Instrument Landing System

Maintenance Manual

02001 v1.2

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Revisions

Revision	Reason for Revision	Date	Author/Reviser	Approved By
1.0	Initial Release	Oct 2016	F. Forget-Theriault	V. Popovici
1.1	Added Software Upgrade Procedures	Apr 2017	F. Forget-Theriault	V. Popovici
1.2	Updated preventive maintenance	July 2017	V. Popovici	V. Popovici

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SAFETY SUMMARY

The following are safety precautions that personnel must understand and apply during the phases of operation and maintenance.

KEEP AWAY FROM LIVE CIRCUITS

To avoid electrical shock, operating personnel must observe all safety regulations at all times. Do not replace components or make adjustments to the equipment with the high voltage supply turned on. Under certain conditions, the potential of danger is present due to charges retained by capacitors that may exist in circuits, even though the power control switch is in the OFF position. To avoid casualties, always remove power, discharge and ground a circuit before touching it.

DO NOT SERVICE OR ADJUST ALONE

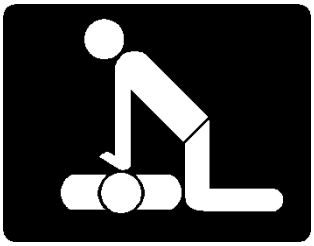
Under no circumstances should any person reach into or enter an enclosure which contains a high voltage component which requires service or adjustment without the presence of another person who is capable of rendering aid.

RESUSCITATION

Personnel working with or near high voltages should be familiar with modern methods of resuscitation.

FIRST AID IN CASE OF ELECTRICAL SHOCK

First aid is the initial care given to an injured person. It is usually performed by a non-expert, but trained personnel to an injured person until definitive medical treatment can be accessed. Certain minor injuries may not require further medical care beyond the first aid intervention. It generally consists of a series of simple and in some cases, potentially life-saving techniques that an individual can be trained to perform with minimal equipment.



Mostly, this timely care prior to the arrival of the medical help can mean the difference between life and death. It must start immediately when the injury or illness occurs and continue until medical help arrives or the casualty recovers. The first hour after the trauma is called the ‘golden hour’. If proper first aid is given, the victim has a greater chance of survival and a reduction in the severity of their injuries.

The basic aims of first aid are:

- To save life
- To prevent further harm: also sometimes called preventing the condition from worsening, or danger of further injuries
- To reduce pain
- To promote recovery

PROTECTION OF ELECTRO STATIC DISCHARGE (ESD)

To reduce the risk of equipment damage, the system should be kept in an electrostatic discharge (ESD) protected environment. The equipment should be properly grounded at all times. When performing routine maintenance on the unit, a wrist strap should be plugged into the ESD jack located on front panel of the cabinet.

To prevent ESD damage the following precautions must be taken:

- Wear an ESD grounding strap connected to a proper ground when handling modules.
- Keep boards in their antistatic protection bags until you are ready to install them.
- Do not touch pins, leads, or solder connections on the boards.
- Handle modules only by their edges, ejector handles, or stiffener rails.
- Store and ship modules in antistatic protection packaging.

ESD GROUND CONNECTION

The rack provides an ESD ground connection in the form of grounding plugs for installation and removal of user-serviceable components. Use an ESD wrist strap attached to the grounding plugs; one is located on the front and one on the rear of the rack.

1. INTRODUCTION

This document provides the technical maintenance theory and procedures for the SKYNAV Localizer model N8100 (LLZ) and the SKYNAV Glide Path model 8200 (GP) used in the SKYNAV Instrument Landing System (ILS).

1.1 Intended Audience

This document is intended for technical personnel involved in the maintenance of the ILS system.

2. LIST OF ABBREVIATIONS

Abbreviation	Meaning
AC/DC	Alternative Current to Direct Current converter
ADC	Analog to Digital Converter
ADU	Antenna Distribution Unit
AGC	Automatic Gain Control
AGM	Audio Generation Module
AM	Amplitude Modulation
BITE	Built-In Test Equipment
CL	Course Line
CLR	Clearance Sector
CMS	Control and Monitoring System
COU	Course
CPLD	Complex Programmable Logic Device
CS	Course Sector
CSB	Carrier and Sideband
DAC	Digital to Analog Converter
DDM	Difference in Depth of Modulation
dBm	Decibels per Milliwatt
DF	Difference of Frequencies
DL	DC Loop
DH	Decision Height
DM	Depth of Modulation
DME	Distance Measuring Equipment
DPDT	Double Pole/Double Throw
DS	Displacement Sensitivity
DSP	Digital Signal Processor
EEPROM	Electrically Erasable Programmable Read Only Memory
EMI	Electromagnetic Interference
EPROM	Erasable Programmable Read Only Memory
FAA	Federal Aviation Agency
FDU	Front Display Unit
FFM	Far Field Monitor
FFT	Fast Fourier Transform
FIFO	First In/First Out

Abbreviation	Meaning
FPGA	Field Programmable Gate Array
FSM	Frequency Synthesizer Module
GP	Glide Path
GS	Glide Slope
GUI	Graphical User Interface
HAM	High Power Amplifier Module
HVAC	Heating, Ventilation and Air-Conditioning
HW	Hardware
ICAO	International Civil Aviation Organization
ID	Identification
ILS	Instrument Landing System
IM	Inner Marker
IMC	Instrument Meteorological Conditions
IO	Input Output
LED	Light Emitting Diode
LLZ	Localizer
LMM	Local Maintenance Monitoring
LRU	Line Replaceable Unit
MB	Marker Beacon
MCU	Monitor Combine Unit
MM	Middle Marker
MOM	Modulation Module
MOU	Monitoring Unit
MPU	Main Processing Unit
MTBF	Mean Time Between Failures
NF	Near Field
NFM	Near Field Monitor
NTP	Network Time Protocol
OM	Outer Marker
PIR	Portable ILS Receiver
PLL	Precision-High Frequency Synthesizer
PSU	Power Supply Unit
RCMS	Remote Control Monitoring System
RCU	Remote Control Unit
RF	Radio Frequency

Abbreviation	Meaning
RMM	Remote Maintenance and Monitoring
RMU	Remote Monitoring Unit
RSU	Remote Status Unit
RTC	Real Time Clock
SBO	Suppressed Carrier Sideband Only
SPI	Serial Peripheral Interface
SCU	Sub Control Unit
SDM	Sum in Depth of Modulation
STB	Standby
SW	Software
TCP IP	Transmission Control Protocol/Internet Protocol
TFT LCD	Thin-Film Transistor/Liquid Crystal Display
TMCU	Transmitter Monitor Control Unit
TSU	Transmitter Selection Unit
TXU	Transmitter Unit
UDIO	User Defined I/OS
USB	Universal Serial Bus
VSWR	Voltage Standing Wave Ratio

3. PREVENTIVE MAINTENANCE

Intelcan recommends that regular scheduled maintenance be performed on the ILS systems to ensure its proper operation and extend its life. There are four recommended maintenance periods:

- Weekly
- Monthly
- Every six months
- Every twelve months

The four maintenance periods are recommendations for ILS systems operating in a normal environment. It is assumed that technical maintenance personnel are trained in the operation and maintenance of ILS equipment.

Technical maintenance authorities may wish to adjust intervals or add additional maintenance checks in accordance with their policies and available test equipment.

All recommended maintenance applies to Category II and III installations.

Note: During the maintenance checks, no adjustments or alignments of any configurable parameter are to be done. All measured parameters shall be recorded and compared with the nominal operational values that were recorded as baseline references after the flight check.

During the expected life span of the equipment, some parameters may change, caused by the environment. Changes of less than 50% of the configured alarm limit threshold are acceptable. For example, if the nominal parameter is 100 and the alarm limit is 110, a change of 50% will be 105.

