Eddystone Broadcast

XA150/300 Series
150W/300W
FM Amplifiers

Installation
and
Operation

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SECTION ONE : INTRODUCTION

! CAUTION !

These Amplifiers operate at **high RF power levels, internal supply energy levels and mains supply current levels**. They also incorporate devices containing **toxic BeO**. Installation, operation and maintenance of this unit must therefore, only be carried out by suitably qualified personnel, familiar with and fully utilising the safety procedures such equipment demands.

NO attempt at installation should be made without full reference to and compliance with SECTION TWO : INSTALLATION.

NO attempt at internal maintenance should be made without full reference to and compliance with the appropriate sections (fuse changing and internal option links are detailed in INSTALLATION).

1.1 : GENERAL DESCRIPTION

The XA150/300 Series of FM Amplifiers provide output powers of up to 150W (XA150) or 300W (XA300) in the standard Band II frequency range of 87.5-108MHz.

The Amplifiers are totally self-contained (including forced air-cooling) and can be mounted within a standard 19 inch rack with at least 600mm depth and 2U height. All that is required is a connection to a mains supply, to an RF source and to an antenna.

Remote control and monitoring of the Amplifier can be by serial RS232 or TCP/IP connection (internal preset link) using asynchronous data. Basic parallel control and monitoring is also provided. On certain variants, a mains supply on/off switch is provided on the rear panel (see section 1.2).

The Amplifier consists of a number of modules described as follows (1.1.1 – 4 inc.). Front and rear views, block and circuit diagrams, showing these modules are bound at the rear of this manual (E2175-00GA, E2175-00BK and E2175-00CT).

1.1.1 : Front Panel Module

The Front Panel module provides all local control and monitoring of the Amplifier functions. It also enables this control and monitoring to be performed remotely via an RS232 or TCP/IP serial interface.

The module is microprocessor based with a back illuminated, high contrast 4 line by 20 character display and separate ‘FAN’, ‘SYSTEM NORMAL’, ‘MUTE’ and various Amplifier (‘PA’) status red/green indicators. A robust, sealed membrane keypad is provided with a sounder to indicate correct key entry. A connection is provided, from the module, to RS232 and TCP/IP monitor/control ports on the rear of the Amplifier. Selection of TCP/IP or RS232 is done by internal connections to the Main Board.

The Front Panel module also has a preset control, SET POWER, adjustable via an access hole in the front panel, for setting the Amplifier output power level. A connector providing a sample of the final RF output signal is provided, adjacent to the preset control, for temporary connection to external monitoring equipment (RF MON).

Front Panel control and monitoring of the Amplifier is via a two-way serial data link to the hardware control microprocessor on the Main Board (section 1.1.2).

1.1.2 : Main Board

The Main Board contains the main hardware control and monitor microprocessor and all connections to other boards within the Amplifier.

The Main Board also carries all the parallel and RS232 serial control and monitoring connections to a 25 way ‘D’ socket and a 9 way ‘D’ plug respectively, on the rear panel, along with protection and filtering for all these input/output circuits as well as the ‘open collector’ output transistors for the parallel status output connections.

The microprocessor on the Main Board provides all control and monitoring of the hardware on the board, including analogue to digital conversion of power supply levels. It also interfaces, via serial data links, with other hardware control microprocessors on the Amplifier Control Board and on the Front Panel module (separate dedicated bus – section 1.1.1).

A separate hardware 'watchdog' circuit monitors the running of the microprocessor's program and provides warnings (on board led, to Front Panel and to rear panel output) if the program fails to run, and also automatically mutes the Amplifier's output. The microprocessor also generates a mute signal under various circumstances, this signal being directed via the safety 'Interlock' relay. This relay will itself provide an over-riding mute signal if the external Interlock line is open-circuited, irrespective of any internal Amplifier condition.

1.1.3 : 150/300W Amplifier Module, Control and Power Supply

The 150/300W Amplifier Module is fitted on a fan-cooled heatsink which runs between the front and rear panels. To reduce ingress of dust, nearly all of the forced air is directed over the heatsink fins with only a small 'bleed' of air over components mounted on the heatsink surface itself. The Module can provide at least 150W or 300W output from approximately 2-4W RF input. The amplifier itself is an integrated 50Ω gain block consisting of a dual RF Mosfet transistor with matching sections at its input and output. This 'pallet' is mounted on an aluminium block and is easily replaced as a unit if required.

The maximum output power level is determined by the Power Supply fitted (36V for 150W, 48V for 300W). The output power level is set by the bias voltage applied to the output Mosfet by the Control Board. A range of approximately 40W to 150W (XA150) or 40W to 300W (XA300) is provided with the power input specified.

The Amplifier Module feeds a lowpass filter and directional coupler (both in a separate screened section). The filter is a nine section Tchebycheff, giving a very high level of attenuation at harmonic frequencies. The module itself also has sensors to measure heatsink temperature and output Mosfet current. Voltages from the coupler (indicating forward and reverse power) and the sensors are fed to the Control Board to enable accurate setting of forward output power, with a automatic reduction in that power if reverse power, heatsink temperature or output Mosfet current becomes excessive.

A low level sample of the output power is taken from the Amplifier Module (after the separate low pass filter section) to feed the front panel RF MON output connector.

As already described, the Control Board contains (analogue) circuitry to generate a control reference voltage to set the bias voltage applied to the output Mosfet in the Amplifier Module. This control voltage is initially set by the front panel SET POWER control to generate a desired power output level. Excessive reverse power, heatsink temperature or amplifier current, above preset 'trip' points, then automatically adjusts the set control voltage, gradually reducing the output power ('fold-back'). Various muting or external interlock conditions also over-ride the set control voltage, instantaneously reducing the power output to a minimum.

