



ISAR Procedures Manual v1.01

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Reference:	Procedures_manual_v1.01.docx
Issue:	01
Date of issue:	July 2011
Document type:	Procedure Manual

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Document change record

Author	Modification	Issue	Rev.	Date
J Hopkins	Section 9 of original ISAR manual removed and incorporated into ISAR Procedures Manual v1.01. Instrument opening and closing procedures added. Procedures updated for ISAR-5D. Setup procedures section added. Appendix A added for updated spares list.	Draft	1.01	July 2011

Table of contents

1	Introduction	5
2	Maintenance procedures	6
2.1	General maintenance	6
2.2	Opening & closing the ISAR instrument (Procedures O & C)	7
2.2.1	Equipment and supplies	7
2.2.2	Opening (Procedure O)	7
2.2.3	Closure (Procedure C)	7
2.3	Bulkhead splitting (Procedure BS)	9
2.3.1	Equipment and supplies	9
2.3.2	Procedure BS	9
2.4	Replacement of mirror (Procedure RM)	10
2.4.1	Equipment and supplies	10
2.4.2	Procedure RM	10
2.5	Replacement of ISAR-5D ZnSe window (Procedure RW)	14
2.5.1	Equipment and supplies	14
2.5.2	Procedure RW	14
2.6	Reconfiguration of US-DIGITAL shaft encoder Procedure (SE)	18
2.6.1	Equipment and supplies	18
2.6.2	Procedure SE	18
2.7	Optical alignment (Procedure OA)	22
2.7.1	Equipment and supplies	22
2.7.2	Procedure OA	22
3	Set up procedures	24
3.1	Configuration of the PNI-TCM2.6 (Procedure PNI)	24
3.1.1	Equipment and supplies	24
3.1.2	Procedure PNI	24
3.2	Configuration of Lassen SK-II GPS card (procedure GPS)	26
3.2.1	Equipment and supplies	26
3.2.2	Procedure GPS	26
	APPENDIX A: ISAR Spare Parts List	30

1 Introduction

This manual incorporates some of the common start up and maintenance procedures that the user is likely to encounter. This document is not meant to be an exhaustive step-by-step guide into dismantling and re assembling the ISAR instrument, but should be used as a guide to maintaining the instrument in good working condition.

The correct and regular maintenance of your ISAR-5D instrument is fundamental to ensuring that accurate and dependable data are obtained. All components have been selected for their resistance to seawater and the harsh marine atmosphere but inevitably, after long deployments, optical and mechanical components will require a thorough service. It is recommended that deployments between the servicing procedures described in this manual, do not last longer than three months.

The following symbols are used within this manual:



Indicates useful information and tips to help you work with your ISAR



Indicates critical information that should be read carefully to avoid damage to the ISAR instrument.



It is essential that a proper calibration is carried out before and after any maintenance activity.

2 Maintenance procedures

2.1 General maintenance

After every deployment:

External checks (non intrusive)

- Check all external plugs
- Check all external cables
- Check all visible seals
- Check the operation of the shutter system
- Check the operation of the Optical Rain Gauge (ORG)
- Check for visible signs of water ingress
- Check operation of scan motor

Internal checks (requires instrument to be opened)

- Check for visible signs of water ingress
- Check the drive belt sprocket
- Check the ISAR Mirror
- Check the ISAR ZnSe window
- Check the scan drum main bearing
- Check the encoder shaft seal
- Check the shutter motor shaft seal
- Check the shaft encoder to drive motor coupling

 [Service and/or replace any parts as required \(see Appendix A\).](#)

This section describes the following maintenance procedures in detail:

- Opening and closing the instrument
- Bulkhead splitting
- Replacement of the Scan Drum mirror
- Replacement of the ZnSe window
- Reconfiguration of the US Digital shaft encoder
- Optical alignment

For information on other maintenance procedures, please contact the ISAR team.

2.2 Opening & closing the ISAR instrument (Procedures O & C)

The opening and closing up of the ISAR instrument is common to many of the maintenance procedures detailed in this section. Be sure to allocate sufficient space on the workbench for this procedure, preferably in a clean dust free laboratory to avoid contamination of the optical components. Be sure to update the instrument maintenance record spreadsheet with serial numbers etc. on completion.



The ISAR weighs ~ 20 kg. Ensure that the instrument is adequately secured prior to starting work.

2.2.1 Equipment and supplies

For this procedure you will need the following tools:

- 2 x large flathead screwdrivers
- M6 socket nut spanner

You may need the following replacement ISAR-5D components and supplies:

- 4 x O-ring seal for bulkhead and end cap (Part no. IS5D-P006)
- 6 x Dowty washers (Part no. IS5D-P009)
- 6 x M6 Dome nuts (Part no. IS5D-P010)
- Silicone grease

2.2.2 Opening (Procedure O)

- O-1 Stand the instrument on its end cap ensuring that the section to be worked on is uppermost.
- O-2 Undo and remove the 6 x M6 dome nuts and associated Dowty washers.
- O-3 Inserting the flat head screwdrivers into the recesses between end cap and body carefully ease the end cap, in equal increments, away from the body and remove. This may be a particularly tight fit and requires patience. Do not use excessive force.
- O-4 If required, gently ease the cap away and disconnect the inline plugs. Disconnect the GPS antenna from the GPS board and the earth wire from the case.
 Be careful not to damage the window thermistor cable which should be looped around one of the retaining rods.
- O-5 Remove the outer casing.
- O-6 If required, unscrew and remove the six retaining rods that are now visible, from the instrument body.
- O-7 Inspect all visible components for obvious signs of wear and stress.

2.2.3 Closure (Procedure C)

- C-1 If necessary, replace the six retaining rods by screwing them back into the instrument body.

- C-2 Inspect the bulkhead O-seal for obvious signs of damage. Replace with part IS5D-P006 as required.
- C-3 Lightly grease the bulkhead and O-seal with silicone grease and replace the outer casing.
- C-4 Inspect the O-seal on the main body for obvious signs of damage and replace with part IS5D-P006 as required.
- C-5 Ensure that all electronics cables and plugs are centred and accessible so that they can be accessed after the main body case is replaced.
- C-6 If necessary, reconnect all plugs, the earth wire and GPS unit.
- C-7 Lightly grease the O-seal with silicone grease and replace the end cap.
- C-8 Carefully press the end cap firmly home ensuring that there is sufficient thread exposed on the end cap retaining rods to be able to start the dome nuts once the Dowty washers are in place.
- C-9 Add a small amount of silicone grease to the end of each retaining rod.
- C-10 Inspect the Dowty washers for obvious signs of damage. Replace with part IS5D-P009 as required. Inspect the M6 dome nuts for obvious signs of damage. Replace with part IS5D-P010 as required.
- C-11 With Dowty washers in place over each retaining rod carefully tighten each dome nut equally to 5 – 6 Nm whilst ensuring the even seating of the end cap.
- C-12 Enter details of the replacement components into the instrument maintenance record making sure to quote all serial and batch numbers as required.

2.3 Bulkhead splitting (Procedure BS)

This procedure describes the steps required to split the ISAR instrument in two at the aluminium bulkhead. Be sure to allocate sufficient space on the workbench for this procedure, preferably in a clean dust free laboratory to avoid contamination of the optical components. Be sure to update the instrument maintenance record spreadsheet with serial numbers etc. on completion.



The ISAR weighs ~ 20 kg. Ensure that the instrument is adequately secured prior to starting work.

