SYNCHRO TRANSMISSION UNIT
KW903-SX3

AMI – GFV MARINE

SYNCHRO TRANSMISSION UNIT KW903-SX3

TECHNICAL MANUAL

CONTENTS

Sales and Administration Office
AMI – GFV MARINE Ltd
Parham Drive
Eastleigh
Southampton
SO50 4NU
UK

Tel 44 (0) 2380 480450 Fax 44 (0) 2380 480452
Email m.k.woods@btinternet.com
Web http://www.amimarine.com

Research, development and manufacture
AMI-GFV Marine Ltd
Cefn Laboratories
Abergavenny UK

Tel (0)1873 840405 Fax 44 (0) 1873 840106
Email af-aditel@btinternet.com
Web http://www.aditelmarine.com

Andrew Fairgrieve 29/11/2005

KW903-SX3 INSTALLATION AND TEST GUIDE.

CAUTION.
The KW903 operates on high voltages and can generate high currents.
If the unit is not set-up correctly it is capable of damaging itself, or the synchro repeaters it is connected to. Please take care. If you are not sure in what you are doing call someone who is. FAN: please keep your fingers out.

PRE-INSTALLATION CHECKS.
When a gyro is replaced because it is old and worn out our experience shows that there will also be repeaters old and worn out. This includes electrical and mechanical faults. The gears should be checked for wear, particularly the small gear. It is essential that faulty repeaters are repaired or disconnected. Just one faulty repeater can stop the whole system working.

On a refit, use the existing gyro before it is switched off. Turn the gyro and check that all repeaters follow smoothly. Do not forget repeaters in a course recorder and in the steering flat.

Disconnect the synchro transmitter and measure the resistance of all the repeaters in the system connected in parallel. Do not connect to the KW903 until the readings are correct.

R1 - R2 = ... Ohms. Typically greater than 50 ohms.

S1 - S2 = ... Ohms. S2 - S3 = ... Ohms. S3 - S1 = ... Ohms.
These values should be equal, and typically greater than 50 ohms.

R1 - S1. Should be open circuit.
R1 – Ground. Should be open circuit.
S1 – Ground. Should be open circuit.

POWER SUPPLY INPUT.
Set SW4 for nominal 115v or 220v 50 or 60 Hz.
Wire up to SK4 and ensure the equipment is well grounded.
Note that all the connector blocks remove off to ease wiring.

SYNCHRO REFERENCE OUTPUT.
The transformer has two 52/55 nominal volt secondaries. For special applications the transformer may be changed for different voltages, but these principles still apply.

Set slide switch SW5 for SERIES CONNECTION or PARALLEL CONNECTION, to suit the reference voltage your system requires.
Series connection will give nominal 110 volts reference out.
Parallel connection will give nominal 55 volts out.

The 110 volt output suits all systems having a nominal 115 volt reference, whilst the 55 volts output suits those with 50 to 60 volts reference.
If the reference voltage output is too high the synchro repeaters may burn out.

USE OF TRANSFORMER ADAPTER.
The KW903-SX only produces up to about 45 volts maximum between phases. Anschutz repeaters require 20 to 24 volts phase voltage so the KW903-SX may be used directly.

Synchros requiring intermediate voltages of 50 volts will also work directly. Synchros are not critical as to absolute voltage. In fact is beneficial to under-run them.

For 115v reference, 90 volts nominal phase voltage, the KW903SX transformer adapter may be used which will step up the synchro voltage.

- Mount it on the door with M3 10mm spacers.
- Because of the weight of the transformers it **should not be fitted to the door for shipment.** It gives too much strain on the hinges.
- Remove the red jumpers fitted in PL1.
- Connect up with the ribbon cable supplied.
- Set the reference switch for series operation, 115v reference.

DO NOT CONNECT THE SYNCHRO REPEATERS YET.

NMEA 0183 INPUT.
Connect to SK10 using screened twisted pair cable.

SYNCHRO VOLTAGE PRE-ADJUSTMENT.
Use a trimming tool and turn multiturn potentiometer R1 anticlockwise 12 turns. This means that synchro output voltage is low at first switch on.