A microprocessor on the Control Board provides all monitoring of the hardware on the board, including analogue to digital conversion of forward/reverse power, heatsink temperature, amplifier current and set power level. It also interfaces, via a serial data link, with the hardware control microprocessor on the Main Board (RS485 bus – section 1.1.2). Digitised versions of all the mentioned levels and various fault conditions (low power, power fail etc.) are sent to the Main Board and then onwards for display on the Front Panel or remotely. A separate hardware 'watchdog' circuit monitors the running of the microprocessor's program and provides a Front Panel PA - CPU led warning if the program fails to run, and puts the adjacent PA - FWD, REV, TEMP and CURRENT leds all off (their indications would be invalid in this circumstance).

The Power Supply is a universal input, switched mode design, with a power rating and output voltage dependent on the maximum output power from the Amplifier. The XA150 has a 36V, 300W supply and the XA300 has a 48V, 600W supply. Its single output is fed to the '12V Supply and Fan Control Board' (section 1.1.4).

1.1.4 : 12V Supply and Fan Control Board

This board contains a 20W DC-DC converter, which provides a regulated +12V dc supply from the main 36V (XA150) or 48-50V (XA300) Power Supply. The +12V supply is further processed and regulated to provide +5V and - 12V at point of delivery. The board also provides accurately tapped outputs from the input 36/48V line and output 12V line to feed the A-D converter on the Main Board, thus enabling a display of these voltage levels on the Front Panel or remotely.

This board further provides the 10A/16A fused supply to the 150/300W Amplifier Module and the fused supply for the amplifier fan. The fan operates at 24V (XA150) or 48V (XA300) and thus there is a factory-set link on the board, which is set according to the input supply (36V or 48-50V) to generate the correct fan supply. The fan supply return lead is feed through a current detector circuit on this board, which signals any low fan current state to the Main Board microprocessor.

1.2 : VARIANTS AND OPTIONS

The main variants and options (indicted by number or letter suffixes respectively) are as follows :-

E2175-01	Basic XA150 150W Amplifier
E2175-02	Basic XA300 300W Amplifier
E2175-03	Basic XA150 150W Amplifier with Mains Supply Switch
E2175-04	Basic XA300 300W Amplifier with Mains Supply Switch

No options are available for these units.

1.3 TECHNICAL SPECIFICATIONS

The XA150/300 Series of FM Amplifiers is designed to meet or exceed ETSI Standards :-

EN 301 489-01 : ERM/EMC for Radio Equipment, Part 1, Common Technical Requirements.
EN 301 489-11 : ERM/EMC for Radio Equipment, Part 11,Special Conditions for FM Transmitters.
EN 302 018-02 : ERM (Spectral Occupancy) for the FM Radio Broadcast Services
EN 60215:1989 : Safety Requirements for Radio Transmitting Equipment.

1.3.1: Common Specifications

RF Interface Ports	50Ω nominal, TNC connector for input, N Type for output.
Carrier Frequency	87.5-108MHz
Input Drive Power	RF Input from Exciter/Drive, 2-4W typical, 8W maximum
Output Power	With any load with a return loss >14dB (1.5:1 VSWR) any angle. XA150 Adjustable over range of at least 40W to 150W XA300 Adjustable over range of at least 40W to 300W Variation : Not more than ± 0.5dB under all specified operating conditions
Output Power Shutdown	Output power is automatically reduced or shutdown to ensure that any load producing reverse power greater than approximately 30W including open and short circuits, does not cause any damage to the Amplifier. Excessive heatsink temperature (greater then +85 deg.C) or output amplifier current also automatically reduces or shutdowns the output power.
Reverse Intermodulation	Reverse intermodulation products will be better than or equal to –10dB, relative to the interfering incident signal, this being offset over the range ±300kHz to ±20MHz (but remaining within 87.5MHz to 108MHz).
Spurious and Harmonic Emissions	In the range 9kHz to 1000MHz : - Better than or equal to –75dBc - typically better than –85dBc In the range 87.5MHz to 137MHz : - Better than or equal to –85dBc at greater than 500kHz removed from carrier. Measured in a 10kHz bandwidth, with and relative to, an unmodulated carrier.
Adjacent Channel Spurious Emissions	Better than or equal to –20dBc at ±125kHz removed from carrier Better than or equal to –40dBc at ±150kHz removed from carrier. Better than or equal to –60dBc at ±175kHz removed from carrier Better than or equal to –80dBc at ±200kHz removed from carrier. Better than or equal to –85dBc at ±300kHz to ±500kHz removed from carrier. Measured in a 1kHz bandwidth, with a ±75kHz deviation, 400Hz mono signal. Spurious levels relative to peak signal carrier/sidebands (i.e. within a spectrum mask defined by above limits).
Status Indications	Four line by 20 character back-lit LCD display with selectable screens showing forward and reverse power; individual system normal status components; comprehensive bargraph and digital readout metering of analogue levels. Red/green/off led indicators for fan operation, system normal status and mute status. Red/green pass/fail led indicators of Amplifier Module output forward and reverse power, heatsink temperature, dc supply current and CPU status.