2.3.1 Equipment and supplies

For this procedure you will need the following tools:

- Tools as listed for Procedures O and C
- M8 hex key
- M5 open end spanner
- Bulkhead splitting bolts

You may need the following replacement ISAR-5D components and supplies:

- Supplies as listed for Procedures O and C

2.3.2 Procedure BS

- BS-1 Open the ISAR instrument in accordance with Procedure O above. Remove both outer casings and lay the instrument horizontally with the bulkhead section appropriately supported.
- BS-2 With the motor section (the shorter section) bulkhead facing the user, remove the seven M8 hex head bolts.
- BS-3 Remove the single M5 nut and associated threaded rod that is located adjacent to the scan drum motor housing.
- BS-4 Unplug the scan drum power cable bulkhead connection (the shutter motor bulkhead power connection may need to be disconnected first for better access) and remove the RJ45 connection from the scan drum encoder. Undo and remove the four retaining rods that hold the motor housing in place. Remove the scan drum motor assembly.
- BS-5 Examine the holes in which the M8 hex headed bolts were located and identify the three that have a thread throughout their length. These are the bulkhead splitting locations.
- BS-6 Insert the special bulkhead splitting bolts into the bulkhead splitting locations and evenly tighten them to split the two sections of the bulkhead apart.  Ensure that the bolts are tightened equally or the two bulkhead pieces may jam.

2.4 Replacement of mirror (Procedure RM)

This procedure describes the steps required to replace the scan drum mirror that is located within the scan drum assembly. Whilst this is a fairly simple operation, it requires disassembly of the ISAR to allow for the scan drum assembly to be removed. Be sure to allocate sufficient space on the workbench for this procedure, preferably in a clean dust free laboratory to avoid contamination of the optical components. Be sure to update the instrument maintenance record spreadsheet with serial numbers etc. on completion.

 The gold plated mirror used in the ISAR system has a protective coating deposited on the gold surface that may easily be scratched. It is therefore prudent to carry this procedure out in a clean environment and to only handle the mirror using clean rubber gloves.

2.4.1 Equipment and supplies

For this procedure you will need the following tools:

- Tools as listed for Procedures O and C
- 8mm spanner
- 5mm spanner
- M5 hex key
- M8 hex key
- Small flat head screwdriver
- Philips head screwdriver

You may need the following replacement ISAR-5D components and supplies:

- Supplies as listed for Procedures O and C
- 1 x Replacement Gold mirror window (Part no. IS5D-P001)
- 4 x M3 countersunk screws (Part no. IS5D-P011)
- 1 x Encoder O seal (Part no. IS5D-P005)
- Threadlock compound
- Latex gloves

2.4.2 Procedure RM

- RM-1 Open the ISAR instrument in accordance with Procedure O above. Ensure the drive body (the shorter section) is uppermost.
- RM-2 Loosen the four M5 Nyloc nuts holding the drive assembly in place and remove the associated threaded rods using the small flat head screwdriver.
- RM-3 Disconnect the Shaft encoder and scan motor power cable at the bulkhead.
- RM-4 Remove the drive motor housing assembly from the ISAR. If the drive motor cannot be easily removed, the ISAR main bulkhead may be split (see Procedure BS) and the entire scan drum assembly removed with the drive bulkhead.

 If the latter option is chosen, be extremely careful to ensure that nothing falls onto the ISAR ZnSe window as this will then need replacing.

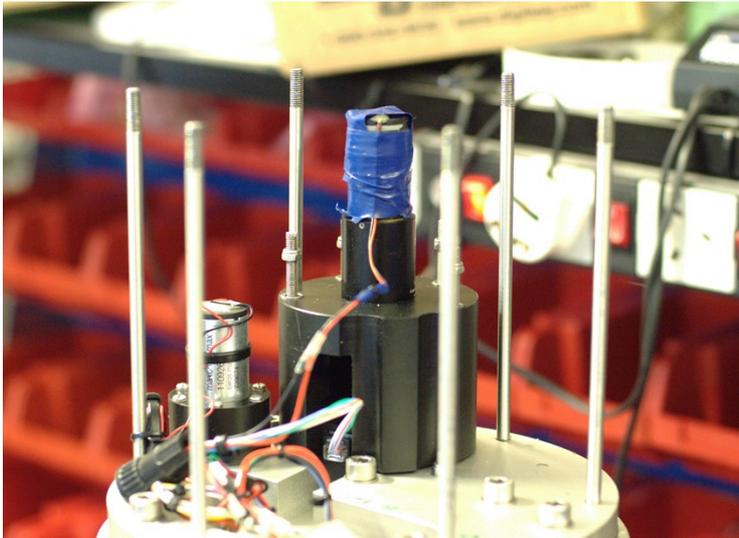


Fig. RM1 View of ISAR with cover removed showing encoder assembly (Note: this image is of ISAR 3)

- RM-5 The US-Digital encoder has an O-ring on the front face that will require delicate manoeuvring to remove.
- RM-6 Gently slide the scan drive assembly out.
⚠️ When the scan drive assembly is removed from the ISAR, take care not to allow anything to enter the blackbody apertures or to damage the ZnSe window.
- RM-7 The scan drive sub assembly should now be accessible. Examine the blackbody apertures for contamination as best you can. It may be prudent to cover the apertures to prevent contamination. In addition, examine the ZnSe window using a small flashlight. Examine the scan drum main bearing for wear. Examine the integrity of the shaft coupling between the shaft encoder and the encoder drive motor. Examine all components for corrosion and wear. Finally examine the scan drum bush seals and compression springs for wear and damage. Replace any parts as required.
- RM-8 Locate the 3 x M5 scan drum retaining grub screws on the side of the scan drum and remove.

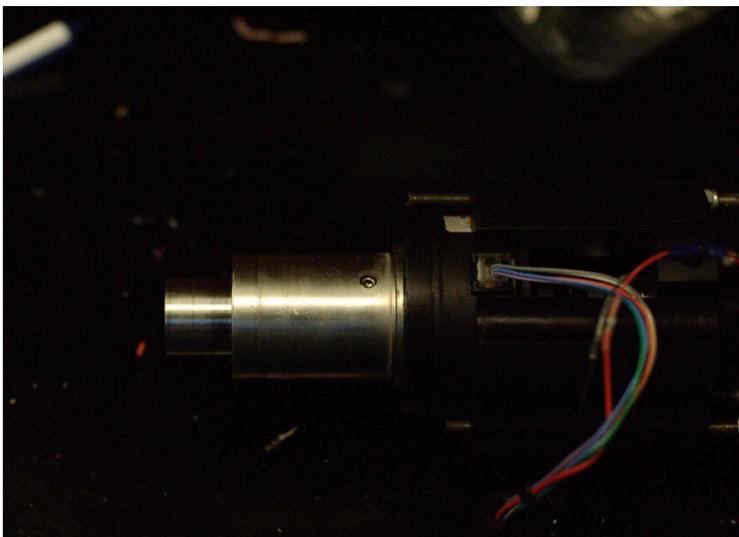


Fig. RM2 Scan drum showing one of the retaining grub screws.

RM-9 Using a suitable technique, remove the outer scan drum.

🔴 Take care with the 2 small drive keys locating the scan drum and mirror mounting.

RM-10 The scan drum mirror should now be accessible. Inspect the mirror and record the results in the instrument log.



Fig. RM3 Outer scan drum removed and mirror and mirror retaining plate visible.

RM-11 Unscrew the four countersunk screws holding the scan mirror retaining plate in place.

