ATOMISER RPM INDICATOR TO GPS INTERFACE

Operator's Handbook

and

Parts Catalogue

ATOMISER RPM INDICATOR TO GPS INTERFACE

Operator's Handbook

and

Parts Catalogue

Micron Sprayers Limited
Bromyard Industrial Estate
Bromyard
Herefordshire HR7 4HS
United Kingdom

Telephone: +44 (0) 1885 482397
Fax: +44 (0) 1885 483043
E-mail: micron@micron.co.uk
Web site: www.micron.co.uk

Iss 1
08/2018

TABLE OF CONTENTS

1. INTRODUCTION

The Micronair RPM Indicator to GPS Interface measures the rotational speed of up to ten atomisers and transfers this data to any compatible* GPS guidance system via a serial (RS-232) port. Atomiser RPM is shown on the GPS display screen and can also be included in the GPS log file. Logged RPM can be reviewed after flight together with other application parameters using the GPS log replay software.

Monitoring the rotational speed of all atomisers ensures that they are producing the correct spray droplet size and helps to avoid the risk of atomisers running at an excessive speed. Any variation in rotational speed due to the effect of atomiser position, the aircraft propeller etc can be measured and corrected by adjustment of the atomiser fan blades.

The GPS system can create a permanent log of atomiser RPM throughout each job. The web based Micronair Droplet Size Calculator can be used to estimate the spray droplet size at any point in the area sprayed. See http://www.microngroup.com/droplets for details.

The interface unit and associated RPM transducer kits are compatible with Micronair AU4000, AU5000 & AU7000 wind-driven atomisers and AU6539 electric atomisers.

* Consult the GPS system supplier for compatibility details. Both the GPS processor and the PC based log replay system must be running the necessary software. The GPS system unit must have one free serial port.

2. SPECIFICATION

Power supply:	8 – 32 V DC @ 30 mA maximum.
Inputs:	1 – 10 Micronair RPM indicator transducers installed on atomisers. Transducer kits are supplied separately.
Speed range:	700 – 20,000 RPM
Output:	Serial (RS-232) port operating at 57600 or 115200 baud (user selectable).
Dimensions:	L 110 x W 125 x H 35 mm (4.3 x 4.9 x 1.4 inches) excluding connectors.
Weight:	275 grams (10 oz).
Environmental:	Enclosure protected to IP54. Ambient temperature -20 – +50 ˚C.

3. INSTALLATION OF INTERFACE UNIT

The interface unit should be installed in a a position that is easily accessible for ground maintenance, preferably adjacent to the GPS system unit. The unit should be protected from rain or the ingress of water used to clean the aircraft and should not be close to any source of heat. The orientation of the unit is not important provided that there is easy access to the connectors.

If necessary, the option jumpers inside the interface must be set for compatibility with the GPS system before mounting the unit. See section 7.1 for details.

The procedure to mount the unit is as follows:

1. Indentify a suitable location where the unit can be attached to an unstressed part of the aircraft structure. If necessary, a mounting bracket can be made from aluminium alloy sheet. Any mounting bracket must be sufficiently rigid to avoid vibration in flight.
2. Position the interface unit and mark through the four holes in the flanges of the end plates.
3. Remove the unit and drill four 4.5 mm (11/64”) diameter holes.
4. Position the unit over the holes and secure in position using the four 8-32 UNC screws, nuts and washers provided. Alternative screws can be used if necessary or the nuts can be replaced with anchor (plate) nuts if access is difficult.

If the interface is to be opened for configuration or testing on the ground as described in section 7, this should be done before mounting the unit.

4. INSTALLATION OF RPM INDICATOR TRANSDUCERS

The interface unit may be used to measure the rotational speed of each of up to ten atomisers. These may be Micronair AU4000, AU5000, AU6539 or AU7000 models. Each atomiser must be provided with a transducer and the associated wiring etc.

4.1 Wind-driven Atomisers

The installation procedure for wind-driven AU4000, AU5000 or AU7000 atomisers is as follows:

1. Fit transducer mounting bracket:

   i) AU4000 on EX2857 or EX2968 mounting block:

   Fit the bracket (EX193) in place with the four 8-32 UNC screws and washers provided as shown in Fig. 1. On EX2968 mounting blocks drill and tap four 8-32 UNC holes in the end of the block and fit the bracket as above. Note that the face of the bracket with the large hole should be towards the atomiser.

ii) AU4000 on cast mounting clamp:

Secure the transducer mounting bracket (EX1792) as shown in Fig. 2, using the two 8-32 UNC countersunk screws provided. Ensure that the screws are tight.

iii) AU5000 or AU7000 on cast mounting clamp:

Remove the atomiser from its mounting clamp. Fit the transducer mounting bracket (EX1793 for AU5000 or EX2651 for AU7000) over the atomiser spindle as shown in Fig. 3. Ensure that the spindle passes through the smaller of the two holes in the bracket and that the bracket is positioned so that the bend faces away from the atomiser, giving maximum clearance between the transducer nut and the atomiser hub.