If a parameter varies by more than 50% of its configured alarm limit, corrective action shall be taken to investigate and correct the issue. If corrective measures do not resolve the problem, the defective unit should be replaced with a spare unit. Depending on the severity of the equipment fault issue, a flight check may be advisable to check that all parameters are within the standard required operating tolerances.

The defective unit should be returned to the factory for service.

3.1 Maintenance Schedule

The schedule for recommended maintenance procedures is described in Table 1.

Table 1 - Schedule of Recommended Maintenance Procedures

No.	Parameter	Expected	Test Equipment	Periodicity	Note
1	Visual check antennas, FFM, NFM, critical area and shelter	Normal and In good shape	N/A	Weekly	
2	Monitors Status Readings	No Alarms or Warnings	FDU / RMM	Weekly	

No.	Parameter	Expected	Test Equipment	Periodicity	Note
3	BITE Status Readings	No Warnings	FDU / RMM	Weekly	
4	Print Status Report		RMM	Weekly	
5	COU DDM	0.000 ± 0.005	PIR	Monthly	
6	COU SDM	40 ± 0.5% (LLZ) 80 ± 1% (GP)	PIR	Monthly	
7	CLR DDM	0.000 ± 0.005 (LLZ) 0.800 ± 0.005 (GP)	PIR	Monthly	
8	CLR SDM	40 ± 0.5% (LLZ) 80 ± 1% (GP)	PIR	Monthly	
9	LLZ Field Test	Near field test points Far field width points	PIR	Monthly	Note 1
10	CL, DS and CLR Alarms	Changeover /Shutdown	RMM	Monthly	Note 2
11	Course Structure (CATIII)	ILS Point “D” to “E” ±5 µA	PIR	Quarterly	Note 1
12	COU CSB RF Power	FLT CHK settings ± 0.50 dB	Power Meter	Quarterly	Note 3
13	COU SBO RF Power	FLT CHK settings ± 0.20 dB	Power Meter	Quarterly	Note 3
14	CLR CSB RF Power	FLT CHK settings ± 0.50 dB	Power Meter	Quarterly	Note 3
15	CLR SBO RF Power (LLZ)	FLT CHK settings ± 0.30 dB	Power Meter	Quarterly	Note 3
16	AC Voltage	Station AC Voltage	Multimeter	6 months	
17	DC Voltage	PSU DC Voltage	Multimeter	6 months	
18	Battery Voltage	24V Battery (12V x 2)	Multimeter	6 months	
19	Battery Discharging	24V Battery (12V x 2)	Multimeter	6 months	
20	COU Frequency	Station Freq ± 1 KHz (LLZ) Station Freq ± 3 KHz (GP)	Freq. Counter	Annually	
21	CLR Frequency	Station Freq ± 1 KHz (LLZ) Station Freq ± 3 KHz (GP)	Freq. Counter	Annually	
22	COU/CLR DIFF Frequency	8 ± 1 KHz (LLZ) 16 ± 3 KHz (GP)	Freq. Counter	Annually	
23	COU LF Frequency	90 Hz ± 1 Hz (LLZ)/(GP) 150 Hz ± 1 Hz (LLZ)/(GP) 1020 Hz ± 10 Hz (LLZ)	Freq. Counter	Annually	
24	TX CLR LF Frequency	90 Hz ± 1 Hz (LLZ) 150 Hz ± 1 Hz (LLZ)/(GP) 1020 Hz ± 10 Hz (LLZ)	Freq. Counter	Annually	
25	COU CSB Waveform	Kissing Pattern	Oscilloscope	Annually	
26	COU SBO Waveform	Five-Finger Pattern	Oscilloscope	Annually	
27	CSB/SBO Synchronization	Phase-locked <10°	Oscilloscope	Annually	
28	COU/CLR Synchronization	Phase-locked <10°	Oscilloscope	Annually	
Note 1	Need permission from ATC to get runway or near runway access (around 3 hours for each ILS)				

No.	Parameter	Expected	Test Equipment	Periodicity	Note
Note 2	Transmitter will be on/off. The ILS operation will be interrupted (around 1 hours for each ILS)				
Note 3	Need to turn off the transmitters. The ILS operation will be down (around 4 hours for each ILS)				

3.1.1 Weekly Maintenance Checks

The following actions are performed during the weekly maintenance checks:

- Visually check site condition and status
- Check all noted parameters
- Record all parameters and compare with nominal operating values
- Generate a status report using RMM

3.1.1.1 Site Visual Check

- Visually check the LLZ and GP antenna array
- Visually check FFM and NFM antennas
- Visually check shelter
- Visually check the critical area of any changes
- Make a “Visual Check Normal or Abnormal” note on maintenance log book. If abnormal, describe the details on the maintenance log book.

3.1.1.2 Monitors Status Readings

- Check all monitor parameter status readings using RMM or FDU
- Confirm that there are no alarms or warnings
- Compare with nominal operating values

3.1.1.3 BITE Status Readings

- Confirm all maintenance values are within specifications using RMM or FDU
- Compare with nominal operating values

3.1.1.4 Print Status Report

- Print status report using RMM
- Archive the report in binder.

3.1.2 Monthly Maintenance Checks

The following actions are performed during the monthly maintenance checks:

- Check DDM and SDM parameter of both transmitter outputs
- Record the tested values and comparing with the 1st test after flight check
- Do field test at near and far field test points.
- Review the field test result and make a chart

- Compare with the 1st field test after flight check

3.1.2.1 COU DDM / SDM

- Using an ILS portable receiver (PIR), measure the DDM and SDM at the TSU test ports to confirm that they are as configured
- Perform changeover to check both TX1 and TX2
- Record all parameters
- Compare with nominal operating values and make sure the parameters are in the tolerance.

3.1.2.2 CLR DDM / SDM

- Using the PIR, measure the DDM and SDM at the TSU test ports to confirm that they are as configured
- Perform changeover to check both TX1 and TX2
- Record all parameters
- Compare with nominal operating values and make sure the parameters are in the tolerance.

3.1.2.3 Field Measurements

- Using the PIR with field antenna, measure the field modulation at each of the fixed near field test point (see Figure 1)
- Using the PIR with field antenna, measure the field modulation at three far field test points (see Figure 2)
- Record measurement values and compare to the first field test after flight check values
- Generate a field test chart with Excel.