RM-12 Remove the scan mirror retaining plate.



Fig. RM4 Mirror retaining plate removed.

RM-13 Observing the precautions above, carefully remove the scan mirror.

RM-14 It is recommended that the mirror be replaced with part IS5D-P001.

🔴 Take great care not to touch the mirror surface.

RM-15 Replace the mirror retaining plate. Secure in place with four new countersunk screws (part no. IS5D-P011). You may use a small amount of threadlock to secure the screws in place.

RM-16 Replace the scan drum, using the keys to properly locate it.

- RM-17 Replace the scan drum retaining grub screw using a small amount of threadlock as required.
- RM-18 The scan drum subassembly is now ready to be replaced back into the ISAR instrument. Prior to inserting the US-Digital shaft encoder, check the O-ring on the encoder faceplate for wear (replace if necessary with part no. IS5D-P005) and grease it with silicon grease.
- RM-19 Replace the scan drive retaining bolts and tighten.
- RM-20 Close the instrument up in accordance with Procedure C above.

2.5 Replacement of ISAR-5D ZnSe window (Procedure RW)

This procedure describes the steps required to replace the ZnSe window. Whilst this is a fairly simple operation, it requires the disassembly of the ISAR as the window is situated deep within the instrument. Be sure to allocate sufficient space on the workbench for this procedure, preferably in a clean dust free laboratory to avoid contamination of the optical components. Be sure to update the instrument maintenance record spreadsheet with serial numbers etc. on completion.

 Zinc selenide (ZnSe) is toxic. It is recommended that the user consult local health and safety guidelines when handling this material. The window is very brittle structure and can be easily broken. Furthermore, the antireflection coatings deposited onto the window can be easily scratched. Therefore it is prudent to carry this procedure out in a clean environment and to only handle the window using clean latex gloves.

2.5.1 Equipment and supplies

For this procedure you will need the following tools:

- Tools as listed for Procedures O and C
- Optical bench jacking assembly and appropriate spanner
- Philips head screwdriver
- Small flat head screwdriver
- M4 hex key
- M8 hex key

You may need the following replacement ISAR-5D components and supplies:

- Supplies as listed for Procedures O and C
- 1 x Replacement ZnSE window (Part no. IS5D-P003)
- 2 x O-ring seals for ZnSe retaining plate (Part no. IS5D-P002)
- Silicon grease
- Thermal grease
- Latex gloves
- Acetone
- Lint free cloth

2.5.2 Procedure RW

RW-1. Open the ISAR instrument in accordance with Procedure O above. Ensure the main body (the longer section) is uppermost.

 Be careful not to strain any wires when removing the end cap.

RW-2. Taking care not to damage the sensor cable, remove the M3 retaining screw holding the window thermistor P-clip.

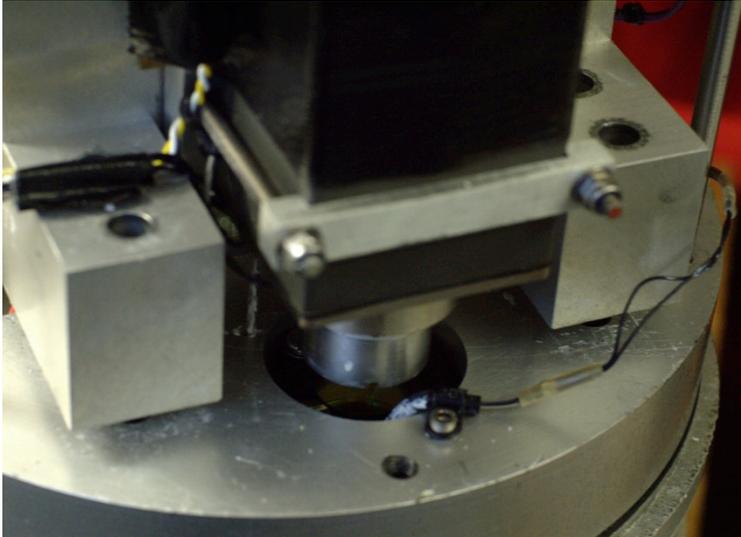


Fig. RW-1. View of optical bench assembly with cover removed.

- RW-3. Carefully remove the window thermistor from its mount.  Take great care not to contaminate the area with old thermal grease during this operation. Carefully wrap the thermistor in protective foam as any physical shock or damage may render the calibration void.
- RW-4. In order to gain access to the ZnSe window, it will be necessary to remove the entire optical bench from the ISAR main bulkhead. Undo and remove the four M8 hex head bolts holding the optical bench to the main bulkhead. The optical bench should remain in place as two precision dowel pins locate it.
- RW-5. Prepare a safe and clean area to place the optical bench when removed. Using the optical bench jacking assembly, carefully remove the optical bench (with the KT15 and electronics in place) from the main bulkhead (a gentle rocking motion may help to release the dowels).  Be careful not to damage any cables by pulling or stressing them when removing the optical bench.
- RW-6. The ZnSe window should now be able to be seen. It is held in place by 4 x M4 flat head screws and a black retaining plate. Inspect the area for moisture/salt contamination and note any contamination. Contamination may indicate a broken seal on the window mounting plate.

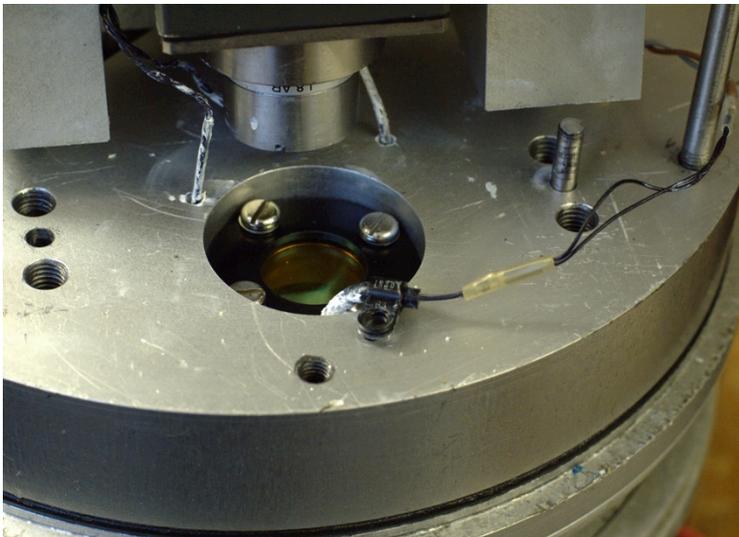


Fig. RW-2. P clip retaining screw and optical bench assembly removed.

- RW-7. Remove the 4 x M4 flat head screws and inspect the O-ring seals for damage.
- RW-8. Carefully remove the ZnSe window retaining plate and inspect the area for moisture/salt contamination.