Local Control	Eight key sealed membrane keypad including : - main and mode screen dedicated keys, two cursor keys and four soft keys.
Remote Control and Monitoring	RS232 or TCP/IP (preset internal link setting) using 2400, 4800, 9600 or 19200 Baud asynchronous data (1 start, 8 data, 2 stop, no parity) rate selectable from front panel. All local control and monitoring is duplicated over the serial link. RS232 on nine way 'D' plug, TCP/IP on RJ45 socket. Basic parallel control/monitoring including analogue output voltage levels indicating forward and reverse output power (on 25 way 'D' socket). RF monitoring BNC output on front panel.
Safety Interlock	Safety interlock on separate 2 way screw terminal connector. Note that this duplicates a pair of inputs on the Remote Control 25 way 'D' socket detailed above.
Environmental	Ambient Temperature (operating) : -5 to +50 deg.C Ambient Temperature (storage) : -20 to +70 deg.C Relative Humidity (operating) : Less than or equal to 95%, non condensing with the Amplifier at a higher temperature than the ambient. Altitude (operating) : Up to 3000 metres a.s.l.
Mechanical	Width : 483mm (19 in.) Height : 88mm (2U) Depth : 520mm Weight : Approx. 15kg. Note depth is intrusion into rack including cabling at the rear.
Power Supply	Single phase input on 10A IEC connector: - XA150 : 100-260VAC (47-63Hz) 3A at 100V to 1.2A at 260V (at 150W RF output) Power factor meets EN61000-3-2 Peak inrush current 14A - 28A at 100V - 260VAC input XA300 : 100-260VAC (47-63Hz) 6A at 100V to 2.4A at 260V (at 300W RF output) Power factor meets EN61000-3-2 Peak inrush current 14A - 28A at 100V - 260VAC input

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SECTION TWO : INSTALLATION

! CAUTION !

These Amplifiers operate at **high RF power levels, internal supply energy levels and mains supply current levels**. They also incorporate devices containing **toxic BeO**. Before commencing installation, it is recommended that the complete INSTALLATION section is read and understood. **The instructions should then be strictly followed, by suitably qualified personnel, otherwise sub-standard or even dangerous operation may result.**

2.1 : PHYSICAL DIMENSIONS AND FITTING

2.1.1 Installation Accessories

Various installation accessories may be supplied as required. A list of these (including spare fuses) is given below. Actual requirements depend on the configuration of the equipment supplied and whether or not leads are supplied ready made etc. Note that extra, unlisted parts may be required for connections to any Amplifier that is supplied (see manuals supplied with them).

Typical Quantity	Description	Function
1	10A (C13) IEC mains connector.	For connection to lead from mains supply distribution point.
Length as req'd	3 core,1.0mm^2 per core, insulated cable (EPR insulated, HOFR sheathed)) or 3 core,1.5mm^2 per core, insulated cable (PVC insulated and sheathed)	Mains supply lead for operation in up to 50 deg.C ambients.
1	10A 'C' rated 2 pole miniature circuit breaker (MCB).	Fitted at mains supply distribution point to protect supply lead and mains input components in the Amplifier.
1	N type RF coaxial free plug plus low loss RF coaxial cable as req'd (rated in excess of Amplifier output power at maximum ambient temperature)	For connection to RF output
1	TNC type 50Ω coaxial free plug plus RF coaxial cable as req'd	For connection to RF input
1	2 Way, 5.08mm pitch screw terminal block (c/w wire shorting link). (e.g. Weidmuller BL5.08/2)	External safety interlock connector (wire shorting link is removed when connector is wired to external safety circuits)
1	9 Way D plug c/w cover.	For connection to leads from serial RS232 control/monitor ancillary equipment.
1	25 Way D plug c/w cover.	For connection to leads from parallel control/monitor ancillary equipment.
Length as req'd	Multi-core screened cable (number of cores as required).	Control/monitor leads.
Length as req'd	Heavy gauge grounding wire/strap.	For safety earth lead.
4	Screws c/w plastic cup washers and rack caged nuts.	For fixing unit into19 inch rack.
2	Side support 'L' brackets c/w fixing screws and washers.	For extra support to carry the Amplifier's weight in the rack.
1	6.3A (T) HBC 5x20mm Fuse	For protection of ac supply input circuitry
1 (XA150 only)	10A (T) HBC 5x32mm (¼ x1¼ in) Fuses	For protection of internal dc supply to output amplifier
1 (XA300 only)	16A (T) HBC 5x32mm (¼ x1¼ in) Fuses	For protection of internal dc supply to output amplifier

2.1.2 Rack Mounting

If the Amplifier is not supplied ready mounted in a 19 inch rack, this will be required to be done at time of installation.

The 19 inch rack should ideally be of standard 600mm depth and requires at least 2U for the XA150/300. Additional height will be required if a second Amplifier is to be fitted into the same rack.

Additional bottom support 'L' brackets may also be required at each side, below the Amplifier, to help carry its weight. The Amplifier is then fixed to the front of the racking using four screws, plastic cup washers and caged nuts.

2.2 EXTERNAL CONECTIONS

All permanent external connections are made at the rear of the unit in accordance with system requirements. The connections required are made as described in the following sub sections.

2.2.1 Mains Supply Connector

This is a standard IEC connector PL02, at the right rear of the unit, intended for connection to a single phase (plus protective earth) supply. The input is protected by a 20mm 6.3A(T) HBC fuse fitted in a carrier in PL02.

! CAUTION ! – On certain variants, a rear panel on/off switch is provided in-line with this connector. Note that this switch interrupts the Neutral supply line only (see section 1.2).

For the XA150, the supply is in the range 100-260VAC (47-63Hz) with no setting required. The maximum current drawn from the supply is in the order of 3A at 100V to 1.2A at 260V (at 150W RF output).

For the XA300, the supply is also in the range 100-260VAC (47-63Hz) with no setting required. The maximum current drawn from the supply is in the order of 6A at 100V to 2.4A at 260V (at 300W RF output).

