The famous KW950 - E

DATA REPEATER AND MULTI-FUNCTION INTERFACE

ADITEL MARINE ELECTRONICS

KW950 – E DATA REPEATER AND INTERFACE

TECHNICAL MANUAL
KW950E3.DOC or PDF

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MORE INFORMATION IS AVAILABLE ON THE WEB SITES SHOWN BELOW

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The manual was last updated by the designer, Andrew Fairgrieve 13/03/2007

KW950 – E   DATA REPEATER AND INTERFACE.

INSTALLATION NOTES.

MOUNTING:
The enclosure is a standard DIN case normally trunnion mounted. The panel cut out is 68 x 132 mm. Panel mount clamps are not normally supplied by AMI. Depending on availability DIN cases from several manufacturers may be used, which have different clamping arrangements.

WIRING:
Cable entry is via glands for miniature screened cables. Ground the power cable screen, and NMEA 0183 data output screens.

CONNECTORS:
Remove the rear panel and take care not to loose the screws! The interface PCB slides out. Note that the connector blocks lift off and may be fitted vertically or horizontally.

POWER. SK1:
10 to 30 volts DC at 5 watts. The 0 volts line is connected to the NMEA 0183 output.

GYRO INPUT. SK2:
Refer to the tables which follow. Robertson SKR80 current loop input requires a hardware mod described later.

DATA INPUTS: SK3 or SK5.
Refer to the tables which follow.

DATA OUTPUT: SK3.
This is the standard NMEA 0183 output (A-B). It can be used as RS232 compatible from A to 0. Note that the power line 0 volts connects to "0". Before making the connection check that there is no more than 5 volts difference between the KW950-E output and the lines of the receiving equipment. If a voltage exists damage may be caused to the KW950.

KW950's output circuits can not be damaged by short circuits. It may be damaged if power is forced into the KW950 data output. This is easily detected and the warranty does not cover such damage.

DATA OUTPUT: SK4.
For an NMEA 0183 or similar data output, use D1, D2. For RS232 use D1, 0v.

Furuno output:	CLOCK H and DATA H	SK4, 1, +5v.
	CLOCK C	SK4, 2, D1.
	DATA C	SK4, 3, D2.
Pulse output:	D1 or D2, and 0v.	

JUMPER J1:
This is "norm" except in the case of Robertson SKR80 current loop data into SK5, when it is set to "inv."

OPTION SWITCH SETTING:
Set the switch according to the table, then power-up. This manual will become out of date as more options are added, but you can download the latest data sheets from the web sites, and request EPROM data in Intel hex format by email so that you can program your own EPROMS. If you need an option that is not in the table it can be done.

PULSE LOG INPUT:
Apply a voltage pulse, 4 to 30 volts to SK5 (Or SK3 1,2 in option 2C.) If the source is a relay simply wire the DC input through the relay to SK5. You will see the reference input LED LD7 flash.

ECHO SOUNDER START & STOP PULSE CONNECTION:
This is for an echo sounder with an output for an external depth display. It is not to be connected to the echo sounder transducer or test points. Suitable echo sounders typically have a "start" or "transmit" pulse and a "stop" or "receive" pulse for the remote display. The KW950 measures the time between the pulses and calculates depth.

Because of its complexity a separate section on echo sounder interfacing follows later.

MARCONI SEACHART INTERFACING
Option 45 allows connection to the data output of a Marconi Seachart. Data goes in to SK5, with J1 set to inverse. For survey use a correction can be entered by using the buttons, and is applied to the data output but not the display.

JRC JLN 202/203 LOG
This has been done on some ships before but we do not have any details on how to connect to the log. The log has a data and clock output. Data is input to the NMEA input port SK3 and the clock to SK5. Do not connect other input.

FUNCTION LABEL:
It is a good idea to make a label to indicate the function of the display, depth in metres, speed etc.

ROBERTSON SKR80 CURRENT LOOP INPUT

The KW950 does not have a current loop input but a simple modification can be made to handle it. The mod has been carried out by Erik of Points North Ltd many times.

1. Remove IC11. Replace it with a CNY17 opto-isolator. This is a 6 pin opto which goes into the 8 pin socket's pins 2,3,4,5,6,7. CNY17 goes into sockets pin 2.
2. Short out R8 pins 7 to 8. There are 2 holes in the PCB to make it easy. Label SK5 "SKR80 data"
3. Fit J1 in the "INV" position
4. Use option 25.
5. Data in to SK5. LD7 will be lit continuously.

