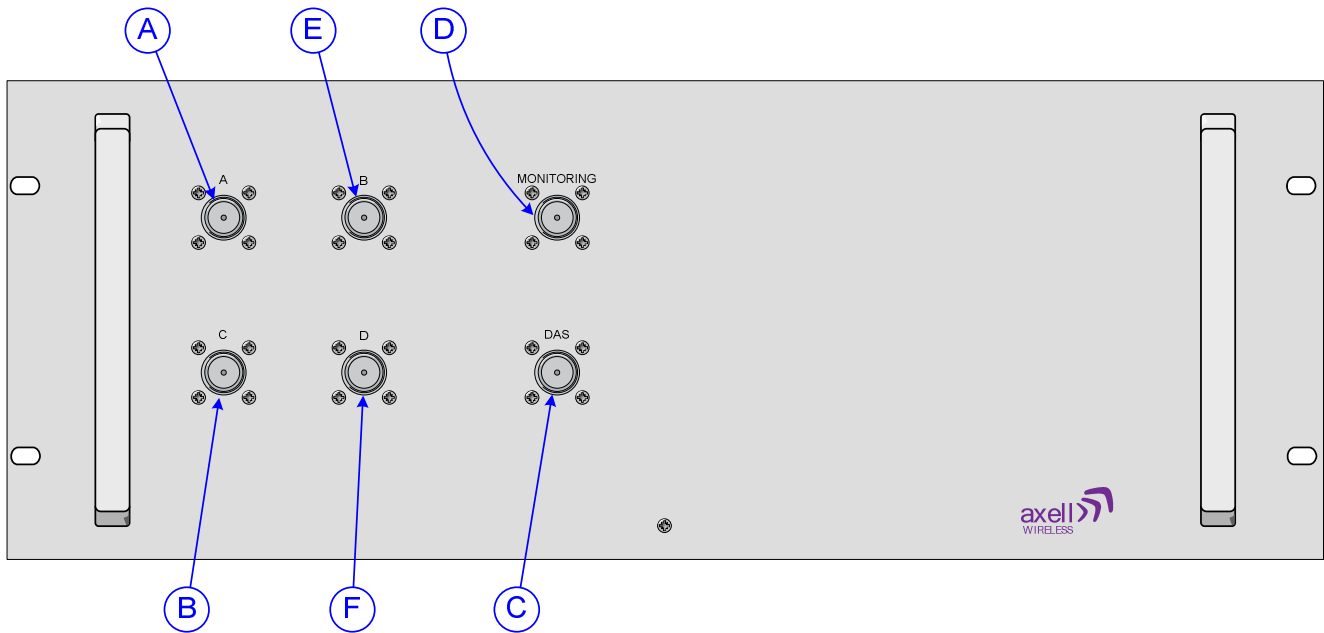
PARAMETER	SPECIFICATION
Band 1 D/L (port A to DAS port)	
Frequency Range	489.5-491.0 MHz
Rejection	492.5-494.0 MHz > 65 dB
Insertion Loss	≤ 3.0 dB
Port A to Monitoring port	33dB ±1 dB
Band 1 U/L (DAS port to port B)	
Frequency Range	492.5-494.0 MHz
Rejection	489.5-491.0 MHz > 40 dB 496.3-496.7 MHz > 65 dB
Insertion Loss	≤ 3.0 dB
Band 2 D/L (port C to DAS port)	
Frequency Range	496.3-496.7 MHz
Rejection	492.5-494.0 MHz > 65 dB 499.3-499.7 MHz > 60 dB
Insertion Loss	≤ 3.0 dB
Port C to Monitoring port	33dB ±1 dB
Band 2 U/L (DAS port to port D)	
Frequency Range	499.3-499.7 MHz
Rejection	496.3-496.7 MHz > 75 dB
Insertion Loss	≤ 3.0 dB

4.9.3. Quadplexer (DAS) 60-228706 System Diagram



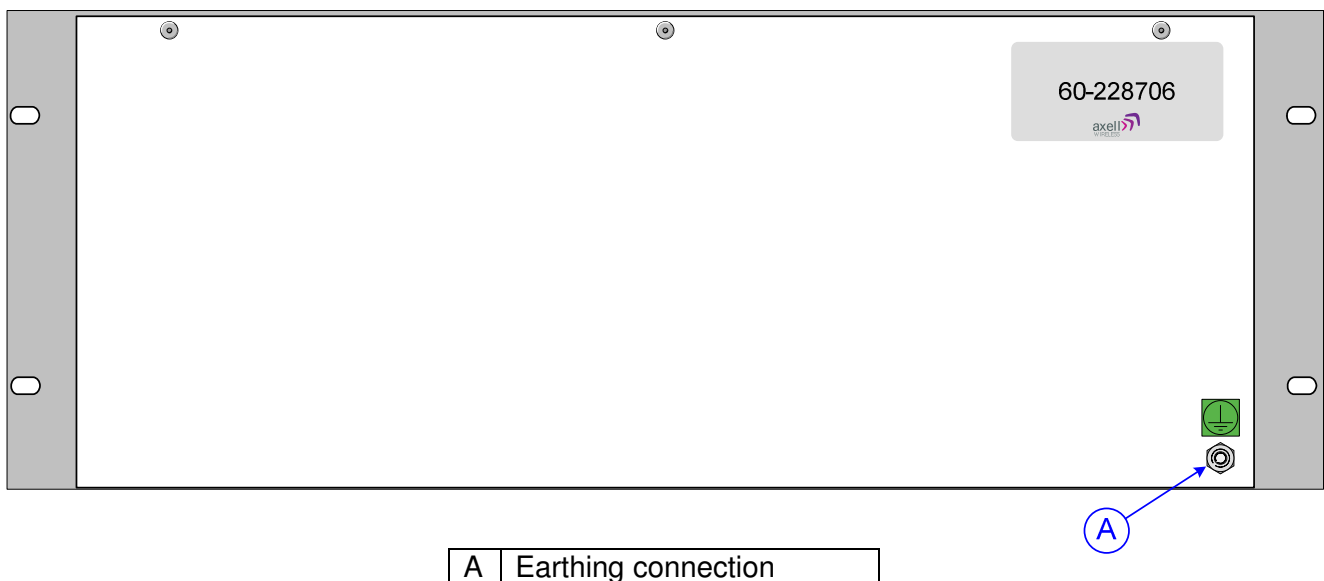
Date: 23/11/2009	Quadplexer (DAS) 60-228706 System Diagram	Not to Scale
© AWL 2009		Drawn by: EW/AJS
 <p>Aerial House Asheridge Road Chesham Buckinghamshire HP5 2QD United Kingdom Telephone: +44 (0) 1494 777000 Facsimile: +44 (0) 1494 777002 E-Mail: info@axellwireless.com www.axellwireless.com</p>		Issue: 1
		A4
		Page 1 of 1

4.9.4. Quadplexer (DAS) 60-228706 Front View



A	N type port "A", Band 1 Downlink input from 8 Ch. Squelch Gated BDA 60-228704
B	N type port "C", Band 2 Downlink input from 8 Ch. Squelch Gated BDA 60-228705
C	N type port "DAS", Downlink output to and Uplink input from the DAS
D	N type port "MONITORING", 30dB test/monitor port coupled from the Downlink O/P path
E	N type port "B", Band 1 Uplink output to 8 Ch. Squelch Gated BDA 60-228704
F	N type port "D", Band 2 Uplink output to 8 Ch. Squelch Gated BDA 60-228705

4.9.5. Quadplexer (DAS) 60-228706 Rear View



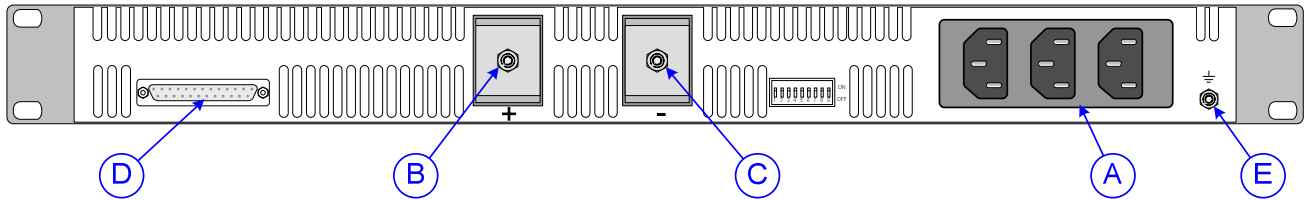
4.10. PSU Housing Shelf 96-300090

This is a 1U, 19" Rack Mount shelf housing two, 960W, fan cooled, AC mains driven PSU modules (96-300091) the outputs of which are combined to provide a 24V DC supply to the other chassis in the system. The DC leads connected to the output terminals (annotated "B" and "C" in section 4.10.2.) are terminated with right-angle XLR female connectors which mate with corresponding panel mounting male XLR connectors on the front panels of those units which require a DC input.

4.10.1. PSU module 96-300091 Specification

Output	DC Voltage	24V
	Rated Current	40A
	Current Range	0 ~ 40A
	Rated Power	960W
	Ripple & Noise (max.)	200mVp-p
	Voltage Adj. Range	23.2 ~ 24.8V
	Voltage Tolerance	±1.0%
	Line Regulation	±0.5%
	Load Regulation	±0.5%
	Setup, Rise Time	1000ms, 60ms/230V AC at full load
Hold Time (Typ.)	16ms/230V AC at full load	
Input	Voltage Range	90 ~ 264V AC 127 ~ 370V DC
	Frequency Range	47 ~ 63Hz
	Efficiency (Typ.)	87%
	AC Current (Typ.)	10.5A/115V AC 5.5A/230V AC
	Inrush Current (Typ.)	Cold Start 50A
	Leakage Current	<1.1mA / 230VAC
Protection	Over Load	105 ~ 125% rated output power Protection type : Constant current limiting, recovers automatically after fault condition is removed
	Over Voltage	26.4 ~ 32.4V Protection type : Shut down o/p voltage, re-power on to recover
	Over Temperature	75 5°C ±5°C (TSW1) Detect on heatsink of power transistor 85 5°C ±5°C (TSW2) Detect on heatsink of power diode Protection type : Shut down o/p voltage, recovers automatically after temperature goes down

4.10.2. PSU Module Chassis 96-300090 Rear View

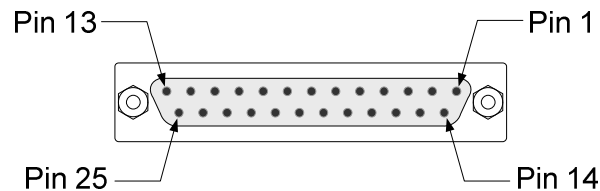


A	AC inputs
B	24V DC terminal (connects to rack 24V busbar)
C	0V DC terminal (connects to rack 0V busbar)
D	Alarm output to Krone terminal block on rack
E	Earthing connector

4.10.3. PSU Module Chassis 96-300090 Alarm Wiring

25 pin "D" panel socket, local alarm/control output to Krone terminal block on rack (annotated "D" in section 4.10.2.)

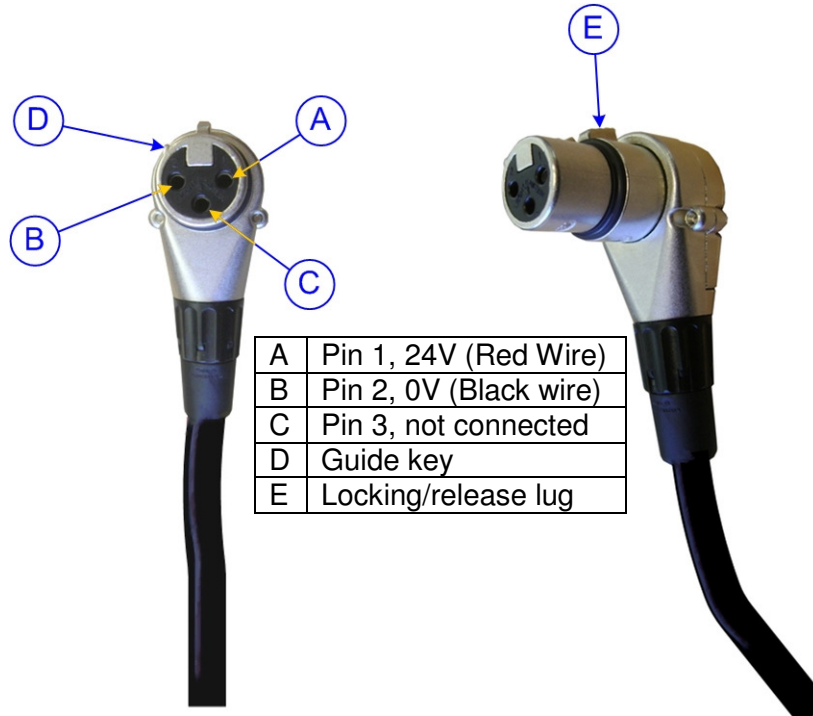
- Pin 1 ON/OFF PSU A
- Pin 2 AC OK PSU A
- Pin 3 DC OK PSU A
- Pin 5 T-ALARM PSU A
- Pin 9 AC OK PSU B
- Pin 8 ON/OFF PSU B
- Pin 10 DC OK PSU B
- Pin 12 T-ALARM PSU B
- Pin 21 -S -ve SENSING
- Pin 20 +S +ve SENSING



4.10.4. DC Connector Details

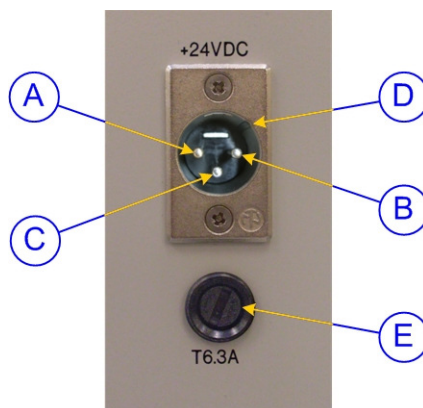
4.10.4.1. DC Inlet Free Socket

These are the free sockets that are connected to the rack busbars



5.10.4.2. Typical DC Inlet Panel Plug

Typical DC Inlet Panel Plug showing pin allocations for the rack equipment shelves



A	Pin 1, 24V (Red Wire)
B	Pin 2, 0V (Black wire)
C	Pin 3, not connected
D	Guide keyway
E	Fuse access

5. 60-228901 - WMATA Gallery Place Station CRAS System

The WMATA Gallery Place Station CRAS System consists of the following equipment mounted in two 41U, 19" equipment housing racks, each rack is loaded with equipment on both the front and rear aspects.

Rack 1 (part No, 60-228902)

Front:

Part No. 96-300090 PSU Housing Shelf
Contains Qty. 2, Part No. 96-300091 PSU Modules
Part No. 60-228703 Dual Fiber Optic Unit
Part No. 60-228905 RF Failover Switch Unit
Part No. 60-228907 Combiner Unit
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 22)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 23)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 24)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 25)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 26)

Rear:

Part No. 60-228909 Combiner Unit
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 15)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 16)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 17)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 18)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 19)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 20)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 21)

Rack 2 (part No, 60-228903)

Front:

Part No. 96-300090 PSU Housing Shelf
Contains Qty. 2, Part No. 96-300091 PSU Modules
Part No. 60-228906 Combiner Unit
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 1)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 2)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 3)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 4)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 5)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 6)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 7)

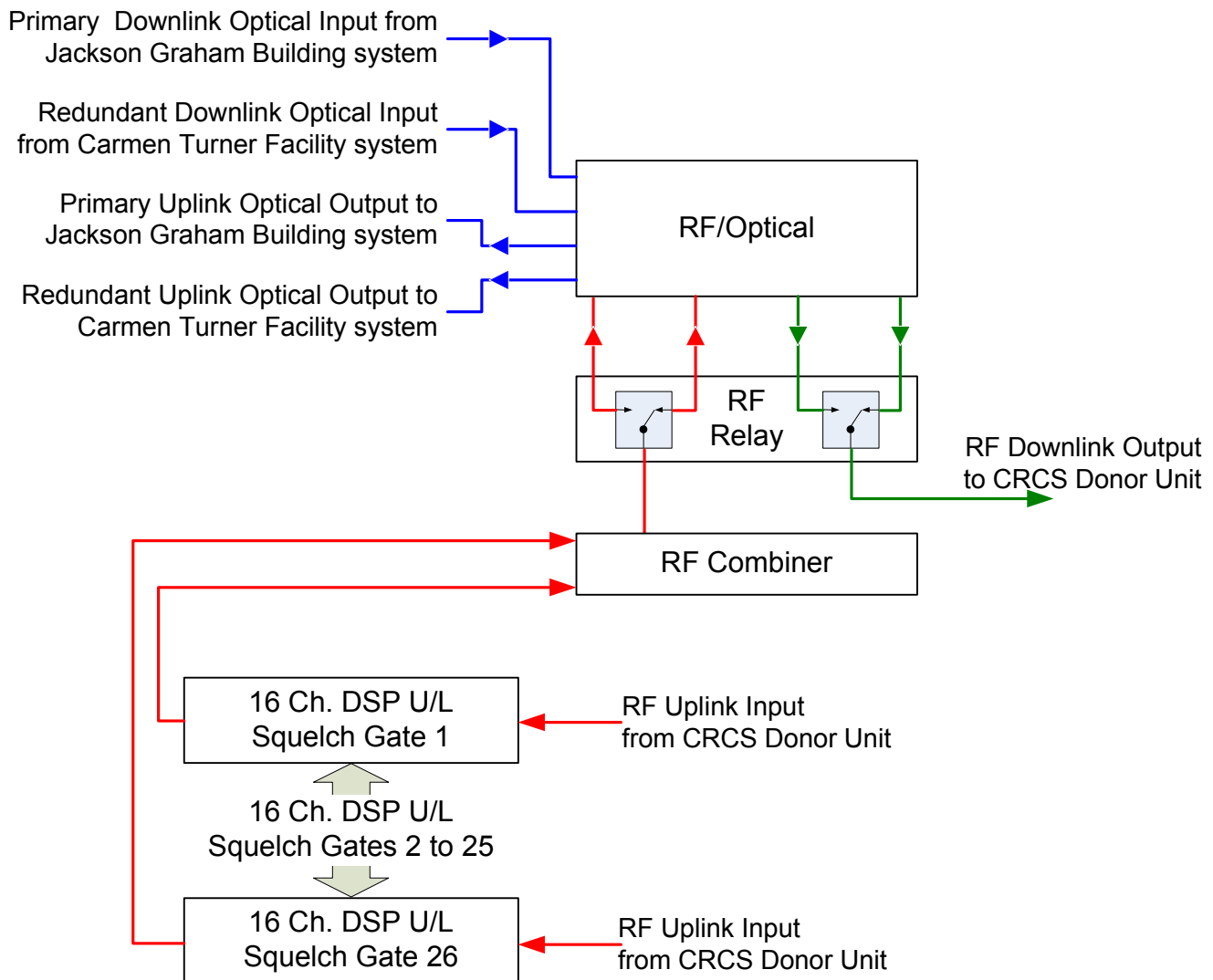
Rear:

Part No. 60-228908 Combiner Unit
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 8)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 9)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 10)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 11)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 12)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 13)
Part No. 60-228904 16 Ch. DSP U/L Squelch Gate (No. 14)