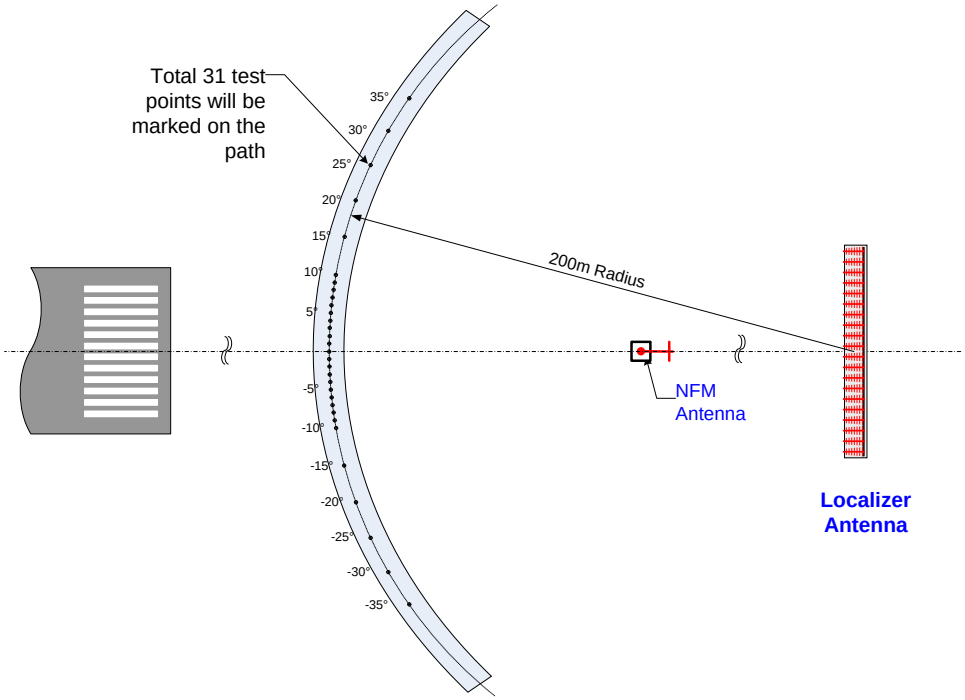


Figure 1 - Near Field Test Points

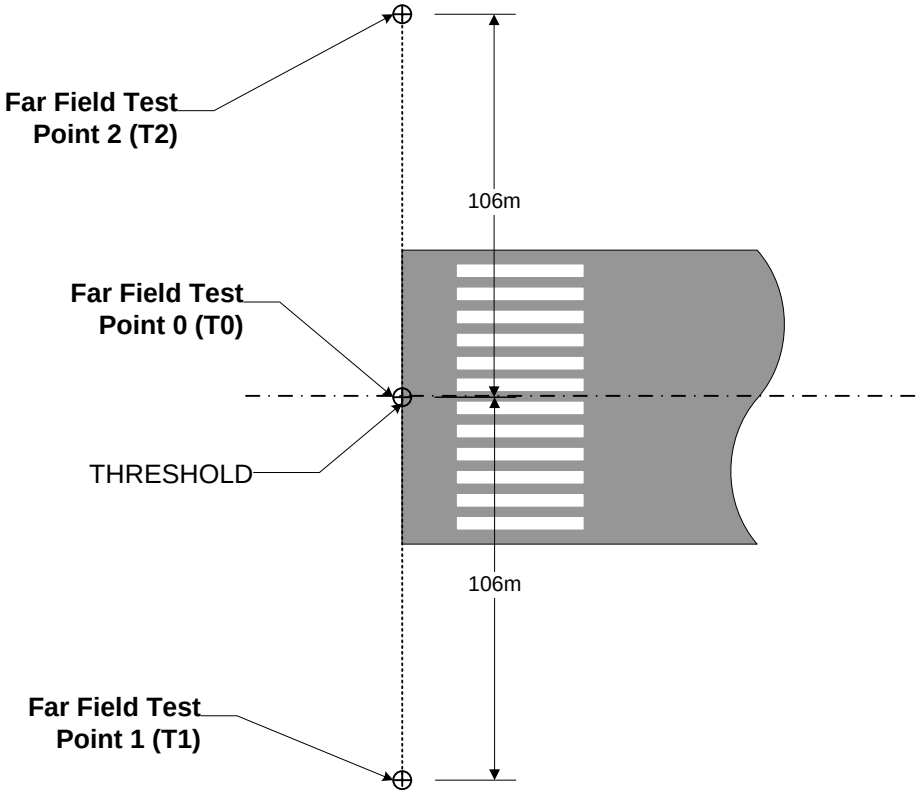


Figure 2 - Far Field Test Points

3.1.2.4 CL. DS and CLR Alarm Test

This test puts the system out of operation; ensure that it is conducted at the proper time and that the concerned parties are informed (NOTAM may be required).

- Using the RMM flight check window, create CL 90Hz and 150 alarms to check if the system will changeover to standby transmitter then the standby transmitter will shut down automatically if alarm still exist.
- Using the RMM flight check window, create DS wide and narrow alarms to check if the system will changeover to standby transmitter then the standby transmitter will shut down automatically if alarm still exist.
- Using the RMM flight check window, create CLR wide alarm to check if the system will changeover to standby transmitter then the standby transmitter will shut down automatically if alarm still exist.

3.1.3 Quarterly Maintenance Checks

The following actions are performed during the quarterly maintenance checks:

- Field check on runway for localizer course structure
- Record the tested values and comparing with the 1st test after flight check
- Measure transmitter output power with power meter.
- Record the tested values and comparing with the 1st test record after the flight check

3.1.3.1 Runway Course Structure (CAT III Only)

- Using the PIR with field antenna, measure the DDM course structure along the runway centerline at 500 meter intervals from Threshold to Threshold.
- Record measurement values and compare to the 1st measurement of the flight check.
- Generate a field test chart with Excel.

3.1.3.2 COU CSB / SBO RF Power

This test puts the system out of operation; ensure that it is conducted at the proper time and that the concerned parties are informed (NOTAM may be required).

- Using a power meter and an RF directional coupler (or attenuator), connect to the output ports located on the top of the equipment rack and confirm that CSB and SBO RF output power are almost the same as the first measurement after the flight check.

3.1.3.3 CLR CSB / SBO RF Power

This test puts the system out of operation; ensure that it is conducted at the proper time and that the concerned parties are informed (NOTAM may be required).

- Using a power meter and RF directional coupler, connect to the output ports located on the top of the equipment rack and confirm that CSB and SBO RF output power are are almost the same as the first measurement after the flight check.

3.1.4 Six-Month Maintenance Checks

The following actions are performed during the six-month maintenance checks:

- Check AC voltage and DC voltage
- Check the battery voltage
- Check the battery discharging.
- Record all parameters and compare with nominal operating values

3.1.4.1 AC Voltage

- Using a multimeter, check the AC voltage at the ILS electrical AC voltage panel breaker

3.1.4.2 DC Voltage

- Using a multimeter, check the DC voltage at the digital backplane DC connectors

3.1.4.3 Battery Voltage

- Using a multimeter, check the DC voltage at the battery terminals in normal operation mode
- Remove AC power from the PSU and check the battery DC voltage under load

3.1.4.4 Battery Discharging

- Using a multimeter, check the DC voltage at the battery terminals in normal operation mode
- Remove AC power from the PSU and run the system on battery for 10-15 minutes
- Reconnect AC power back to the PSU and check the DC charging voltage at the battery terminals

3.1.5 Annual Maintenance Checks

The following actions are performed during the annual maintenance checks:

- Check transmission frequency
- Check modulation frequency

- Check modulation signal waveform
- Check Synchronization between CSB and SBO
- Check Synchronization between COU and CLR

3.1.5.1 TX COU / CLR Frequency

- Using a frequency counter, check the RF frequency on the test ports of the TSU front panel (COU CSB and CLR CSB)

3.1.5.2 TX COU / CLR LF Frequency

- Using a frequency counter, check the LF frequency on the CSB LF, SBO LF BNC test ports of all TXUs

3.1.5.3 COU / CLR CSB Waveform

- Using an oscilloscope, check the LF wave pattern on the CSB LF BNC test ports of all the TXUs
- Check for the correct kissing pattern (see Figure 3)

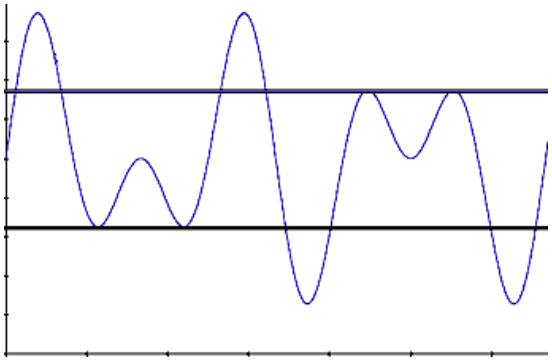


Figure 3 - CSB Waveform (Kissing Pattern)