(SYNCHRO REPEATERS STILL NOT CONNECTED.)
If you do not follow this procedure you risk blowing up the KW903

Set rotary hex switch SW2 to position “B.”
Set the dip switch SW1 all off, the 360:1 position.
THIS IS AN ESSENTIAL PART OF THE INSTALLATION PROCEDURE.

Positions A to F are test positions and allow the KW903 to be set up, and the synchros tested without reference to the gyro compass.

Switch on, and the KW903 will come to life. Data test point LED LD8 will be flashing every second.

Measure the synchro reference output voltage at SK1, R1 – R2. It may be higher or lower than nominal, and this is normal.

Measure the synchro output S1-S3 at SK1 ***or at the transformer adapter output, if fitted.*** Be very careful never to short between pins.

Adjust R1 clockwise for the maximum phase voltage you require. It is a good idea to set it 10 per cent lower for safety, and the synchros will follow well. The 3 output LEDs will light up. You should not need to touch R1 again.

Try SW2 in its various test positions to see how the synchro output LEDs rotate in 360:1 mode. Next you can switch off and set the ratio.

SWITCH SW2 FUNCTIONS..

0 to 9.	Rotation follow-up rate for normal operation
A	Anticlockwise turn
B	Stop, or “belay”

C	Clockwise turn
D	Very slow speed demo
E	Demo at moderate speed.
F	Fast demo mode.

SETTING THE RATIO.
Always check this for the KW903SX may not be set to the ratio you need.
Switch off. Set the DIP switch.

OUTPUT RATIO SETTING, DIP SWITCH SW1
0 = Off, 1 = On, x = does not matter

Option	Switch 1234	Ratio
0	000x	360:1 = 1 revolution per degree
1	001x	180:1 = 2 revolutions per degree
2	010x	90:1
3	011x	36:1
4	100x	30:1
5	101x	10:1
6	110x	9:1
7	111x	1:1 = 1 revolution for 1 revolution of the ship

TEST OF THE SYNCHRO REPEATERS.
Switch off.
NEVER CONNECT OR DISCONNECT THE REPEATERS WITH POWER ON.
Ensure SW2 is set to “B” and the ratio DIP switch is set according th the table.
Connect the synchro repeaters.
Switch on.

The synchro repeaters will jump to an initial start position. The repeaters will require mechanical alignment to the ship’s head eventually.

Move SW2 to “C” then “D” and check that the repeaters are moving in a slow steady manner, reversing direction from time to time. Switch back to “B” to check they are still in alignment. You can exercise the repeater system in this mode. If any repeaters do not follow there is a fault.

If the repeaters turn the wrong way switch off and adjust the phase connection wires. Reversing S1-S2 will reverse the direction. (You MUST switch off first.)

Only the 1:1 ratio is self-aligning, in which case R1, R2, S1, S2 and S3 wires must be changed until it aligns correctly. There are 12 possibilities.

Always switch off before disconnecting any repeaters. When you know that all the repeaters are following switch off and set SW2 to an operating position.

SW2 OPERATIONAL POSITION.
The synchro follow-up speed is set by SW2 approximately according to the formula, rotation degrees per second = 2 + switch. Thus position 4 is about 6 degrees per second. Set it slightly faster than the ship can turn. The facility is there to minimise the movement of the motors and prevent oscillation.

Do not confuse follow up rate with tracking rate. The KW903 will always catch up with the NMEA 0183 heading data.

TESTING THE GYRO COMPASS.
Switch on with SW2 in an operational position, 0 to 9.

The NMEA 0183 input LED normally flashes, although some compasses may be sending non-stop so it appears to be on steadily.

The bi-colour LED LD2 will be green if the NMEA 0183 data input is correct. If LD2 flashes it means that the data is not correct. This sometimes happens because some gyros are set in the factory to give a proprietary output rather than proper NMEA 0183 data. If there is any doubt you need to read the data on a PC and confirm it is really valid NMEA 0183 data. Have no doubt, if the LED is flashing the input data is wrong.