ANSCHUTZ COURSEBUS OUTPUT

Options 14, 19, & 1F. The Anschutz output was created specifically for Raytheon Anschutz, Kiel, to solve some of their interfacing requirements. The Anschutz Coursebus output was tested by Raytheon Anschutz, Kiel, and they declared it to be correct. A Coursebus reader program for PC is available to check it. Unfortunately some repeaters or radars have proved not able to read this signal, although others read it fine. The reasons are not all known. The options for Anschutz Coursebus should be treated with caution. It is not guaranteed but if it works it's a bonus.

FORWARD OR REVERSE HEADING, OPTION 13

The NMEA input port SK3, pins 1 & 2, has to have a DC voltage of 5 to 15 volts applied to cause heading to reverse. This is easily accomplished with a switch or isolated relay contacts. The KW950 is not designed to connect directly to all types of ship's output.

Ship's may have different methods of providing an output to indicate if heading has to be reversed. Example, 24 volts DC, a switch shared with other services, 230 volts AC. Whatever the configuration of an individual ship I suggest that engineers fit a switch or relay with isolated contacts for use by the KW950E.

COURSE AND DATA RECORDER

The KW950E must be fitted with an EPROM programmed with CR8 (or later) available at the time of order, or as an Intel Hex file by email. The standard EPROM does not do the course and data recorder function.

Input GPS to SK3, 1 and 2. Input heading in the normal way, NMEA, synchro or stepper.

When rudder angle RSA sentence is available it can be input combined with GPS or with heading NMEA data.

Connect an RS232 serial printer set for 4800 baud, 8 bits, no parity, 1 stop bit to SK3 data output
- SK3 pin 4 = data +. SK3 pin 5 = signal GND. SK3 pin 3 = cable screen
- Printer D 9 or 25 pin connectors pin 3 = receive data.
- Printer 9 pin D connector pin 5 = signal GND
- Printer 25 pin D connector pin 7 = signal GND
- Printer 25 pin, connector pin 7 = cable ground

We can not give switch settings for all printers and the printer will probably not print unless set up absolutely correctly, and with its RTS and CTS signals are linked.
- 9 pin and 25 pin D connector, join pins 4 and 5

Press the AL button and the KW950E will give an instant line of data which will be printed. You can read it on a PC.

The printout relies on time from GPS being delivered EVERY second. If there is no GPS there will be no automatic printout. One line is printed every 6 minutes, and at 10 second intervals when the heading changes more than 2 degrees. So, on passage there are generally 10 line printed per hour. When manoeuvring the printout is more rapid. A thermal printer using fanfold paper, or a paper roll, is a good choice. If you select a small font on the printer the paper use is maximised.

Set option switch to 00 for heading display. Set to 01 for rudder angle display. The rudder sensor angle in an RSA sentence does not necessarily equal actual rudder angle. If not, then it needs to taken care of in the rudder angle interface not the KW950E. Rudder angle only appears on the paper if it actually exists.

The printout gives these parameters:

UTC time, latitude, longitude, heading, rudder angle, GPS speed over ground, GPS course over ground, Date.

RADAR TRACKED TARGET INTERFACE

Program RAD950 is used to receive radar messages, and output one selected target message. The DIP switch can be set for three options.

0000 0000	Displays heading
0000 0001	Displays selected target number
0000 0010	Displays target bearing

To change the selected target hold the "align" button and use "inc" or "dec". This works in all three options. To check which target is selected just press the "align" or circle button.

Radar is input at SK3 and heading at SK5.

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CHECKING OPERATION

SWITCH ON:
The display will come to life, and LEDs will start flashing on the interface board.

STEPPER OR SYNCHRO GYRO:
With gyro stepper input S1,2,3 LEDs should never be all on or all off. If heading turns the wrong way reverse S1 and S2. Stepper and synchro is resolved to 1/6th degree. M-Type step is 1/3rd degree.

ALIGNING HEADING:
Hold the AL button for 3 seconds and keep holding it. Use INC and DEC to align heading.

ILLUMINATION:
The INC and Dec buttons control 32 steps of illumination.

ALARM FLASHING:
Press AL to accept an alarm. The gyro alarm is given if errors are detected, such as false step data or loss of signals.

HEADING DEMONSTRATION MODE:
Hold the AL button at switch on. Pressing AL, INC or DEC can change or pause the heading. You can use this mode to test the receiving equipment independent of the gyro.