3.1.5.4 COU / CLR SBO Waveform

- Using an oscilloscope, check the LF wave pattern on the SBO LF BNC test ports of all TXUs
- Check for the correct five-finger pattern (see Figure 4)

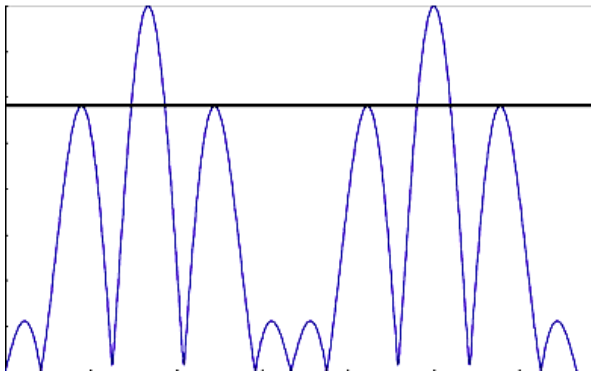


Figure 4 - SBO Waveform (Five-Finger Pattern)

3.1.5.5 CSB / SBO Synchronization check

- Using an oscilloscope to display both CSB and SBO wave patterns at the same time.
- Check for the synchronization between these two signals (see Figure 5)

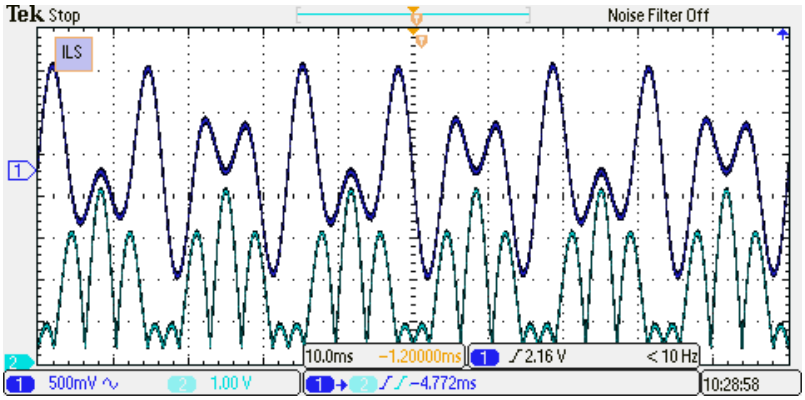


Figure 5 – CSB/SBO Synchronization Waveform

3.1.5.6 COU / CLR Synchronization check

- Using an oscilloscope to display both COU CSB and CLR CSB wave patterns at the same time.
- Check for the synchronization between these two signals (see Figure 6)

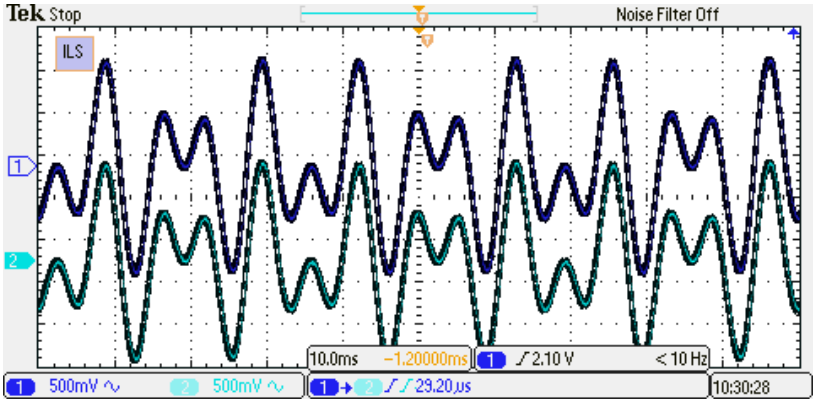


Figure 6 – COU/CLR Synchronization Waveform

4. CORRECTIVE MAINTENANCE

The architecture and build of the system allows restoration to service by simple exchange of modules, module trays or whole equipment. Faulty LRUs are quickly identified through the RMM or visually on the equipment indicators. The result is an MTTR (Mean Time to Repair) of less than 12.5 minutes for each LRU.

The faulty LRUs are sent to Intelcan or another authorized depot for repair. This strategy keeps the equipment in service, limits the time, skill, and equipment needs of onsite personnel, and limits assembly level diagnosis, repair, and testing to those facilities with the highly specialized equipment and technicians required to do it efficiently.

Wear an electrostatic discharge (ESD) wrist strap that is connected to a ground point. The LRUs are electrostatic-sensitive devices. Touching the units without ESD protection will cause irreparable damage to them.

4.1 Replacement Monitor Calibration

The ILS monitors are designed to be used in GP and LLZ without any hardware or software modification; only during installation should they be calibrated to the station values. This procedure is applicable in case of monitor replacement.

4.1.1 Materials

- Maintenance laptop
- RMM software installed
- Ethernet cable

4.1.2 Preparation

1. Install the RMM software on the maintenance laptop and add the ILS station to the station list.
2. Select a static IP address for the laptop within the IP subnet 192.168.8.xxx, where xxx will be a unique number (0 to 255) for the laptop.

   Note: If necessary, review the laptop's IP address list to ensure that the IP address is available.

4.1.3 Procedure

1. Install the monitor card.
2. Using the RMM, log in to the system as a Level 3 user.

   The system should be in local mode with monitor bypass.
3. On the RMM menu bar, click Configuration, then click System, and then click the Monitor tab.

   The System Configuration (Monitor Tab) window appears.

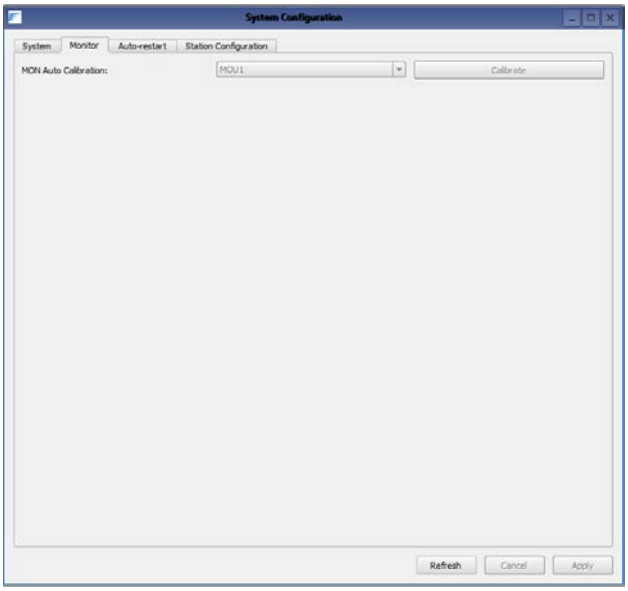


Figure 7 - System Configuration (Monitor Tab) Window

4. In the MON Auto Calibration drop-down list, click the newly installed monitor (MON1 or MON2).
5. Ensure that the monitor input power is -35 dBm +/- 0.5 dB.
6. Click Calibrate.
7. Wait until a confirmation popup message is displayed.
8. Reset the monitor card (press reset button in the front panel of the MOU card).

4.2 DC Loop Verification

DC loop initiates an immediate transmission shutdown. The problem may have occurred in the antenna, DC loop circuit or SCU.

The logic flowchart for DC loop verification is displayed below.