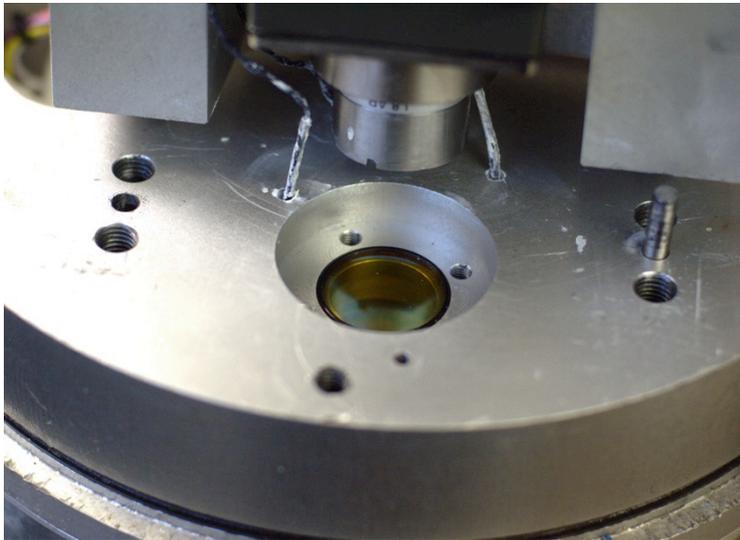


Fig. RW-3. Window retaining plate removed.

- RW-9. Remove the O-ring seal above the window and discard.
- RW-10. Thoroughly clean the retaining plate and set to one side.
- RW-11. Observing the precautions above, carefully remove the ZnSe window. **ⓘ** It may be easier to turn the ISAR upside down and tip the window out into your gloved hand rather than risk contaminating the window.
- RW-12. Observing the precautions above, inspect the ZnSe window for corrosion, scratches or damage. It is recommended that the window be replaced with part IS5D-P003 each maintenance cycle.
- RW-13. Inspect the ZnSe window mount plate for corrosion. Remove the mount plate and inspect the O seal. Replace O seal with part IS5D-P002 if there is any obvious sign of damage.
- RW-14. Thoroughly clean the ZnSe seating area. **☠** Be careful not to spill or drop anything onto the gold scan mirror which is beneath the ZnSe window mounting.
- RW-15. Lightly grease the window mount plate O seal and replace into cavity with the thinnest edge of the mount facing downwards.
- RW-16. If required, replace the thermal grease in the ZnSe window thermistor mounting, ensuring that any excess grease is carefully wiped off.
- RW-17. Observing the precautions above, replace the ZnSe window. **☠** Avoid touching the face of the component.
- RW-18. Lightly grease a new ZnSe O-ring seal (part IS5D-P002). **☠** Lay this onto the face of the ZnSe window taking care not to contaminate the window surface.

RW-19. Replace the ZnSe window retaining plate.

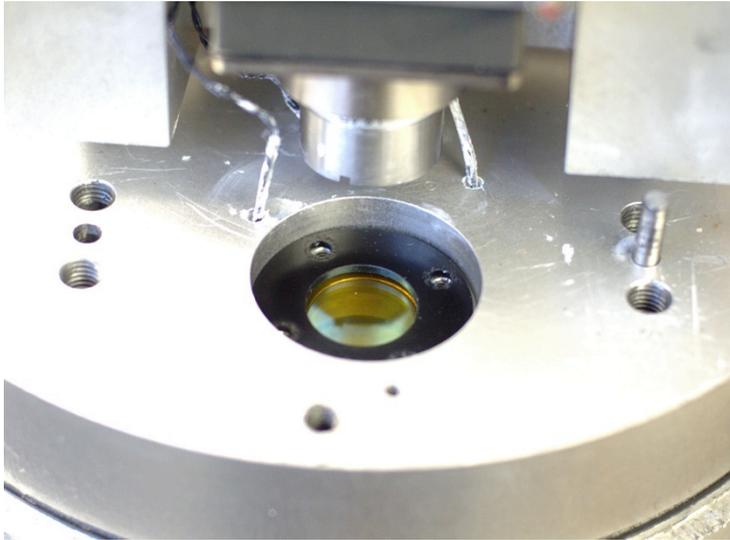


Fig. RW-4 Window retaining plate replaced.

RW-20. Replace the 4 x M4 flat head screws and lock washers.  Take care to tighten each screw slowly and evenly to prevent excessive strain on the window and possible cracking.

RW-21. Relocate the ZnSe window thermistor into its thermal grease filled seating.

RW-22. Replace the M3 window thermistor cable P-clip screw making sure that the cable is clear of the end cap retaining rod tapped hole.

RW-23.  Inspect the new window and verify that everything looks OK.

RW-24. Carefully replace the optical bench on the location dowels. Locate with long M6 bolts to start to ease the optical bench assembly into place.

RW-25. Once correctly located, replace the four M6 hex head retaining screws and tighten slowly to ensure an even seating of the optical bench.  Inspect the seating and verify everything looks OK.

RW-26. Close the instrument up in accordance with Procedure C above.

2.6 Reconfiguration of US-DIGITAL shaft encoder Procedure (SE)

Follow the instructions in the US-digital manual provided on the ISAR-5D CD-ROM. Settings should be for 14400 increments, as this will provide an encoder resolution of 0.025° . The reference position should be set and recorded and the value entered into the isarconf.cfg file.

2.6.1 Equipment and supplies

For this procedure you will need the following tools:

- Tools as listed for Procedures O and C
- U.S Digital AD2-B adaptor
- U.S Digital 9v dc power supply
- PC with com port and terminal
- U.S Digital software.

You may need the following replacement ISAR-5D components and supplies:

- Supplies as listed for Procedures O and C

2.6.2 Procedure SE

- SE-1 Ensure that the problem does not lie with a damaged shaft coupling. Once this is verified as being intact, proceed with the procedure by making sure the ISAR shutter is in the open position.
- SE-2 Using the ISARTOOLS software, try to set the scan drum aperture edge to just touch the back face of the ISAR main body (an absolute angle of 355.5° assuming the shaft encoder zero is set at 0°).

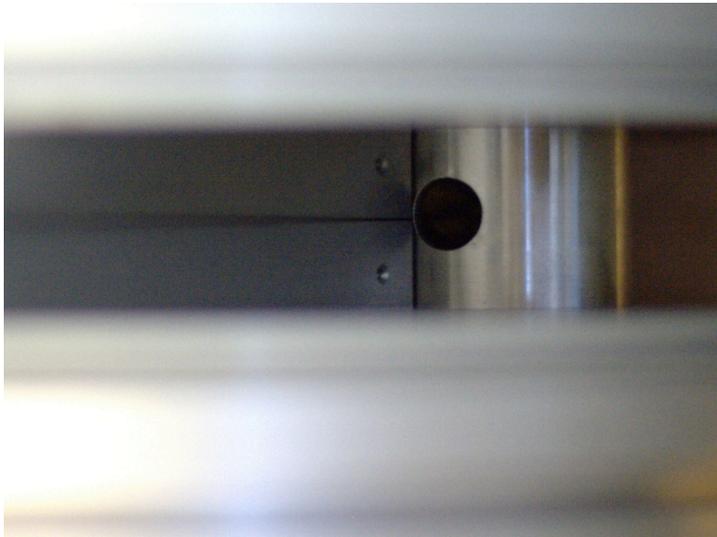


Fig. SE-1. Scan drum aperture touching back face.

- SE-3 Open the ISAR instrument in accordance with Procedure O above to gain access to the shaft encoder RJ45 plug.