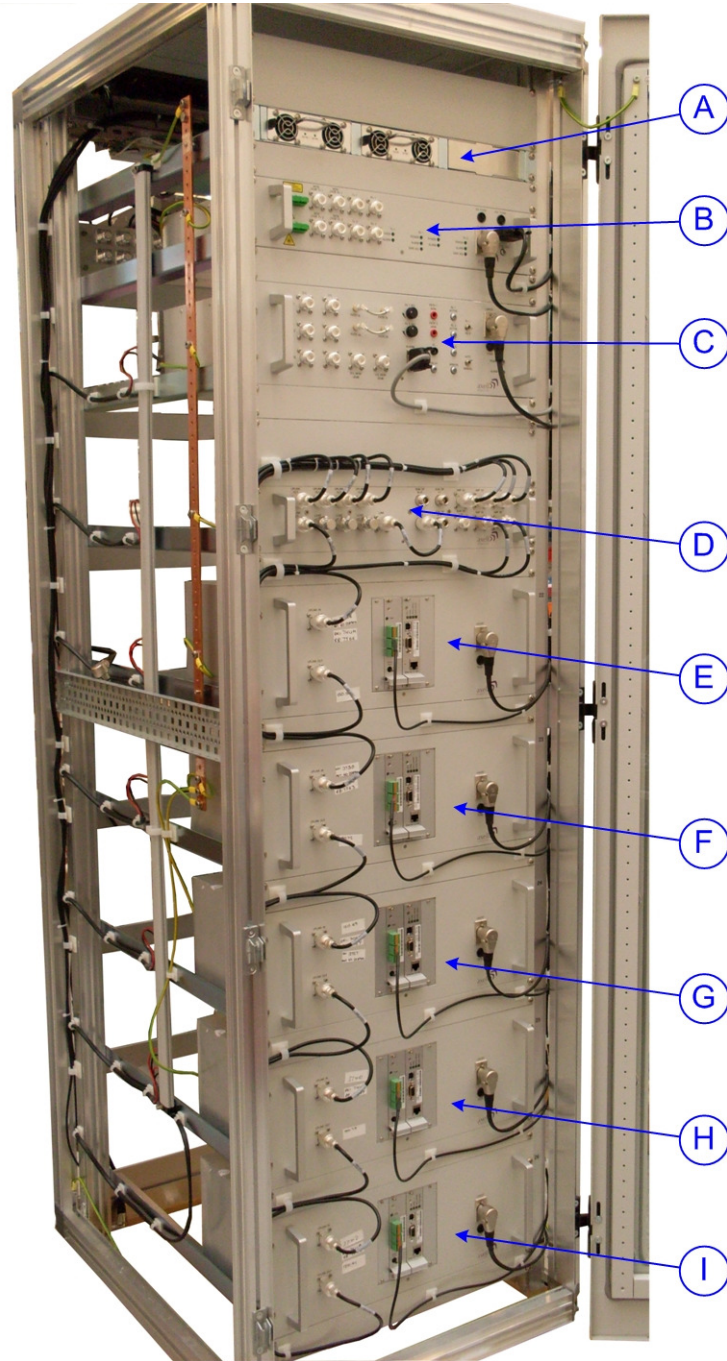
The Gallery Place Station CRAS System receives a Primary optical Downlink from the Jackson Graham Building CRAS System and a Redundant optical Downlink from the Carmen Turner Facility CRAS System, both optical Downlink feeds enter the Gallery Place Station CRAS System and are demodulated to RF. Normally the Primary Downlink signal from the Jackson Graham Building is passed on to the CRCS Donor Unit but if the signal strength of the Primary Downlink path falls below a pre-set threshold then RF relays in the Gallery Place Station CRAS System automatically switch to the Redundant signal path from the Carmen Turner Facility CRAS System.

26 Uplink paths are received from the CRCS Donor Unit; each path is fed into a Channelized DSP U/L Squelch Gate and the outputs from those 26 units are combined and modulated onto optical signals, the Primary optical Uplink being fed to the Jackson Graham Building CRAS System and in the event that the main signal path is switched out, the Redundant optical Uplink path is fed to the Carmen Turner Facility CRAS System

5.1. Simplified System Sketch



5.4. Rack 1 Front View



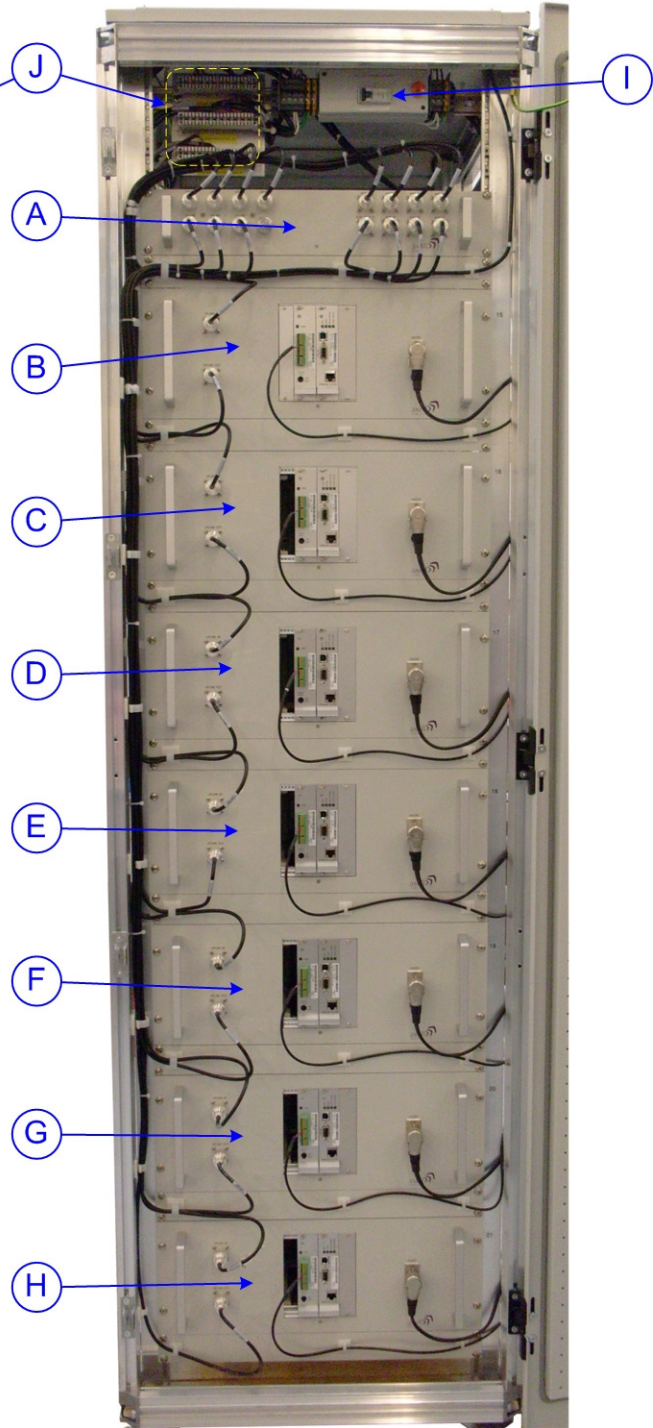
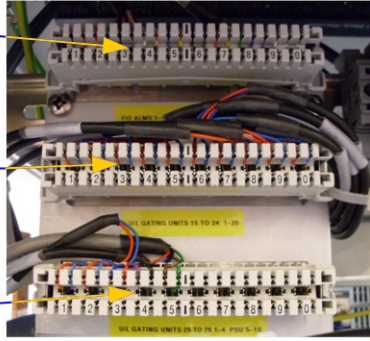
A	PSU Housing Shelf 96-300090 + Qty. 2, Part No. 96-300091 PSU Modules
B	Dual Fiber Optic Unit 60-228703
C	RF Failover Switch Unit 60-228905
D	Combiner Unit 60-228907
E	16 Ch. DSP U/L Squelch Gate No. 22
F	16 Ch. DSP U/L Squelch Gate No. 23
G	16 Ch. DSP U/L Squelch Gate No. 24
H	16 Ch. DSP U/L Squelch Gate No. 25
I	16 Ch. DSP U/L Squelch Gate No. 26

5.5. Rack 1 Rear View

Krone Terminal Block A

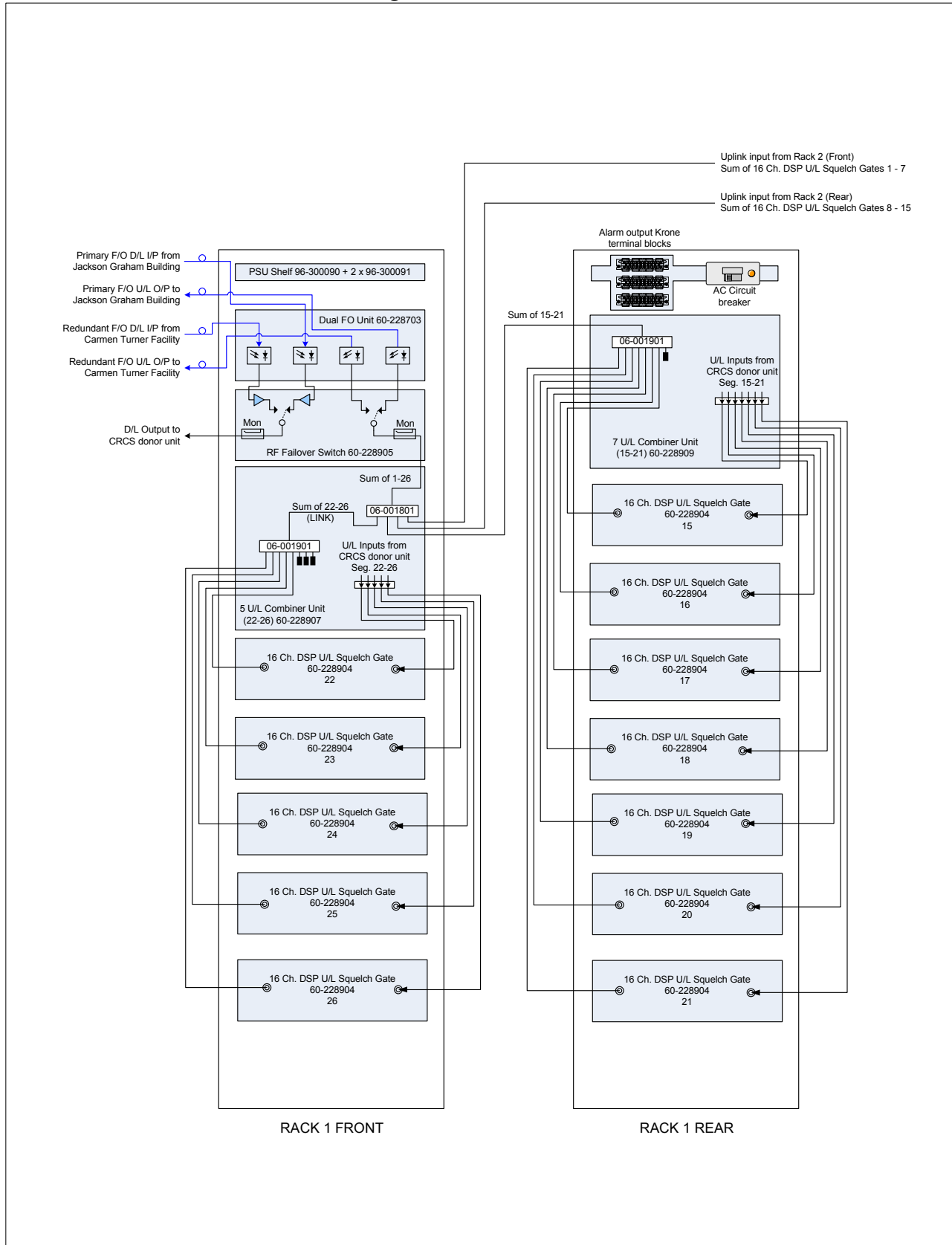
Krone Terminal Block B

Krone Terminal Block C

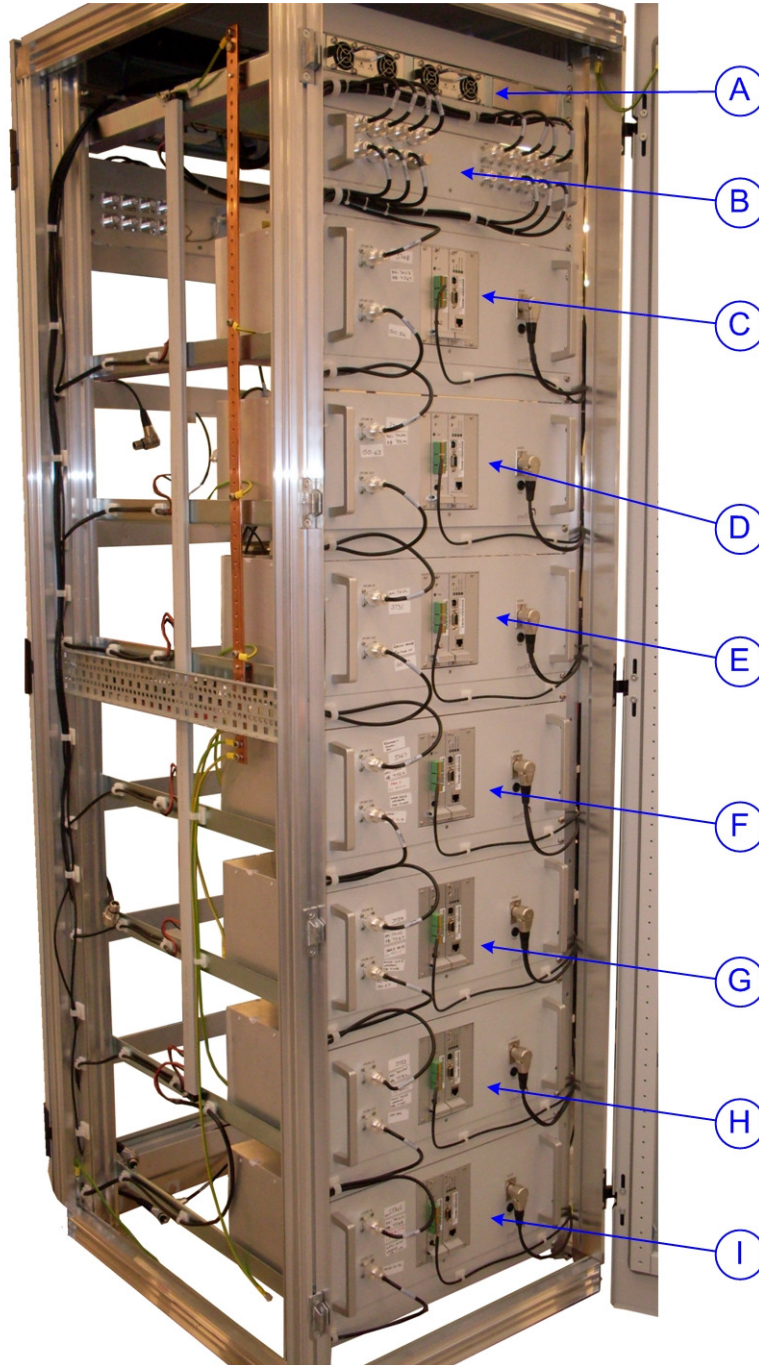


A	Combiner Unit 60-228909
B	16 Ch. DSP U/L Squelch Gate No. 15
C	16 Ch. DSP U/L Squelch Gate No. 16
D	16 Ch. DSP U/L Squelch Gate No. 17
E	16 Ch. DSP U/L Squelch Gate No. 18
F	16 Ch. DSP U/L Squelch Gate No. 19
G	16 Ch. DSP U/L Squelch Gate No. 20
H	16 Ch. DSP U/L Squelch Gate No. 21
I	AC Circuit Breaker
J	Krone terminal blocks for alarm outputs

5.6. Rack 1 elevations showing RF connections

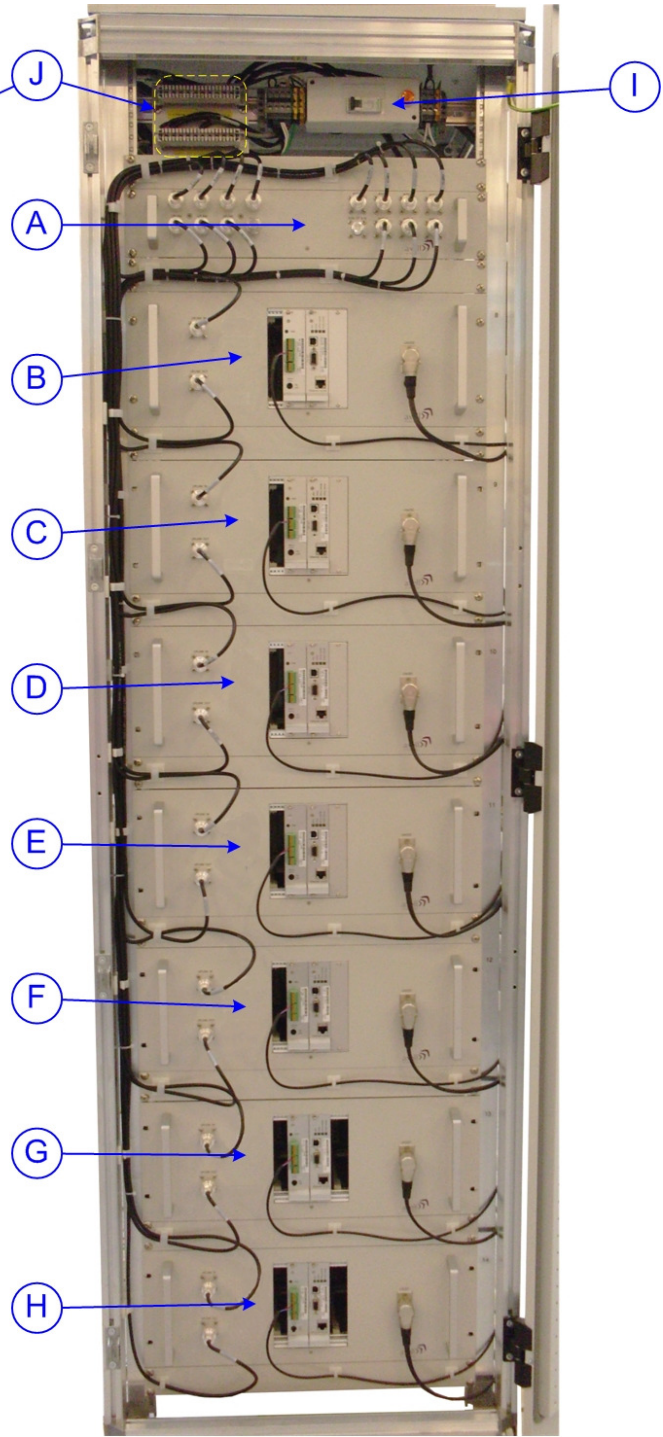
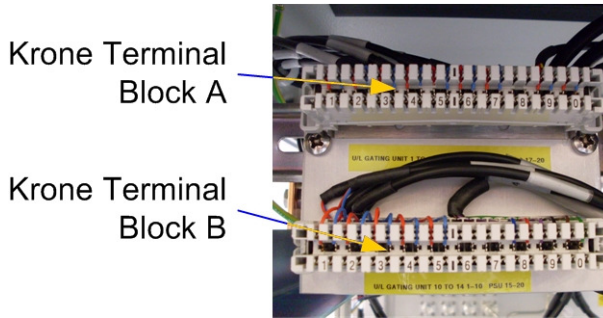