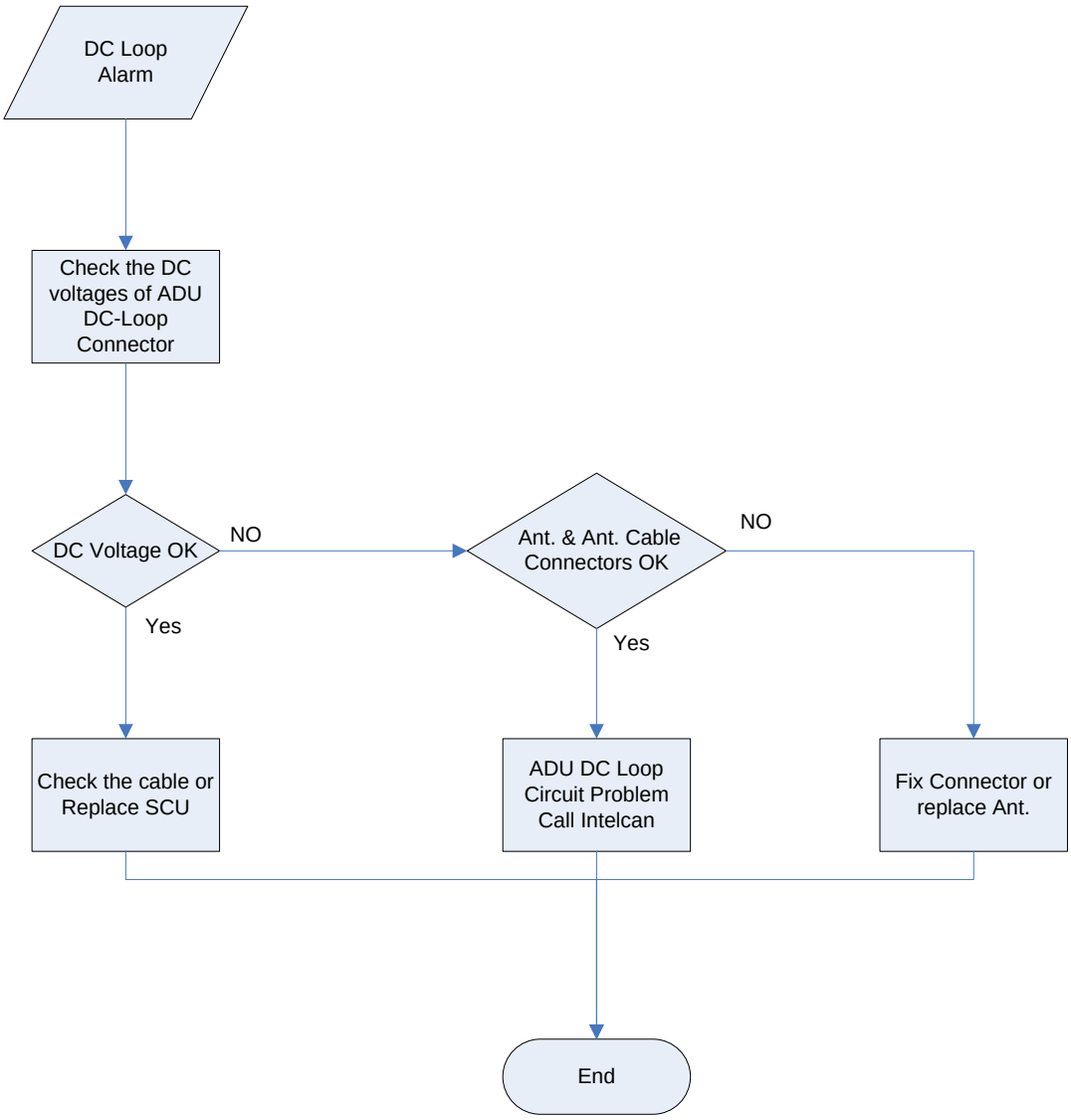


Figure 8 - DC Loop Test Procedure 1

4.2.1 Materials

- Multimeter
- Screw driver

4.2.2 Preparation

1. Remove the antenna cable covers under the ADU.
2. Ensure that the system is in local mode, transmission is OFF, and DC Loop Display is ON.

4.2.3 Procedure

- Verify the impedance on the DC loop connector. Refer to table below for nominal impedance and to the figure below for cable color/antenna matching.

81C211			
P2 Pin#	Color	Antenna #	P3
1	WH/BL	5	5
2	BL	4	4
3	WH/GR	3	3
4	OR	2	2
5	WH/OR	1	1

81C221			
P1 Pin#	Color	Antenna #	P4
1	WH/BL	10	5
2	BL	9	4
3	WH/GR	8	3
4	OR	7	2
5	WH/OR	6	1

Figure 9 - ADU–DC Loop Connection

Table 2 - DC Loop Connector Nominal Impedance Values

	kΩ
L disconnected	36 - 37
R disconnected	75 - 76
All antennas disconnected	AL
All antennas connected	24 -25

4.3 Antenna Verification

There are two methods to verify if an antenna is working: one for LLZ antennas and another for GP or LLZ antennas.

4.3.1 LLZ Antenna Verification

This method is applicable only for LLZ.

The logic flowchart for LLZ antenna verification is displayed below.

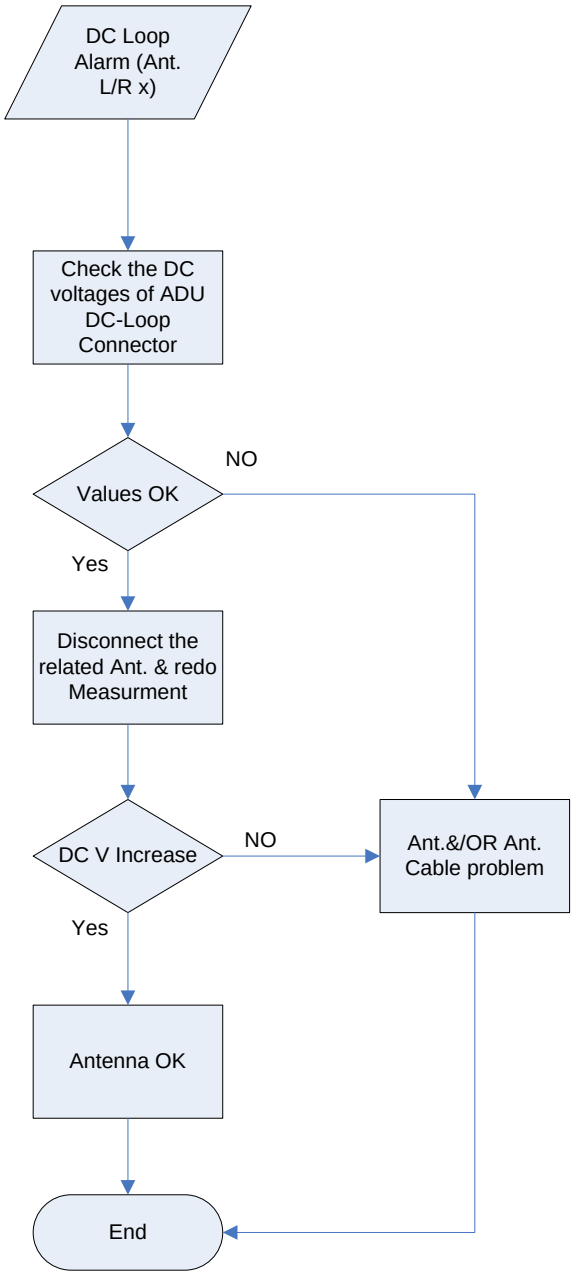


Figure 10 - DC Loop Test Procedure 2

4.3.1.1 Materials

- Multimeter
- Screw driver

4.3.1.2 Preparation

1. Remove the antenna cable covers under the ADU.

2. Ensure that the system is in local mode, transmission is OFF, and DC Loop Display is ON.

4.3.1.3 Procedure

1. Ensure that all antennas are connected, measure the DC loop connector voltages as per table in Section 4.2.3, and record the voltage values.
2. Disconnect the cable of the antenna shown in an alarm state in the DC loop FDU display.
3. Measure the DC voltage of the DC loop connector pin related to the alarmed antenna as per table in Section 4.2.3. If the value is changed (increased) then the antenna is well connected, otherwise the defect has occurred in the antenna cable connectors or the antenna.