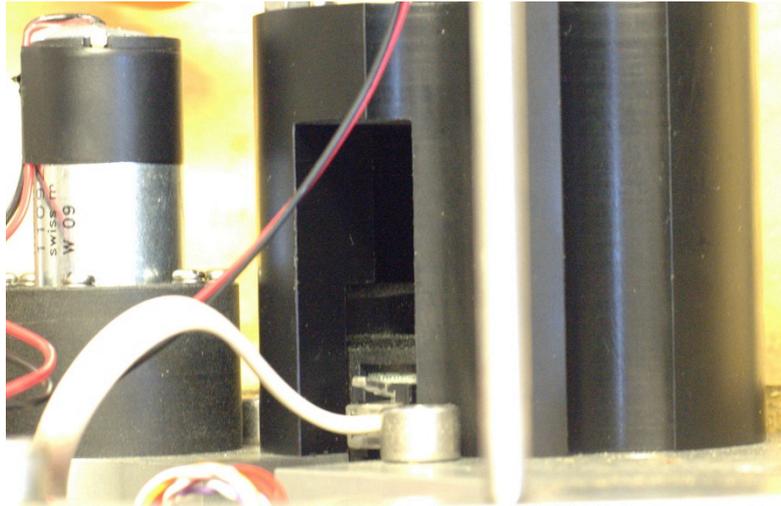


Fig. SE-2. Shaft encoder with RJ-45 plug visible.

SE-4 It is necessary to set the zero position of the shaft encoder. This can be achieved by the following steps:

- i. Move the scan drum (ISARTOOLS; command E) so that the aperture hole lines up with the longer of the two face lines (the whole aperture hole must be visible).

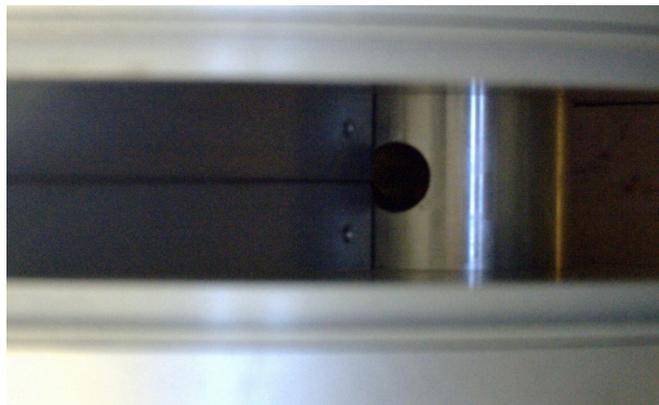


Fig. SE-3. Scan drum aperture rotated back to zero degree position

- ii. This is now in the absolute position 4.5 degrees.
- iii. Using the software, rotate the scan drum to zero degrees (some of the aperture hole will now disappear).

SE-5 Disconnect the ISAR RJ45 plug.

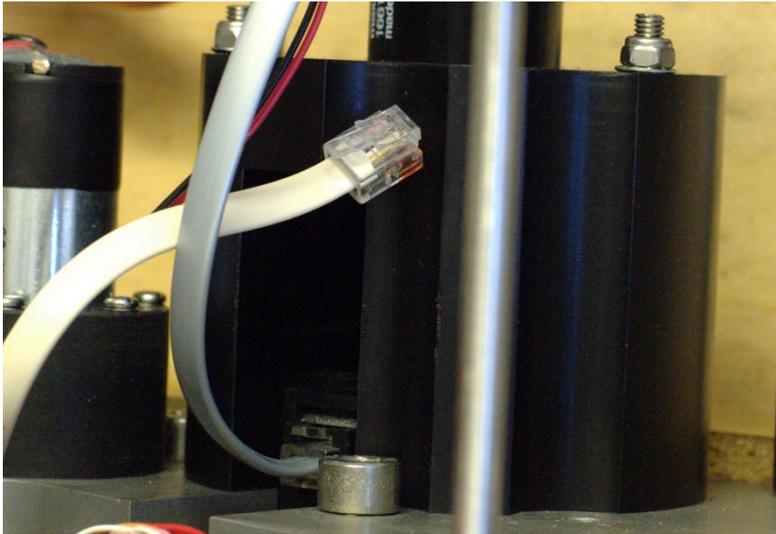


Fig. SE-4. A2D-B adaptor connected to RJ-45 port

SE-6 Connect the A2D-B adaptor RJ45 plug to the ISAR shaft encoder.

SE-7 Use the US-Digital software “SEI Explorer” to set the encoder for 14400 resolution (0.025° increment). Select the menu option found on the top left hand window pane showing the encoder response. Change each setting in turn. A2 Encoders should be set to:

- A resolution of 14400 (0.025 deg resolution),
- 9600 baud,
- Scale factor of 1 and no mode setting,
- Assign address 0x0E (decimal 14) to the encoder to prohibit contention with other RS485 devices.

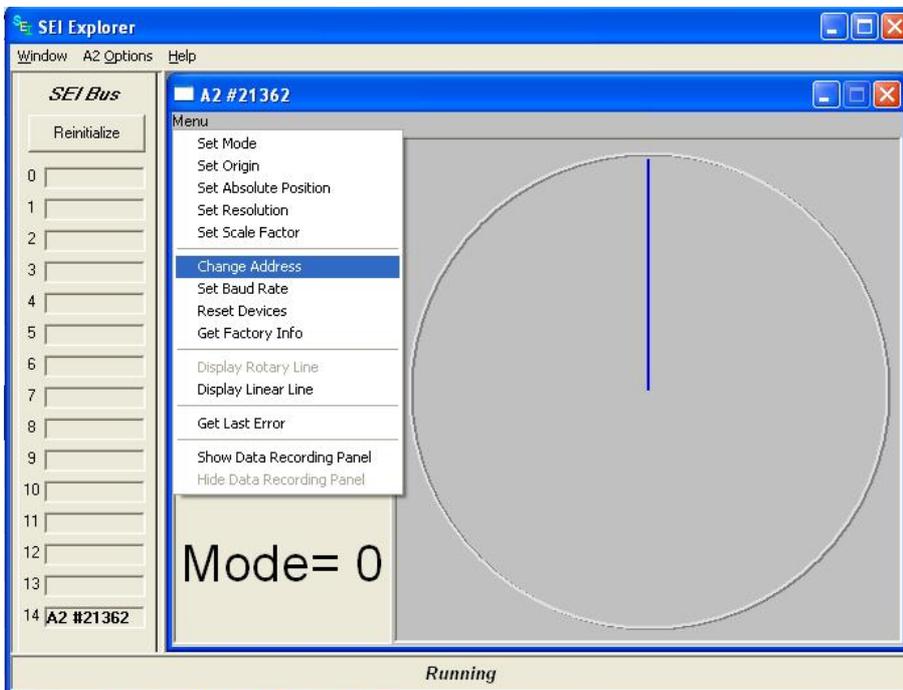


Fig. SE-5. Menu to set variables and change address.

SE-8 Use the “Get Factory Info” menu item to check the configuration.

SE-9 Set the encoder with the SEI-Explorer software to zero. Store the zero position.

