Eddystone Broadcast

XA500 Series
Low Power
FM Amplifiers

Installation
and
Operation

Issue 2
E2136-00MA-02
August 2011

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Bound at Rear

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 (apart from fuse changing which is detailed in INSTALLATION).

1.1 : GENERAL DESCRIPTION

The XA500 Series of Low Power FM Amplifiers provide output powers of up to 500W (used singly) in the standard Band II frequency range of 87.5-108MHz. They can be supplied with either one or two Exciters (with automatic changeover unit, 'E2075') capable of generating a standard mono or stereo FM signal from a variety of analogue or digital audio or data sources (including left/right audio, MPX, RDS, SCA, DARC etc.). It is important to note that the Exciter(s) supplied will depend on the user's actual requirements in this regard which, therefore, must be clearly specified at time of ordering. The Amplifiers may also be supplied as pairs, with a XC2000 Combiner, generating up to 1kW, again with one or two drives.

The Amplifiers are totally self-contained (including forced air-cooling) and can be mounted as a complete unit (less Exciters) within a standard 19 inch rack with at least 600mm depth and 3U height. All that is required is a connection to a mains supply, to an antenna and to the Exciter/Drive(s).

The Amplifier consists of a number of modules described as follows (1.1.1 – 7 inc.). Front and rear views, a block diagram and a circuit diagram showing these modules are bound at the rear of this manual (E2136-00GA, E2136-00BK and E2136-00CT).

1.1.1 : Power Supply

Depending on the variant, one or two 'hot-plugable' E2322 Power Supply Units are provided (removable from the Amplifier front panel) each with its own forced air cooling, output control and monitoring circuitry with status indicators. These highly efficient, switched mode units generate a regulated 50V dc supply, of up to 42A total, from mains supplies of 110 to 260V, with the input power factor approaching 100%. 50V dc outputs for each Amplifier Pallet and for all the low current circuits are provided via separate fuses within the Amplifier. These fuses, as well as circuitry to measure total supply current and monitor DC supply and fan status are fitted on the Power Supply Board, at the rear of the Power Supply Units. On variants fitted with two switched mode units, if one should fail, the XA500 will continue to deliver full output power. E2136-05, 06, 07 and 08 variants have a mains supply on/off switch situated on the rear panel.

1.1.2 : Input Splitter

This connects the RF input N type connector to the two amplifier 'pallets' The splitter section is a two way Wilkinson utilising standard 75Ω coaxial cable and two 50Ω load resistors

1.1.3 Amplifier Modules ('Pallets')

Two amplifier modules are provided, each contributing one half of the total output power. Each amplifier module is an integrated 50Ω gain block consisting of a dual RF Mosfet transistor (in 'push-pull') 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. Amplifier modules (as well as input splitting and output combining/ filtering circuitry) are mounted on a heatsink, which is forced air cooled by two fans directly supplied from the Power Supply units. 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.

1.1.4 : Two Way Combiner, Low Pass Filter and Directional Coupler

These interface between the two amplifier outputs and the antenna. The combiner section is a two way Wilkinson utilising standard 70.7Ω or 75Ω coaxial cable and two 50Ω load resistors. The following low pass filter is nine section Tchebycheff, giving a very high level of attenuation at harmonic frequencies. The filter capacitors utilise PTFE boards in a screened 'sandwich'. The output directional coupler utilises microstrip lines on PTFE board with a dielectric overlay to optimise directivity. The coupler board also contains the forward and reverse diode detectors and thus provides dc levels, to the Control board, representing the forward and reverse power levels present. The final RF output connector is either a 7/8in. (E2136-01, 03, 05 and 07) or 7-16 (E2136-02, 04, 06 and 08).