4.3.2 GP or LLZ Antenna Verification

This antenna verification method is applicable to both LLZ and GP antennas.

The logic flowchart for GP or LLZ antenna verification is displayed below.

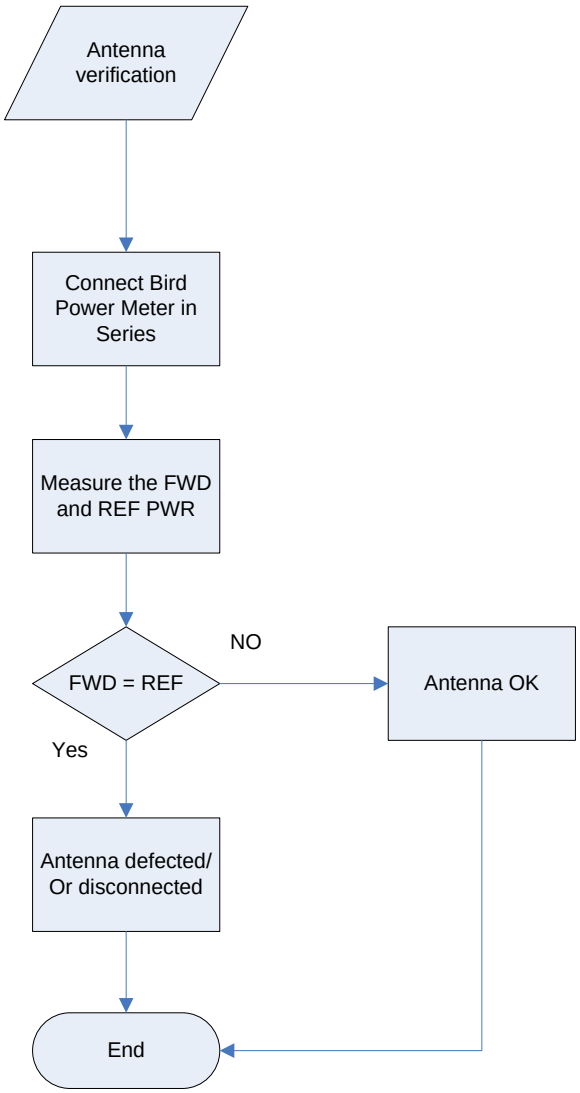


Figure 11 - Antenna Test Procedure

4.3.2.1 Materials

- Power meter (Bird 4391) with appropriate detection element
- Screw driver
- Coaxial with N-type connector
- Adaptors

4.3.2.2 Preparation

1. Remove the antenna cables covers under the ADU.
2. Ensure that the system is in local mode, transmission is OFF, and DC Loop Display is ON.

4.3.2.3 Procedure

1. Ensure that all antennas are connected, measure the DC Loop connector voltages as per table in Section 4.2.3, and record the voltage values.
2. Disconnect the cable of the antenna shown in an alarm state in the DC loop FDU display.
3. Measure the DC voltage of the DC loop connector pin related to the alarmed antenna as per table in Section 4.2.3. If the value is changed (increased) then the antenna is well connected, otherwise the defect has occurred in the antenna cable connectors or the antenna.

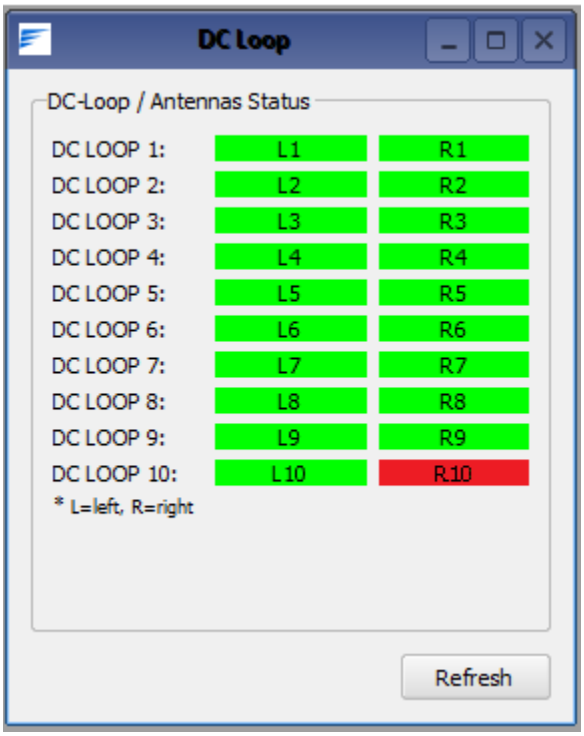


Figure 12 - DC Loop/Antenna Status

4.4 SD Card Purge

Due to system design, the SD memory card content should be deleted once every three months; otherwise no new records will be added until files are erased.

This procedure is applicable to both LLZ and GP.

4.4.1 Materials

- Maintenance laptop with RMM software

4.4.2 Preparation

1. Connect the laptop to the network in the system shelter (it is better to run this procedure inside the shelter).

2. Set the IP address in the same subnet of the ILS system.
3. Log in as a Level 3 user.

4.4.3 Procedure

1. On the RMM menu bar, click Logging, and then click History Log.
   The Download History Logs window appears.
2. Click the Select/Deselect All check box to select all files.
3. Click Download and wait until the download process is finished (20 to 30 minutes).
4. After the download process stops, click Remove, and then click Yes to purge the SD card.

4.5 SD Card Reformat

In the case of SD memory card corruption, it may be required to reformat the SD Card file system.

4.5.1 Materials

- Maintenance laptop with RMM software

4.5.2 Preparation

- Connect the laptop to the network in the system shelter (it is better to run this procedure inside the shelter).

4.5.3 Procedure

1. On the RMM menu bar, click **File**, and then click **Reformat uSD Card**.
2. Once the reformat operation is completed, reboot the MPU through RMM menu bar > File > Reboot MPU.

4.6 Software Upgrade

Intelcan may release upgrade packages for the MPU and/or RMM. An official notice will be sent to the client along with the update package. Then the client can perform the upgrade by following the steps described in this section.

Important notes:

- Make sure to perform update in the following order: MPU first, then RMM.
- Pay attention to specific installation notes included in the SW upgrade package.

4.6.1 Materials

- Maintenance laptop with RMM software
- Software upgrade package files

4.6.2 Preparation

- Copy the software update package files to the laptop or PC running LMM/RMM

4.6.3 MPU upgrade procedure

1. Launch the current ILS RMM on the Laptop/PC.
1. Connect to the ILS using Level3 or Level4 account.
2. Save the current configuration to a file through Menu: File > Save Station Configuration….
3. Update the MPU software through Menu: File > Update Station Software.
4. Click the  button and browse for the new MPU SW package file (ils-mpu-x.x.x.x.tar.bz2) where x.x.x.x corresponds to the software version..
5. Click **Upload**.
6. Once upload is complete, click **Install**.
7. Select **Yes** to preserve the current configuration unless specified otherwise in the SW package installation notes.
8. MPU will install the new package and reboot automatically.

4.6.4 RMM upgrade procedure

1. Uninstall current RMM through Windows Start Menu > Intelcan ILS V2 > Uninstall.
2. Install new RMM by executing the RMM SW installer (IntelcanILSSetup-x.x.x.x.exe) where x.x.x.x corresponds to the software version.
3. Launch the new ILS RMM on the Laptop/PC.
4. Connect to the ILS using Level3 or Level4 account.
5. Save the current configuration to a file through Menu: File > Save Station Configuration….

4.7 MPU Replacement Procedure

This method is applicable to both LLZ and GP.