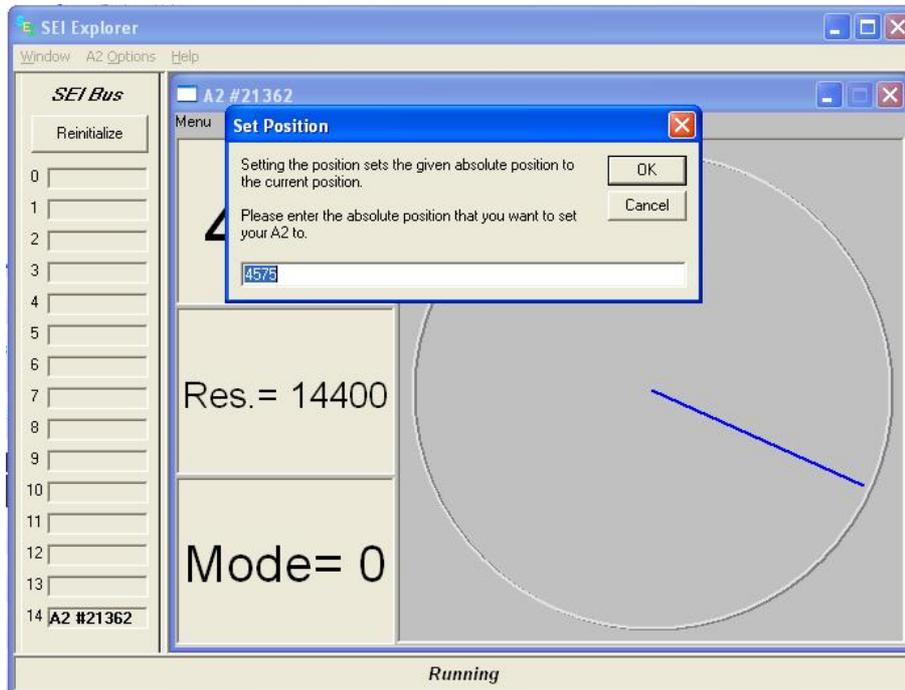


Fig SE-6. Resetting position to zero.

SE-10 Unplug the A2D-B adaptor RJ45 plug from the ISAR shaft encoder and reconnect the ISAR RJ45 plug.

SE-11 Close the instrument up in accordance with Procedure C above.

2.7 Optical alignment (Procedure OA)

This procedure describes how to verify that the KT15 is optically aligned within the ISAR instrument. The design of the ISAR instrument is such that full optical alignment can be performed without the need for an optical bench or external target sighting system.

2.7.1 Equipment and supplies

For this procedure you will need the following tools:

- Tools as listed for Procedure RW
- Sighting laser module
- Sighting laser mount
- ISAR optical alignment tool
- ISAR eccentric washer spanner tool



Read all safety advisory notes included with the laser system and ensure that your laboratory conforms to all safety standards when using laser light devices. Note that laser light may damage your eyes and appropriate eyewear protection and safety procedures should be followed at all times. It is your responsibility to protect yourself and your colleagues from the hazards of laser light injury.

You may need the following replacement ISAR-5D components and supplies:

- Parts as listed for Procedure RW

2.7.2 Procedure OA

- OA-1 Follow steps RW-1 to RW-12 of procedure RW to remove the ZnSe window. Do not remove the six retaining rods.
- OA-2 Remove the electrical bench as required for access to the KT 15 mounting plate bolts.
- OA-3 Loosen the KT15 mounting plate retaining bolts and slide KT15 mounting plate to the rearmost position
- OA-4 Attach the laser module and laser mount to KT15 lens.
- OA-5 Replace the optical bench assembly in accordance with steps RW 24 and RW 25 of procedure RW above.
- OA-6 Slide the KT15 back into its operational position and finger tighten retaining screws. Make sure that eccentrics are aligned so that the KT15 is approximately parallel with the optical bench axis.
- OA-7 Turn ISAR so that the KT15 is standing vertically upright with the electronics side closest to the table and the motor side on top.
- OA-8 Attach the optical alignment tool by carefully dropping it into the encoder seating. Ensure the laser holder and module are free to rotate without catching.
- OA-9 Observing the precautions above, start the laser on low power and use the eccentric spanner to align the laser with the lower hole. Carefully adjust the positioning of the KT15 to then ensure that the beam passes through the lower and upper holes in the alignment tool and is visible on the ceiling above the assembly (see diagram below – not to scale).

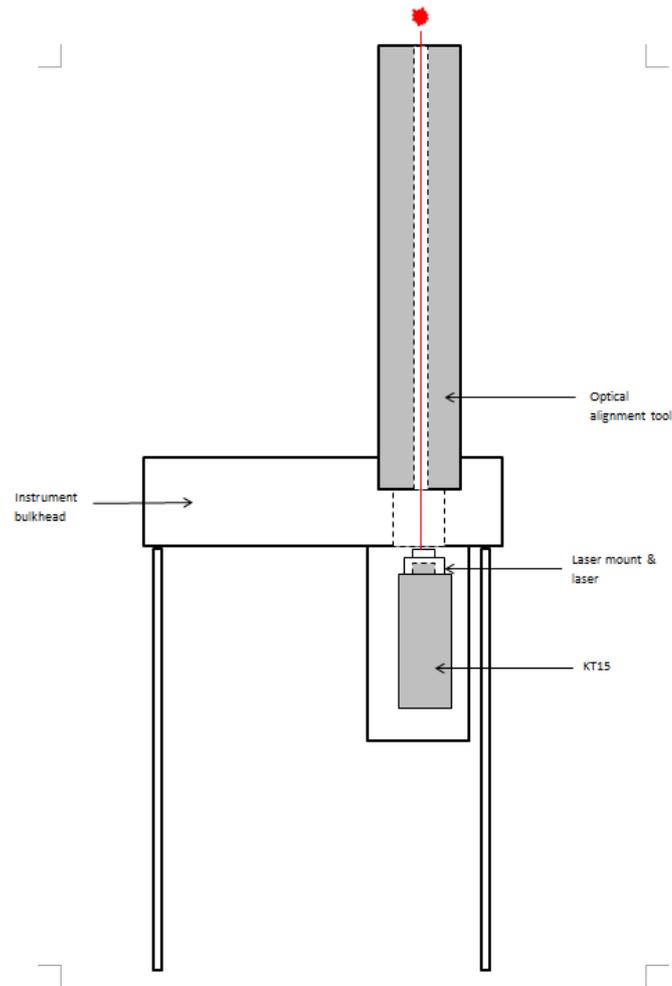


Figure 1 Setup for optical alignment procedure.

OA-10 Once satisfied with the alignment, tighten the KT15 into position.

OA-11 Remove the optical alignment tool and replace the scan drum assembly.

OA-12 Remove the optical bench assembly, laser mount and laser module.

OA-13 Replace the ZnSe window, optical bench assembly and close the instrument in accordance with steps RW-13 to RW-26 in procedure RW above.

3 Set up procedures

3.1 Configuration of the PNI-TCM2.6 (Procedure PNI)

The PNI TCM-2.6 compass module must be correctly configured before using it in an ISAR instrument. The configuration of a PNI0-TCM2.6 module is performed using the ISARTOOLS software system that must be run from the ISAR directory. The ISARTOOLS option 'P' in the menu is used to send configuration commands to the PNI instrument. These are then stored on the PNI TCM-2 EEPROM. The output configuration of the PNI-TCM2.6 can be checked at any time using the ISARTOOLS command 'p'.