1.1.5 : Control/DisplayInterface Boards

The front Control Board contains circuitry to measure the Amplifier's final output forward and reverse powers via the output directional coupler, the temperature of the heatsink, via a precision temperature sensor mounted on the heatsink, and the current drawn from the power supply via Hall effect current sensors fitted on the Power Supply Board. These levels, as well as the analogue level representing the required set output power, are converted to digital form by a microprocessor. This microprocessor also receives direct information about the status of the Amplifier and any external inputs. All this information, along with any fault messages, are fed to the Front Panel Display Board to be displayed, the analogue levels in digital form, on a two line, sixteen character display and two red/green LEDs. Individual levels and fault indications are selected by a push-button switch on the front panel Display Board. A 'watchdog' circuit on the Control Board checks the microprocessor operation and sets an additional red/green 'CPU' LED accordingly on the Display Board.

Equivalent information about levels and status is also fed to the Interface Board (see section 1.1.6) and, when fitted, the optional Serial Remote Control and Monitoring Board (see section 1.1.7)

The Control Board itself also has outputs to control the power level of each amplifier 'pallet'. A multi-turn preset potentiometer, adjacent to the LCD on the Display Board, is accessible via the front panel to enable setting of the power level. This setting will be over-ridden and the power level reduced automatically ('folded-back') if excessive temperature, or excessive reverse power is detected or if the external mute/interlock circuit is activated (output muted in this case). The front panel power level control can also be disabled if required (using a link on the rear panel Status connector) and power level then set by an external DC voltage applied via the Status connector. This is the normal arrangement when two XA500s are combined using an XC2000 which provides the overall power level setting.

1.1.6 Interface Board

The rear Interface Board contains circuitry to provide filtered, protected status outputs, via open collector transistors, equivalent to the status information provided on the front panel. Analogue outputs representing the forward and reverse powers are also provided as is a fused +50V dc output, diode-OR'd from the one or two E2322 Power Supply Units, for operation or control of external circuits (including the XC2000 Combiner)

Inputs are provided to enable remote power level setting ('select internal/external control' and external control voltage). Two inputs are also provided for connection to an external interlock circuit. When the connection between these two pins is broken, the Amplifier will automatically mute. Slave relay output contacts are provided which sense this condition and which can be used to simultaneously mute the drive(s).

The Interface Board also contains a DC-DC converter to generate +12V dc from the diode OR'd 50V dc supply. This lower voltage supplies the Control and Display Boards (see section 1.1.5) where it is used directly and also converted to +5V and –12V dc levels.

1.1.7 Serial Remote Control and Monitoring Board (/A and /T options only)

Serial ASCII remote control and monitoring, either at RS232 level (/A option) or utilising TCP/IP (/T option) can also be provided on all variants. The optional board is fitted in the rear of the unit and has a nine way 'D' plug in the case of the RS232 /A option or an RJ45 connector in the case of the TCP/IP /T option. This plug/connector is on the rear panel as PL06 (/A) or SK06 (/T). The board contains a microprocessor, which receives serial data from the Control Board (see section 1.1.5) and converts it into asynchronous ASCII data representing Amplifier analogue levels and status. On the /A option, this data is presented at RS232 level at PL06. On the /T option it is fed via an additional circuit which provides TCP/IP protocols and levels at SK06. External muting using serial control is also enabled via this optional board.

1.2 : VARIANTS AND OPTIONS

The variants (indicted by number suffixes) are as follows :

E2136-01	Basic XA500 500W Amplifier fitted with 7/8 in. RF Output connector (single PSU)
E2136-02	Basic XA500 500W Amplifier fitted with 7-16 RF Output connector (single PSU)
E2136-03	Basic XA500 500W Amplifier fitted with 7/8 in. RF Output connector (dual PSUs)
E2136-04	Basic XA500 500W Amplifier fitted with 7-16 RF Output connector (dual PSUs)
E2136-05	Basic XA500 500W Amplifier fitted with 7/8 in. RF Output conn. with supply switch (single PSU)
E2136-06	Basic XA500 50W Amplifier fitted with 7-16 RF Output conn. with supply switch (single PSU)
E2136-07	Basic XA500 500W Amplifier fitted with 7/8 in. RF Output conn. with supply switch (dual PSUs)
E2136-08	Basic XA500 500W Amplifier fitted with 7-16 RF Output conn. with supply switch (dual PSUs)