4.7.1 Materials

- Maintenance laptop with RMM software
- Electrostatic discharge (ESD) wrist strap

4.7.2 Preparation

1. Suspend the MPU by pressing and holding the FDU Reset button for 3 seconds.
2. Turn OFF the ILS station using the DC on/off switch.
3. Put on the ESD wrist strap and make sure it is connected to a ground point.

4.7.3 Procedure

1. Wearing the ESD wrist strap, unscrew both thumb screws on the MPU and FDU.
2. Disconnect the cables between the FDU and the MPU, and then remove the MPU card from its slot.
3. Remove the SD memory card from the old MPU card.
4. On the new MPU card, select the correct position of the DIP switches (SW2) Pin 4:.
5. ON (Up Side) ☐ GP
6. OFF (Down Side) ☐ LLZ
7. Insert the SD memory card into the new MPU card (for system configuration purposes).
8. Insert the new MPU card into the first slot position for digital cards and make sure it is firmly secured.
9. Reconnect the cables between the FDU and the MPU.
10. Tighten both thumb screws on the MPU and the FDU.
11. Turn ON the ILS system.
12. For a new SD card, restore the station configuration using RMM > File > Load Config.

4.8 SCU Replacement Procedure

This method is applicable to both LLZ and GP.

4.8.1 Materials

- Maintenance laptop with RMM software
- Electrostatic discharge (ESD) wrist strap

4.8.2 Preparation

1. Suspend the MPU by pressing and holding the FDU Reset button for 3 seconds.
2. Turn OFF the ILS station using the DC on/off switch.
3. Put on the ESD wrist strap and make sure it is connected to a ground point.

4.8.3 Procedure

1. Wearing the ESD wrist strap, unscrew both thumb screws on the SCU and remove the SCU card from its slot.
2. Insert the new SCU card into the second slot position for digital cards and make sure it is firmly secured.
3. Tighten both thumb screws.
4. Turn ON the ILS system.
5. Verify that:
   - The SCU displays all green LEDs

- The TSU displays a green LED for either TX1 or TX2

6. Using the RMM, open the SCU BITE and verify the displayed values.

4.9 FDU Replacement Procedure

The FDU can freeze or shut down due to software error or hardware problems. FDU issues will not affect the system functionality; transmission, RCU and RSU communication will not be interrupted.

The logic flowchart for FDU replacement is displayed below.

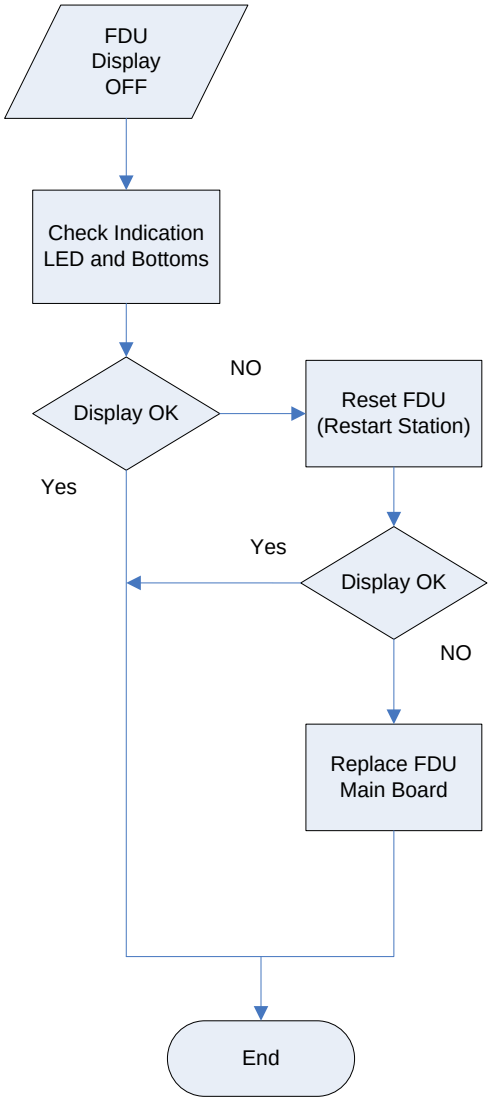


Figure 13 - FDU Test Procedure

4.9.1 Materials

- Maintenance laptop with RMM software

- Electrostatic discharge (ESD) wrist strap

4.9.2 Preparation

1. If the FDU's LCD screen is frozen, press Lamp Test (see figure below) and verify that all LEDs are ON.

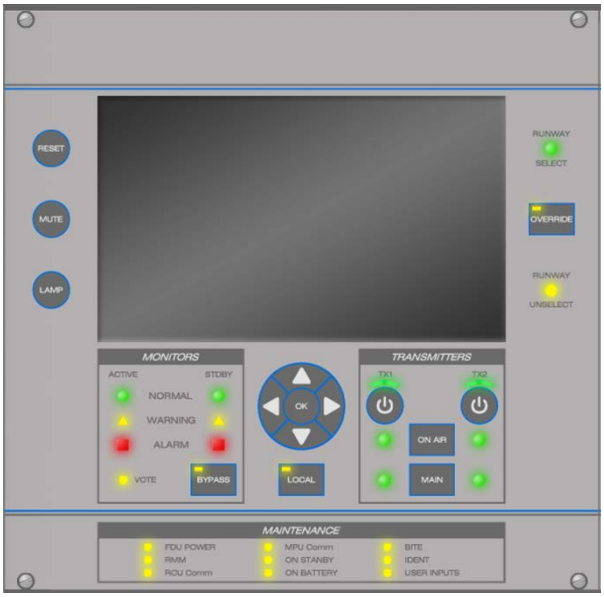


Figure 14 - FDU Display Panel

2. If there is no response from the LCD screen, restart the ILS station using the DC on/off switch.
3. During ILS start-up, the LCD screen should take two to three minutes to flash the Intelcan logo and then display the Home screen
4. If there is no response from the LCD screen, the FDU must be replaced.

4.9.3 Procedure

1. Suspend the MPU by pressing and holding MPU Reset button for 3 seconds.
2. Turn OFF the ILS station using the DC on/off switch.
3. Put on the ESD wrist strap and make sure it is connected to a ground point.
4. Wearing the ESD wrist strap, unscrew both thumb screws on the MPU and FDU.
5. Disconnect the cables between the FDU and the MPU, and then remove the FDU card from its slot.
6. Insert the new FDU card into its slot and make sure it is firmly secured.
7. Reconnect the cables between the FDU and the MPU.
8. Turn on the ILS Station.
9. Check the new FDU.

4.10 MOU Replacement Procedure

This method is applicable to both LLZ and GP.

4.10.1 Materials

- Maintenance laptop with RMM software
- Electrostatic discharge (ESD) wrist strap

4.10.2 Preparation

- Put on the ESD wrist strap and make sure it is connected to a ground point.

4.10.3 Procedure

1. Suspend the MPU by pressing and holding FDU Reset button for 3 seconds.
2. Turn OFF the ILS station using the DC on/off switch.
3. Wearing the ESD wrist strap, unscrew both thumb screws on the MOU and remove the MOU card from its slot.
4. Insert the new MOU card into its slot and make sure it is firmly secured.
5. Tighten both thumb screws.
6. Turn ON the ILS system.
7. Run the MOU calibration procedure.

4.11 PSU Replacement Procedure

The stability of the main power supply is an important factor for system reliability; the ILS uses the RMM and FDU to monitor both of the cabinet AC and DC supply voltages. The user can read the voltage values, AC voltage mains and the system DC voltages through the PSS BITE menu. Also, if any of the monitored voltages cross the alarm threshold limit (high or low), a maintenance alarm is activated and an event is recorded in the event log.