RATE OF TURN BAR GRAPH:
The bars have values of 30, 60, 90 and 120 degrees per minute. They are only intended to give the simplest indication of rate of turn, as a better alternative to rotating LEDs.

PULSE LOG OPERATION:
Pulses from a log are frequently erratic. The KW950 software includes a smoothing, filtering, algorithm to greatly enhance poor logs. You may notice a difference in reading between the KW950 and other displays due to their method of converting pulses to a speed. The KW950 measures time in steps of 250 microseconds, so is highly accurate.

ECHO SOUNDER OPERATION:
Depth is calculated from the time difference of the transmit and receive pulse, in steps of 0.1 metres. The display adjusts for no decimal parts if the depth is more than 999.9 metres. There may be small difference between the KW950 display and that of the echo sounder. There is a minimum depth of about 1.5 metres to allow for the ringing of transducers. Additional advice follows.

THE OPTION LIST:
This list gives various notes about the interface.

FEEDBACK AND ADVICE:
This manual is deliberately kept simple as the KW950E is expected to be installed by experienced engineers who dislike reading manuals. Any feedback on the performance of the instrument is welcomed.

Andrew Fairgrieve
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GYRO INTERFACE WIRING. This list is NOT repeat NOT guaranteed to be totally accurate. There are so many variations in gyro outputs that it is best to measure the output and then decide how to interface it.

FINAL PHASE ADJUSTMENT, If the heading turns the wrong way reverse one pair of phase wires.

PURE DC STEPPER, NEGATIVE STEPS
S1   to   S1-
S2   to   S2-
S3   to   S3-
Common + to   S1+, S2+ S3+   (This is the most common stepper system)

PURE DC STEPS, POSITIVE STEPS
S1   to   S1+
S2   to   S2+
S3   to   S3+
Common + to   S1-, S2-, S3-   (This is not common, but exists.)

UNSMOOTHED RAW RECTIFIED STEPPER
You can measure on a 'scope. On a multimeter you can measure a voltage on AC and DC ranges, whereas with the previous pure DC steps only the small AC ripple may be measurable. The best connection uses the gyro repeater + and – supply which is often available for illumination.

UNSMOOTHED RECTIFIED STEPPER, NEGATIVE STEPS
S1   to   S1-
S2   to   S2-
S3   to   S3-
Common + to   S1+, S2+ S3+, R1+
Common – to   R2-

UNSMOOTHED RECTIFIED STEPPER, POSITIVE STEPS
S1   to   S1+
S2   to   S2+
S3   to   S3+
Common - to   S1-, S2- S3-, R2-
Common + to   R1+

UNSMOOTHED RECTIFIED STEPPER, NEGATIVE STEPS, Negative supply line not available.
S1   to   S1- and via a diode to R1-
S2   to   S2- and via a diode to R1-
S3   to   S3- and via a diode to R1-
Common + to   S1+, S2+ S3+, R1+

UNSMOOTHED RECTIFIED STEPPER, POSITIVE STEPS, Positive supply line not available.
S1   to   S1+ and via a diode to R1+
S2   to   S2+ and via a diode to R1+
S3   to   S3+ and via a diode to R1+
Common - to   S1-, S2- S3, R1-

M-TYPE STEPPER
S1   to   S1+ and S3-
S2   to   S2+ and S1-
S3   to   S3+ and S2-

SYNCHRO 360:1, 1 REV/DEGREE, and 180:1
R1   to   R1+
R2   to   R2
S1   to   S1+ and S3-
S2   to   S2+ and S1-
S3   to   S3+ and S2-

90 X 400 Hz "CONTACTLESS SYNCHRO" TRANSMITTER
This is found in some Sperry and Tokimek gyros. It looks like a synchro but has 6 connections.
R1   to   R1+
R2   to   R2+   (If this does not work try reversing R1, R2)
S1   to   S1+
S2   to   S2+
S3   to   S3+
N   to   S1-, S2-, S3-

DC SYNCHRO, 24 VOLTS
This technique is used by Yokogawa and some Microtechnica gyros.
S1   to   S1+ and S3-
S2   to   S2+ and S1-
S3   to   S3+ and S2-

KW950 ECHO SOUNDER "REMOTE DISPLAY" INTERFACE

The KW950 needs a DC transmit pulse and a DC received echo pulse. It measures the time between the pulses and using a sound velocity of 1500 metres per second calculates depth.