The options (indicted by letter suffixes) are as follows :

/A	XA500 500W Amplifier fitted with serial remote control/monitoring at RS232 level
/T	XA500 50W Amplifier fitted with serial remote control/monitoring utilising TCP/IP

Example :- E2136-02/T= XA500 with 7-16 Output Connector, single PSU and TCP/IP Remote Control

1.3 : TECHNICAL SPECIFICATIONS

The XA500 range 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, Specific 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

Note that the following figures do not include any which principally depend on the Exciter/Drive being used (e.g. frequency stability). The figures given below may also be affected by the Exciter/Drive's performance. In both cases the Exciter/Drive's own manual should be consulted.

RF Interface Ports	50Ω nominal
Input Drive Power	RF Input from Exciter/Drive supplied :- 8-10W (13W absolute maximum)
Output Power Level	With any load with a return loss ≥ 16dB (1.38:1 VSWR) any angle. .Adjustable over range of at least 125W to 500W.
Output Power 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 with return loss <10dB (relative to 500W), including open and short circuits, does not cause any damage to the Amplifier
Output 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).
Frequency Range	87.5 -108MHz
Spurious Emissions	In the range 9kHz to 1000MHz : - Better than or equal to –76dBc (typically better than –80dBc)
Out of Band (Adjacent Channel) Emissions	Better than or equal to –110dBc/Hz, at ±200kHz offsets, and 145dBc/Hz at ±2MHz. When measured in a 1kHz bandwidth, the limit figures become –80dBc at ±200kHz offsets and –115dBc at ±2MHz.
Incidental Amplitude Modulation	Synchronous (AM due to FM) :- Not greater than 0.5% with a peak deviation of ±40kHz at a modulation frequency of 500Hz. Asynchronous (residual AM due to hum and noise with no FM modulation) :- Not greater than 0.3% when measured unweighted in a 20Hz to 20kHz bandwidth.
Status Indications	Selectable front panel reading of output forward and reverse power, heatsink temperature and dc supply current. Selected screen also shows any relating fault or condition ('Low', High', 'Muted', 'Interlock', 'DC Fail', 'Fan Fail' etc.) Green/red pass/fail led indicators of system normal and CPU status. Green/red/amber indicator of mute/interlock status PSU green/off pass/fail led indicators of power supplies' DC outputs and AC inputs.

Environmental	Ambient Temperature (operating) : 0 to +45 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 ; 133mm (3U) Depth ; 570mm intrusion into rack (exc. 7/8 in. RF output connector) Weight ; Approx. 22kg.
Power Supply	Single phase input on 16A IEC connector: - 110V to 260V AC, 47- 63Hz. Apparent power factor 99%. Efficiency typically better then 55% (at 500W output). Supply current typically :- 9A at 110V AC (with 500W RF output) 4A at 260V AC (with 500W RF output)

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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 (e.g. with or without Exciter/Drive(s), separate to or already fitted into a 19 inch rack, whether or not leads are supplied ready made etc.). Note that extra, unlisted parts may be required for connections to any Exciter/Drive(s) that are supplied (see manuals supplied with them).

Typical Quantity	Description	Function
1	16A IEC mains connector.	For connection to lead from mains supply distribution point.
Length as req'd	3 core, 2.5mm^2 per core, insulated cable.	Mains supply lead.
1	16A '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	7-16 RF coaxial free plug (E2136-02, 04, 06 and 08)	For connection to lead from Antenna or RF output load.
1	7/8 in coaxial connector/bullet (E2136-01, 03, 05 and 07)	For connection to lead from Antenna or RF output load.
Length as req'd	Low loss RF coaxial cable, rated in excess of Amplifier output power at maximum ambient temperature.	RF output lead.
1	N type RF coaxial free plug.	For connection to lead from Exciter/Drive
Length as req'd	Low loss RF coaxial cable, rated in excess of Exciter/Drive output power at maximum ambient temperature.	RF input lead.
1	25 Way D plug c/w cover.	For connection to leads from 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.
2	16A (T) HBC 5x32mm (¼ x1¼ in) Fuses	For protection of internal dc supply leads to individual internal amplifier 'pallets'..