2. Fit sensing tabs or plate to the atomiser:

i) AU4000:

Fit one sensing tab under the head of each clamp ring securing bolt in place of the existing washer. Ensure that the radius at the corner of the tab is positioned as shown to allow the tab to move back if it should touch the transducer whilst the atomiser is rotating (see Fig. 4).

ii) AU5000 or AU7000:

Remove all clamp ring securing bolts and fit a sensing plate (EX1794 for AU5000 or EX2652 for AU7000) against the front face of the clamp ring. Replace the securing bolts.

IMPORTANT: Do not over-tighten the clamp ring securing bolts when replacing them - see Atomiser Handbook for full details.

3. Replace the atomiser in its mounting clamp if removed for steps (1) and (2). Do not tighten the spindle nut at this stage.
4. Fit the RPM transducer into the mounting bracket. Ensure that the two plastic bushes (EX356) are in position on either side of the bracket. For an AU4000 installation with the EX198 mounting angle, the smaller end of each bush should fit into the hole in the bracket. For all other brackets, one bush should fit into the bracket and the other should be fitted to act as a washer with the smaller end away from the bracket. See Fig. 4.
5. For AU5000 and AU7000 atomisers only: rotate the bracket on the spindle so that the transducer is about 12 mm (1/2”) away from the mounting bracket. Tighten the atomiser securing nut.
6. Adjust the two nuts on the transducer body until the gap between the pip on the end of the transducer and tabs or 'finger' plate is 2.5 mm (0.1”) as shown in Fig. 4. Lock the transducer firmly in position.
7. Ensure that the gap set in (6) is the same for all tabs or 'fingers' of the plate. If necessary, bend the tabs or 'fingers' slightly to adjust the gap.