The mains supply lead to the Amplifier must use at least **10A rated three core (P+N+protective earth)** insulated cable. **A double pole 10A (C rated) MCB must be provided at the supply distribution board (preferred) or a 10A HBC fuse in the associated plug at the supply outlet, to protect this lead.** Also, since the supply input circuitry contains a filter, which passes current to the Amplifier chassis, **the chassis must be connected to a safety ground** via the earthing bolt provided adjacent to the mains supply input connector.

The supply lead terminates in a 10A (C13) IEC free socket at the Amplifier end, which is wired as follows :-

L or Brown	Line
N or Blue	Neutral
⊥ or Green/Yellow	Protective Earth

Care MUST be taken to connect these leads to the supply as detailed in the above table. If a lead with different coloured wires is used, further advice MUST be taken.

Also ensure whilst making any connections to the mains supply, that the Amplifier's rear panel interlock circuit at PL07, pins 1 and 2, is open-circuit (i.e. Amplifier muted).

2.2.2 RF Output Connector

! CAUTION !

When operating, high RF Voltages are present on this connector. Always ensure when making connections here, or working on any load connected, that the Amplifier's mains supply is either disconnected or switched to 'off' at the distribution board (preferably being locked in that position).

This is an N Type coaxial socket SK08 at the rear of the unit. Care must be taken to use adequately rated (at maximum ambient temperature) low loss cable for the lead to the antenna, amplifier or load.

2.2.3 RF Input Connector

This is a 50Ω TNC coaxial socket SK06 at the rear of the unit. The input signal is typically 2-4W and must not exceed 8W.

2.2.4 TCP/IP Connector

This is an RJ45 connector SK03 fitted at the rear of the unit. This enables all the control and monitoring detailed in Section 2.4 to be performed using TCP/IP (Transmission Control/Internet Protocol).

This arrangement requires the unit to be assigned a unique Internet Protocol address. When first connected to the network via its RJ-45 connector, the Amplifier's TCP/IP adapter will attempt to acquire an IP address automatically (it's quite common to have networks configured to use 'DHCP', which provides these addresses on demand). The address to which a device has been assigned can then be determined and, if required, be overridden with a desired fixed value, using Eddystone supplied software.

Note that an internal lead connection determines if serial control and monitoring is via this RJ45 connector or via the rear panel (RS232) COM Port connector PL04 (see 2.2.12). For TCP/IP control, the 3 pin screened lead from the Front Panel board connector (6)CON05 must be plugged into the Main Board connector (5)CON04.

2.2.5 RF Monitor Connector

This is a 50Ω BNC coaxial socket SK01 on the left hand side of the Amplifier front panel. This provides an harmonically filtered sample of the Amplifier's forward output power at a level, into 50Ω, of approximately 10mW at maximum power output. This connector is for test purpose only with the test equipment and lead being disconnected when not in use. **NOTE that the levels of any harmonics present are not necessarily equal to those at the antenna.**

2.2.6 COM Port Connector

This is a 9 Way D plug PL04 on the rear panel. This enables all the control and monitoring, detailed in Section 2.4, to be performed using a personal computer with its (RS232) COM port connected to this port. Multi-core screened cable, not exceeding 30 metres in length, should be used for the interconnecting lead. The lead terminates in a 9 Way free D socket at the Amplifier end which is wired as follows :-

Pin 1	Not connected
Pin 2	Received Data (to Amplifier)
Pin 3	Transmit Data (from Amplifier)
Pin 4	Not Connected
Pin 5	Ground
Pin 6	Not Connected
Pin 7	Not Connected
Pin 8	Not Connected
Pin 9	Not Connected

Note that the assigned pin numbers and their functions are for a standard 9 pin plug on 'Data Terminal Equipment' (DTE) such as computers. Standard crossover or 'null modem' leads must thus be used for connection to a personal computer or PC. The length of the interconnecting lead may be extended by use of compatible RS422/485 or fibre-optic line drivers.

Note that an internal lead connection determines if serial control and monitoring is via this RS232 connector or via the rear panel TCP/IP connector SK04 (see 2.2.7). For RS232 control, the 3 pin screened lead from the Front Panel board connector (6)CON05 must be plugged into the Main Board connector (5)CON05.

2.2.7 Status Connector

This is a 25 Way D socket SK05 at the rear of the unit. This is used to enable basic external monitoring and control. Multi-core screened cable, not exceeding 3 metres in length, should be used for the interconnecting lead.

The lead terminates in a 25 Way free D plug at the Amplifier end which is wired as follows :-

Pins 1 -6	Not Used 1-6
Pin 7	Forward Power Low (approx. –2dB rel. set o/p - pulled to ground when good)
Pin 8	Forward Power Fail (approx. –12dB rel. max o/p - pulled to ground when good)
Pin 9	Reverse Power High (approx. 30W - pulled to ground when good)
Pin 10	Not Used 7
Pin 11	Heatsink Temperature status output (pulled to ground when good i.e.<85deg.C)
Pin 12	Not Used 8
Pin 13	System Normal status output (pulled to ground when good)
Pin 14	Chassis Ground
Pin 15	Chassis Ground
Pin 16	Forward power analogue monitor voltage output (0-5V into >1kΩ) approx.2V at 150W to 3V at 300W
Pin 17	Reverse power analogue monitor voltage output (0-5V into >1kΩ) approx. 0.7V at 15W to 1V at 30W
Pin 18	Chassis Ground
Pin 19	Chassis Ground
Pin 20	Chassis Ground
Pin 21	Safety Interlock input (ground to de-mute) in parallel with PL07
Pin 22	Mute RF input (ground to mute) – for control not safety purposes
Pin 23	+12v dc fused supply output (150mA maximum)
Pin 24	CPU status output (pulled to ground when Main Board CPU good)
Pin 25	Fan status output (pulled to ground when good)

The Mute RF input pin 22 (ground to mute) is read by software (with a short delay) and thus is not so direct, being intended for control purposes only **and not as part of a safety interlock system**.