5.7. Rack 2 Front View



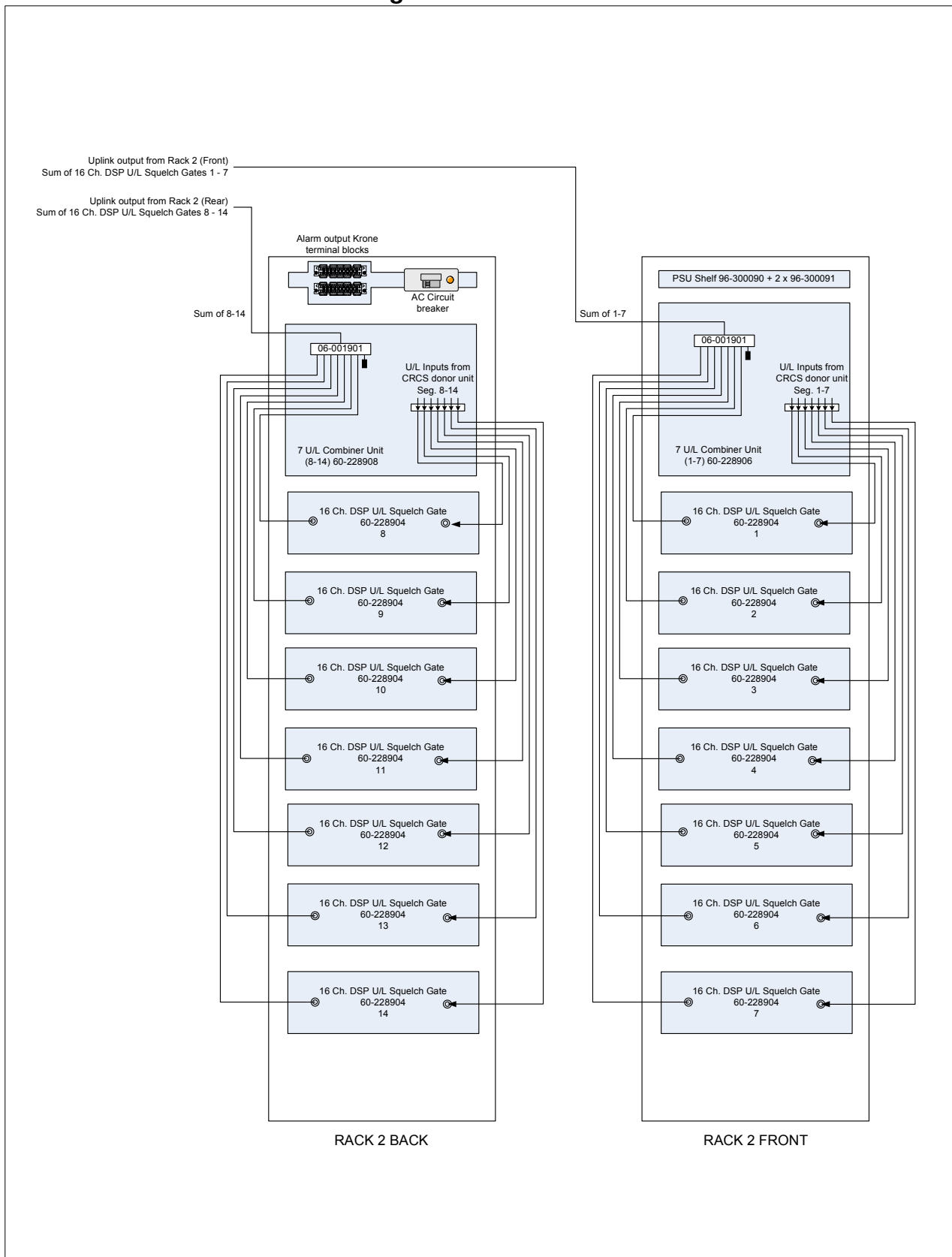
A	PSU Housing Shelf 96-300090 + Qty. 2, Part No. 96-300091 PSU Modules
B	Combiner Unit 60-228906
C	16 Ch. DSP U/L Squelch Gate No. 1
D	16 Ch. DSP U/L Squelch Gate No. 2
E	16 Ch. DSP U/L Squelch Gate No. 3
F	16 Ch. DSP U/L Squelch Gate No. 4
G	16 Ch. DSP U/L Squelch Gate No. 5
H	16 Ch. DSP U/L Squelch Gate No. 6
I	16 Ch. DSP U/L Squelch Gate No. 7


5.8. Rack 2 Rear View



A	Combiner Unit 60-228908
B	16 Ch. DSP U/L Squelch Gate No. 8
C	16 Ch. DSP U/L Squelch Gate No. 9
D	16 Ch. DSP U/L Squelch Gate No. 10
E	16 Ch. DSP U/L Squelch Gate No. 11
F	16 Ch. DSP U/L Squelch Gate No. 12
G	16 Ch. DSP U/L Squelch Gate No. 13
H	16 Ch. DSP U/L Squelch Gate No. 14
I	AC Circuit Breaker
J	Krone terminal blocks for alarm outputs

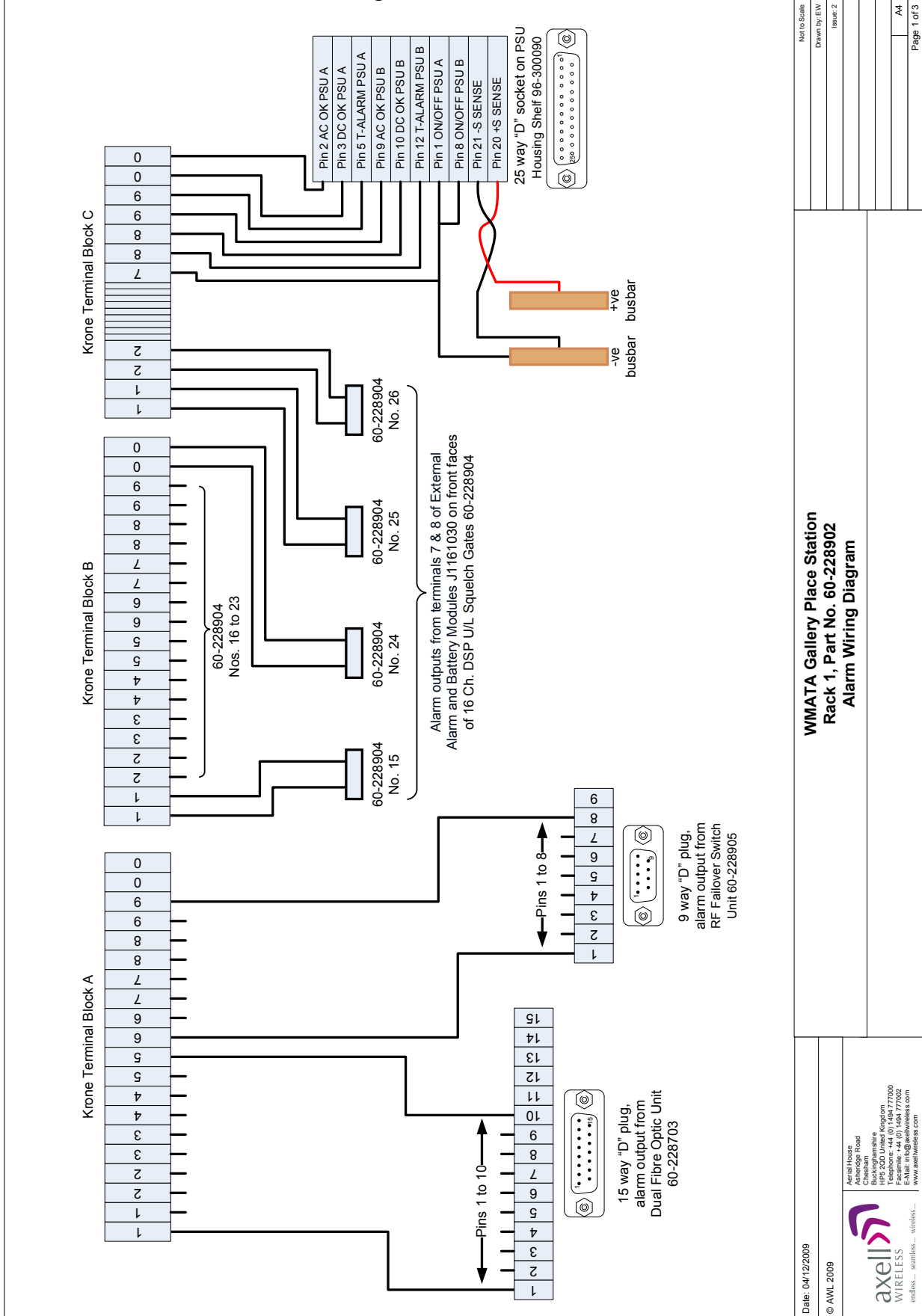
5.9. Rack 2 elevations showing RF connections



Date: 03/12/2009	WMATA Gallery Place Station System Rack 2 Front and Rear Views	Not to Scale
© AWL 2009		Drawn by: EW/AJS
 Aerial House Asheridge Road Chesham Buckinghamshire HP5 2QD United Kingdom Telephone: +44 (0) 1494 777000 Facsimile: +44 (0) 1494 777002 E-Mail: info@axellwireless.com www.axellwireless.com		Issue: 1
		A3
		Page 1 of 1

5.10. Rack Alarm Wiring Diagrams

5.10.1. Rack 1 Alarm Wiring



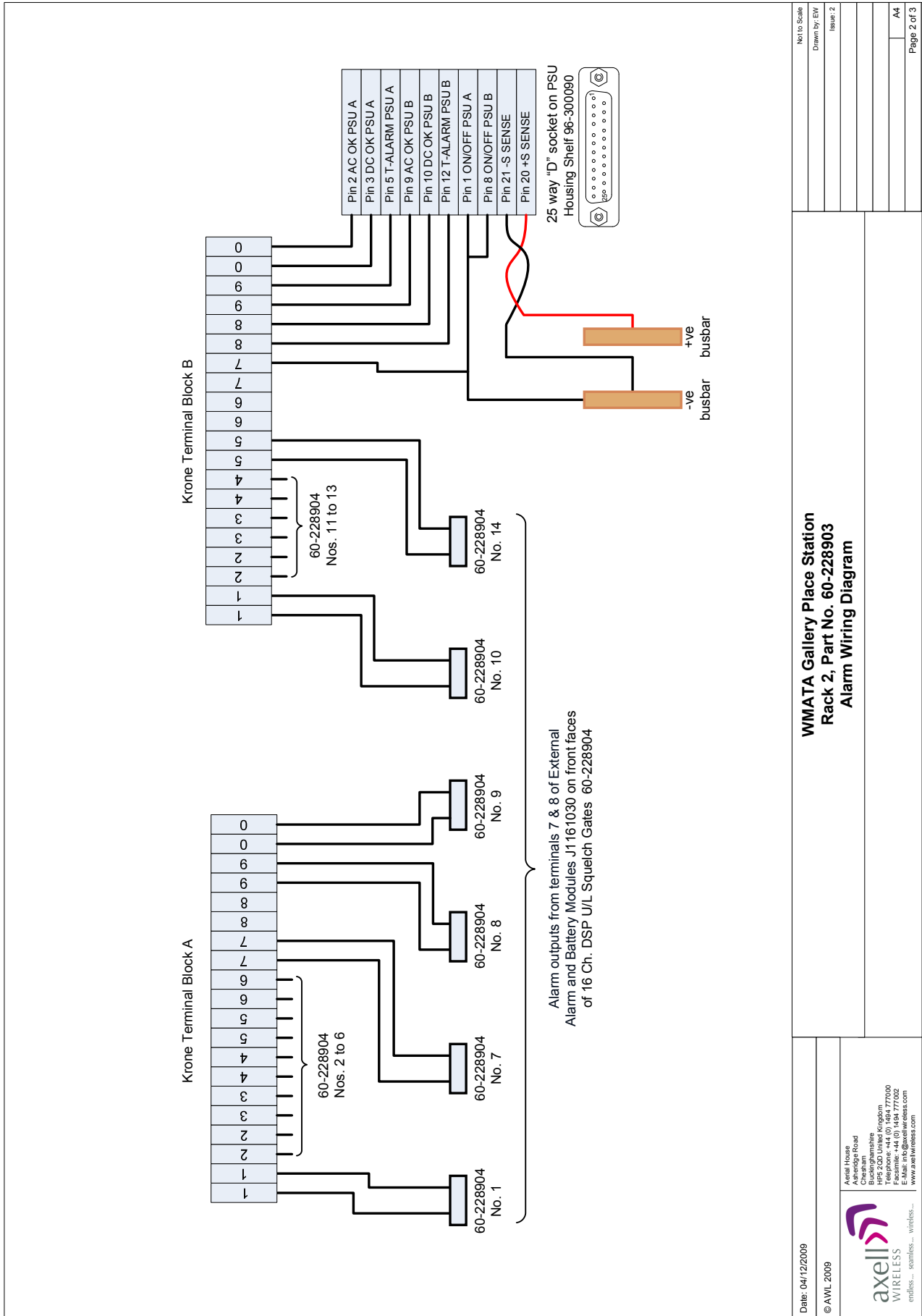
**WMATA Gallery Place Station
Rack 1, Part No. 60-228902
Alarm Wiring Diagram**

Date: 04/12/2009
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5.10.2. Rack 2 Alarm Wiring



Date: 04/12/2009		Not to Scale	
© AWL 2009		Drawn by: EW	
		Issue: 2	
		A4	
		Page 2 of 3	
WMATA Gallery Place Station Rack 2, Part No. 60-228903 Alarm Wiring Diagram			
Axell Wireless Limited Bucks House Chesham Buckinghamshire HP8 4JN Telephone: +44 (0) 1494 777000 Facsimile: +44 (0) 1494 777002 E-Mail: info@axellwireless.com www.axellwireless.com		endless... seamless... wireless...	

5.11 Dual Fiber Optic Unit 60-228703 (Gallery Place Station)

Dual Fiber Optic Unit 60-228703 is built into a 2U, 19" rack-mount case.

The Primary Downlink optical signal from the Jackson Graham Building CRAS System enters the Dual Fiber Optic Unit via the SC/APC optical port 1 "RX" (annotated "A" in section 5.11.4.) and passes into a Fiber Optic Receiver Module 20-005501 which demodulates the Downlink optical signal to RF and the Downlink RF signal then passes through a 20dB Directional Coupler 90-852420 which couples off a small portion of the signal and feeds it to the N type port labeled "MON -20dB RX 1" (annotated "C" in section 5.11.4.) which provides a 20dB test/monitor port for the Primary Downlink output. The Primary Downlink path then exits the Dual Fiber Optic Unit for the RF Failover Switch Unit 60-228905 via the N type port labeled "RX 1" (annotated "B" in section 5.11.4.)

The Redundant Downlink optical signal from the Carmen Turner Facility CRAS System enters the Dual Fiber Optic Unit via the SC/APC optical port 2 "RX" (annotated "G" in section 5.11.4.) and passes into a Fiber Optic Receiver Module 20-005501 which demodulates the Downlink signal to RF and the Downlink RF signal then passes through a 20dB Directional Coupler 90-852420 which couples off a small portion of the signal and feeds it to the N type port labeled "MON -20dB RX 2" (annotated "I" in section 5.11.4.) which provides a 20dB test/monitor port for the Redundant Downlink output. The Redundant Downlink path then exits the Dual Fiber Optic Unit for the RF Failover Switch Unit 60-228905 via the N type port labeled "RX 2" (annotated "H" in section 5.11.4.)

The Primary RF Uplink from the RF Failover Switch Unit 60-228905 enters the Dual Fiber Optic Unit via the N type port labeled "TX1" (annotated "D" in section 5.11.4.) and passes through a 20dB Directional Coupler 90-852420 which couples off a small portion of the signal and feeds it to the N type port labeled "MON -20dB TX 1" (annotated "E" in section 5.11.4.) which provides a 20dB test/monitor port for the Primary Uplink input.

The Primary Uplink path then passes into a Fiber Optic Transmitter Module 20-005401 where the RF signal is modulated onto a laser and the optical signal thus produced then exits the Dual Fiber Optic Unit via the SC/APC optical port 1 "TX" (annotated "F" in section 5.11.4.) and is transmitted to the Jackson Graham Building CRAS System via a fiber optic cable link.

The Redundant RF Uplink from the RF Failover Switch Unit 60-228905 enters the Dual Fiber Optic Unit via the N type port labeled "TX2" (annotated "J" in section 5.11.4.) and passes through a 20dB Directional Coupler 90-852420 which couples off a small portion of the signal and feeds it to the N type port labeled "MON -20dB TX 2" (annotated "K" in section 5.11.4.) which provides a 20dB test/monitor port for the Redundant Uplink input.

The Redundant Uplink path then passes into a Fiber Optic Transmitter Module 20-005401 where the RF signal is modulated onto a laser and the optical signal thus produced then exits the Dual Fiber Optic Unit via the SC/APC optical port 2 "TX" (annotated "L" in section 5.11.4.) and is transmitted to the Carmen Turner Facility CRAS System via a fiber optic cable link.

Dual Fiber Optic Unit 60-228703 is powered by a 24V DC supply from one of the PSU Modules 96-300091 in PSU Housing Shelf 96-300090, The 24V DC supply powers two on-board DC/DC converters 96-200024 arranged in a parallel dual redundant configuration, the outputs of which are combined by power diodes to provide a 12V DC supply for the fiber optic modules within the unit

An alarm system is fitted to Dual Fiber Optic Unit 60-228703, each of the fiber optic modules carries its own voltage-free contact alarm relay output which are summed at the 15 way "D" panel plug labeled "ALARM" (annotated "EE" in section 5.11.4.)