ALIGNING THE REPEATERS.
Unless the ratio of the output is 1:1 the repeaters will need aligning to the gyro compass, at the repeater itself. This includes any electronic interfaces.

Finally turn the gyro compass and check that all the repeaters follow.

EXTERNAL ALARM.
The KW903-SX has low power relay contacts for an external gyro alarm. The contacts are closed in the alarm state and when power is off. The alarm must be an independently powered unit.

The KW903-SX has no feedback from its synchro output, so it can not know if the output has failed. AMI's range of heading repeaters, off course and compass comparator alarms are best used to independently monitor the synchro transmission.

HIGH CURRENT DETECTION
The KW903-SX2 has a circuit and LD10 to detect high current on the 3 phase output and reference output. Bi colour LED LD2 flashes very fast in the case of high current.

A synchro motor acts as a transformer and could feed voltage INTO the KW903. The circuit is tolerant of some overload as it tries to sink excess voltage but it will protect itself if possible. There are resettable thermal fuses in the output. The most likely cause of over-current is a faulty synchro, not a faulty KW903.

One type of old Kurs gyro repeater proved particularly troublesome in this respect. I am advised that the motors were very big. The KW903 should not be used with those Kurs gyros unless approached with extreme caution. Connect one synchro repeater at a time, checking to see what current is drawn, as explained later. Check that the amplifiers remain cool. I suggest that Kurs repeaters are used with 55v reference, not 110v, and with a lower synchro phase voltage.

Eric of Points North Ltd has successfully used KW903-SX with Kurs repeaters. The KW903-SP model is not recommended for Kurs.

KW903-SX3 SYNCHRO TRANSMISSION UNIT

PRINCIPLES AND TECHNICAL NOTES.

MICROPROCESSOR CONTROL.
It is the program in EPROM which make the device work at all. The EPROM must be changed to give different ratios of synchro output.

There is a data test-point J7 for development purposes. (Data + on the left pin.) Use a PC or data reader to monitor a proprietary NMEA sentence indicating the set up and performance of the KW903.

POWER SUPPLIES.
There are 3 supplies involved. +5 logic, +/- nominal 35 volts for the amplifiers, and the reference transformer.

Always ensure red LED LD7 is OFF before changing any components

SYNCHRO GENERATION.
There have been 3 different types of amplifier used in the KW903-SX, SX2 and SX3 successively, taking advantage of more powerful amplifiers becoming available. Surprisingly none have been known to fail in service due to natural causes.

The three power amplifier modules receive a low voltage sample of the mains power input controlled by the microprocessor. The output circuit includes a resettable fuse and 1 ohm sense resistor.

OUTPUT CURRENT.
1 ohm series resistors R6, 7 and 10 in each output allows the output current to be monitored, and this is a most useful thing to do in any new installation. Take care not to slip with the probe.