3.1.1 Equipment and supplies

- An ISAR instrument with a PNI-TCM2.6 device correctly installed
- A version of the ISARTOOLS software
- PNI-TCM2.6 reference manual

3.1.2 Procedure PNI

- PNI-1 Stop the ISOC operational code after turning the ISAR on by pressing 'Y' (or 'Q' if ISOC has already loaded). You should be returned to the Linux prompt.
- PNI-2 At the Linux prompt change to the `/home/isar/software/` directory and run the ISARTOOLS software.
- PNI-3 The module can either be auto configured by using the 'o' option from the menu. If this option is selected, the procedure is now complete and the module defaults will be set.
- PNI-4 The module may also be manually configured using option 'P' from the menu. The on-board calibration data can now be cleared by sending the command: `cc <enter>`
- PNI-5 Enable single character halt by sending the command: `halt=e <enter>`
- PNI-6 Halt continuous sampling of the TCM-2.6 by sending the command: `h <enter>`
- PNI-7 Set the PNI-TCM2 baud rate to 9600 using the command: `baud=5 <enter>`
- PNI-8 Set the PNI-TCM2 temperature units to centigrade using the command: `ut=c <enter>`
- PNI-9 Set the PNI-TCM2 compass units to 360° full circle using the command: `uc=d <enter>`
- PNI-10 Set the PNI-TCM2 inclinometer units to 360° full circle using the command: `ui=d <enter>`
- PNI-11 Set the PNI-TCM2 RS232 word format to standard TCM2 output word using the command: `sdo=t <enter>`
- PNI-12 Enable the PNI-TCM2 compass data for output word using the command: `ec=e <enter>`
- PNI-13 Enable the PNI-TCM2 pitch data for output word using the command: `ep=e <enter>`
- PNI-14 Enable the PNI-TCM2 roll data for output word using the command: `er=e <enter>`

PNI-15 Enable the PNI-TCM2 temperature data for output word using the command: **et=e**
<enter>

PNI-16 Disable the PNI-TCM2 magnetometer data for output word using the command: **em=d**
<enter>

PNI-17 Disable the PNI-TCM2 magnetic distortion data for output word using the command: **ed=d**
<enter>

PNI-18 Select uncorrected magnetometer readings using the command: **ma=u** <enter>

PNI-19 Select North as True North using the command: **sn=t** <enter>

PNI-20 The PNI-TCM2 device should now be configured correctly for the ISAR instrument. Use the ISARTOOLS command '**p**' to read a data packet from the PNI-TCM2.6. It should return a record identical in format to:

\$C149.3P-1.1R0.0T29.0*0C

3.2 Configuration of Lassen SK-II GPS card (procedure GPS)

The Lassen SK-II GPS unit used within an ISAR is configured for a default output other than a \$GPGGA NMEA string. This procedure describes how to modify the Lassen SK-II on-board EEPROM configuration settings to allow \$GPRMC, \$GPGLL and \$GPGGA NMEA output only.

3.2.1 Equipment and supplies

For this procedure you will need the following tools:

- Tools as listed for Procedures O and C
- GPS interface board
- Desktop Power supply
- Trimble GPS Studio software
- PC computer

You may need the following replacement ISAR-5D components and supplies:

- Supplies as listed for Procedures O and C

3.2.2 Procedure GPS

GPS-1 Install Trimble GPS Studio (TGS) configuration software onto PC

GPS-2 Remove ISAR end cap in accordance with Steps O-1 to O-4 of Procedure O above.

GPS-3 Locate GPS unit within ISAR (small PCB to the left of the electronics package – there should be a gold connector visible that is wired to the centre BNC socket on the ISAR end cap)

GPS-4 Disconnect the GPS plug carefully noting connection direction (remove outer casing if this is difficult). Red and black cables indicate power supply connections.

GPS-5 Connect the Red and black cables from the interface board to 5V DC on a PSU.

GPS-6 Attach the interface board plug to the GPS unit making sure that the red and black cables are located properly. Attach the yellow D-type connector to the PC COM port (port 1 of interface cable)

GPS-7 Start the TGS program by double clicking the TrimbleStudio icon on the Desktop.

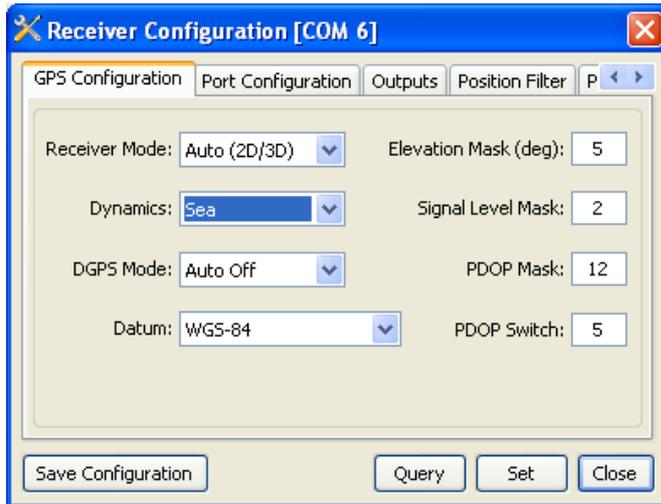
GPS-8 On the Menu Bar select 'Connect to device' and then select 'GPS receiver...'

GPS-9 In the New Connection window check the 'Auto-detect settings' tick box. The module should now automatically be detected.

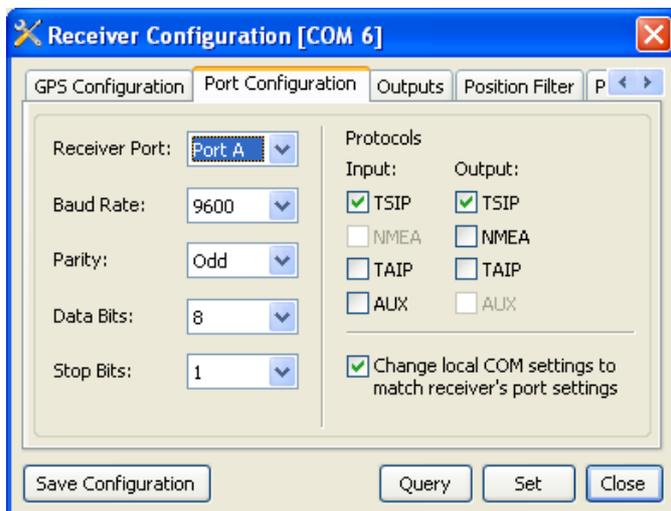
GPS-10 From the Lassen SK8-II Monitor window that now appears, select 'Receiver' from the Menu Bar and then select 'Configure...'. A Receiver Configuration window should appear.

GPS-11 Each tab should be configured as per the following screenshots:

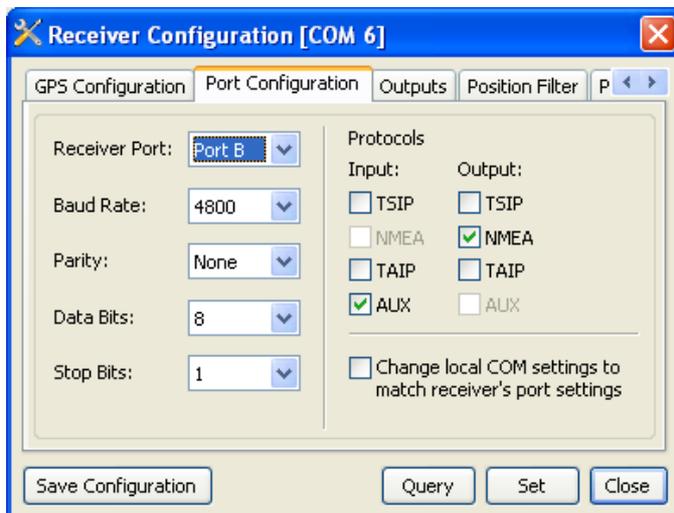
GPS Configuration



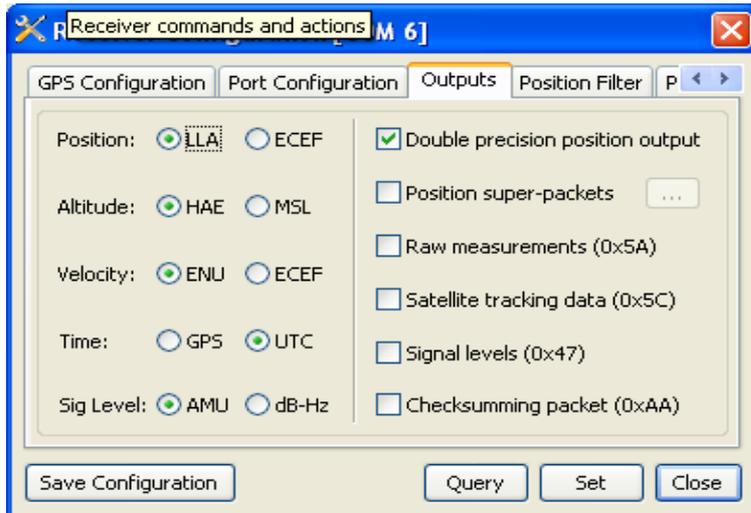
Port A Configuration



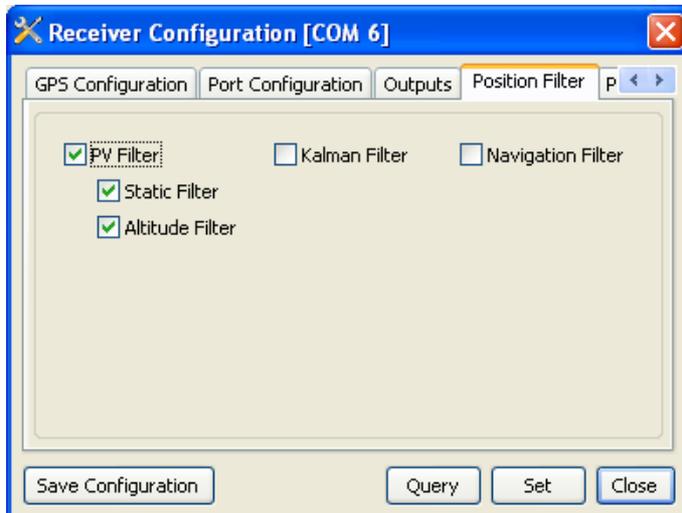
Port B configuration



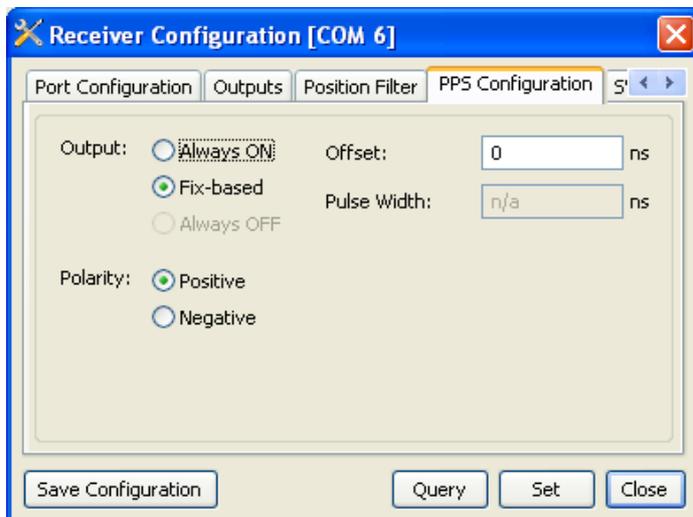
Outputs



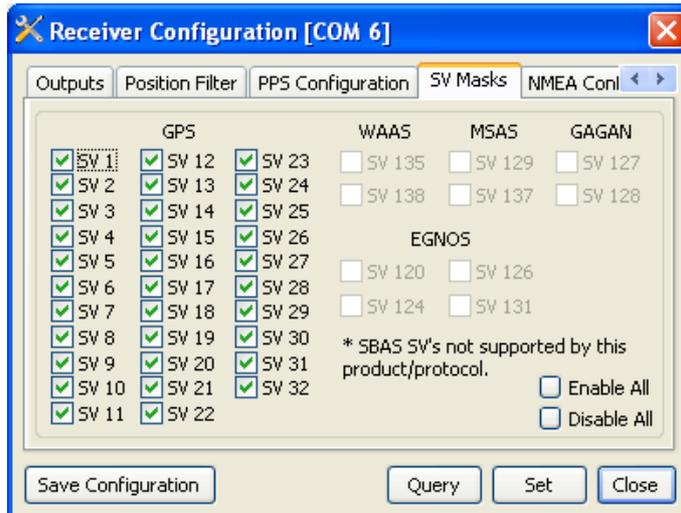
Position Filter



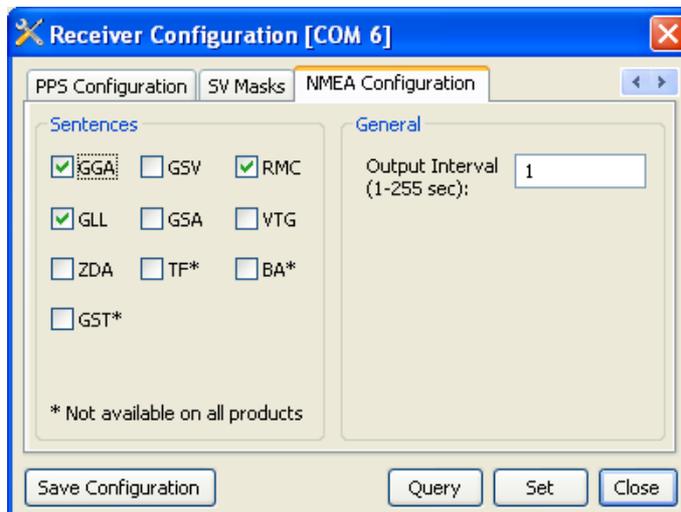
PPS Configuration



SV Masks



NMEA configuration



GPS-10 When configuration is complete, click 'Save configuration'.

GPS-11 Turn off the power supply to the GPS card for a minimum of 2 minutes. Close the TGS software.

GPS-12 Disconnect the yellow D-type plug from the PC COM1 port and connect the orange D-Type to COM1. This port provides an ASCII output that can be viewed using hyperterm (set to Baud 4800, no handshake). Start up hyperterm in this configuration and power up the GPS card. Initially only GPGGA strings may be visible as the GPS unit locates satellites from a warm boot. Once these are located GPRMC, GPGLL and GPGGA strings should be visible.

GPS-13 Power down the GPS card and disconnect the interface from GPS unit PSU and PC.

GPS-14 Reconnect the ISAR internal plug noting direction of plug (red and black wires)

GPS-15 Verify the GPS output by booting ISAR and noting the output.

GPS-16 Replace the ISAR end cap in accordance with Steps C-5 to C-10 of Procedure C above.

APPENDIX A: ISAR Spare Parts List

Part Number	Description	Quantity required per ISAR
IS5D-P001	Scan drum mirror	1
IS5D-P002	Mirror and window O seals	4
IS5D-P003	ZnSe window	1
IS5D-P004	Scan drum shaft seal	1
IS5D-P005	Encoder O seals	1
IS5D-P006	End cap & main body O seals	4
IS5D-P007	Shutter drive belt	1
IS5D-P008	Scan drum coupling	1
IS5D-P009	Dowty washers	12
IS5D-P010	M6 dome nuts	12
IS5D-P011	M3 countersunk screws	4
IS5D-P012	M4 cap screws	4
IS5D-P013	Laser module	1
IS5D-P014	Laser alignment tool	1