5.11.1. Dual Fiber Optic Unit 60-228703 List of Major Sub-Components

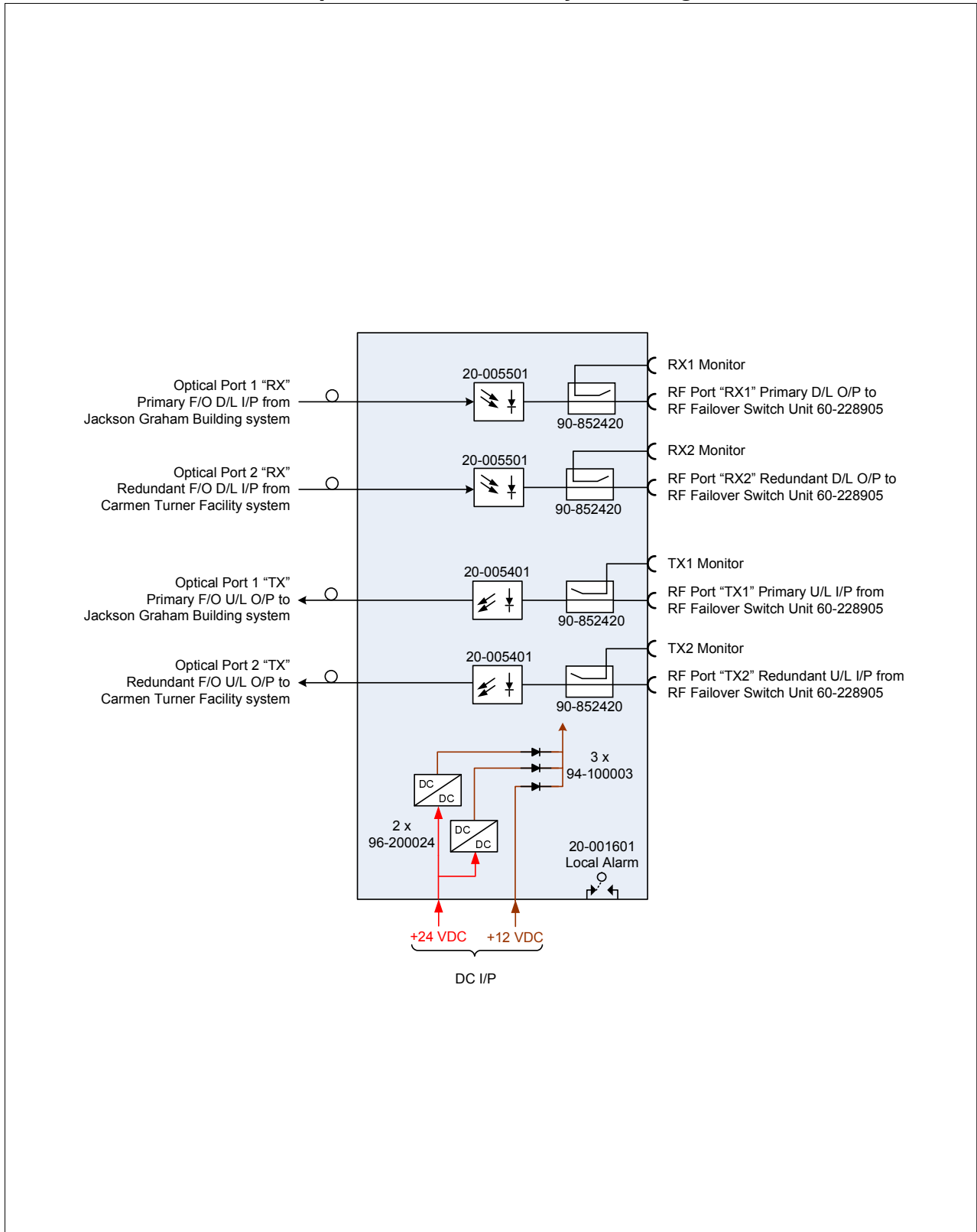
Component Part	Part Description	Qty Per Assembly
20-001601	12V Dual Relay Board	1
20-005401	Fiber Optic Transmitter Module	2
20-005501	Fiber Optic Receiver Module	2
96-110013	3.15 A Fuse	2
96-200024	DC/DC Converter	2
90-852420	20dB Directional Coupler	4
94-100003	Power Diode	3


5.11.2. Dual Fiber Optic Unit 60-228703 Specification

PARAMETER	SPECIFICATION
RF Downlink	
Frequency range	489.5MHz to 491.0MHz 496.3MHz to 496.7MHz
Coupling TX1 to Mon TX1	20 dB \pm 1dB
Coupling TX2 to Mon TX2	20 dB \pm 1dB
Optical Downlink	
Wavelength	1310nm
TX(A) Optical TX Power	1-3 dBm
TX(B) Optical TX Power	1-3 dBm
Optical Uplink	
Wavelength	1550nm
RX(A) Gain	>+15 dB
RX(A) Gain Set To	0 dB \pm 0.5
RX(A) Alarm Threshold	< -10dBm
RX(B) Gain	>+15 dB
RX(A) Gain Set To	0 dB \pm 0.5
RX(B) Alarm Threshold	< -10dBm
RF Uplink	
Frequency range	499.3MHz to 499.7MHz 492.5MHz to 494.0MHz
Coupling RX1 to Mon RX1	20 dB \pm 1dB
Coupling RX2 to Mon RX2	20 dB \pm 1dB
General	
Supply Voltage	12V DC or 24V DC
Current consumption	< 1.0A @ 24V DC input < 1.5A @ 12V DC input
Alarm output Summary volts free dry contact output (Closed = Normal / Open = Alarm)	F/O TX1 contact output Pin 1 & 2
	F/O TX2 contact output Pin 3 & 4
	F/O RX1 contact output Pin 5 & 6
	F/O RX1 contact output Pin 7 & 8
	24V DC-DC contact output Pin 9 & 10**

**This alarm is not operational when the unit is powered from 12V DC

5.11.3. Dual Fiber Optic Unit 60-228703 System Diagram



Date: 8/12/2009	Dual Fibre Optic Unit 60-228703 System Diagram (Gallery Place Station System)	Not to Scale
© AWL 2009		Drawn by: EW/AJS
 Aerial House Asheridge Road Chesham Buckinghamshire HP5 2QD United Kingdom		Issue: 2
	Telephone: +44 (0) 1494 777000 Facsimile: +44 (0) 1494 777002 E-Mail: info@axellwireless.com www.axellwireless.com	
		Page 1 of 1

5.11.3.1. Dual Fiber Optic Unit 60-228703 Alarm Outputs

15 pin “D” panel plug “ALARM”, local alarm output to Krone terminal block “A” on rack (see section 5.5.)

Dry Contact Outputs (Closed = Normal / Open = Alarm)

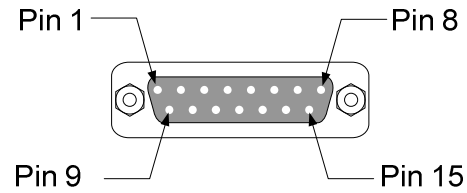
F/O TX 1 (main), contact output Pin 1 & 2

F/O TX 2 (standby), contact output Pin 3 & 4

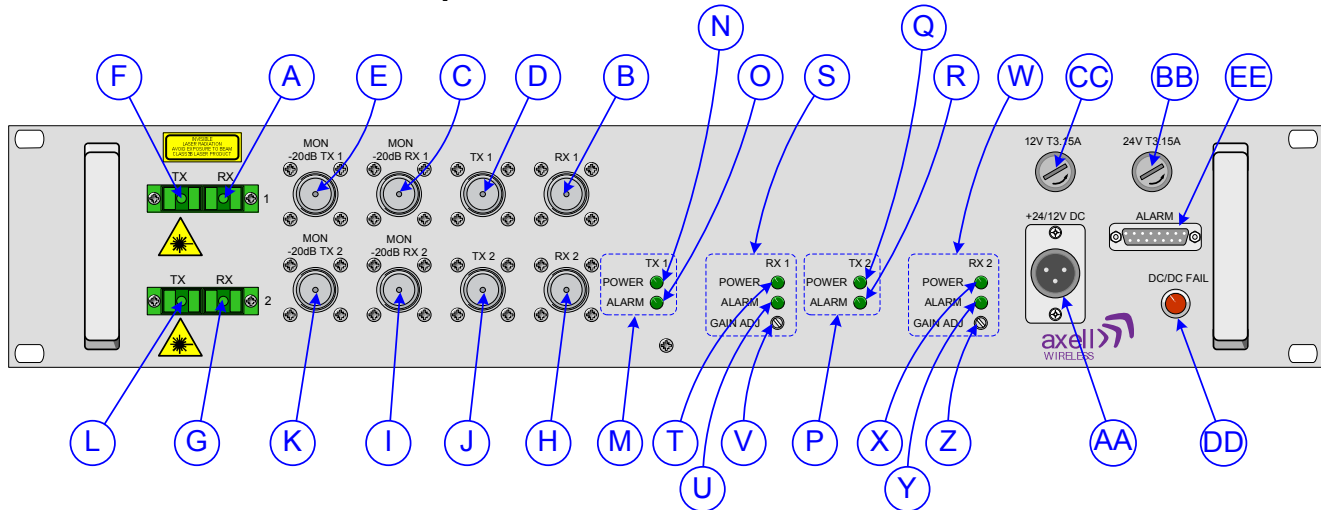
F/O RX 1 (main), contact output Pin 5 & 6

F/O RX 2 (standby), contact output Pin 7 & 8

24V DC>DC contact output Pin 9 & 10

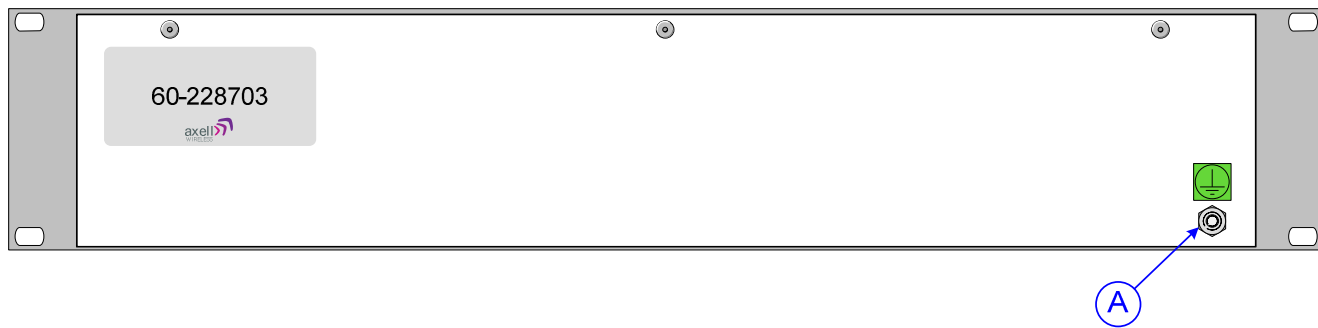


5.11.4. Dual Fiber Optic Unit 60-228703 Front View



A	SC/APC optical port 1 "RX", Primary optical D/L I/P from Jackson Graham Building CRAS System
B	N type port "RX1", Primary D/L O/P to RF Failover Switch Unit 60-228905
C	N type port "MON -20dB RX 1", 20dB test/monitor port coupled from D/L O/P to port "RX1"
D	N type port "TX1", Primary U/L I/P from RF Failover Switch Unit 60-228905
E	N type port "MON -20dB TX 1", 20dB test/monitor port coupled from U/L input from port "TX1"
F	SC/APC optical port 1 "TX", Primary optical U/L O/P to Jackson Graham Building CRAS System
G	SC/APC optical port 2 "RX", Redundant optical D/L I/P from Carmen Turner Facility CRAS System
H	N type port "RX2", Redundant D/L O/P to RF Failover Switch Unit 60-228905
I	N type port "MON -20dB RX 2", 20dB test/monitor port coupled from D/L O/P to port "RX2"
J	N type port "TX2", Redundant U/L I/P from RF Failover Switch Unit 60-228905
K	N type port "MON -20dB TX 2", 20dB test/monitor port coupled from U/L input from port "TX2"
L	SC/APC optical port 2 "TX", Redundant optical U/L O/P to Carmen Turner Facility CRAS System
M	Status Indicators for F/O TX Module 1 (Primary F/O U/L O/P to Jackson Graham Building CRAS System)
N	Green LED "POWER", Fiber Optic TX Power On indicator illuminated during normal operation
O	Green LED "ALARM", Fiber Optic TX Alarm indicator extinguished during alarm state
P	Status Indicators for F/O TX Module 2 (Redundant F/O U/L O/P to Carmen Turner Facility CRAS System)
Q	Green LED "POWER", Fiber Optic TX Power On indicator illuminated during normal operation
R	Green LED "ALARM", Fiber Optic TX Alarm indicator extinguished during alarm state
S	Status Indicators for F/O RX Module 1 (Primary F/O D/L I/P from Jackson Graham Building CRAS System)
T	Green LED "POWER", Fiber Optic RX Power On indicator illuminated during normal operation
U	Green LED "ALARM", Fiber Optic RX Alarm indicator extinguished during alarm state
V	Fiber Optic RX RF gain adjustment
W	Status Indicators for F/O RX Module 2 (Redundant F/O D/L I/P from Carmen Turner Facility CRAS System)
X	Green LED "POWER", Fiber Optic RX Power On indicator illuminated during normal operation
Y	Green LED "ALARM", Fiber Optic RX Alarm indicator extinguished during alarm state
Z	Fiber Optic RX RF gain adjustment
AA	DC input (12V/24V)
BB	3.15A Fuse for 24V DC input
CC	3.15A Fuse for 12V DC input
DD	Red LED "DC/DC FAIL" illuminated in alarm state (DC/DC convertor failure)
EE	15 pin "D" panel plug "ALARM" local alarm output to Krone terminal block on rack

5.11.5. Dual Fiber Optic Unit 60-228703 Rear View



A | Earthing connection

5.12. RF Failover Switch Unit 60-228905

RF Failover Switch Unit 60-228905 is built into a 2U, 19" rack-mount case and receives both Primary (Jackson Graham Building) and Redundant (Carmen Turner Facility) Downlink signals from the Dual Fiber Optic Unit 60-228703; the RF level of the Primary Downlink is monitored by a power detector and if the signal falls below a preset threshold the unit automatically switches from the Primary to the standby Redundant path; the Uplink paths are switched at the same time.

The Primary Downlink signal from the Jackson Graham Building CRAS System by way of Dual Fiber Optic Unit 60-228703, enters RF Failover Switch Unit 60-228905 via the N type port labeled "PATH 1 D/L" (annotated "A" in section 5.12.5.) and the signal passes through an 8dB In-line Attenuator 93-000065 and then through a 1W Low Power Amplifier 12-030301 which provides 30dB of signal gain, the amplifier is used to overcome the subsequent power splitting losses of the CRCS fiber system. The Downlink path is then fed out of the shelf via the SMA port labeled "PATH 1a" (annotated "B" in section 5.12.5.) which is connected to the SMA port labeled "PATH 1b" (annotated "D" in section 5.12.5.) by a short length of UT141 cable (annotated "C" in section 5.12.5.). This break in the signal path allows the amplifier to be isolated from the rest of the path for testing purposes.

Upon re-entering the unit the Primary Downlink path passes through a 20dB Directional Coupler 90-852320 which couples off the signal and feeds it to an RF Detector Module 17-019805 which monitors the Downlink signal strength and the main Primary Downlink path passes through the Downlink RF Transfer Relay 96-900045. The detector module has a DC monitor jack labeled "PATH 1 MON" (annotated "W" in section 5.12.5.) where the signal can be monitored with a multimeter with reference to the "0V" jack (annotated "Y" in section 5.12.5.), the RF level at which the transfer relay operates is adjusted by the variable potentiometer labeled "RX 1 ADJ" (annotated "U" in section 5.12.5.). There is a Green LED indicator labeled "RX 1 ACTIVE" (annotated "BB" in section 5.12.5.) that illuminates when the RF signal level is above the required threshold.

The Redundant Downlink signal enters RF Failover Switch Unit 60-228905 via the N type port labeled "PATH 2 D/L" (annotated "G" in section 5.12.5.) and the signal passes through an 8dB In-line Attenuator 93-000065 and then through a 1W Low Power Amplifier 12-030301 which provides 30dB of signal gain, the amplifier is used to overcome the subsequent power splitting losses of the CRCS fiber system. The Redundant Downlink path is then fed out of the shelf via the SMA port labeled "PATH 2a" (annotated "H" in section 5.12.5.) which is connected to the SMA port labeled "PATH 2b" (annotated "J" in section 5.12.5.) by a short length of UT141 cable (annotated "I" in section 5.12.5.). As with the Primary Downlink, this break in the signal path allows the amplifier to be isolated from the rest of the path for testing purposes.

Upon re-entering the unit the Redundant Downlink path passes through a 20dB Directional Coupler 90-852320 which couples off the signal and feed it to an RF Detector Module 17-019805 which monitors the Redundant Downlink signal strength and the Redundant Downlink path also passes into the Downlink RF Transfer Relay 96-900045 to provide the signal should the Primary Downlink signal fail. The detector module has a DC monitor jack labeled "PATH 2 MON" (annotated "X" in section 5.12.5.) where the signal can be monitored with reference to the "0V" jack, the RF level at which the Green LED indicator labeled "RX 2 ACTIVE" (annotated "CC" in section 5.12.5.) illuminates is adjusted by the variable potentiometer labeled "RX 2 ADJ" (annotated "V" in section 5.12.5.).

After passing through the RF Relay the Downlink path passes through a 30dB Directional Coupler 90-852330 which couples off the signal to provide a monitor/test port labeled "D/L MON -30dB" (annotated "F" in section 5.12.5.) for the Downlink output. The Downlink path then exits the Unit for CRCS Donor Unit via the N type port labeled "REMOTE D/L" (annotated "E" in section 5.12.5.).

The Automatic changeover of the transfer relay function can be overridden by selecting the Manual position of the switch labeled “AUTO / MANUAL” (annotated “S” in section 5.12.5.), the GREEN LED labeled “AUTO” (annotated “DD” in section 5.12.5.) is illuminated when in the Auto mode, the YELLOW LED labeled “MANUAL” (annotated “EE” in section 5.12.5.) will illuminate when the Manual mode is selected. In the Manual mode, the switch labeled “RX 1 / RX 2” (annotated “T” in section 5.12.5.) enables the signal source to be manually selected between Primary and Redundant paths.

When the Transfer Relay has selected the Redundant path, the RED LED labeled “RELAY” (annotated “AA” in section 5.12.5.) will illuminate.

In the reverse direction back to the Donor base station, the Uplink signals from the external Combiner Unit 60-228907 enters the RF Failover Switch Unit via the N type port labeled “REMOTE U/L” (annotated “K” in section 5.12.5.) and passes through a 30dB Directional Coupler 90-852330 which couples off the signal to provide a monitor/test port labeled “UL MON -30dB” (annotated “L” in section 5.12.5.) for the Uplink input.

The Uplink path then passes through the Uplink RF Transfer Relay 96-900045 which is normally set to pass the Uplink signal along the Primary Uplink path to the Jackson Graham Building CRAS System by way of Dual Fiber Optic Unit 60-228703; this path exits the RF Failover Switch Unit via the N type port labeled “PATH 1 U/L” (annotated “M” in section 5.12.5.) but if the RF Transfer Relays 96-900045 have been switched from the Primary to the Redundant paths then the Uplink signal is diverted to the Redundant path to the Carmen Turner Facility CRAS System by way of Dual Fiber Optic Unit 60-228703, this path exits the RF Failover Switch Unit via the N type port labeled “PATH 2 U/L” (annotated “N” in section 5.12.5.)

RF Failover Switch Unit 60-228905 is powered by a 24V DC supply from one of the PSU Modules 96-300091 in PSU Housing Shelf 96-300090, The 24V DC supply powers two on-board DC/DC converters 96-200024 arranged in a parallel dual redundant configuration, the outputs of which are combined by power diodes to provide a 12V DC supply active modules within the unit

Each of the two LPAs and the dual DC/DC convertors are monitored for alarms, should a fault occur the front panel RED LED labeled “ALARM” (annotated “R” in section 5.12.5.) will illuminate and a contact alarm relay output will be activated on “D” panel plug labeled “ALARM” (annotated “EE” in section 5.12.5.) the status of the Transfer relay is also indicated on the Alarm connector.