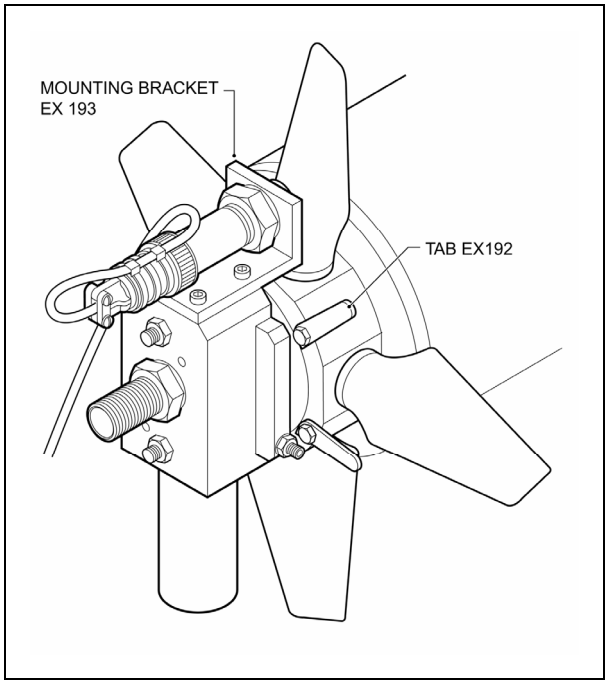


Fig. 1 – AU4000 on Mounting Block

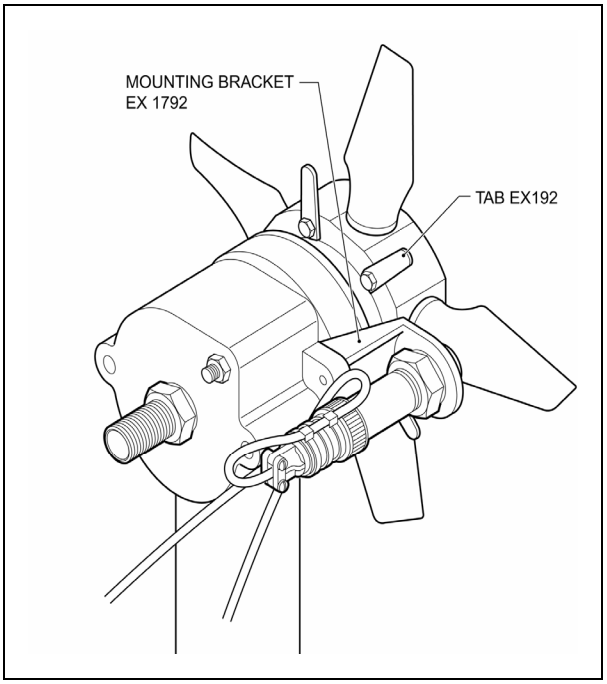


Fig. 2 – AU4000 on Cast Clamp

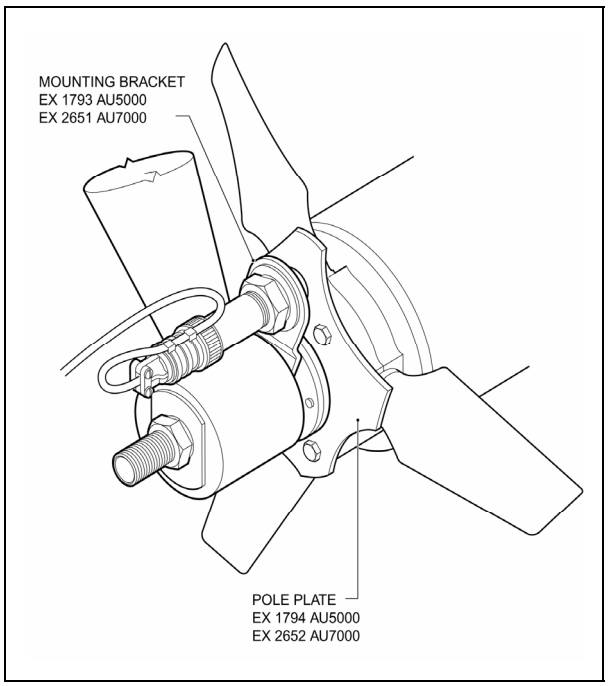


Fig. 3 – AU5000/7000 on Cast Clamp

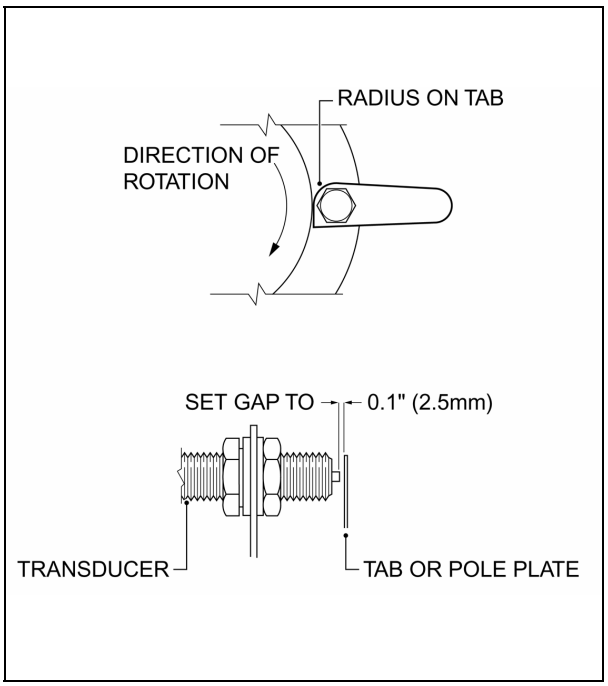


Fig. 4 – Adjustment of Transducer

8. Wire (safety) lock the two transducer securing nuts to the transducer bracket, using the holes provided. If the atomiser has been removed, ensure that the securing nut is tight and wire (safety) lock the securing nut, diaphragm check valve and feed pipe as described in the atomiser handbook.

IMPORTANT: All parts of the RPM transducer installation must be wire (safety) locked to eliminate the possibility of a component coming loose and damaging the atomiser.

4.2 AU6539 Electric Atomiser

Installation of a RPM transducer an AU6539 atomiser requires an EX6924 atomiser feed body with a tapped mounting hole. If the feed body does not have a mounting hole it must be replaced with an EX6924 body. The installation procedure is as follows (refer to Fig. 5 for details):

1. Remove the atomiser gauze and feed body from the motor (refer to the AU6539 handbook for details).
2. Remove the EX6391 spacer sleeve from the motor shaft and replace it with the EX6951 drilled sleeve supplied in the transducer kit.
3. Re-assemble the feed body and gauze on the motor.
4. Fit the grub screw CBP675 into the 8-32 UNC tapped hole in the feed body, ensuring that it is clear of the transducer mounting hole. Screw the RPM transducer EX6966 into the 3/8" UNF tapped hole in the atomiser feed body until the end of the transducer just touches the drilled sleeve in a position between holes.
5. Unscrew the transducer by a half turn and secure in position with the grub screw.