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.

! CAUTION !

The XA500 is **heavy**. Adequate handling arrangements must therefore be made before installation in a rack is attempted,

The 19 inch rack should ideally be of standard 600mm depth and requires at least 3U for the XA500 itself. Additional height will be required if Exciter/Drive(s) are to be fitted into the same rack (recommended). These should be fitted below the actual Amplifier section,

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

2.2.1 Mains Supply Connector

This is a standard 16A IEC plug PL01 at the right rear of the unit. The supply must be single phase, 110V to 260V AC, 47- 63Hz. The maximum current drawn from the supply is in the order of 9A at 110V to 4A at 260V (at 500W RF output).

Note that certain variants (E2136-05, 06, 07 and 08) have a rear panel on/off switch in-line with this connector (see section 1.2)

! CAUTION !

The mains supply lead to the Amplifier must consist of three core (P+N+protective earth) insulated cable. **Each core must be at least 2.5mm^2 and not mounted in a conduit with other supply cables**. **A double pole, 16A (C rated) MCB must be provided at the supply distribution board(s) to protect both leads and Amplifier supply input circuitry.** Also, since the supply input circuitry contains capacitors, which pass current to the Amplifier chassis, **the Amplifier chassis must be connected to a safety ground**.

Also ensure whilst making any connections to the mains supply, that the Amplifier's rear panel interlock circuit at SK02, pins 20-21, is open-circuit (i.e. Amplifier muted).

The supply lead terminates in a 16A 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

An earthing bolt is provided adjacent to the mains supply input connector to allow the Amplifier chassis to be permanently bonded to nearby safety ground directly or via rack metalwork.

2.2.2 Status Connector

This is a 25 Way D socket SK02 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 :-

Pin 1	System Normal status output (pulled to ground when good)
Pin 2	Spare status output
Pin 3	Spare status output
Pin 4	Current status output (pulled to ground when good)
Pin 5	DC Supply (PSU) status output (pulled to ground when good)
Pin 6	Fans status output (pulled to ground when good)
Pin 7	Fwd Power Fail o/p(approx. –12dB rel. max o/p - pulled to ground when good)
Pin 8	Fwd Power Low o/p (approx. –2dB rel. set o/p - pulled to ground when good)
Pin 9	Reverse Power High output (approx. 35W - pulled to ground when good)
Pin 10	Heatsink Temperature status output (pulled to ground when good i.e.<90deg.C)
Pin 11	Internal/external power control input (pull to ground for external control)
Pin 12	Mute RF input (pull to ground to mute) – for control not safety purposes
Pin 13	DC supply fused output (+50V dc at 500mA maximum)
Pin 14	Reverse power analogue monitor voltage output (0V to +5V into >1kΩ) approximately 0.7V at 35W
Pin 15	Forward power analogue monitor voltage output (0V to +5V into >1kΩ) approximately 2V at 500W.
Pin 16	CPU status (pulled to ground when good)
Pin 17	Chassis Ground for above inputs and outputs
Pin 18	Chassis Ground for above inputs and outputs
Pin 19	Chassis Ground for above inputs and outputs
Pin 20	Chassis Ground for Safety Interlock input
Pin 21	Safety Interlock input (ground to de-mute)
Pin 22	Chassis Ground for External Power Control Voltage Input
Pin 23	Ext. Power Control Voltage Input (0V to +5V DC for min to max power) >10kΩ
Pin 24	*Interlock status relay contact
Pin 25	* Chassis Ground for Interlock status relay contact

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.

For the safety interlock, a circuit has to be made between pins 20 and 21, 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 robust, and thus safest, muting of output power. The Mute RF input pin 12 (ground to mute) is intended for control purposes only **and not as part of a safety interlock system**.

! 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 Exciter itself). The total loop resistance should not exceed approximately 100Ω. The external wiring may also be ferrite loaded for emc requirements.