5.12.1. RF Failover Switch Unit 60-228905 List of Major Sub-Components

Component Part	Part Description	Qty Per Assembly
12-030301	1W Low Power Amplifier	2
17-019805	RF Detector Module	2
20-001601	12V Dual Relay Board	3
90-852320	20dB Directional Coupler	2
90-852330	30dB Directional Coupler	2
93-000065	8dB In-line Attenuator	2
93-930007	1W Load Termination	2
94-100003	Power Diode	2
96-110013	3.15A Fuse	1
96-200024	DC/DC Converter	2
96-900045	RF Transfer Relay	2
96-920002	DPDT Mini Toggle Switch	2

5.12.2. RF Failover Switch Unit 60-228905 Specification

PARAMETER	SPECIFICATION
RF Downlink Frequency range	489.5MHz to 491.0MHz 496.3MHz to 496.7MHz
RF Uplink Frequency range	499.3MHz to 499.7MHz 492.5MHz to 494.0MHz
Coupling D/L Output to Mon D/L	20 dB \pm 1dB
Coupling U/L Input to Mon U/L	20 dB \pm 1dB
Optical Downlink	
Wavelength	1310nm
RX(A) Gain	>+15 dB
RX(A) Gain Set To	0 dB \pm 0.5
RX(A) Alarm Threshold	< -10dBm
RX(B) Gain	>+15 dB
RX(A) Gain Set To	0 dB \pm 0.5
RX(B) Alarm Threshold	< -10dBm
Optical Uplink	
Wavelength	1310nm
TX(A) Optical TX Power	1-3 dBm
TX(B) Optical TX Power	1-3 dBm
Coupling RX1 to Mon RX1	20 dB \pm 1dB
Coupling RX2 to Mon RX2	20 dB \pm 1dB
Downlink Gain from Fiber	
Downlink Gain from Fiber	20dB
Typical carrier power to CRCS output	0dBm per carrier
RF Detection Level	-10dBm to +20dBm Composite
Detection Level Setting	0dBm
Relay Switching Time	<200ms
General	
Supply Voltage	24V DC
Current consumption	< 1.0A @ 24V DC input
Alarm output Summary volt free dry contact output (Closed = Normal / Open = Alarm)	Summary Alarm output Pin 1 & 2
	Primary Relay Status output Pin 3,4 & 5
	Redunt. Relay Status output Pin 6,7 & 8
	0v Ground Pin 9

5.12.4.1. RF Failover Switch Unit 60-228905 Alarm Outputs

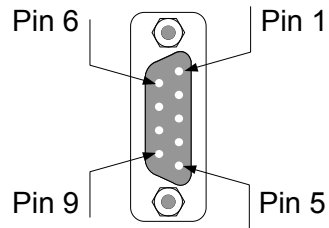
Front panel 9 pin “D” panel plug “ALARM”, local alarm output to Krone terminal block “A” on rack (see section 5.5.)

Dry Contact Outputs (Closed = Normal / Open = Alarm)

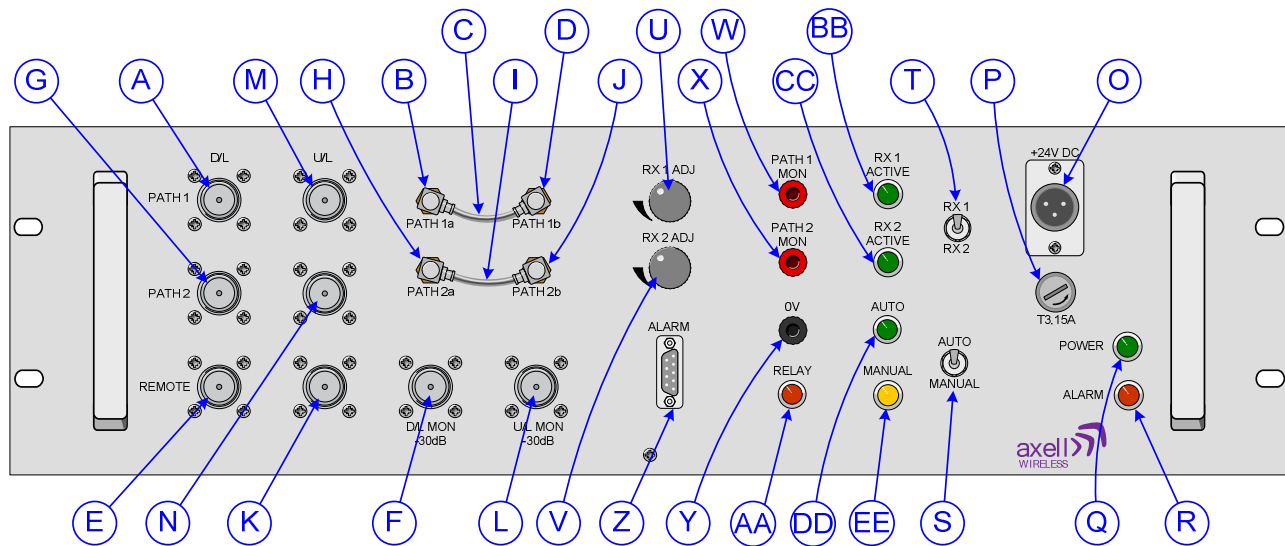
Summary output PSU modules Pins 1 & 2

Uplink path relay Pins 3, 4 & 5

Downlink path relay Pins 6, 7 & 8

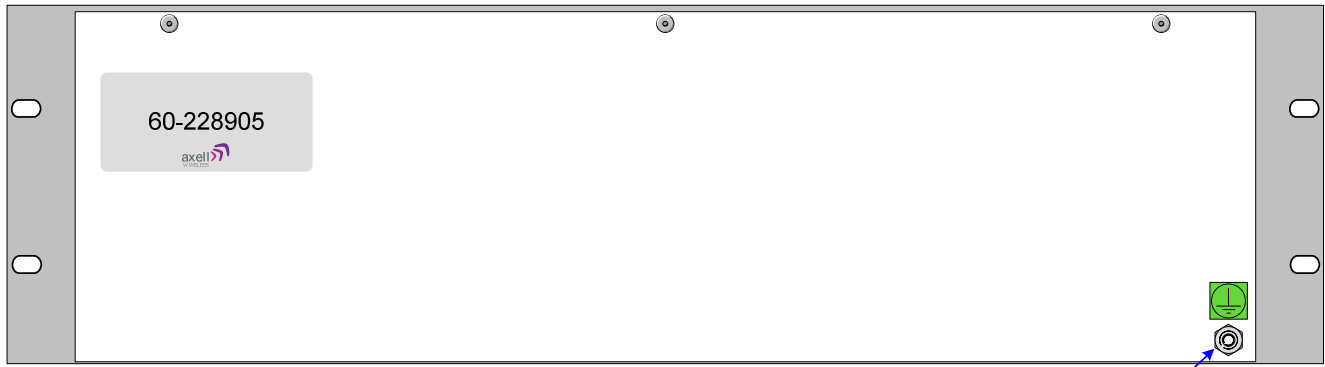


5.12.5. RF Failover Switch Unit 60-228905 Front View



A	N type port "PATH 1 D/L", Primary D/L I/P from Jackson Graham Building CRAS System	
B	SMA port "PATH 1a" Primary D/L O/P	Allows signal path monitoring between ports "A" and "B" and ports "D" and "E"
C	UT141 link between ports annotated "B" and "D"	
D	SMA port "PATH 1b" Primary D/L I/P	
E	N type port "REMOTE D/L", Primary D/L O/P to CRCS donor unit	
F	N type port "D/L MON -30dB", test/monitor port coupled from Primary D/L O/P to CRCS donor unit	
G	N type port "PATH 2 D/L", Redundant D/L I/P from Carmen Turner Facility CRAS System	
H	SMA port "PATH 2a" Redundant D/L O/P	Allows signal path monitoring between ports "G" and "H" and ports "J" and "E" when secondary RF path is switched in
I	UT141 link between ports annotated "H" and "J"	
J	SMA port "PATH 2b" Redundant D/L I/P	
K	N type port "REMOTE U/L", combined U/L I/P from 5 U/L Combiner Unit 60-228907	
L	N type port "U/L MON -30dB", test/monitor port coupled from combined U/L I/P from 60-228907	
M	N type port "PATH 1 U/L", Primary U/L O/P to Jackson Graham Building CRAS System	
N	N type port "PATH 2 U/L", Redundant U/L O/P to Carmen Turner Facility CRAS System	
O	24V DC input from PSU module 96-300091 in PSU shelf 96-300090	
P	3.15A fuse for DC input	
Q	Green LED "POWER", illuminated during normal operation	
R	Red LED "ALARM", illuminated during alarm condition	
S	Toggle switch "AUTO MANUAL", switches out signal sensing to allow manual choice of D/L path	
T	Toggle switch "RX 1 RX 2", for manual switching between Main and Standby Downlink paths	
U	Signal threshold adjust for Primary Downlink path	
V	Signal threshold adjust for Redundant Downlink path	
W	4mm banana socket "PATH 1 MON"	Allows DC monitoring of RF path signal strength
X	4mm banana socket "PATH 2 MON"	
Y	4mm banana socket "0V"	
Z	9 way "D" panel plug "ALARM", local alarm summary output to Krone terminal block on rack	
AA	Red LED "RELAY", illuminated when relay is switched from Primary to Redundant D/L path	
BB	Green LED "RX 1 ACTIVE", illuminated when Primary Downlink path is active	
CC	Green LED "RX 2 ACTIVE", illuminated when Redundant Downlink path is active	
DD	Green LED "AUTO", illuminated when signal sensing is switched in to monitor D/L path signal strength	
EE	Yellow LED "MANUAL", illuminated when signal sensing is switched out to allow manual choice of D/L path	

5.12.6. RF Failover Switch Unit 60-228905 Rear View



A	Earthing connection
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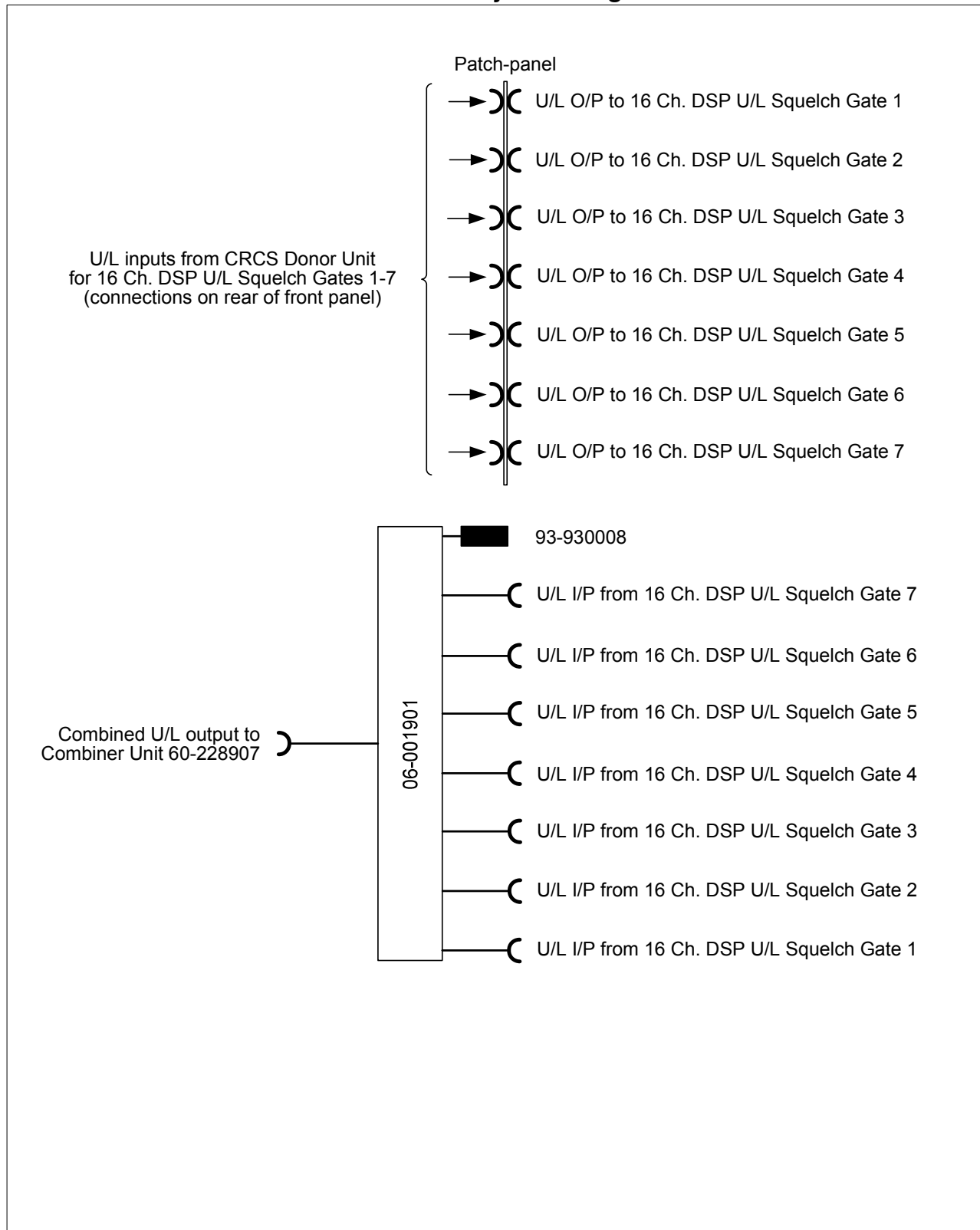
5.13. Combiner Unit 60-228906


Combiner Unit 60-228906 is built onto a 2U, 19" rack mount front panel and combines the Uplink output paths from the seven, 16 Ch. DSP U/L Squelch Gates 60-228904 mounted in the front of Rack 2 and passes the combined Uplink signal to Combiner Unit 60-228907 mounted in the front of Rack 1.

5.13.1. Combiner Unit 60-228906 List of Major Sub-Components

Component Part	Part Description	Qty Per Assembly
06-001901	8 Way Hybrid Splitter/Combiner	1
93-930008	2W Load Termination	1

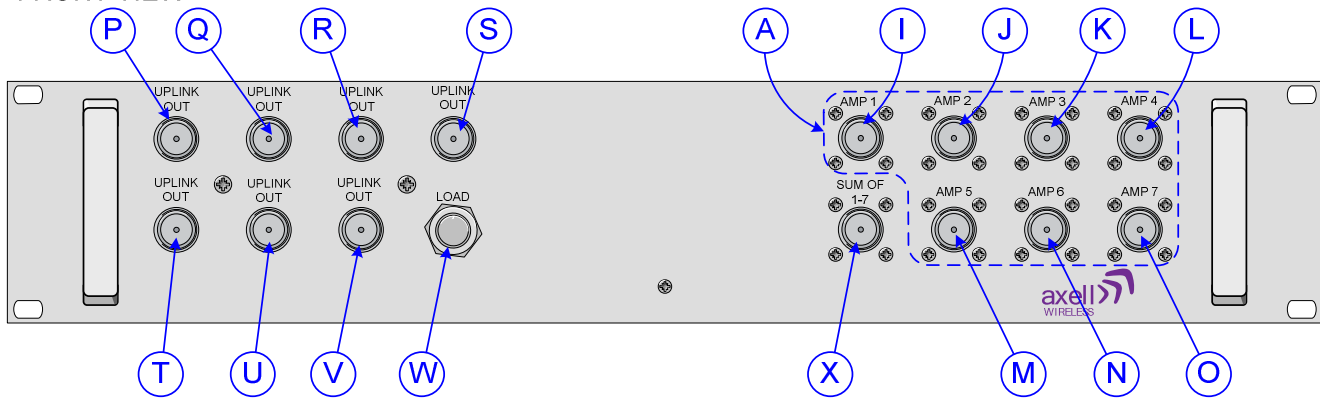
5.13.2. Combiner Unit 60-228906 System Diagram



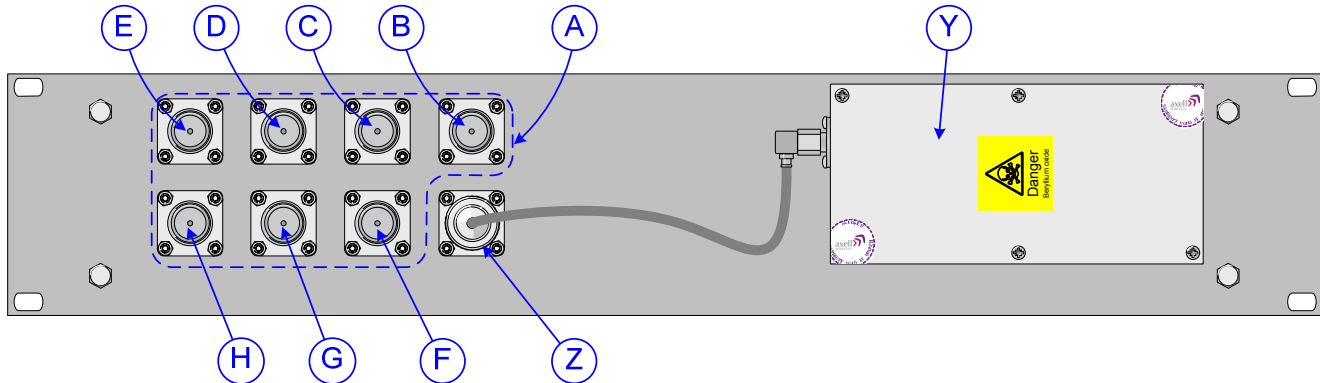
Date: 07/12/2009	Combiner Unit 60-22906 System Diagram	Not to Scale
© AWL 2009		Drawn by: EW/AJS
 <p>Aerial House Asheridge Road Chesham Buckinghamshire HP5 2QD United Kingdom Telephone: +44 (0) 1494 777000 Facsimile: +44 (0) 1494 777002 E-Mail: info@axellwireless.com www.axellwireless.com</p>	Rack 2, Front	Issue: 1
		A4
		Page 1 of 1

5.13.3. Combiner Unit 60-228906 Front and Rear Views

FRONT VIEW



REAR VIEW



A	Patch-panel for U/L I/Ps from CRCS donor unit and O/Ps to 16 Ch. DSP U/L Squelch Gates 1 to 7
B	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 1 from CRCS donor unit
C	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 2 from CRCS donor unit
D	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 3 from CRCS donor unit
E	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 4 from CRCS donor unit
F	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 5 from CRCS donor unit
G	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 6 from CRCS donor unit
H	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 7 from CRCS donor unit
I	N type port "AMP 1, U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 1
J	N type port "AMP 2, U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 2
K	N type port "AMP 3, U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 3
L	N type port "AMP 4, U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 4
M	N type port "AMP 5, U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 5
N	N type port "AMP 6, U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 6
O	N type port "AMP 7, U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 7
P	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 1
Q	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 2
R	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 3
S	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 4
T	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 5
U	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 6
V	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 7
W	Unused U/L input terminated with Load Termination 93-930008
X	N type port "SUM OF 1-7", combined U/L O/P from 16 Ch. DSP U/L Squelch Gates No. 1 to 7
Y	8 Way Hybrid Splitter/Combiner 06-001901 (Combining)
Z	Rear of N type port (X) "SUM OF 1-7"