There are two or three power supply modules for each ILS station. If one module experiences a problem, the RCU, FDU and RMM immediately display warnings. Due to redundancy, if one PSU is defective it will not affect system operation.

The logic flowchart for PSU replacement is displayed in figure below.

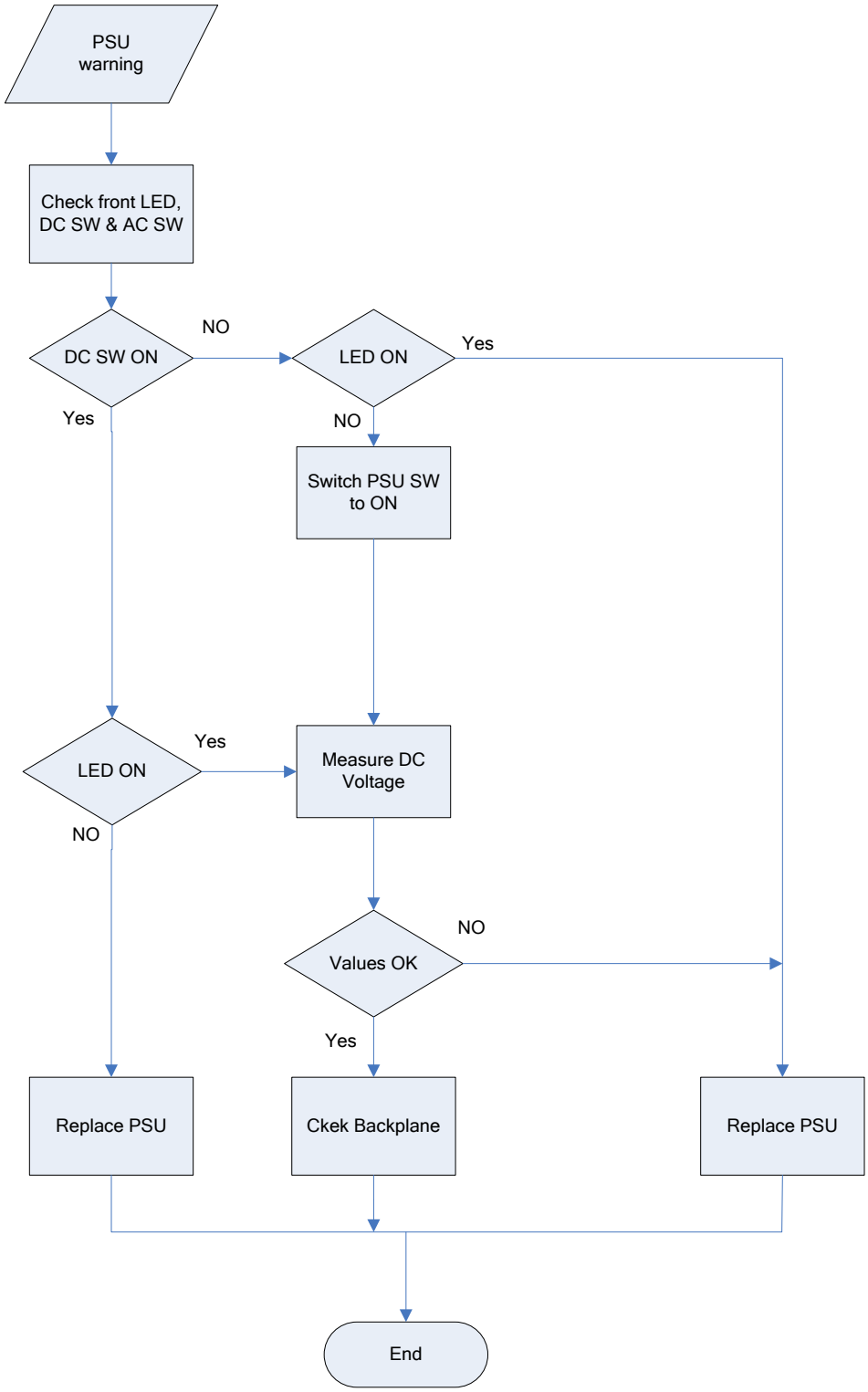


Figure 15 - PSU Test Procedure

4.11.1 Materials

- Multimeter
- Flat screw driver
- Precision screw driver
- Electrostatic discharge (ESD) wrist strap

4.11.1.1 Preparation

1. Turn OFF the appropriate AC switch:
   - AC1 for PSU1/2
   - AC2 for PSU3/4
2. Put on the ESD wrist strap and make sure it is connected to a ground point.

4.11.2 Procedure

1. Wearing the ESD wrist strap, unscrew the thumb screws on the PSU.
2. Follow the logic flowchart to find the reason for the warning.
3. Remove the PSU from its slot.
4. Insert the new PSU into its slot and make sure it is firmly secured.
5. Tighten the thumb screws.
6. Turn ON the appropriate AC switch.
7. Using RMM, open the PSS BITE and verify the displayed values.

4.12 Battery Replacement Procedure

The ILS uses two 12 V, 120 Amp/H batteries in series; each battery has a five-year life under normal operating conditions. Due to site issues (for example, frequent main outage, and battery discharge to minimum, shelter temperature and humidity), battery longevity can decrease and replacements may be needed.

This method is applicable to both LLZ and GP.

4.12.1 Materials

- 10 mm wrench or small adjustable wrench
- Electrical insulating gloves
- Multimeter

4.12.2 Preparation

1. Suspend the MPU by pressing and holding FDU Reset button for 3 seconds.
2. Turn OFF the ILS station using the DC on/off switch.
3. Switch OFF the battery breaker.

4.12.3 Procedure

1. Open the battery drawer.
2. Wearing electrical insulating gloves use the wrench to release the battery cables.
3. Remove the batteries from the cabinet.
4. Insert the new batteries and reconnect the battery cables.
5. Pay attention to battery polarity and cable color
6. Using the multimeter, verify the DCV of the batteries group (red and black cable)
7. Switch ON the battery breaker and turn ON the ILS station.

4.13 TXU Replacement Procedure

This method is applicable to both LLZ and GP.

4.13.1 Materials

- Maintenance laptop with RMM software
- SMA torque wrench
- Power meter
- Electrostatic discharge (ESD) wrist strap

4.13.2 Preparation

1. Using RMM software, connect to the ILS station.
2. On the RMM menu bar, click Status, and then click TX Monitor.

   The TX Monitor window appears.
3. Read the power output values; if they are below acceptable levels, then the TXU must be replaced.

4.13.3 Procedure

1. Suspend the MPU by pressing and holding FDU Reset button for 3 seconds.
2. Turn OFF the ILS station using the DC on/off switch.
3. Put on the ESD wrist strap and make sure it is connected to a ground point.
4. Using the SMA torque wrench, disconnect the RF cables at the back of the TXU.
5. Unscrew the thumb screws on the TXU.
6. Remove the TXU from its slot.
7. Insert the new TXU into its slot.
8. Tighten the thumb screws and reconnect the RF cables.
9. Turn ON the ILS system.
10. Run the transmitter site adapt calibration procedure.

5. MAINTENANCE LOG AND REPORT

5.1 Maintenance Log Book

In order to track the maintenance history of the equipment, a maintenance log book is required in each shelter.

The maintenance engineer will make notes or records on the log book when each maintenance work is done.

5.2 Storing and archiving system data

Intelcan ILS equipment have a SD card inside the equipment to save the daily system data as history file. It can keep saving the data over 10 years without cleaning the SD card.

However the maintenance engineer will archive the system data into the maintenance computer during the monthly maintenance.

5.3 Maintenance Report

A maintenance report will be filled out by the maintenance engineer during the maintenance on site.

END OF DOCUMENT