*Pins 24 and 25 (chassis ground) connect to internal relay contacts, which open when the Interlock/ connection at pins 21 and 22 is broken and the Amplifier muted. They thus can be used to additionally mute the drive or other associated equipment via their Interlock inputs.

2.2.3 RF Output Antenna 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 a 50Ω 7/8 in. (E2136-01, 03, 05 and 07) or 7-16 (E2136-02, 04, 06 and 08) coaxial socket SK05 at the left 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 or load

2.2.4 RF Input Connector

! CAUTION !

When operating, high RF Voltages may be present on this connector. Always ensure when making connections here, that the drive source(s) to the Amplifier are switched off or safely muted.

This is a 50Ω N type coaxial socket SK03 at the centre rear of the unit.

2.2.5 RF Output Monitor Connector

This is a 50Ω BNC coaxial socket SK04 at the centre rear of the unit. This provides a sample of the Amplifier's forward output power into a 50Ω load. This connector is for test purpose only with the test equipment and lead being disconnected when not in use. Note that this sample does not faithfully represent harmonic output levels.

2.2.6 REMOTE (COM) Port Connector (/A option only)

This is a 9 Way D plug PL06 on the rear panel. This enables control and monitoring 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.

2.2.7 REMOTE (TCP/IP) Connector (/T option only)

This is an RJ45 connector SK06 fitted at the rear of the unit. This enables control and monitoring 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.

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 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
0.75A Hold RXEF 075 Resettable Fuse	For protection of control circuits. If fuse goes high impedance, all front panel displays dim or go out but the fans continue operating. The output power level will generally fall to below its maximum.	Access to this fuse is not normally required (fuse is fitted to the Power Supply Board as (2)FS8) This fuse will automatically reset if the mains supply to the Amplifier is interrupted.
0.75A Hold RXEF 075 Resettable Fuse	For protection of the +50V dc output on the rear panel Status connector SK02. If this fuse goes high impedance, any external equipment powered off this supply will cease operation.	Access to this fuse is not normally required (fuse is fitted to the Power Supply Board as (2)FS7). This fuse will automatically reset if the externally supplied equipment is momentarily disconnected or if the mains supply to the Amplifier is interrupted.
16A (T) HBC 5x32mm (¼ x1¼ in) Fuses Two	For protection of internal dc supply leads to the high current circuitry within the four amplifier pallets. If one or more of these fuses blow, the associated amplifier pallet(s)' power level falls to zero causing a reduction in the overall output power (generally, the front panel System Normal led will also go to red).	Remove top dust cover. Fuses are fitted in clips, as (2)FS2/4, on the Power Supply Board at the rear left hand side immediately behind the two PSU's. Ensure that any replacement fuses are tightly held by the clips. **! CAUTION ! Ensure that the mains supply is either disconnected or is switched to 'off' at the distribution board (preferably being locked in that position).**
2.5A Hold RXEF 250 Resettable Fuse	For protection of fans dc supply leads. If fuse goes high impedance, the fans stop operating but front panel displays remain illuminated. Eventually the output power will reduce in level as the heatsink temperature rises.	Access to this fuse is not normally required (fuse is fitted to the Power Supply Board as (2)FS6) This fuse will automatically reset if the mains supply to the Amplifier is interrupted.

2.3.2 Output Power Level and Frequency Adjustment

If the Amplifier is not supplied with preset output power levels and frequency, its front panel SET POWER control and the Exciter/Drive(s)' power output and frequency will need to be set. The manuals for the type of Exciter/Drive(s) supplied or in use must be consulted for information on how the settings required of them are actually made.

The procedure is as follows :

1) Ensure the Amplifier has been installed as detailed in sections 2.1 and 2.2. Check pin 11 of the Status Connector SK02 is not grounded (i.e. is set for internal power level control - see section 2.2.2).

2) Break the rear panel Interlock connection at SK02, pins 20-21.