Any of the 'pulled to ground when good' status outputs required to be used, must be returned to a supply of no greater than 25V and must be limited to drawing no more than 50mA each by additional external resistance (100Ω is provided internally).

All of the 'ground to operate' inputs (except pin 21, the safety interlock) are internally pulled up to +5V via 12kΩ and must be fed from a voltage free source of less than 1kΩ to ground to operate (open circuit for a high non-operating state). These inputs are protected against constant application of up to ±25V dc directly applied.

2.2.8 Safety Interlock Connector

This is a two pin connector PL07 on the rear panel wired in parallel with pins 21/20 of connector SK05 (see section 2.2.7). Either pair, but not both, may be used as described below.

Pin 1	Safety Interlock input (ground to de-mute) - same as pin 21 of PL07
Pin 2	Chassis Ground – same as pin 20 of PL07

For the safety interlock, a circuit has to be made between pins 1 and 2 (or 20 and 21 of PL07) which open-circuits to mute the Amplifier or short-circuits to de-mute. If there are no external safety interlock switches, a short direct link is made, this being the state in which any connector is normally supplied. If connections need to be made to external safety switches, this link is removed and the switches are wired in a series loop to the connector so that if any switch opens, the link is broken. Note that the safety interlock provides the most direct, and thus safest, muting of output power.

! CAUTION !

For the safety interlocks to work correctly, the external switches and link wiring must 'float' (i.e. must not be grounded at any point, apart from at the Amplifier itself). The total loop resistance should not exceed approximately 10Ω. The external wiring may also be ferrite loaded for emc requirements.

2.3 SETTING UP PROCEDURES

2.3.1 Fuses

If any problems occur after the Amplifier has been installed and switched on, fuses may need to be checked and possibly replaced. However, a blown or high impedance fuse would generally indicate the presence of a fault, which would need correcting.

The type, function and access to fuses is as follows :

Type	Function	Access
6.3A (T) HBC 5x20mm Fuse	For protection of ac supply input circuitry. If this fuse blows, all Amplifier operation ceases	FS1 at the right rear of the unit (being part of mains input socket PL02). **! CAUTION ! Ensure that the mains supply is either disconnected or is switched to 'off' at the distribution board (preferably being locked in that position).**
0.21A Hold SMD 030-2 Resettable Fuse	For protection of the +12V dc output on the rear panel Status connector SK05. If this fuse goes high impedance, any external equipment powered off this supply will cease operation.	Access to this fuse is not normally required (smd fuse is fitted to the Main Board, on which SK05 is located). This fuse will automatically reset if the externally supplied equipment is momentarily disconnected or if the mains supply to the Amplifier is interrupted.
0.21A Hold SMD 030-2 Resettable Fuse (XA150) or 0.35A Hold SMD 050-2 Resettable Fuse (XA300)	For protection of the rear panel fan and its supply leads. If this fuse goes high impedance, this fan will cease operation. The Fan and System Normal leds will go red (check System mode display to confirm fault). After a period, the Output Amplifier temperature will increase and the output power eventually turn down (with an over-temperature indication).	Access to this fuse is not normally required. This smd fuse is fitted on the narrow printed circuit board (Fan Control Board) immediately in front of the power supply unit (and behind the front panel). This fuse will automatically reset if the Fan is momentarily disconnected or if the mains supply to the Amplifier is interrupted.
1.4A Hold SMD 200-2 Resettable Fuse	For protection of all circuitry supplied by the internal +12V dc supply. If this fuse goes high impedance, virtually all Amplifier operation ceases (apart from the fan).	Access to this fuse is not normally required. This smd fuse is fitted on the narrow printed circuit board (Fan Control Board) immediately in front of the power supply unit (and behind the front panel). This fuse will automatically reset if the mains supply to the Amplifier is interrupted.

Type	Function	Access
10A/16A (T) HBC 5x32mm Fuse **10A for XA150** **16A for XA300**	For protection of the internal dc supply lead to the high current circuitry within the output amplifier. If this fuse blows, the output power will reduce to zero.	Remove top dust cover. Fuse is fitted in clips on the narrow printed circuit board (Fan Control Board) immediately in front of the power supply unit (and behind the front panel). **! CAUTION ! Ensure that the mains supply is either disconnected or is switched to 'off' at the distribution board (preferably being locked in that position).**

2.3.2 Internal Remote Cable Link

The cable link is as follows :-

Remote Control Option	Link Front Panel Connector (6)CON05 to :-
Serial RS232 via COM Port PL11	Main Board Connector (5)CON05
TCP/IP via RJ45 Connector SK04	Main Board Connector (5)CON04

2.3.3 Output Power Level Adjustment

If the Amplifier is not supplied with preset output power level, its front panel SET POWER control will need to be set. If being used as a drive for another amplifier, the manual for the amplifier must be consulted for information on the level of drive output power required and **care must be taken that the maximum drive level for that amplifier is not exceeded.**

The procedure is as follows :

1) Ensure the Amplifier has been installed as detailed in sections 2.1 and 2.2 and the internal remote cable link is set as in 2.3.2 (as required).

2) Break the rear panel Interlock connection between pins 1 and 2 of PL07 (and any connection between pin 21 and ground on SK07) and ensure all external RF sources are switched off.