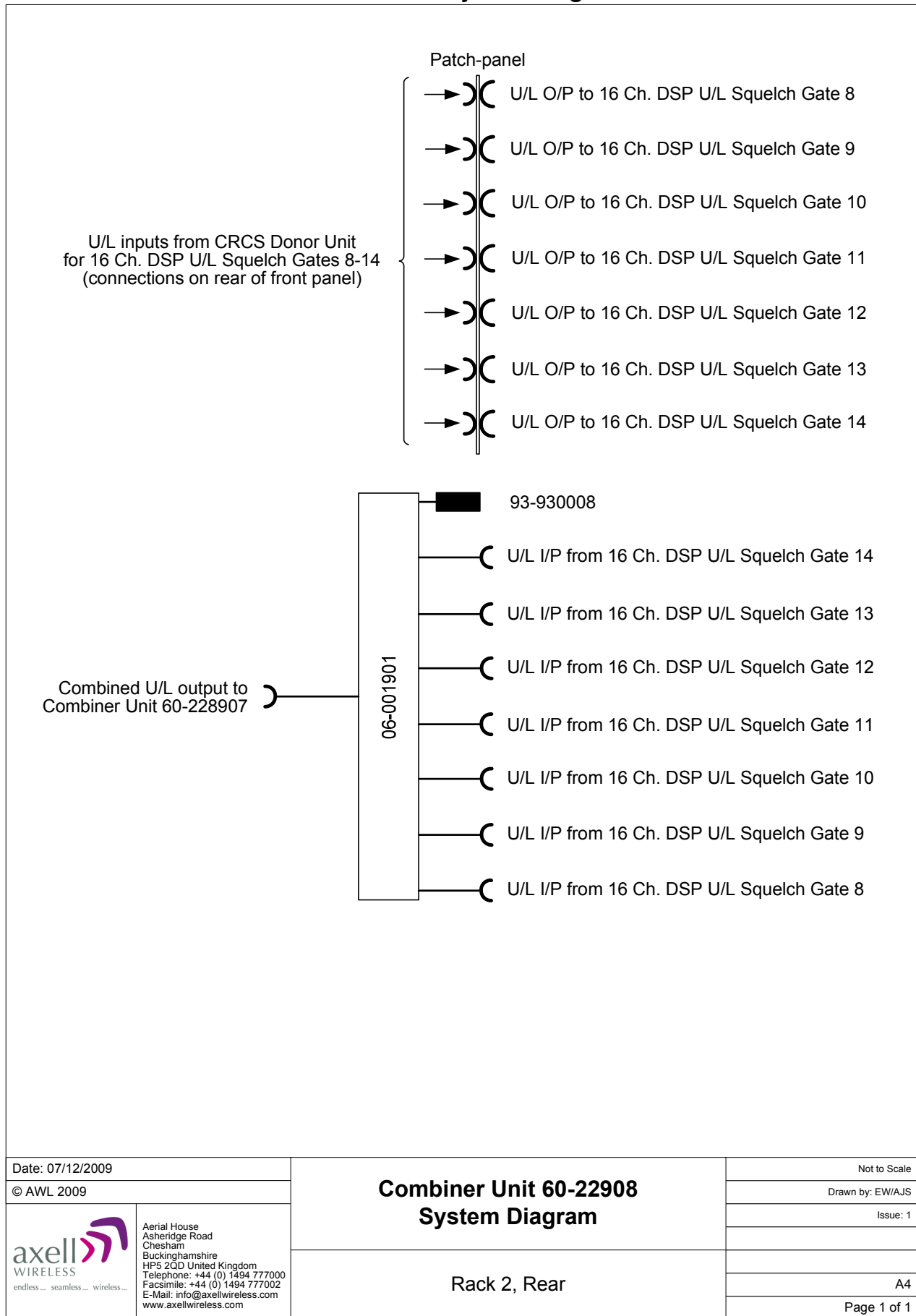
5.14. Combiner Unit 60-228908

Combiner Unit 60-228908 is built onto a 2U, 19" rack mount front panel and combines the Uplink output paths from the seven, 16 Ch. DSP U/L Squelch Gates 60-228904 mounted in the rear of Rack 2 and passes the combined Uplink signal to Combiner Unit 60-228907 mounted in the front of Rack 1.

5.14.1. Combiner Unit 60-228908 List of Major Sub-Components

Component Part	Part Description	Qty Per Assembly
06-001901	8 Way Hybrid Splitter/Combiner	1
93-930008	2W Load Termination	1

5.14.2. Combiner Unit 60-228908 System Diagram



Date: 07/12/2009

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Combiner Unit 60-22908 System Diagram

Rack 2, Rear

Not to Scale

Drawn by: EW/AJS

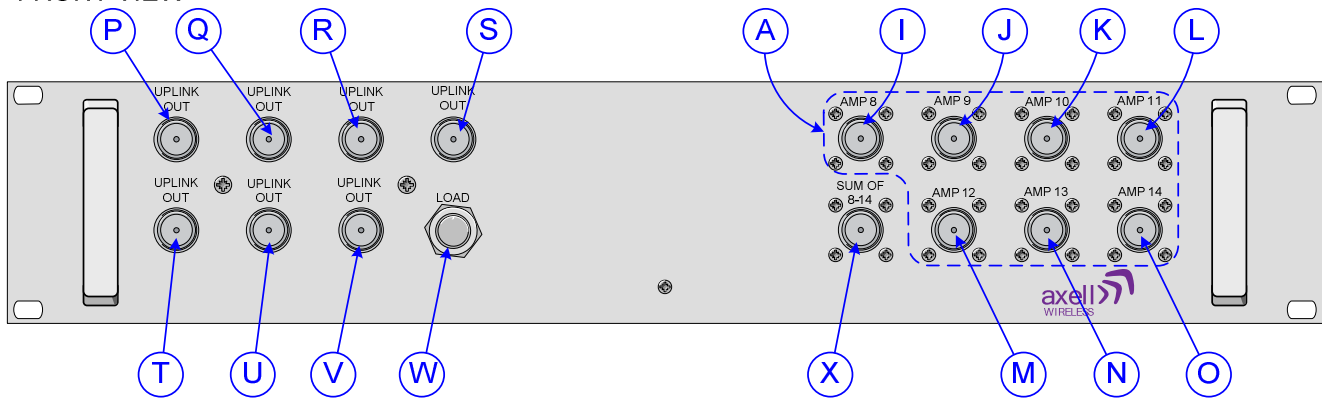
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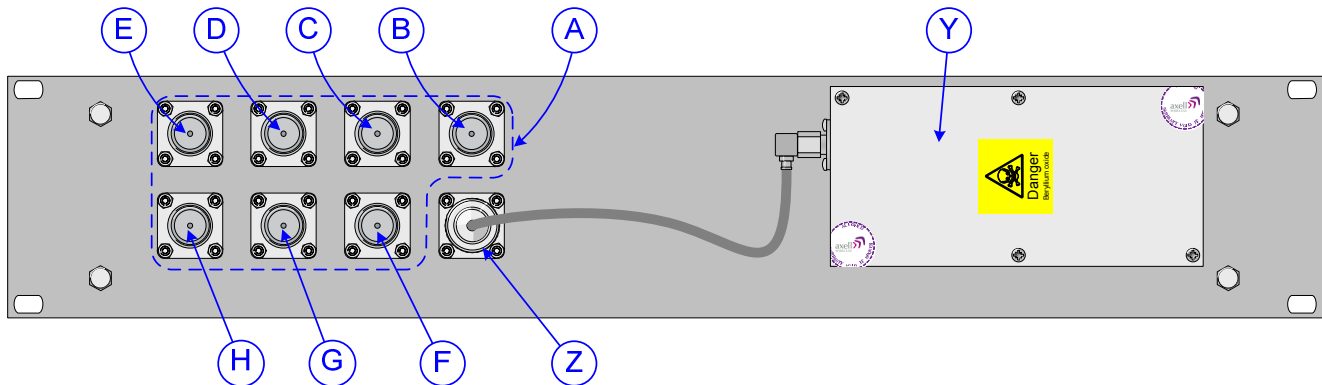
Page 1 of 1

5.14.3. Combiner Unit 60-228908 Front and Rear Views

FRONT VIEW



REAR VIEW



A	Patch-panel for U/L I/Ps from CRCS donor unit and O/Ps to 16 Ch. DSP U/L Squelch Gates 8 to 14
B	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 8 from CRCS donor unit
C	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 9 from CRCS donor unit
D	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 10 from CRCS donor unit
E	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 11 from CRCS donor unit
F	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 12 from CRCS donor unit
G	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 13 from CRCS donor unit
H	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 14 from CRCS donor unit
I	N type port "AMP 8, U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 8
J	N type port "AMP 9, U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 9
K	N type port "AMP 10, U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 10
L	N type port "AMP 11, U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 11
M	N type port "AMP 12, U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 12
N	N type port "AMP 13, U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 13
O	N type port "AMP 14, U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 14
P	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 8
Q	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 9
R	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 10
S	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 11
T	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 12
U	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 13
V	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 14
W	Unused U/L input terminated with Load Termination 93-930008
X	N type port "SUM OF 8-14", combined U/L O/P from 16 Ch. DSP U/L Squelch Gates No. 8 to 14
Y	8 Way Hybrid Splitter/Combiner 06-001901 (Combining)
Z	Rear of N type port (X) "SUM OF 8-14"

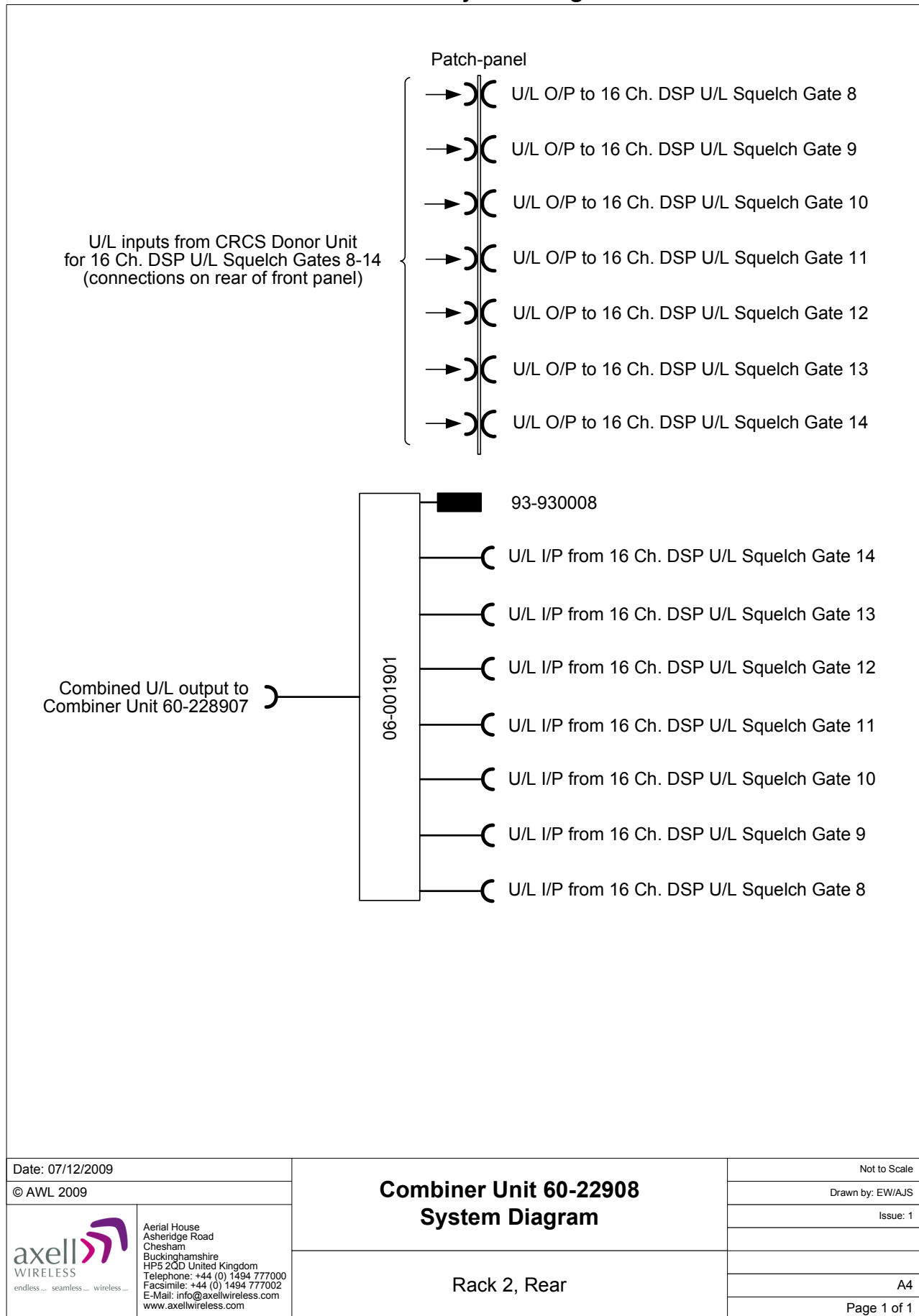
5.15. Combiner Unit 60-228909

Combiner Unit 60-228909 is built onto a 2U, 19" rack mount front panel and combines the Uplink output paths from the seven, 16 Ch. DSP U/L Squelch Gates 60-228904 mounted in the rear of Rack 1 and passes the combined Uplink signal to Combiner Unit 60-228907 mounted in the front of Rack 1.

5.15.1. Combiner Unit 60-228909 List of Major Sub-Components

Component Part	Part Description	Qty Per Assembly
06-001901	8 Way Hybrid Splitter/Combiner	1
93-930008	2W Load Termination	1

5.15.2. Combiner Unit 60-228909 System Diagram



Date: 07/12/2009

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Combiner Unit 60-22908 System Diagram

Rack 2, Rear

Not to Scale

Drawn by: EW/AJS

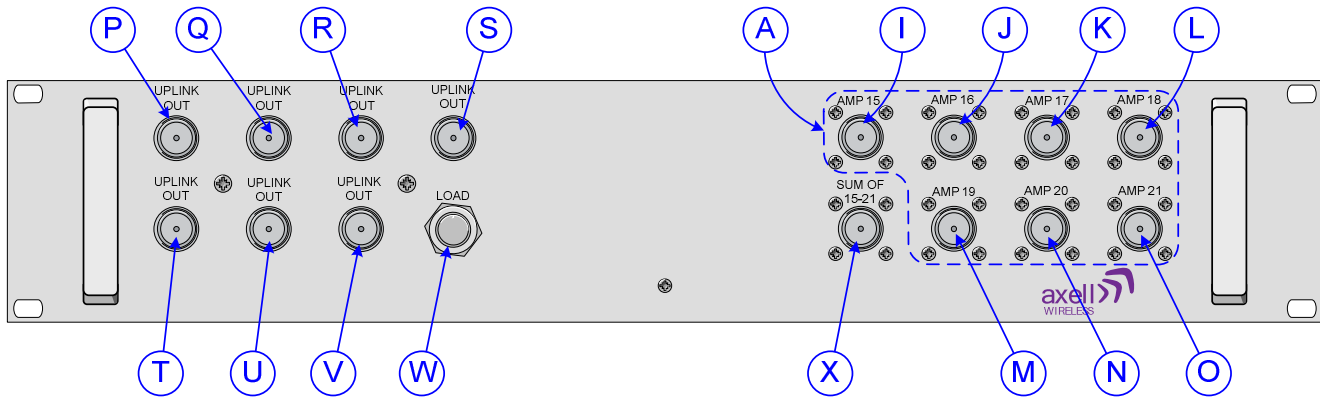
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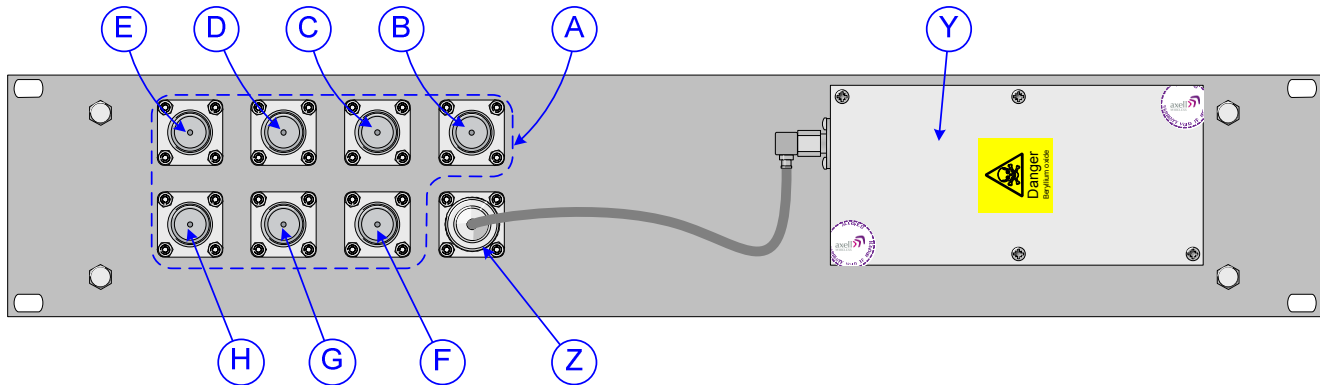
Page 1 of 1

5.15.3. Combiner Unit 60-228909 Front and Rear Views

FRONT VIEW



REAR VIEW



A	Patch-panel for U/L I/Ps from CRCS donor unit and O/Ps to 16 Ch. DSP U/L Squelch Gates 15 to 21
B	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 15 from CRCS donor unit
C	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 16 from CRCS donor unit
D	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 17 from CRCS donor unit
E	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 18 from CRCS donor unit
F	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 19 from CRCS donor unit
G	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 20 from CRCS donor unit
H	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 21 from CRCS donor unit
I	N type port "AMP 15", U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 15
J	N type port "AMP 16", U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 16
K	N type port "AMP 17", U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 17
L	N type port "AMP 18", U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 18
M	N type port "AMP 19", U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 19
N	N type port "AMP 20", U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 20
O	N type port "AMP 21", U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 21
P	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 15
Q	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 16
R	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 17
S	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 18
T	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 19
U	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 20
V	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 21
W	Unused U/L input terminated with Load Termination 93-930008
X	N type port "SUM OF 15-21", combined U/L O/P from 16 Ch. DSP U/L Squelch Gates No. 15 to 21
Y	8 Way Hybrid Splitter/Combiner 06-001901 (Combining)
Z	Rear of N type port (X) "SUM OF 15-21"

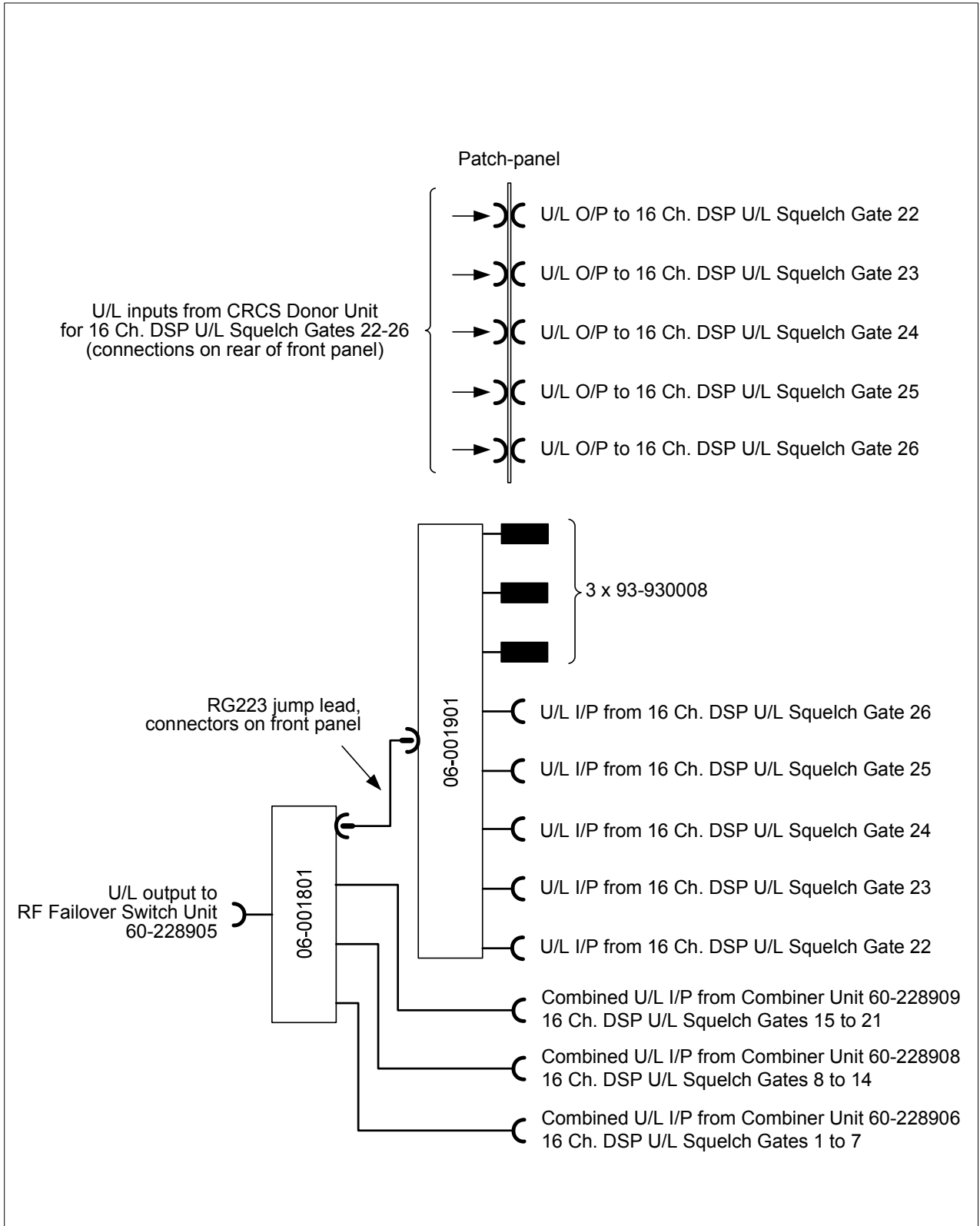
5.16. Combiner Unit 60-228907


Combiner Unit 60-228907 is built onto a 2U, 19" rack mount front panel and combines the Uplink output paths from Combiner units 60-228906, 60-228908 & 60-228909 with the Uplink paths from the five, 16 Ch. DSP U/L Squelch Gates 60-228904 mounted in the front of Rack 1 and passes the combined Uplink signal to RF Failover Switch Unit 60-228905.