3) Apply power to the Amplifier (i.e. ensure the supply distribution 16A MCB is on, the supply lead is connected and, on E2137-05, 06, 07 and 08 variants, the rear panel supply switch SW01 is on 'I')

4) Ensure all the displays are illuminated (else follow fuse checking procedure as detailed in section 2.3.1 (fault finding may be required if this occurs). Check Exciter/Drive(s) are operating and use the Amplifier's front panel push button switch to select the 'Fwd Power' display.

5) Set the Exciter/Drive(s) power output to minimum (which must be less than 13W) and frequency to that required.

6) Set the Amplifier's front panel SET POWER twelve turn control to fully anti-clockwise (i.e. minimum power setting).

7) Reconnect the rear panel Interlock connection at SK02, pins 20-21.

8) Slowly adjust the Amplifier's front panel SET POWER twelve turn control to fully clockwise (i.e. maximum power setting) checking for a gradual rise in output power.

9) Adjust the Exciter/Drive(s) output power so that 500W is just obtained. To ensure complete accuracy, an external calibrated power meter should be used to measure this output power. Increase the input level by a further 1dB (approximately 20%). In no case however must the input power exceed 13W

10) With the Exciter/Drive power set as described, turn the SET POWER control anti-clockwise until the measured output power falls back to 500W (or less if required).

11) Check that the output power displayed on the front panel display. This reading will not be as accurate as the external calibrated power meter but should be within about ±0.25dB (approx. 25W).

12) Use the Amplifier's front panel push button switch to select the 'Rev Power' display and check for reverse power less than about 15W

The Amplifier will now be ready for operation with audio and or data sources applied to the Exciter/Drive(s). The manuals for the type of Exciter/Drive(s) supplied or in use must be again consulted for information on how such sources are applied and controlled.

The RF Monitor connector at the rear of the unit can be used to check the close-in spectrum of the Amplifier output signal. Note that any harmonic levels shown will not necessarily indicate those present at the Amplifier output. Any test equipment should not however normally be left connected.

2.4 : SERIAL REMOTE CONTROL AND MONITORING (/A and /T options only)

2.4.1 Introduction

When the /A option is fitted, serial control and monitoring is provided via a rear panel COM port connector (section 2.2.6) using 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 /T option also enables the same functions using TCP/IP via a rear panel RJ45 connector (section 2.2.7). Note that only one of these two options can be fitted.

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 port 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 RJ45 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 or 'Controls' (after ASCII + Command) - gives details of control required

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

? 0 Request to revert the Output status
+S Sets Amplifier to Start/Unmuted

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	?
Amp_State	Amp state Mute or Start	2B	+

Remote Input Status Requests (third byte sent from controller after **?** command)			
Title	Function	Hex	ASCII
Op_Status	Revert output status	30	0
Amp_Status	Revert Amplifier status	59	Y

Remote Input Controls (third byte sent from controller after **+** command)			
Title	Function	Hex	ASCII
Mute	Set Amplifier to mute	4D	M
Unmute	Set Amplifier to start/unmute	53	S

Note that the Amplifier will be muted if either the local OR the serial remote control mute is enabled . The actual mute state will be displayed on the Amplifier Fwd or Rev Power displays and can be checked remotely using the 'Revert Amplifier Status' command (Ext. Mute Status).

2.4.3 Reverted Status Monitor Information

The status of the Amplifier is reverted in response to a ? 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
Amp_Muted	Amplifier Muted	4D	M
Amp_Start	Amplifier Unmuted	53	S
Int_Sel	Status Internally Selected	49	I
Ext_Sel	Status Externally Selected	56	V
N_Known	Not known	58	X
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

Most meanings are general. A string of fourteen information bytes would normally 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, for example, if the Remote Control and Monitoring Board is unable to obtain verified data from the Control Board and thus cannot determine Amplifier status. The 'Revert Output Status Request' (ASCII 0) returns the equipment type and can be used by the Remote Control Unit to help determine the meanings of data returned from different types of equipments.