3) Apply power to the Amplifier (i.e. ensure the supply distribution 10A MCB, if fitted, is on and the supply lead is connected). If fitted, ensure that the rear panel supply switch is in the 'on' position ('I').

4) Ensure that the power on audio tone sounds, the LCD display illuminates (briefly displaying Amplifier type information) and all LED displays are on red, green or amber. If not, follow fuse checking procedure as detailed in section 2.3.1 (fault finding may be required if this occurs).

5) Check that the LCD display settles, showing the 'MAIN' screen, which gives forward and reverse output powers (both near zero because of interlock).

6) Set the Amplifier's front panel SET POWER twenty-two turn control to fully clockwise (i.e. maximum power setting).

7) Reconnect the rear panel Interlock connection between pins 1 and 2 of PL07.

8) Introduce the Exciter/Drive source at the required frequency (in the range 87.5-108MHz) and at a low level (less than about 0.5W) at SK06.

9) Slowly increase the source power level until 150W (XA150) or 300W (XA300) is obtained. To ensure complete accuracy, an external calibrated meter should be used to measure this output power. On the XA300 only, increase the input level by a further 1dB (approximately 20%). **In no case however, must the input power exceed 8W**.

10) With the source power level set as described, turn the front panel SET POWER control anti-clockwise until the measured power falls back to the output power required (300W maximum on the XA300).

11) Check the forward output power displayed on the front panel LCD display. This reading will not be as accurate as the external calibrated meter but should be within about ±0.25dB (approx.10-15W). The reverse power displayed should be very low, not more than about 5-15W, depending on the load presented to the Amplifier and its set output power.

The Amplifier will now be ready for operation.

The Front Panel RF MON output can be used to check the close-in spectrum of the Amplifier output signal, noting that any harmonic levels shown will not necessarily be the same as those present at the Amplifier output. Any test equipment should not however normally be left connected to this output.

2.4 SERIAL REMOTE CONTROL AND MONITORING

2.4.1 Introduction

Serial control via the rear panel COM PORT connector (section 2.2.6) uses asynchronous data (1 start, 8 data, 1 stop bit, no parity) at 2400, 4800, 9600 or 19200 Baud. Control commands and status monitor requests are detailed in section 2.4.2. The content of status monitor information reverted from the Amplifier is detailed in section 2.4.3. The same functions are also enabled using TCP/IP via a rear panel RJ45 connector (section 2.2.4). Selection of COM port or RJ45 connector is made using internal link leads.

The individual data bytes are defined in ASCII form, to enable basic control and monitoring using a PC running a terminal program. However, a PC program with a dedicated textual and/or graphical user interface is required for proper implementation of a remote control and monitoring system. Eddystone Broadcast should be contacted for further information regarding such programs and hardware implementations using the RS232 and TCP/IP ports directly or via USB or TCP/IP adaptors.

2.4.2 Control Commands and Status Monitor Requests

All command and status monitor requests are initiated by the remote control unit (PC) – the Amplifier never outputs any serial data via the COM PORT or TCP/IP connector unless requested to by that unit.

The remote control unit always sends a sequence of three bytes, waiting for each byte to be 'echoed' correctly before the next one is sent (which must be within 500mS of the previous one). A wait of 500mS is also recommended before the sequence is timed out and aborted. A new sequence of three bytes then can be attempted. Note that an echo will not be returned when an invalid sequence is detected by the Amplifier.

The three bytes are :-

First byte	'Handshake' (always ASCII #) – indicates start of sequence
Second byte	'Command' – indicates form of control or status monitoring
Third byte	'Status Requests' (after ASCII ? Command) - gives details of status monitoring required

Details of the Handshake, Command, Status Request and Control bytes are given in the following two tables. Typical examples of controller generated sequences are as follows :-

# ? 0	Request to revert output power and Amplifier type
# ? W	Request to revert temperature and current

Handshake (first byte sent from controller)			
Title	Function	Hex	ASCII
Async_Hshake	Remote input handshake	23	#

Remote Input Commands (second byte sent from controller)			
Title	Function	Hex	ASCII
Query_Status	Status query (request to revert)	3F	?

2.4.3 Reverted Status Monitor Information

The status of the Amplifier is reverted in response to the ? command (see section 2.4.2). After the third byte is echoed back to the remote control unit, a further fifteen bytes are sent immediately from the Amplifier, with no delays between individual bytes (each 1 start, 8 data, 1stop, no parity).

The first fourteen of the fifteen bytes contains the specific status information requested. The last byte is an exclusive OR checksum of those fourteen bytes. This checksum can be used by the remote control unit to check that the information has not become corrupted.

The meanings of the various bytes in the information string are defined in the table below.

Reverted Status Information (meanings of bytes reverted in response to **?** command)			
Title	Meaning	Hex	ASCII
Norm	Status normal	4E	N
N_Norm	Status not normal	4F	O
Stat_Low	Status low	4C	L
Stat_High	Status high	48	H
Fail	Status fail	46	F
Off	Status off	52	R
On	Status on	51	Q
Mute	Status muted	4D	M
Start	Status start	53	S
De_Sel	Status de-selected	44	D
Int_Sel	Status internally selected	49	I
Ext_Sel	Status externally selected	56	V
N_Known	Not known	58	X
None	None	57	W
N_Applic	Not applicable	5A	Z
Direct Display	Numerical values	30-39	0-9
Direct Display	Sign	2B 2D	+ -
Direct Display	Decimal point	2E	.
Direct Display	Blank	00	NUL
Direct Display	Less than	3C	<

Most meanings are general. A string of fourteen system status information bytes would typically contain several ‘N’s, each one indicating that a particular status (forward power, reverse power etc.) is ‘Normal’.