1. If you have any doubt about the 950 do this simple test.
2. Connect 12v or so onto a 2 pin terminal block.
3. Remove the terminal blocks from SK2 and SK5
4. Switch on with option 2F, for the echosounder function
5. Quickly apply a short 12v pulse to SK5. (Just touch the terminal block onto SK5. That's the start pulse. Note that the LED flashes.)
6. About a second later do the same on SK2, 3 & 4. (That's the receive pulse. The LED flashes.)
7. Look at the display. It will indicate depth. Try and be accurate with your pulse time.

This advice is intended to take away any doubt that the KW950 can time the pulses.

Now you can be absolutely sure that if you apply similar pulses from the echo sounder you must get similar indications. If you do not get a reliable reading, then it is an echo sounder problem not a KW950 problem.

ECHO SOUNDER REMOTE DISPLAY OUTPUT

Many echo sounders have the transmit and receive pulses all ready for a remote display, which makes connection reasonably easy. You still have to know the active direction of the pulses.

TRANSMIT PULSE INTERFACING
- A 5v to 30 volt transmit pulse must be applied to SK5 pins 1 and 2.
  - Pin 1 must go positive compared to pin 2
  - Pulse Length >250 microseconds

- Transmit pulse active high: High when transmitting
  - J1 = "NORM"
  - LD7 must give a quick flash every time the echo sounder transmits. (May be difficult to see)
  - If LD7 seems to be on all the time then try inverting the pulse at J1

- Transmit pulse active low: Low when transmitting, high in idle state
  - J1 = "INV" (This inverts the pulse after passing through the opto coupler IC11)
  - LD7 must give a quick flash every time the echo sounder transmits. (May be difficult to see)

- The KW950E can not function until you have a definite quick pulse on LD7 in time with the echo sounder, even if it is very hard to see.
  - An oscilloscope on IC11 pin 6 would show the pulse best.

RECEIVE PULSE INTERFACING
- A 9v to 50 volt receive pulse must be applied to SK2 pins 3 and 4.
  - Pin 3 must go positive compared to pin 4
  - Pulse Length >250 microseconds
  - If the voltage of the pulse is too low bypass R6 pins 1 to 8 with a 3K3 resistor

- Receive pulse active-high: High when receiving the echo, no action is required
  - LD4 must give a quick flash every time the echo is received.
  - If LD4 is mostly on then the signal is probably active-low
  - (Sorry the 950 does not have an INV jumper on this line)

- Receive pulse active low: Low when receiving the echo, high in idle state
  - Connect SK2, 7, to DC+ SK1, 1
  - Connect SK2, 8, to DC 0v SK1, 3
  - LD6 will be ON
  - LD4 will be ON most of the time, flashing off, which is hard to see.

- The KW950E can not function until definite start & stop pulses are received.
  - You can check that the pulses are good clean pulse on an oscilloscope.
  - The echo Kw950E has a minimum depth delay of about 1 metre.
  - If there is low voltage noise on the pulses it can cause erratic readings
  - If you have any doubt you can simulate operation by manually applying a quick start-pulse to SK5 then a quick stop-pulse to SK2, 3 & 4.
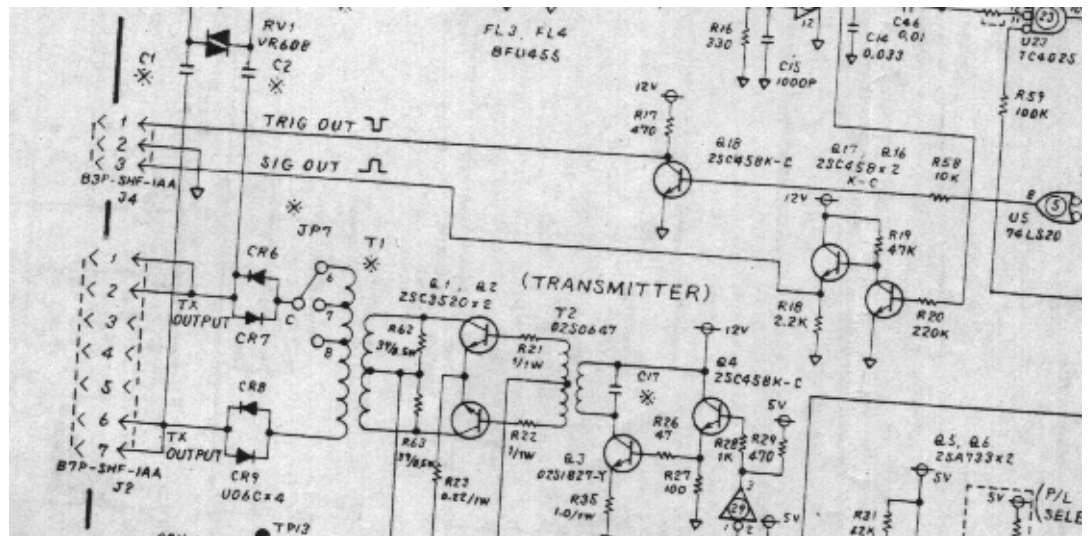
ECHO SOUNDER CONNECTION EXAMPLE

Here is the Furuno FE680 output that can be used to drive the KW950E.