The following two 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 ASCII 0
Op_Data2	Output Forward Power Level MSB (W)	- (minus) . (decimal point) Null (blank) 0 to 9 (inc) or X
Op_Data3	Output Forward Power Level MSB-1 (W)	
Op_Data4	Output Forward Power Level LSB+1 (W)	
Op_Data5	Output Forward Power Level LSB (W)	
Op_Data6	Output Reverse Power Level MSB (W)	
Op_Data7	Output Reverse Power Level MSB-1 (W)	
Op_Data8	Output Reverse Power Level LSB (W)	
Op_Data9	Output Temperature Level MSB (deg.C)	
Op_Data10	Output Temperature Level MSB-1 (deg.C)	
Op_Data11	Output Temperature Level LSB (deg.C)	
Op_Data12	Output OS number MSB	
Op_Data13	Output OS number MSB-1	
Op_Data14	Output OS number LSB	
Op_Data15	Output Amplifier Type	; (1000W) < (500W) = (150W) > (300W) or X
Op_Data16	Output data 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 fans status	N F X
Amp_Data7	Amplifier DC supply status	N F X
Amp_Data8	Amplifier current status	N H X
Amp_Data9	Amplifier Current Level MSB (Amps)	Null (blank) 0 to 9 (inc) or X
Amp_Data10	Amplifier Current Level LSB (Amps)	
Amp_Data11	Spare	
Amp_Data12	Spare	
Amp_Data13	Amplifier Ext. Mute start/mute status	S M X
Amp_Data14	Amplifier Interlock start/mute status	S M X
Amp_Data15	Amplifier Power Control int/ext status	I V X
Amp_Data16	Amplifier status 8 bit EOR checksum (of 2-15 inc. only)	

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SECTION THREE : OPERATION

Once installed and set up as described in Section Two, no manual operation is provided apart from selecting the required meter display. If the SYS NORMAL LED shows red, step through the various displays, using the push button, to determine which do not show 'Normal'. **Note, that for output power to be generated, the Amplifier's rear panel Interlock input, SK02, pins 20-21, must be short circuited, either directly, or by the closing of all connected interlock circuits (see section 2.2.2).** The SYS NORMAL and MUTE LEDs will show red and it will be so indicated, on the Fwd and Rev Power screens, if the Interlock is open and the Amplifier thus muted.

3.1 : CONTROLS AND DISPLAYS

The controls and displays available and their functions are as follows :

3.1.1 Front Panel

Marked	Type	Function
Unmarked Button	Momentary Push Button Switch	To select required display, cycles through :- Fwd Power displays level in Watts and relating status Rev Power displays level in Watts and relating status Temp displays level in Deg.C and relating status Current displays level in Amps and relating status
SET POWER	Preset Potentiometer (twelve turns)	To set output power (clockwise to increase power).
CONTRAST	Preset Potentiometer (single turn)	To optimise Display Contrast.
SYS NORM	LED Display	Red indicates 'Not Normal' by any of: – Fwd Power low, failed or external Interlock open Rev Power, Temp. or Current high A single DC supply (PSU) or one or both fans fail (External muting for control purposes is considered as 'Normal') Green indicates normal operation.
MUTE	LED Display	Red indicates external Interlock open (muted) Amber indicates normal external muting. Green indicates unmuted.
CPU	LED Display	Red indicates module CPU (microcontroller) failure, other LED displays being automatically turned off in this situation. Green indicates normal CPU operation.
Unmarked Display	16 Character by 2 line LCD (back illuminated by-green LEDs)	Displays Forward Power, Reverse power, Heatsink Temperature or DC Supply Current (including relating status in all cases) as selected by adjacent push button switch.
O I	Rocker Switch (on rear panel of E2136-05,06,07,08 variants)	To switch mains supply on ('I') or off ('O')

3.1.2 E2322 Power Supply Units

Marked	Type	Function
DC	LED Display	Green indicates dc output >75-85% of its rated value.
AC	LED Display	Green indicates ac input >78-86Vrms **! CAUTION ! – see note at start of section 2.2.1**

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