Direct display bytes give an immediate numerical display of power, current and temperature etc., even when using a basic terminal program.

If the Amplifier contains no known good information about a particular status, the ‘X’ byte is reverted. This occurs if the Amplifier is unable to interrogate individual modules within the unit and thus cannot determine their status. The ‘Revert Output Status Request’ (ASCII 0) returns the Amplifier type and can be used by the Remote Control Unit to determine the power rating of the Amplifier being interrogated.

The following four tables detail the contents of the various strings of reverted status information. The final column in each defines which ASCII values a particular byte can have. The table above defines the meanings of these values. The first byte in each table is the echo of the third byte sent from the remote control unit.

Reverted Output Data Block (15 extra bytes reverted in response to **# ? 0** sequence)		
Title	Status	Possible Values (ASCII)
Op_Data1	Output data status request byte	third byte echo fixed at 0
Op_Data2	Output forward power MSB (Watts)	Null (blank) 0 to 9 (inc) < (less than) or X
Op_Data3	Output forward power MSB-1 (Watts)	
Op_Data4	Output forward power LSB (Watts)	
Op_Data5	Output reverse power MSB (Watts)	
Op_Data6	Output reverse power MSB-1 (Watts)	
Op_Data7	Output reverse power LSB (Watts)	
Op_Data8	Output data spare	
Op_Data9	Output data spare	
Op_Data10	Output data spare	
Op_Data11	Output data spare	
Op_Data12	Amplifier OS number MSB	0 to 9 (inc) and . (decimal point)
Op_Data13	Amplifier OS number MSB-1	
Op_Data14	Amplifier OS number LSB	
Op_Data15	Amplifier type	= (150W) > (300W) or X
Op_Data16	Output data 8 bit EOR checksum (of 2-15 inc. only)	

Reverted Analogue#1 Data Block (15 extra bytes reverted in response to **# ? W** sequence)		
Title	Status	Possible Values (ASCII)
Ana1_Data1	Analogue#1 request byte	third byte echo fixed at W
Ana1_Data2	Spare	
Ana1_Data3	Spare	
Ana1_Data4	Spare	
Ana1_Data5	Spare	
Ana1_Data6	Spare	
Ana1_Data7	Spare	
Ana1_Data8	Temperature MSB (deg.C)	Null (blank) 0 to 9 (inc) + and - or X
Ana1_Data9	Temperature MSB-1 (deg.C)	
Ana1_Data10	Temperature LSB (deg.C)	
Ana1_Data11	Current MSB (Amps)	Null (blank) 0 to 9 (inc) < . (d.pt) or X
Ana1_Data12	Current MSB-1 (Amps)	
Ana1_Data13	Current LSB+1 (Amps)	
Ana1_Data14	Current LSB (Amps)	
Ana1_Data15	Spare	
Ana1_Data16	Analogue#1 status 8 bit EOR checksum (of 2-15 inc. only)	

Reverted Analogue#2 Data Block (15 extra bytes reverted in response to **# ? X** sequence)		
Title	Status	Possible Values (ASCII)
Ana2_Data1	Analogue#2 request byte	third byte echo fixed at X
Ana2_Data2	High voltage MSB (Volts)	Null (blank) 0 to 9 (inc) . (decimal point) or X
Ana2_Data3	High voltage MSB-1 (Volts)	
Ana2_Data4	High voltage LSB+1 (Volts)	
Ana2_Data5	High voltage LSB (Volts)	
Ana2_Data6	Low voltage MSB (Volts)	
Ana2_Data7	Low voltage MSB-1 (Volts)	
Ana2_Data8	Low voltage LSB+1 (Volts)	
Ana2_Data9	Low voltage LSB (Volts)	
Ana2_Data10	Spare	
Ana2_Data11	Spare	
Ana2_Data12	Spare	
Ana2_Data13	Spare	
Ana2_Data14	Spare	
Ana2_Data15	Spare	
Ana2_Data16	Analogue#2 status 8 bit EOR checksum (of 2-15 inc. only)	

Reverted Amplifier Data Block (15 extra bytes reverted in response to **# ? Y** sequence)		
Title	Status	Possible Values (ASCII)
Amp_Data1	Amplifier data status request byte	third byte echo fixed at Y
Amp_Data2*	Amplifier system normal status	N O X
Amp_Data3	Amplifier forward power status	N L F X
Amp_Data4	Amplifier reverse power status	N H X
Amp_Data5	Amplifier heatsink temperature	N H X
Amp_Data6	Amplifier power amplifier current status	N H X
Amp_Data7	Amplifier high voltage status	N L X
Amp_Data8	Amplifier low voltage status	N L X
Amp_Data9	Spare	
Amp_Data10	Spare	N F W X
Amp_Data11	Amplifier heatsink cooling fan status	N F Z X
Amp_Data12	Spare	
Amp_Data13	Amplifier Ext. Mute State	M S X
Amp_Data14	Amplifier Interlock State	M S X
Amp_Data15	Spare	
Amp_Data16	Amplifier status 8 bit EOR checksum (of 2-15 inc. only)	

*Note : Amp_Data2, Amplifier system normal, will indicate 'not normal' (O) if <u>any</u> of Amp_Data3-8, 11, or 14 do <u>not</u> indicate 'normal' (N) 'none' (W) 'start' (S) or 'not applicable' (Z).