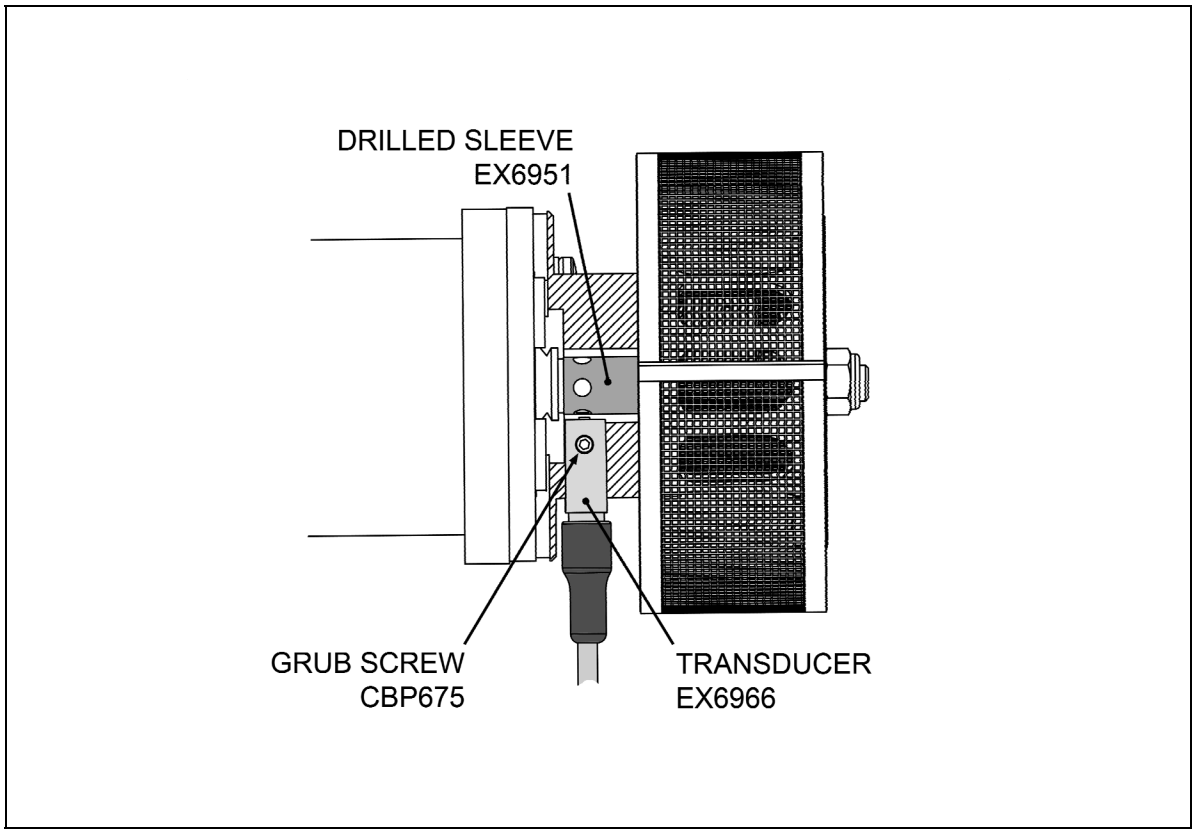


Fig. 5 – AU6539 Electric Atomiser with EX6924 Feed Body

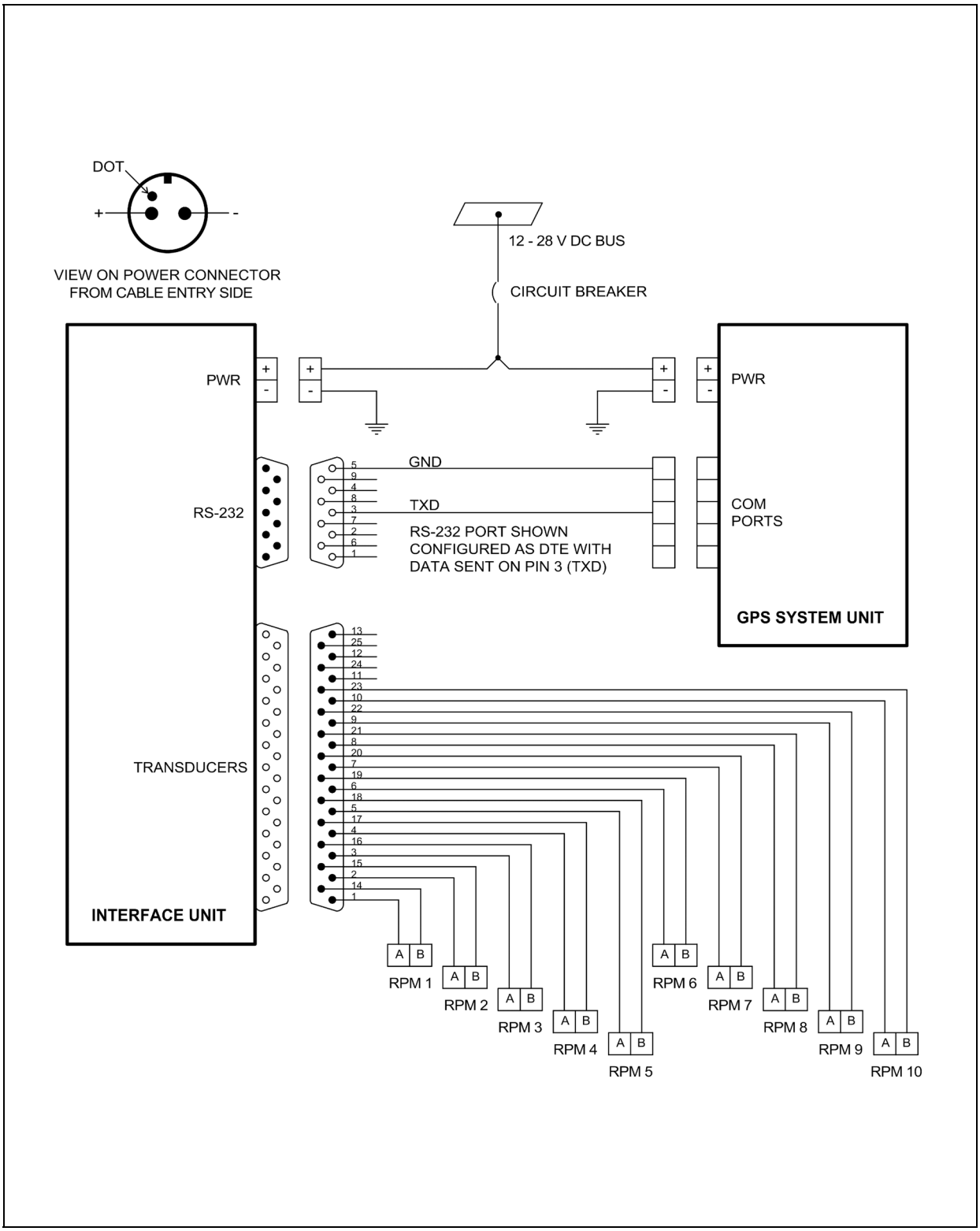


Fig. 6 – Electrical Schematic

4.3 Installation of Cable Assembly

1. Connect a pre-prepared cable assembly (EX3291 for wind-driven atomisers or EX6967 for an AU6539 electric atomiser) to the RPM transducer. Identify the other end of the cable with a piece of tape marked with the atomiser number. It is normal to number the left outboard atomiser No. 1 and to count towards the right. When using a GPS system that displays atomiser RPM on two lines (1 – 5 and 6 – 10) it is preferable to number the right outboard atomiser No 10 and to count down along the right-hand boom in the inboard direction. This will ensure that the atomisers on each boom are grouped together and the outboard atomisers are shown at opposite ends of the display window. Protect the two pins on the end of the cable by wrapping them in a piece of tape during installation.
2. Feed the cable along the boom or structure and through a suitably protected opening into the fuselage. Route the cable to the interface unit.
3. Repeat Steps (1 – 2) for all atomisers.
4. Starting from the outboard atomiser on each side, secure the cables with cable ties. The cable from each connector should be formed into an S - shaped loop alongside the connector body and secured with two ties. This ensures that the cable cannot flex at the point where it enters the connector and allows sufficient length to remove the connector if necessary. Ensure that all cables are secured tightly to the boom and cannot move in the airflow.
5. Open the housing of the 25 pin 'D' plug and remove the cable clamp.
6. Note the numbers adjacent to the holes in the rear (cable entry) face of the plug.
7. Take the cable from atomiser 1 and remove any protective tape from the two pins. Insert the pin on the RED or BLUE wire into hole 1. Press firmly on the wire until the pin clicks into place. Insert the pin on the BLACK wire into hole 14.
8. Repeat (7) for all other cables. The correct pin numbers are shown in Fig. 6, which shows the view on the rear (cable entry) face of the plug.