The Trig out transmit pulse is ACTIVE LOW. The receive pulse is ACTIVE HIGH.

Connect...
SK5,1 to J4,1
SK5,2 to J4,2
SK2,3 to J4,3
SK2,4 to J4,2

Set KW950E J1 to "INV".

If the KW950 does not respond properly you will need to check with an oscilloscope to find out what is the problem with the echo sounder.
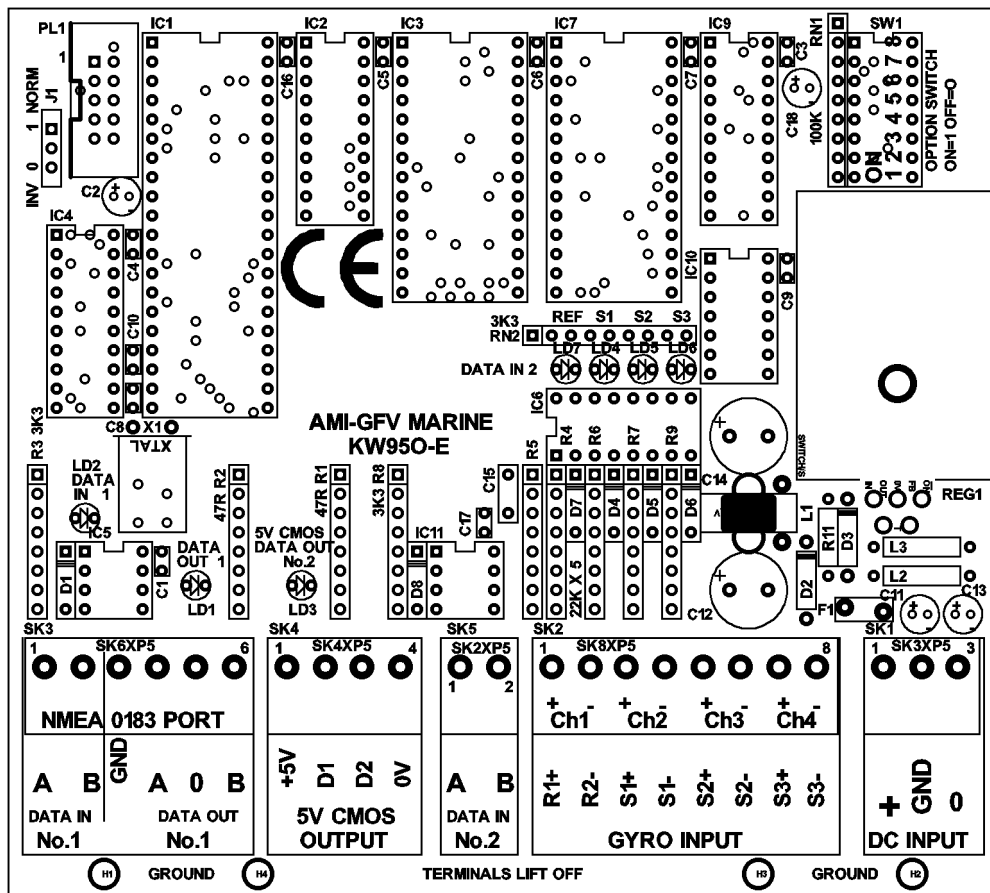
MODIFICATION OF ECHO SOUNDERS

The echo sounder is an essential type approved navigational aid. If an echo sounder does not have an output intended for a remote display or similar device then there should be no attempt to modify it. I consider trying to use internal oscilloscope test points as an unofficial modification. We do not approve of any modifications to type approved navaids, and urge engineers not to try it no matter what pressure is brought. This may well mean that the ship has to fit a new echo sounder when fitting a new VDR.

THANKS

I have updated the echo sounder sections of this manual today because of a report by Shailendra Shukla of Elcome International. Feedback on my designs and manuals is warmly welcomed.

Andrew Fairgrieve 13/03/2007

PCB LAYOUT