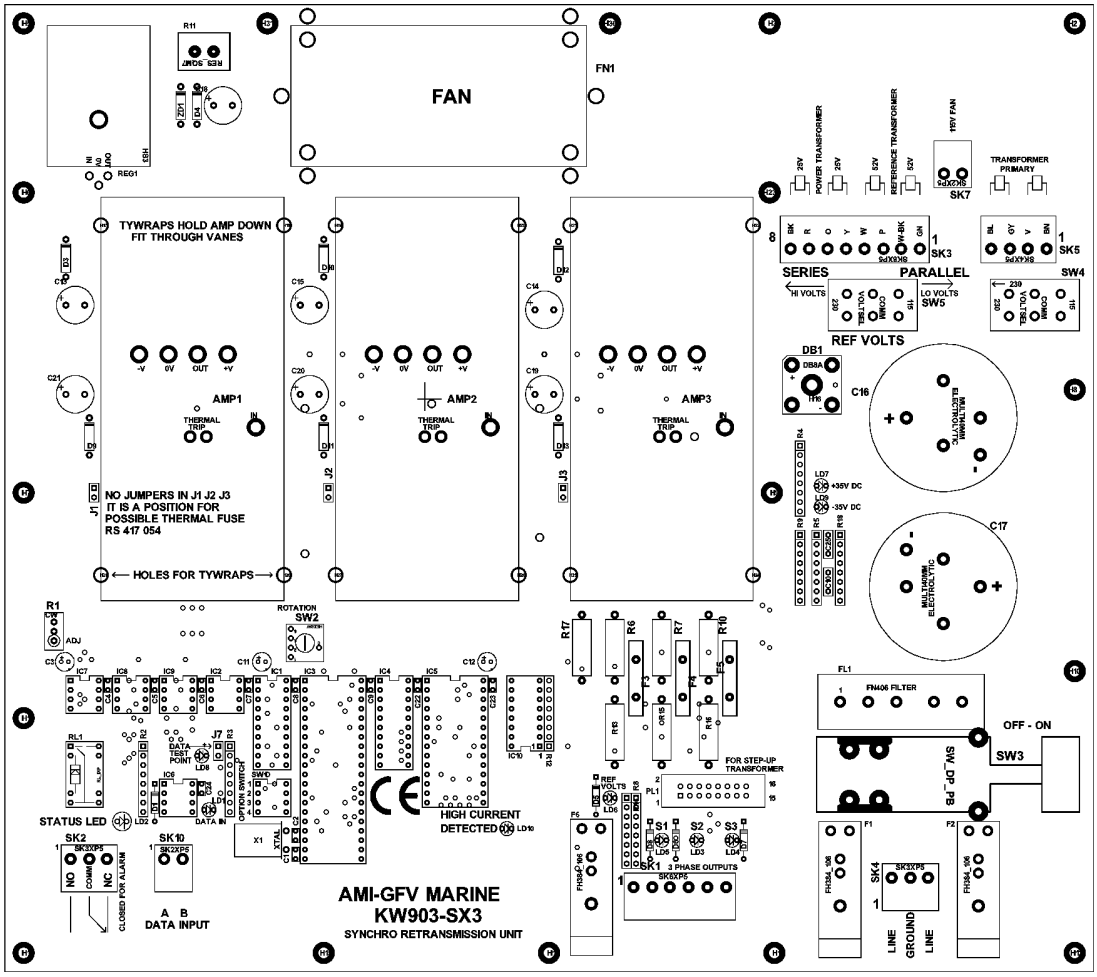
Should any amplifier module be suspect the easy way to test them is like this. Switch off. Remove the synchro output connector SK1. Start up in the demo-mode “F”. Use an oscilloscope of voltmeter to check from GROUND (0v) to S1, S2 and S3. Each should show voltage up to about 20 v RMS.

1 ohm resistor R17 allows the reference current to be measured.

FAN.
Fans have a finite life and should be changed at least every 4 years. Use one with high air volume.

CAUTION.
The KW903 has been designed for long reliable service but any electronic instrument can fail, especially high power, high stress equipment. Please test the unit all you can and any feedback on its performance will be warmly welcomed. Never rely totally on any electronic aid and navigate with caution.

Andrew Fairgrieve 25/9/99


FAN
FN1
TYWRAPS HOLD AMP DOWN
FIT THROUGH VANES
AMP1
AMP2
AMP3
THERMAL TRIP
NO JUMPERS IN J1 J2 J3
IT IS A POSITION FOR
POSSIBLE THERMAL FUSE
RS 417 054
HOLES FOR TYWRAPS
SERIES
PARALLEL
HI VOLTS
LO VOLTS
REF VOLTS
POWER TRANSFORMER
REFERENCE TRANSFORMER
115V FAN
TRANSFORMER PRIMARY
ROTATION
ADJ
STATUS LED
DATA IN
HIGH CURRENT DETECTED
FOR STEP-UP TRANSFORMER
3 PHASE OUTPUTS
FN406 FILTER
OFF - ON
LINE
GROUND
LINE
CLOSED FOR ALARM
DATA INPUT
AMI-GFV MARINE
KW903-SX3
SYNCHRO RETRANSMISSION UNIT