9. Secure the cables with the cable clamp and re-assemble the connector housing.
10. Plug the assembled connector into the socket on the interface unit and secure in position with the two locking screws.
11. Coil any excess lengths of cable and secure to the airframe or to existing wiring.
12. Check the entire installation, paying particular attention to the routing of cables, which must be clear of sharp edges, moving parts, controls etc.

5. POWER SUPPLY

The interface unit must be powered whenever the GPS system unit is operational. It is, therefore, preferable to connect the unit in parallel with the power input to the GPS system, using the same circuit breaker, switch etc. The current consumption of the interface unit is negligible and will not significantly affect the load on the supply to the GPS system.

If a separate supply is provided it must be protected with a fuse or circuit breaker rated at 2 A maximum.

The procedure to connect the power supply to the interface unit is as follows:

1. Remove the flexible boot from the rear of the 2 pin power connector provided.
2. Solder a length of 20 – 22 AWG wire (not provided) for the positive supply to the pin marked with a dot as shown in Fig 6.
3. Solder a length of 20 – 22 AWG wire (not provided) for the ground connection to the second pin of the connector as shown in Fig. 6.
4. Insulate both solder joints with heatshrink sleeve, pass both wires through the flexible boot and clip the boot over the connector.
5. Connect the positive supply wire to the power source (see above).
6. Identify a suitable ground point on an uninsulated part of the aircraft structure, fit a crimp ring tag to the ground wire and attach this to the ground point.
7. Carry out a ground continuity test between the ground pin of the connector and the airframe.
6. Fit the power connector to the interface unit and lock in position by turning the retaining ring by a quarter turn clockwise.
7. Secure the power and ground wires with cable ties to prevent movement or chaffing.