5.16.1. Combiner Unit 60-228907 List of Major Sub-Components

Component Part	Part Description	Qty Per Assembly
06-001801	4 Way Hybrid Splitter/Combiner	1
06-001901	8 Way Hybrid Splitter/Combiner	1
93-930008	2W Load Termination	3

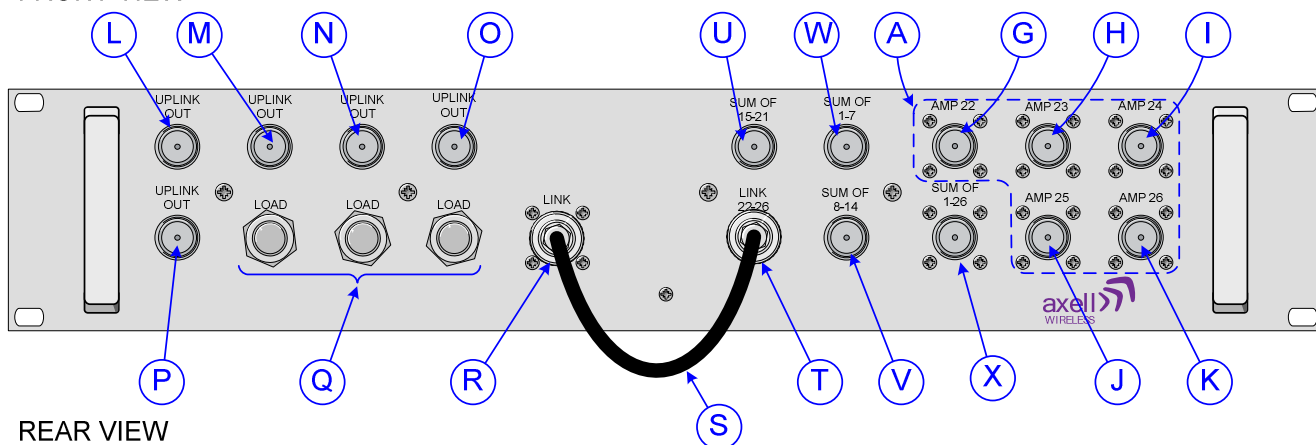
5.16.2. Combiner Unit 60-228907 System Diagram



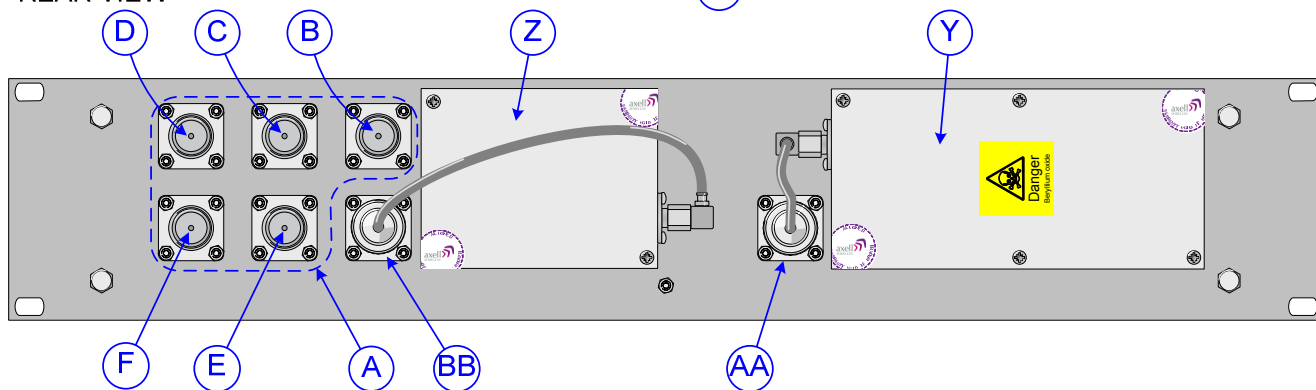
Date: 02/12/2009		Combiner Unit 60-228907 System Diagram	Not to Scale
© AWL 2009			Drawn by: EW/AJS
 <p>Aerial House Asheridge Road Chesham Buckinghamshire HP5 2QD United Kingdom Telephone: +44 (0) 1494 777000 Facsimile: +44 (0) 1494 777002 E-Mail: info@axellwireless.com www.axellwireless.com</p>			Issue: 1
		Rack 1, Front	A4
			Page 1 of 1

5.16.3. Combiner Unit 60-228907 Front and Rear Views

FRONT VIEW



REAR VIEW



A	Patch-panel for U/L I/Ps from CRCS donor unit and O/Ps to 16 Ch. DSP U/L Squelch Gates 22 to 26	
B	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 22 from CRCS donor unit	
C	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 23 from CRCS donor unit	
D	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 24 from CRCS donor unit	
E	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 25 from CRCS donor unit	
F	Uplink input for 16 Ch. DSP U/L Squelch Gate No. 26 from CRCS donor unit	
G	N type port "AMP 22", U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 22	
H	N type port "AMP 23", U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 23	
I	N type port "AMP 24", U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 24	
J	N type port "AMP 25", U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 25	
K	N type port "AMP 26", U/L O/P to 16 Ch. DSP U/L Squelch Gate No. 26	
L	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 22	
M	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 23	
N	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 24	
O	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 25	
P	N type port "UPLINK OUT", U/L input from 16 Ch. DSP U/L Squelch Gate No. 26	
Q	Unused U/L inputs terminated with Load Terminations 93-930008	
R	N type port "LINK", combined U/L O/P from 16 Ch. DSP U/L Squelch Gates No. 22 to 26	
S	RG223 jump lead	
T	N type port "LINK 22-26", combined U/L I/P from 16 Ch. DSP U/L Squelch Gates No. 22 to 26	
U	N type port "SUM OF 15-21", combined U/L I/P from 16 Ch. DSP U/L Squelch Gates No. 15 to 21	
V	N type port "SUM OF 8-14", combined U/L I/P from 16 Ch. DSP U/L Squelch Gates No. 8 to 14	
W	N type port "SUM OF 1-7", combined U/L I/P from 16 Ch. DSP U/L Squelch Gates No. 1 to 7	
X	N type port "SUM OF 1-26," combined U/L O/P to RF Failover Switch Unit 60-228905	
Y	8 Way Hybrid Splitter/Combiner 06-001901 (Combining)	AA Rear of N type port (R) "LINK"
Z	4 Way Hybrid Splitter/Combiner 06-001801 (Combining)	BB Rear of N type port (X) "sum of 1-26"

5.17. 16 Ch. DSP U/L Squelch Gate 60-228904

16 Ch. DSP U/L Squelch Gate 60-228904 is built onto a 4U, 19" rack-mount case.

There are 26 DSP U/L Squelch Gate units in the Gallery Place System each one receives an Uplink input from the existing CRCS donor unit. The purpose of the Squelch gate is to selectively filter the required frequencies from the input broadband noise and intermodulation and to incorporate a digit squelch to the signal. This ensures that only uplink paths with radio traffic are fed to the base station which in turn gives over 13dB improvement in the carrier to signal noise floor.

The 60-228904 utilizes Software Defined Radio (SDR) technology to digitally process the signal to define the required channel frequencies and bandwidth (eight channels in the Uplink band 1 path and eight in the Uplink Band 2 path). As part of the digital signal processing function the signal amplitude is monitored to apply squelch functionality to the signal path to attenuate unwanted noise when the input signal level is low. The unit is pre-programmed with the 16 required uplink frequencies and channel bandwidths as indicated in section 5.17.2., these can be modified by the use of RMC software.

The Uplink signals from the CRCS donor unit fiber optic receivers enter the Squelch Gate unit via the N type port labeled "UPLINK IN" (annotated "A" in section 5.17.4.), the signal passes through a 3dB Splitter/Combiner 05-002603 which splits the signal into two equal paths, each path then enters the UHF SDR Module E921030. Path A handles frequencies in the range of 492.5MHz to 494.0MHz While Path B handles frequencies in the range of 499.3MHz to 499.7MHz. The SDR module selectively amplifies and down converts each band of frequencies to a VHF Intermediate Frequency which is converted from Analogue to Digital before Digital Signal Processing to the required pass bandwidth and frequency (16 Uplink channels per Squelch Gate unit). During the digital processing, the amplitude of the required channel is compared with a preset reference and if the signal exceeds the threshold setting, the signal is enabled to the output. After signal processing has taken place, the signals pass through a Digital to Analogue process before being up converted back to the original to frequency bands. The two Uplink signal paths (A & B) are then recombined by a second 3dB Splitter/Combiner 05-002603 and the Uplink signal exits the Squelch Gate via the N type port labeled "UPLINK OUT" (annotated "B" in section 5.17.4.)

16 Ch. DSP U/L Squelch Gate 60-228904 is powered by a 24V DC supply from the Redundant PSU Modules 96-300091 in PSU Housing Shelf 96-300090, The 24V DC supply feeds an on-board DC/DC converter J1421001 which steps down the 24V supply to provide 6.45v and 15v DC to power the SDR, Controller and Ext. Alarm/battery modules within the Squelch Gate shelf.

An alarm system is fitted, the Squelch Gate shelf has an alarm output which is accessible from the terminals on the front of the External Alarm and Battery Module J1161030 (annotated "E" in section 5.17.4.), from where the alarm data is fed to the Krone terminal block located near the top of the rack (see section 5.10.).

The SDR controller module H561003 is used to control and supervise the SDR functionality, two ports are provided where an operator may connect into the system, a local serial port, (a 9 way "D" panel socket annotated "H" in section 5.17.4.) is used with a laptop PC running suitable terminal-emulation software to interrogate and control the equipment using GET and SET commands. Alternatively the equipment can be configured using RMC software via the RJ45 ethernet port (annotated "I" in section 5.17.4.) To ensure synchronous communications between the SDR and the H56 controller, a high stability 10MHz reference generator, R031002 is incorporated in the equipment backplane.

**5.17.1. 16 Ch. DSP U/L Squelch Gate 60-228904
List of Major Sub-Components**

Component Part	Part Description	Qty Per Assembly
05-002603	3dB Splitter/Combiner	2
19-002202	Interconnection Assembly	1
96-110009	6.3A Fuse	1
E921030	UHF SDR Module (489.25-500.50MHz)	1
H561003	Control Module	1
J1161030	External Alarm and Battery Module	1
J1421001	DC/DC Converter	1
R031002	Reference Generator	1

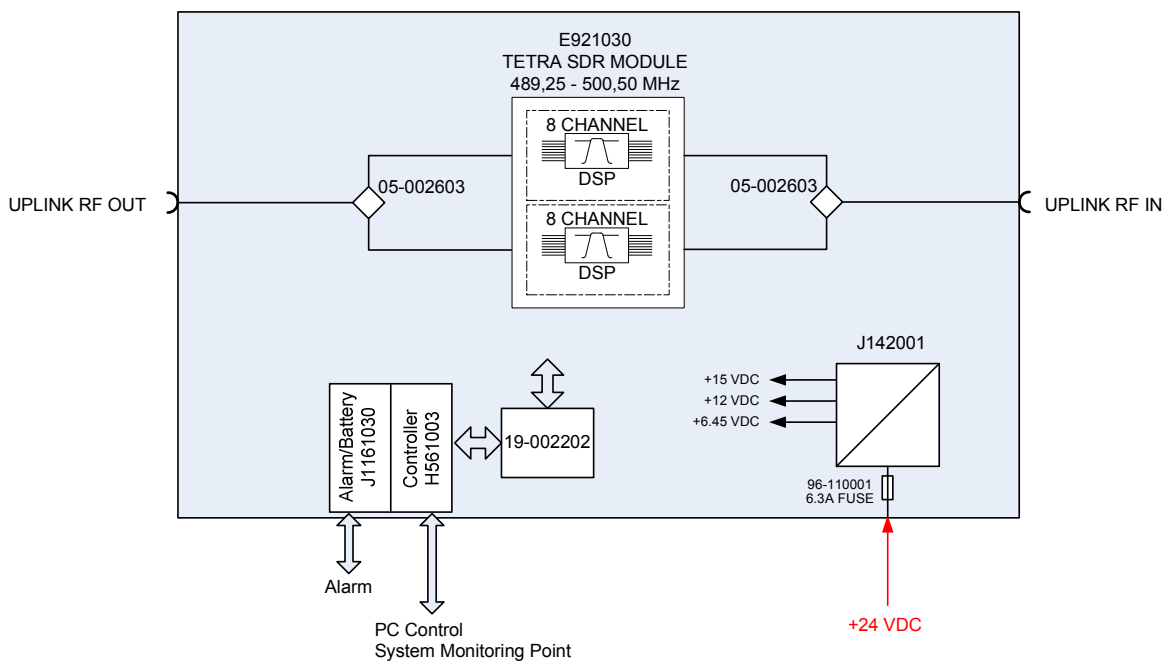
5.17.2. 16 Ch. DSP U/L Squelch Gate 60-228904 Specification

SPECIFICATION	PARAMETER
Uplink	
Frequency Range	492.5MHz to 494.0MHz 499.3MHz to 499.7MHz
No. of Channels	16 ⁽¹⁾
Maximum Gain	+43 ±1dB
Passband ripple	≤ ±1.5 dB
ALC Setting All channels ON	-7.5±1dBm
ALC Dynamic Range	>30 dB
Switched attenuator	0dB to 30 dB in 2dB steps ±1dB
In Band Spurious Noise (30kHz B/W)	< -36 dBm @ max. gain
Squelch Level	-90 ±2dBm
Squelch Level	-80 ±2dBm
Squelch Level	-70 ±2dBm
General	
Supply Voltage	24V DC
Current consumption	< 1.5 A
Alarm output Summary volts free dry contact output (Closed = Normal / Open = Alarm)	pins 7 & 8 - Alarm connector terminal on External Alarm and Battery Module J1161030

⁽¹⁾ Uplink Channels

Channel Number	Channel Frequency	Channel Bandwidth
14	492.5125 MHz	12.5 kHz
13	492.5375 MHz	12.5 kHz
2	493.7875 MHz	25.0 kHz
12	493.8375 MHz	12.5 kHz
1	493.8625 MHz	12.5 kHz
11	493.8875 MHz	12.5 kHz
10	493.9125 MHz	12.5 kHz
9	493.9625 MHz	25.0 kHz
8	499.3375 MHz	25.0 kHz
3	499.4375 MHz	25.0 kHz
7	499.4875 MHz	12.5 kHz
Paging	499.5125 MHz	12.5 kHz
4	499.5375 MHz	12.5 kHz
6	499.5626 MHz	12.5 kHz
15	499.5875 MHz	12.5 kHz
5	499.6125 MHz	12.5 kHz

5.17.3. 16 Ch. DSP U/L Squelch Gate 60-228904 System Diagram



Date: 10/12/2009

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16 Ch. DSP U/L Squelch Gate 60-228904 System Diagram

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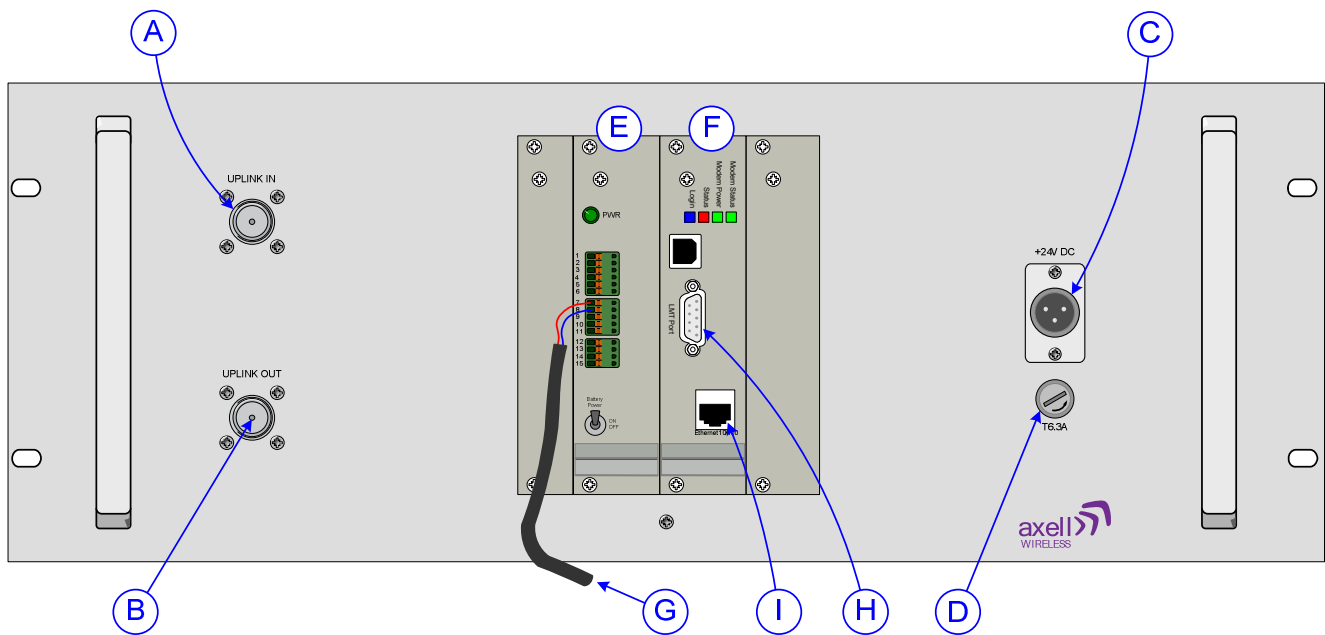
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Page 1 of 1