Amp_Data2 is not affected by Amp_Data13

SECTION THREE : OPERATION

3.1 CONTROLS AND DISPLAYS

Marked	Type	Function
SET POWER	Preset (22T) Potentiometer	To set output power level (anti-clockwise to reduce power).
FAN	LED Display	Red indicates fan off Green indicates fan on
SYSTEM NORMAL	LED Display	Red indicates one or more system conditions are abnormal. Green indicates all significant system conditions are normal. Amber indicates 'Power-on-Reset' period
MUTE	LED Display	Red indicates that the Amplifier is muted by the Interlock input being open-circuit Green indicates normal operation Amber indicates 'Power-on-Reset' period or that the Amplifier is muted by an external control input.
FWD	P.A. LED Display	Red indicates forward output power fail (power fallen more than approximately 12dB below that required). Green indicates normal operation.
REV	P.A. LED Display	Red indicates reverse power to Amplifier in excess of approximately 30W (-10dB on 300W, -7dB 0n 150W) Green indicates normal operation.
TEMP	P.A. LED Display	Red indicates Amplifier amplifier heatsink temperature greater than approximately 85 deg.C. Green indicates normal operation
CURRENT	P.A. LED Display	Red indicates current (to Amplifier Pallet) in excess of approximately 11A. Green indicates normal operation.
CPU	P.A. LED Display	Red indicates amplifier module CPU (microcontroller) failure, other P.A. LED displays will automatically be turned off. Green indicates normal CPU operation.
CONTRAST	Preset (1T) Potentiometer	To set the contrast of Amplifier's liquid crystal display (LCD) for best contrast in the prevailing viewing and ambient temperature conditions.
MAIN	Membrane Switch	To directly select the main LCD screen showing the Amplifier's operating channel and frequency, output forward power, reverse power and the instantaneous deviation.
MODE	Membrane Switch	To select other Amplifier functions ('modes') such as system status and meter monitoring, channel frequencies and any option settings and status.
∧	Membrane Switch	To step upwards through choices offered in the mode selected.
∨	Membrane Switch	To step downwards through choices offered in the mode selected.
Unmarked 'Soft' keys	Membrane Switches	To select various choices offered in the mode selected.
Unmarked Display	20 Character by 4 line LCD (back illuminated by-green LEDs)	Indicates present mode (middle of top line) with status, input parameters etc. and next key operation choices below.
O I	Rocker Switch (on rear panel of E2175-03 and E2175-04 variants)	To switch mains supply on ('I') or off ('O')

Note an internal sounder indicates correct membrane switch key operation by a single beep or an invalid key input by a short series of beeps.

3.2 STATUS, PERFORMANCE AND LEVEL MONITORING

Once installed as described in Section 2, most operations only involve monitoring Amplifier status, performance and levels etc**. Note however, that for output power to be generated, the Amplifier's rear panel Interlock pins (pins 1 and 2 of PL07) must be short circuited, either directly, or by closing of all connected Interlock circuits (see section 2.2.13).**

The membrane switches grouped around the LCD display are used to select which parameter(s) to monitor, the results being displayed on the LCD. The displays are grouped into 'modes' as follows. Note that a display '???' indicates that a particular status cannot be monitored by the Amplifier's microcontroller, a permanent display of '???' indicates a fault.

3.2.1 MAIN Display Mode

To display the Amplifier's forward and reverse power, press [MAIN]. No matter what state the Amplifier is in, pressing this key will always display these main Amplifier parameters. MAIN mode is the normal mode in which the Amplifier is left to operate.

3.2.2 MENU (of Modes) Display Mode

To display other Amplifier statuses, levels etc., press [MODE], then press the [soft key] beneath the LCD display, corresponding to the group or mode required ('System' - 'Options' – 'Meter'). An individual status or level within the selected group can then be displayed by pressing the [∧] or [∨] keys on the left hand side of the LCD display. No matter what state the Amplifier is in, pressing [MODE] will always display the display mode menu.

3.2.3 SYSTEM Display Mode

If 'System' mode is selected, pressing the [∧] or [∨] keys steps through various system status conditions, showing 'Normal', 'Fail', 'High', 'Low', 'None' etc. Statuses which also have a varying level (e.g. forward and reverse power etc.) can be further checked by going directly to 'Meter' mode, where the actual level status presently be checked will be immediately displayed (see section 3.2.5).

An overall 'SYSTEM Normal' display is shown, on all 'System' mode selections, this changing to 'SYSTEM Not Normal' if any of the major individual statuses are not normal (i.e. forward and reverse power, heatsink temperature, amplifier current, high and low voltages, and heatsink cooling fan). This system normal indication corresponds with the front panel SYSTEM NORMAL LED (green for Normal, red for Not Normal). If this LED goes red, 'System' mode should be selected and the status(es) causing the warning should be determined by pressing the [∧] or [∨] keys to check them individually. Note that this LED will also go red during power-on-reset.

On all 'System' mode selections, the display also shows the front panel software operating system number as X.X in the top right hand corner.

3.2.4 OPTIONS Display Mode

If 'Options' mode is selected, the maximum power level of the amplifier section (150W, or 300W) will be displayed.

3.2.5 METER Display Mode

If 'Meter' mode is selected, pressing the [∧] or [∨] keys steps through various system status levels (forward and reverse power, heatsink temperature, amplifier current, high and low voltages etc.). Levels are shown simultaneously in horizontal bargraph form and as actual digitally values in 'real-time'.

Note that when 'Meter' mode is entered directly after checking a specific status in 'System' mode which has a variable level, such as heatsink temperature, then the first 'Meter' mode display will be of that level (see section 3.2.3). This allows rapid checking of any system status faults discovered.

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