6. CONNECTION TO GPS SYSTEM UNIT

The RS-232 (serial) output of the interface must be connected to an available COM port on the GPS system unit. The male DB-9 connector on the unit is wired as Data Terminal Equipment (DTE) with data flowing from the interface on pin 3 and the ground return on pin 5 as shown in Fig. 6.

If the GPS system is provided with a serial interface cable with a female DB-9 connector wired as Data Communication Equipment (DTE) with data flowing into pin 3 it can be plugged directly into the interface unit.

If the GPS system has a male DB-9 connector wired as DTE with data flowing into pin 2 it will be necessary to fit a null modem crossover cable or adaptor (not provided) between the GPS serial cable and the interface.

If the GPS system uses a different type of connector it will be necessary to make up a cable with a female DB-9 connector at the interface end and the appropriate connector for the GPS input at the other. In this case the connector pins should be wired as shown in Fig. 6. This cable may be available from the GPS system supplier.

All DB-9 connectors should be fitted with locking screws and these must be tightened after installation.

7. CONFIGURATION AND TEST

In order to access the configuration jumpers and test indicator LEDs inside the interface unit it is necessary to remove four screws retaining the front cover plate and withdraw the plate and Printed Circuit Board (PCB) from the casing. It is recommended that the unit should be configured, tested and reassembled prior to final installation (see section 3).

Configuration and test options are set by means of jumper caps on pin header H1 as shown in Fig. 7.