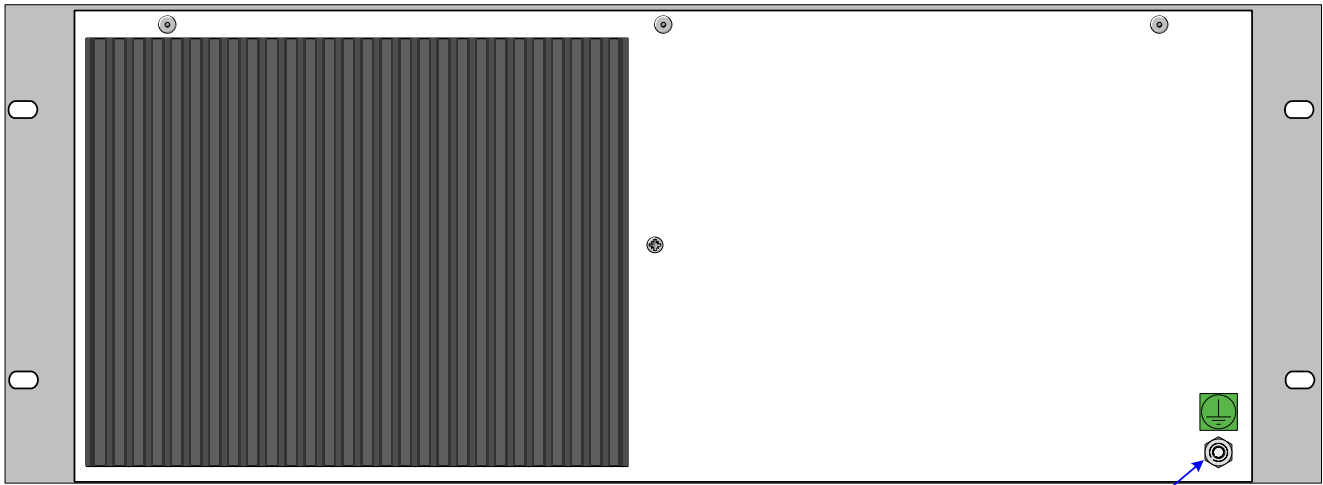
5.17.4. 16 Ch. DSP U/L Squelch Gate 60-228904 Front View



A	N type port “A”, Uplink input from Combiner Unit 60-228907
B	N type port “B”, Uplink output to Combiner Unit 60-228907
C	24V DC input from PSU module 96-300091 in PSU shelf 96-300090
D	6.3A fuse for DC input
E	External Alarm and Battery Module J1161030 ⁽¹⁾
F	Control Module H561003 ⁽¹⁾
G	Alarm to Krone Terminal Block on rack
H	9 pin “D” panel socket “LMT Port”, A local serial port enabling interrogation of alarm data by PC/laptop
I	RJ45 Ethernet socket enabling interrogation of alarm data by PC/laptop

⁽¹⁾ For more information on the Control Module H561003 and External Alarm and Battery Module J1161030, see document A1829300.

5.17.5. 16 Ch. DSP U/L Squelch Gate 60-228904 Rear View



A	Earthing connection
---	---------------------

A

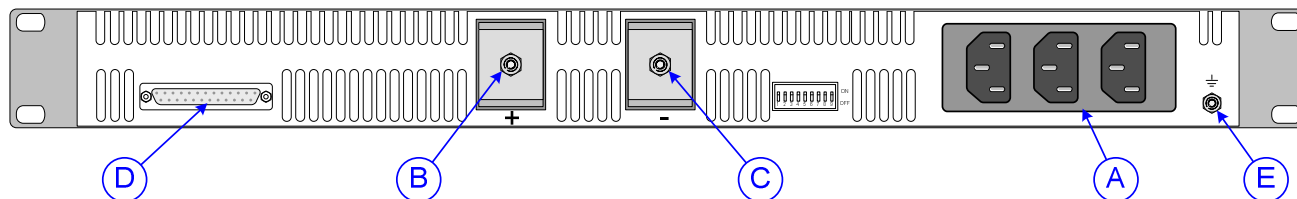
5.18. PSU Housing Shelf 96-300090

These are 1U high, 19" Rack Mount shelves each housing two, 960W, fan cooled, AC mains driven PSU modules (96-300091) the outputs of which are combined to provide a 24V DC supply to the other chassis in the system. The DC leads connected to the output terminals (annotated "B" and "C" in section 5.18.2.) are connected to two pairs of busbars, one on either side of each rack. Separate DC leads for each shelf are then connected to the busbars, one pair of busbars feeds the shelves loaded into the front of the rack and the second pair of busbars feeds the shelves loaded into the rear of the rack. The DC leads from the busbars are terminated with right-angle XLR female connectors which mate with corresponding panel mounting male XLR connectors on the front panels of those units which require a DC input.

5.18.1. PSU module 96-300091 Specification

Output	DC Voltage	24V
	Rated Current	40A
	Current Range	0 ~ 40A
	Rated Power	960W
	Ripple & Noise (max.)	200mVp-p
	Voltage Adj. Range	23.2 ~ 24.8V
	Voltage Tolerance	±1.0%
	Line Regulation	±0.5%
	Load Regulation	±0.5%
	Setup, Rise Time	1000ms, 60ms/230V AC at full load
	Hold Time (Typ.)	16ms/230V AC at full load
Input	Voltage Range	90 ~ 264V AC 127 ~ 370V DC
	Frequency Range	47 ~ 63Hz
	Efficiency (Typ.)	87%
	AC Current (Typ.)	10.5A/115V AC 5.5A/230V AC
	Inrush Current (Typ.)	Cold Start 50A
	Leakage Current	<1.1mA / 230VAC
Protection	Over Load	105 ~ 125% rated output power
		Protection type : Constant current limiting, recovers automatically after fault condition is removed
	Over Voltage	26.4 ~ 32.4V
		Protection type : Shut down o/p voltage, re-power on to recover
Over Temperature	75 5°C ±5°C (TSW1) Detect on heatsink of power transistor 85 5°C ±5°C (TSW2) Detect on heatsink of power diode	
	Protection type : Shut down o/p voltage, recovers automatically after temperature goes down	

5.18.2. PSU Module Chassis 96-300090 Rear View

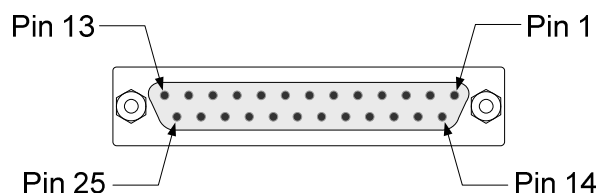


A	AC inputs
B	24V DC terminal (connects to rack 24V busbar)
C	0V DC terminal (connects to rack 0V busbar)
D	Alarm output to Krone terminal block on rack
E	Earthing connector

5.18.3. PSU Module Chassis 96-300090 Alarm Wiring

25 pin “D” panel socket, local alarm/control output to Krone terminal blocks on rack (see section 5.10)

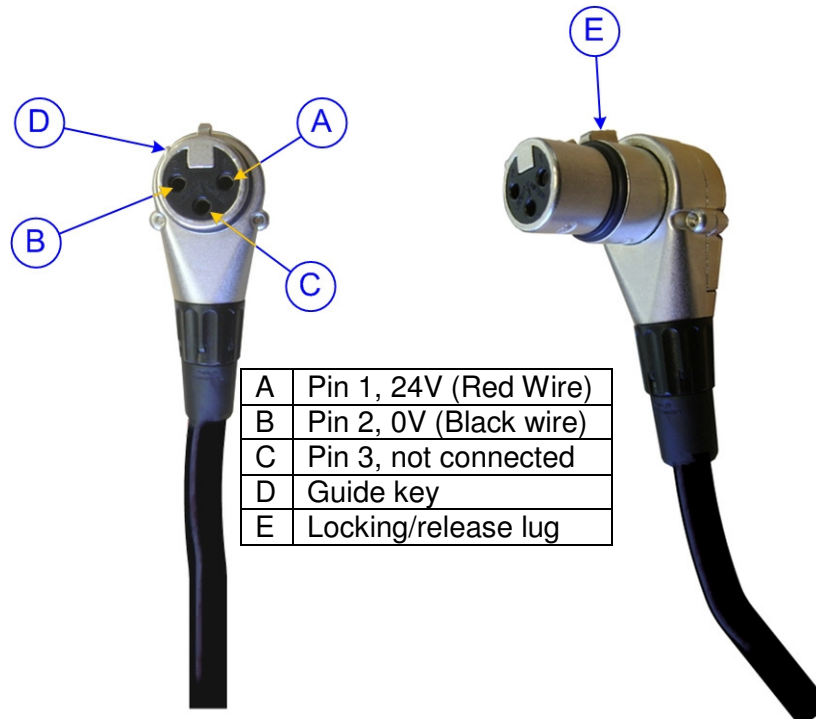
- Pin 1 ON/OFF PSU A
- Pin 2 AC OK PSU A
- Pin 3 DC OK PSU A
- Pin 5 T-ALARM PSU A
- Pin 9 AC OK PSU B
- Pin 8 ON/OFF PSU B
- Pin 10 DC OK PSU B
- Pin 12 T-ALARM PSU B
- Pin 21 -S -ve SENSING
- Pin 20 +S +ve SENSING



5.18.4. DC Connector Details

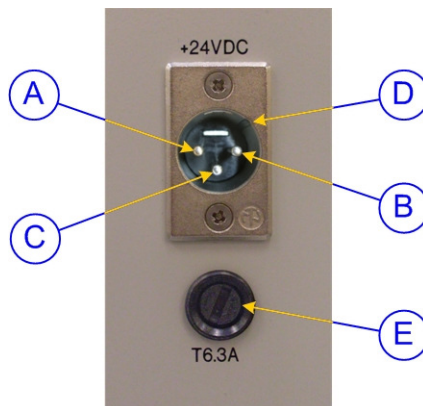
5.18.4.1. DC Inlet Free Socket

These are the free sockets that are connected to the rack busbars



5.18.4.2. Typical DC Inlet Panel Plug

Typical DC Inlet Panel Plug showing pin allocations for the rack equipment shelves



A	Pin 1, 24V (Red Wire)
B	Pin 2, 0V (Black wire)
C	Pin 3, not connected
D	Guide keyway
E	Fuse access

Appendix A

A.1. Glossary of Terms used in this document

Repeater or Cell Enhancer	A Radio Frequency (RF) amplifier which can simultaneously amplify and re-broadcast Mobile Station (MS) and Base Transceiver Station (BTS) signals.
Band Selective Repeater	A Repeater designed for operation on a range of channels within a specified frequency band.
Channel Selective Repeater	A Repeater, designed for operation on specified channel(s) within a specified frequency band. Channel frequencies may be factory set or on-site programmable.
AC	Alternating Current
AGC	Automatic Gain Control
BDA	Bi-directional Amplifier
BTS	Base Transceiver Station (Base Station)
B/W	Bandwidth
C/NR	Carrier-to-Noise Ratio
CRCS	Comprehensive Radio Communications System
CRAS	CRCS Redundant Antenna System
DAS	Distributed Antenna System
DC	Direct Current
Downlink (D/L)	Signals transmitted from the BTS to the Mobiles
DSP	Digital Signal Processing
F/O	Fiber Optic
GND	Ground
ID	Identification (Number)
I/P	Input
LCX	Leaky Coaxial Cable (Leaky Feeder).
LED	Light Emitting Diode
LNA	Low Noise Amplifier
LPA	Low Power Amplifier
Mobile(s)	Hand-portable or other "Mobile" RF Transceiver equipment
MOU	Master Optical Unit
MTBF	Mean Time Between Failures
N/A	Not Applicable
N/C (of Relays)	Normally Closed
N/O (of Relays)	Normally Open
OFR	On Frequency Repeater
OIP3	Output Third Order Intercept Point
O/P	Output
P1dB	1dB Compression Point
PA	Power Amplifier
RF	Radio Frequency
RHNC	Relative Humidity, Non Condensing
RSA	Receiver/Splitter Amplifier
RX	Receiver (Received)
SDR	Software-Defined Radio
S/N	Serial Number
TX	Transmitter (Transmitted)
Uplink (U/L)	Signals transmitted from the Mobiles to the BTS
VSWR	Voltage Standing Wave Ratio
Date Format	Date Format used in this document is dd/mm/yyyy

A.2. Key to Drawing Symbols used in this document

1	2	3	4	5	6	7	8	9	
HUBS FIBRE MAIN HUB EXPANSION HUB TAPPER/COUPLER		COUPLERS 10dB COUPLER 6 dB DIRECTIONAL COUPLER 10dB DIRECTIONAL COUPLER 6dB DIRECTIONAL COUPLER DIRECTIONAL COUPLER CROSS BAND COUPLER		CABLES 8/FIBRE OPTIC CABLE/LINK 24/FIBRE OPTIC CABLE/LINK JUMPER CABLE 1/2" RADIATING CABLE CAT 5 CABLE CO-AX CABLE 1/2" DIA CO-AX CABLE 7/8" DIA		SPLITTERS HYBRID SPLITTER SPLITTER		ANTENNAS OMNI ANTENNA YAGI ANTENNA FLAT PLATE ANTENNA (MOUNTED AT HIGH LEVEL) DIRECTIONAL ANTENNA ANTENNA REMOTE ANTENNA UNIT PANEL ANTENNA BLADE ANTENNA	
MISC BASE TRANSCEIVER STATION CHANNEL MODULE FIBRE-OPTIC MODULATOR FIBRE-OPTIC DEMODULATOR PLUG & SOCKET SOCKET PLUG FIBRE OPTIC CONNECTOR FC/APC		MISC BAND PASS FILTER CAVITY RESONATOR NOTCH FILTER ISOLATOR HYBRID COMBINER EARTH STUD LEEKY FEEDER R.S.A <i>Outputs to receivers</i>		MISC AMPLIFIER ATTENUATOR (VARIABLE) ATTENUATOR (FIXED) A.G.C MONITORING CONTROLLER MODEM BI-DIRECTIONAL AMPLIFIER (CELL ENHANCER) DUMMY LOAD LOCAL OSCILLATOR		MISC AC TO DC PSU DC TO DC CONVERTER FUSE N.O. (CLEAR CONTACT) RELAY N.C. (FILLED CONTACT)		SIGNAL KEY • = READING POSITION 602 = BCCH (BROADCAST CONTROL CHANNEL) 22 = BASIC (BASIC SITE IDENTITY CODE) -82 = ACCEPTABLE SIGNAL LEVEL (dBm) -83 = BELOW ACCEPTABLE SIGNAL LEVEL (dBm) -72 = ACCEPTABLE SIGNAL LEVEL (dBm) -73 = BELOW ACCEPTABLE SIGNAL LEVEL (dBm)	
MISC BTS FREQUENCY PROGRAMMING DATA		MISC MONITORING CONTROLLER MODEM LOCAL OSCILLATOR		MISC AC TO DC PSU DC TO DC CONVERTER FUSE N.O. (CLEAR CONTACT) RELAY N.C. (FILLED CONTACT)		SIGNAL KEY • = READING POSITION 602 = BCCH (BROADCAST CONTROL CHANNEL) 22 = BASIC (BASIC SITE IDENTITY CODE) -82 = ACCEPTABLE SIGNAL LEVEL (dBm) -83 = BELOW ACCEPTABLE SIGNAL LEVEL (dBm) -72 = ACCEPTABLE SIGNAL LEVEL (dBm) -73 = BELOW ACCEPTABLE SIGNAL LEVEL (dBm)		STANDARD EXCEPT FOR AIRPORTS (SEE BELOW) STANDARD FOR ALL AIRPORTS	
PL DATE 10/05/00		DATE 10/05/00		TITLE AXELL STANDARD SYMBOLS		ISSUE No DESCRIPTION DATE BY		DATE 30/08/04 LS 28/07/04 PL 26/01/04 PL 21/06/00 PL 23/05/00 PL	
MB APPD PL		SCALE NTS		CUSTOMER 90-000001		DRAWING No 90-000001		BY 3	
PL ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED		TOLERANCES NO DECIMAL PLACE ± 1mm ONE DECIMAL PLACE ± 0.3mm TWO DECIMAL PLACES ± 0.1mm UNLESS OTHERWISE STATED		THIS IS A PROPRIETARY DESIGN OF AXELL WIRELESS LTD. REPRODUCTION OR USE OF THIS DESIGN BY OTHERS IS PERMITTED ONLY IF EXPRESSLY AUTHORISED IN WRITING BY AXELL WIRELESS LTD.		THIRD ANGLE PROJECTION		DATE 30/08/04 LS	

A.3. EC Declaration of Conformity



In accordance with BS EN ISO/IEC 17050-1&-2:2004

Axell Wireless Limited
Aerial House
Asheridge Road
Chesham
Buckinghamshire HP5 2QD
United Kingdom

C E0086

Declares, under our sole responsibility that the following product:
Product Part Nos. and Product Descriptions

60-228701 - WMATA Carmen Turner Facility CRAS System
60-228801 - WMATA Jackson Graham Building CRAS System
60-228901 - WMATA Gallery Place Station CRAS System

In accordance with the following directives:

1999/5/EC The Radio & Telecommunications Terminal Equipment Directive Annex V
and its amending directives

Has been designed and manufactured to the following standard[s] or other normative document[s]:

BS EN 60950 Information technology equipment.
Safety. General requirements.

ETS EN 301 489-1 EMC standard for radio equipment and services.
Part 1. Common technical requirements.

I hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced specifications. The unit complies with all essential requirements of the Directives.

SIGNED

A handwritten signature in black ink, appearing to read "B. S. Barton".

B. S. Barton
Operations Director

DATE: DATE: 18/11/2009

Registered Office: Aerial House, Asheridge Road, Chesham, Buckinghamshire, HP5 2QD England Registered No. 4042808 (England)
www.axellwireless.com

A.4. Waste Electrical and Electronic Equipment (WEEE) Notice



The Waste Electrical and Electronic Equipment (WEEE) Directive became law in most EU countries during 2005. The directive applies to the disposal of waste electrical and electronic equipment within the member states of the European Union.

As part of the legislation, electrical and electronic equipment will feature the crossed out wheeled bin symbol (see image at left) on the product or in the documentation to show that these products must be disposed of in accordance with the WEEE Directive.

In the European Union, this label indicates that this product should not be disposed of with domestic or "ordinary" waste. It should be deposited at an appropriate facility to enable recovery and recycling.

A.5. Document Amendment Record

Issue No.	Date	Incorporated by	Section Amended	Reason for new issue
1	18/11/2009	AJS/GD		Draft
2	15/02/2010	AJS		Customer changes CRCS & CRAS
3	28/05/2010	AJS		Reformat to US Letter size