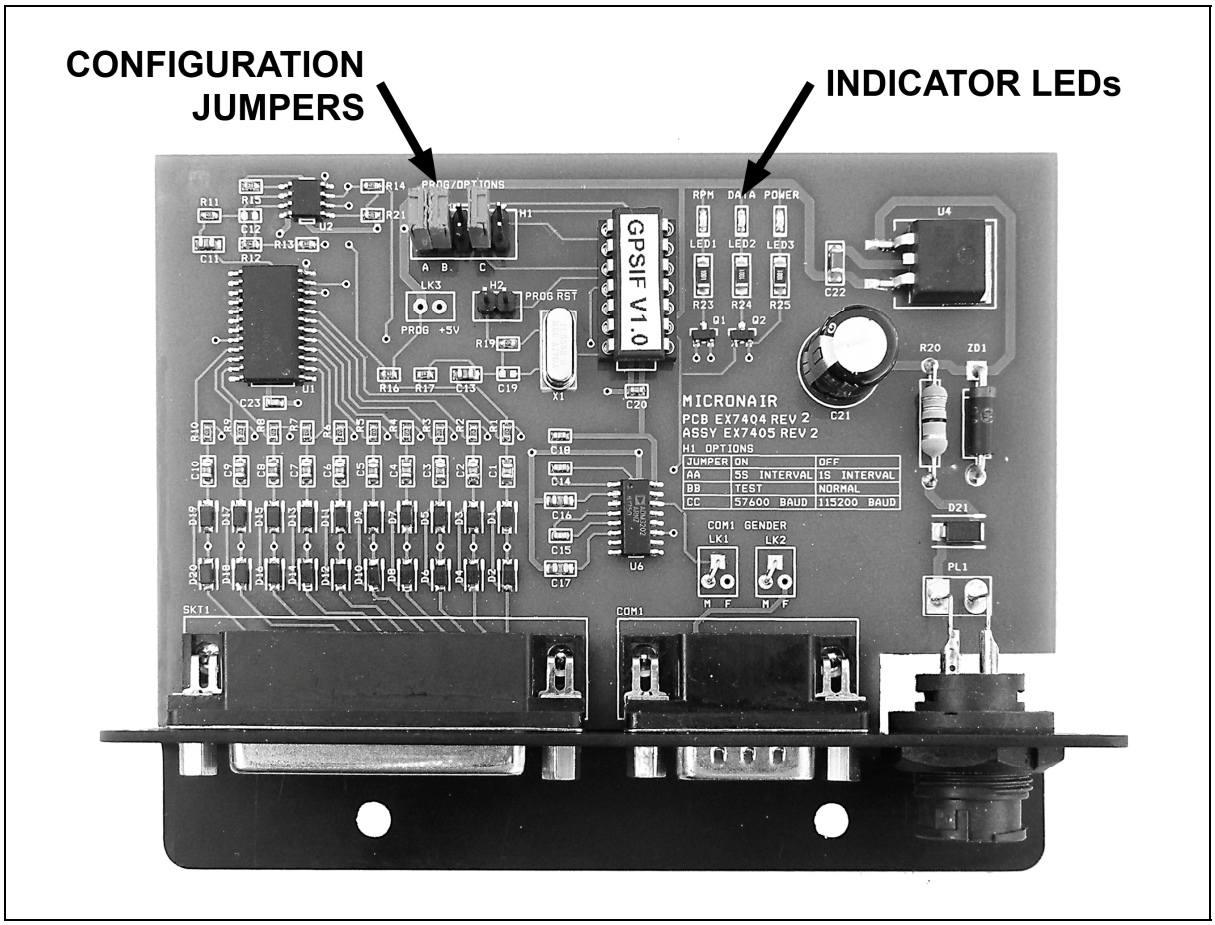


Fig. 7 – Configuration Jumpers and Indicators on PCB

7.1 Configuration

1. Serial interface speed (baud rate). The interface can send serial data at 57600 or 115200 baud. The speed must be set to correspond to the speed used by the serial (COM) port of the GPS system. This will be specified by the GPS system supplier. If the speed of the GPS COM port can be varied it is important that it should be set to match that of the interface. The speed is set by fitting or removing a jumper cap between pins CC of H1. The settings are:

Cap on	57600 baud
Cap off	115200 baud

2. Update interval. The interface can send updated atomiser RPM data to the GPS system every 1 second or every 5 seconds. The preferred option is every 1 second as this provides the most precise display and log record of atomiser speed, especially if this changes rapidly. However, the shorter update interval may result in a larger log file in the GPS system and in some cases it may be necessary to increase the interval to 5 seconds. The interval is set by fitting or removing a jumper cap between pins AA of H1. The settings are:

Cap on	5 second update interval
Cap off	1 second update interval

7.2 Test Mode

The interface unit can be set to send simulated atomiser RPM data to the GPS system for testing on the ground. The test mode is enabled by fitting a jumper cap between pins BB of H1. The settings are:

Cap on	Test mode
Cap off	Normal operation

The jumper cap must be removed before reassembling the unit.

The simulated RPM value is different for each atomiser and the speeds cycle through 16 increments of 10 RPM. This makes it possible to check that the displayed and logged RPM values are updating correctly. The range of simulated RPM for each atomiser is shown in Appendix 2.

7.3 Indicator LEDs

There are three indicator LEDs on the PCB as shown in Fig. 7. The functions of these are as follows:

Power	The LED is illuminated when the unit is connected to a power source and the internal voltage regulator is operating correctly.
Data	The LED flashes each time serial data is sent to the GPS system. The interval between flashes should correspond to the update interval selected by jumper cap AA on H1 (see above).

RPM — The LED flashes when pulses are received from the transducer on any of the atomisers. The functioning of the transducer and integrity of the wiring can be checked on the ground by rotating each atomiser fast by hand and ensuring that the RPM LED flashes.

8. PART NUMBERS

8.1 RPM to GPS Interface

RPM to GPS interface kit	PC1137
RPM to GPS interface unit*	EX7410
Power connector (female)*	CBP3783
25 pin D connector housing*	CBP1925
25 pin D connector shell*	CBP1926

** These items included in kit PC1137*

8.2 RPM Transducers and Parts

RPM transducer installation kits[#]:

AU4000 on mounting block	PC1035
AU4000 on cast clamp	EX4012
AU5000	EX4013
AU7000	EX4014
AU6539	PC1070

[#] *These kits include applicable parts listed below.*

RPM transducer cable assemblies:

AU4000/5000/7000	EX3291
AU6539	EX6967

RPM transducers

AU4000/5000/7000	EX2373
AU6539	EX6966

RPM transducer retaining screw (AU6539) CBP675

RPM transducer bush (AU4000/5000/7000) EX356

RPM transducer mounting brackets:

AU4000 on EX2968 block	EX193
AU4000 on cast clamps	EX1792
AU5000	EX1793
AU7000	EX2651

RPM sensing tabs/plates/sleeves:

AU4000	EX192
AU5000	EX1794
AU7000	EX2652
AU6539	EX6951

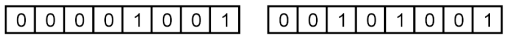
9. CONVERSION FACTORS

1 yard	= 3 feet	= 0.91 metre
1 metre	= 39.37 inches	= 1.09 yard
1 statute mile	= 0.87 nautical mile	= 1.61 kilometre
1 nautical mile	= 1.15 statute mile	= 1.85 kilometre
1 kilometre	= 0.62 statute mile	= 0.54 nautical mile
1 statute mile	= 1760 yards	= 5280 feet
1 nautical mile	= 2027 yards	= 6081 feet
1 kilometre	= 1094 yards	= 3282 feet
1 metre/sec	= 2.237miles per hr	= 196.9 ft/min
1 acre	= 43560 sq feet	= 4840 sq yards
1 acre	= 4047 sq metres	= 0.40 hectare
1 hectare	= 107600 sq feet	= 11955 sq yards
1 hectare	= 10000 sq metres	= 2.47 acres
1 sq mile	= 640 acres	= 259 hectares
1 sq kilometre	= 247 acres	= 100 hectares
1 US gal	= 0.83 Imp gal	= 3.78 litres
1 Imp gal	= 1.20 US gal	= 4.54 litres
1 litre	= 0.26 US gal	= 0.22 Imp gal
1 US pint	= 16 US fl ounces	= 0.47 litre
1 Imp pint	= 20 Imp fl ounces	= 0.57 litre
1 US gal/acre	= 8 US pints/acre	= 9.45 litres/hectare
1 Imp gal/acre	= 8 Imp pints/acre	= 11.35 litres/hectare
1 litre/hectare	= 0.11 US gal/acre	= 0.081 Imp gal/acre
1 pound	= 16 ounces	= 0.45 kilogram
1 kilogram	= 2.20 pounds	= 35.3 ounces
1 ounce	= 28.35 grams	
1 pound/sq inch	= 0.068 atmosphere	= 0.067 bar
1 atmosphere	= 14.70 pounds/sq in	= 1.01 bar
1 bar	= 14.50 pounds/sq in	= 0.98 atmosphere
1 kilopascal	= 0.01 bar	= 0.145 pound/sq in

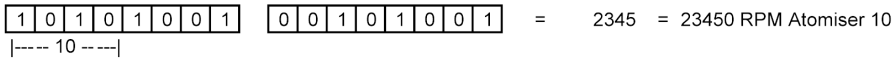
APPENDIX

1. Serial Data Format

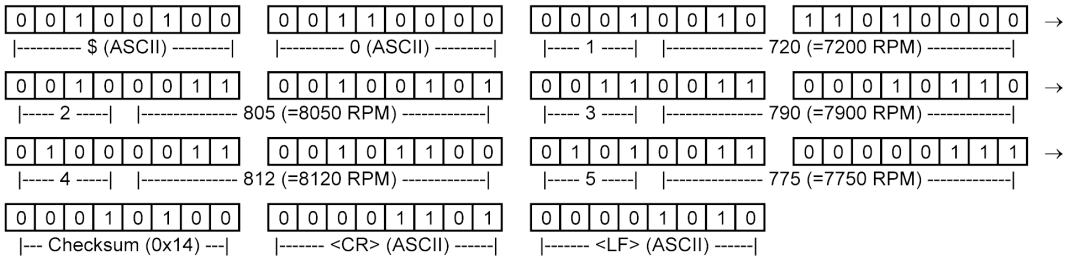
1. Protocol: RS232 (+/- 9 V levels)
2. Speed: 57600 or 115200 baud (jumper selectable)
3. Stop bits: 1
4. Parity: None
5 Handshaking: None
5. Connector: DB9 male connector on box, configured as DTE (output on pin 3).
6. Serial data strings:
   - 6.1 Two strings, each 15 bytes long, containing RPM data for up to five atomisers.
   - 6.2 Strings sent consecutively with 10 ms delay between strings.
   - 6.3 Pair of strings sent every 1 or 5 seconds (jumper selectable)
   - 6.4 Each string has a unique two byte ASCII header: $0 (0x 24 30) for atomisers 1 - 5 and $1 (0x 24 31) for atomisers 6 -10.
   - 6.5 The following 10 bytes contain the speeds of the atomisers as tens of RPM in binary format in two bytes each, eg:



   - 6.6 The first two RPM bytes in each string are the speed of the lowest numbered atomiser (ie 1 or 6).
   - 6.7 The high four bits of the first byte of each pair contain the atomiser number.



   - 6.8 The 13th byte of each string contains a checksum generated from the X-OR of all the preceeding 12 bytes.
   - 6.9 The last two bytes contain <CR> and <LF> characters.
   - 6.10 Example string for atomisers 1 - 5 (shown in order sent):



2. Simulated RPM Data in Test Mode

Atomiser	String Header	RPM O/P (Hex)[1]		RPM O/P (Decimal)[2]	
		Min	Max	Min	Max
1	$0	0C0	0CF	1920	2070
2	$0	120	12F	2880	3030
3	$0	190	19F	4000	4150
4	$0	1F0	1FF	4960	5110
5	$0	250	25F	5920	6070
6	$1	2B0	2BF	6880	7030
7	$1	320	32F	8000	8150
8	$1	380	38F	8960	9110
9	$1	3E0	3EF	9920	10007
10	$1	440	44F	1088	11030

Notes:

1. Data in string is RPM/10. Value in string must be multiplied x10.
2. Values in these columns are after multiplication x10.

Notes: