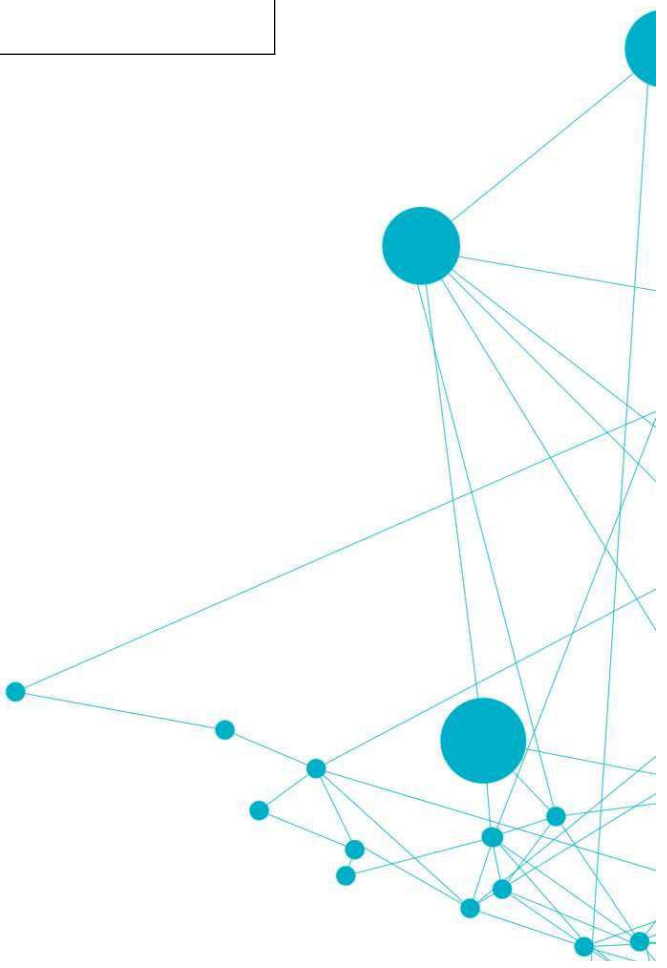
DISTANCE MEASURING EQUIPMENT (DME) NORMARC LDB-103

TECHNICAL MANUAL

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FABRICANTE PRODUCTO / *PRODUCT MANUFACTURER*

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DIRECCION / *ADDRESS*: Avda. Bruselas, 35. CP 28108 Alcobendas, Madrid, (España)

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Nombre / *Name*: **NORMARC LDB-103 DME**
Marca / *Trademark*: **INDRA**
Modelo/ *Model*: **N/A**
Código del Elemento / *Part Number*:
NORMARC LDB-103 DME 1kW–CEE7/4 Convenience Outlets, **PN=0063420000105**
NORMARC LDB-103 DME 1kW–AS3112 Convenience Outlets, **PN=0063420000106**
NORMARC LDB-103 DME 100W–CEE7/4 Convenience Outlets, **PN=0063420000107**
NORMARC LDB-103 DME 100W–AS3112 Convenience Outlets, **PN=0063420000108**
NORMARC LDB-103 DME 100W–AS3112 Convenience Outlets & DC Supply Option, **PN=0063420000114**
NORMARC LDB-103 DME 1kW–AS3112 Convenience Outlets & DC Supply Option, **PN=0063420000115**
NORMARC LDB-103 DME 100W– CEE7/4 Convenience Outlets & Frontal RF Measurement Panel, **PN=0063420000131**
NORMARC LDB-103 DME 1kW– CEE 7/4 Convenience Outlets & Frontal RF Measurement Panel, **PN=0063420000141**
Configuración / Configuration: **00634200000100IFxx.xx**
Código del Organismo Notificado (si procede) / Notified Body (if applicable): **O.N. 2031 / NB 2031**

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DIRECTIVA 2013/35/EU Campos Electromagnéticos / DIRECTIVE 2013/35/EU Electromagnetic Fields

NORMAS ARMONIZADAS PARA LAS DIRECTIVAS
HARMONIZED STANDARDS TO THE DIRECTIVES

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EUROCAE ED-57N 50385:2002

"El organismo notificado ALTER TECHNOLOGY TÜV NORD, S.A.U., número 2031, ha realizado la revisión de la documentación técnica del producto indicado y expedido el Certificado de examen UE de tipo ATN-CER-0043-0059/2017"

"Notified Body ALTER TECHNOLOGY TÜV NORD, S.A.U., number 2031, has examined the technical documentation of the indicated product and issued the EU Certificate of Examination type ATN-CER-0043-0059/2017"

Firmado / *Signed:*	José Jesús Hernández Gonzalo
Cargo/ *Function:*	Director de Calidad
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Fecha / *Date*	27/07/2017
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Project : NORMARC LDB-103 DME Radio Navigation Systems

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List of Abbreviations

A	Amperes (unit of electric current)	**A/D**	Analog to Digital
AC	Alternate Current	**ADC**	Analog to Digital Converter
BIT	Built In Test	**BITE**	Built-In Test Equipment
CBIT	Continuous Built-In Test	**CMU**	Control and Monitoring Unit
CPU	Control Processor Unit	**CR**	Commission Regulation
CW	Continuous Wave	**DAC**	Digital to Analog Converter
DME	Distance Measuring Equipment	**DOD**	Depth of Discharge
DVI-D	Digital Visual Interface - Digital	**DVOR**	Doppler VHF Omnidirectional Radio Range
EC	Configuration Item	**ePC**	Embedded PC
ERP	Effective Radiated Power	**ESD**	Electrostatic Discharge
ETX	Embedded Technology eXtended	**FPGA**	Field-Programmable Gate Array
ft	Feet, length unit	**GND**	Ground
GUI	Graphic User Interface	**HP**	Horizontal Pitch
HPA	High Power Amplifier	**HTTP**	Hypertext Transfer Protocol
Hz	Hertz (unit of frequency)	**IBIT**	Initial BIT
ICD	Interface Control Document	**ID**	Identification
ILS	Instrument Landing System	**I/O**	Inputs and Outputs
ISG	Interrogator Signal Generator	**JTAG**	Joint Test Action Group
LAN	Local Area Network	**LCD**	Liquid Crystal Display
LCU	Local Control Unit	**LDES**	Long Distance Echo Suppression
LDO	Low Dropout	**LED**	Light Emitting Diode
LHS	Left-Hand Side	**LMT**	Local Monitoring Terminal

LRU	Line Replaceable Unit	**LVDS**	Low-Voltage Differential Signaling
MIB	Management Information Base	**MTBF**	Mean Time Between Failures
MTBMP	Mean Time Between Maintenance Periods	**MTBO**	Mean Time Between Outage
MTTR	Mean Time To Repair	**MTU**	Monitor Test Unit
N/A	Not Applicable	**NARIC**	Navigational Aid Remote Indication and Control
NCO	Numeric Control Oscillator	**NM**	Nautical Mile
NMP	Network Management Processor	**N/U**	Not Used
PBIT	Power-up Built-In Test	**PC**	Personal Computer
PCB	Printed Circuit Board	**PLL**	Phase-Locked Loop
ppm	parts per million	**pps**	pair of pulses per second
PSU	Power Supply Unit	**RCA**	Radio Corporation of America
RCSU	Relay Changeover & Status Unit	**RCU**	Relay Changeover Unit
RF	Radiofrequency	**RHS**	Right-Hand Side
RMM	Remote Management Monitoring	**RoHS**	Restriction of Hazardous Substances
RSU	Relay Status Unit	**RTC**	Remote Terminal Connection
RU	Rack Unit	**RXU**	Receiver Unit
s	Seconds (unit of time)	**SBC**	Single Board Computer
SDES	Short Distance Echo Suppression	**SMA**	Sub-Miniature A Connector
SMD	Surface Mount Device	**SNMP**	Simple Network Management Protocol
S/PDIF	Sony/Philips Digital Interchange Format	**TBC**	To Be Confirmed

TBD	To Be Defined	**TCP/IP**	Transmission Control Protocol/Internet Protocol
TFT	Thin Film Transistor	**TXU**	Transmitter Unit
U	Rack Unit	**USB**	Universal Serial Bus
V	Volts (unit of voltage)	**VAC**	Volts of Alternate Current
VCA	Voltage Controlled Amplifier	**VDC**	Volts of Direct Current
VGA	Video Graphics Adapter	**VOR**	VHF Omnidirectional Radio Range
VPN	Virtual Private Network	**VSWR**	Voltage Standing Wave Ratio
VVA	Voltage Variable Attenuator	**W**	Watts (Unit of Power)
WAN	Wireless Area Network	**Ω**	Ohms (unit of electric resistance)

Trademarks and Product Names

NORMARC LDB-103 is a trademark of Indra.

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DOCUMENTS

The following documents, in the specified edition and revision, are part of this specification within the scope defined herein.

In the event of conflicts between the contents of any document, the documents referenced bellow and this one, this document shall have precedence.

Applicable Documents

Ref.	Document Title	Document Code
[AD.1]	International Standards and Recommended Practices, Aeronautical Telecommunications, Annex 10, Volume I (Radio Navigation Aids) to the Convention on International Civil Aviation, 6th Edition, July 2006, included Amendments 70-77.	ICAO, Annex 10, Vol. 1
[AD.2]	Manual On Testing Of Radio Navigation Aids, Volume I, Fourth Edition, 2000.	ICAO Doc. 8071 Vol. 1
[AD.3]	Minimum Operational Performance Specification for Distance Measurement Equipment (DME/N and DME/P) (Ground Equipment) Edition 2. The European Organisation for Civil Aviation Equipment December 1986.	EUROCAE ED-57
[AD.4]	RED – 2014/53/EU.	RED
[AD.5]	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements.	ETSI EN 301 489-1 V1.9.2
[AD.6]	Information technology equipment - Safety -- Part 1: General requirements	EN 60950-1
[AD.7]	Information technology equipment - Safety Generalements	AS/NZS 60950.1
[AD.8]	Product standard to demonstrate the compliance of radio base stations and fixed terminal stations for wireless telecommunication systems with the basic restrictions or the reference levels related to human exposure to radio frequency electromagnetic fields (110 MHz - 40 GHz) - General public.	EN 50385
[AD.9]	Software Integrity Assurance considerations for communication, navigation, surveillance and Air Traffic Management (CNS/ATM) systems.	EUROCAE ED-109A

Reference Documents

Ref.	Document Title	Document Code
[RD.1]	Procedimiento General. Sistema de Codificación e Identificación de Indra (General Procedure. Code and Identification System of Indra)	PRG-IDR-068
[RD.2]	External Interface Document (ICD)	0063400000100IC00 (A/0)
[RD.3]	Compatibilidad electromagnética (CEM). Parte 4-2: Técnicas de ensayo y de medida. Ensayo de inmunidad a las descargas electrostáticas.	EN61000-4-2
[RD.4]	Indra DME Software Loader User Guide – CMU SW Update	0063400000100IF17 (A/0)
[RD.5]	Interconnection Diagram Document	0063410000100DI00 (A/3)
[RD.6]	Technical Manual RCSU IND-35D (A2)	0066910000100MA04 (A/2)
[RD.7]	Technical Manual RCSU IND-35D (A0)	0066910000600MA00 (A/0)

FIRST AIDS IN CASE OF ELECTRIC SHOCK

The three steps of cardiopulmonary resuscitation (CPR) is the recommended technique for use in any case of electrical shock. It is comparatively simple and produces the best and quickest results when correctly applied.

Send for medical assistance if possible.

Start immediately but do not touch the victim until the circuit is broken.

1. Break the electrical circuit by switching OFF or, if not possible, PROTECT YOURSELF with dry insulating material and pull the victim clear of the conductor.



2. Start chest compressions. Place the heel of your hand on the center of the victim's chest. Put your other hand on top of the first with your fingers interlaced.

3. Press down so you compress the chest at least 2 inches in adults and children and 1.5 inches in infants. "One hundred times a minute or even a little faster is optimal.

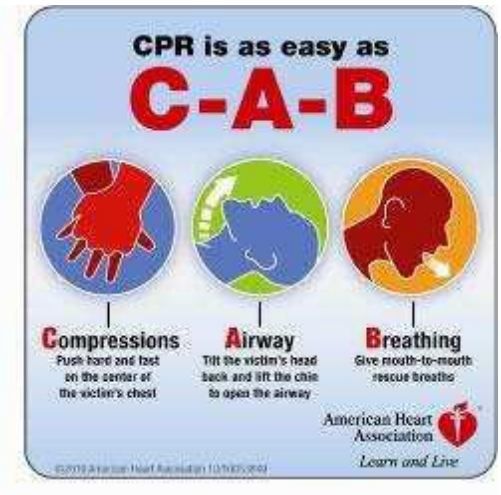


4. If you're been trained in CPR, you can now open the airway with a head tilt and chin lift. Make a brief inspection of the mouth and throat and ensure that they are clear of obvious obstruction.

5. Pinch closed the nose of the victim. Take a normal breath, cover the victim's mouth with yours to create an airtight seal, and then give two, one-second breaths as you watch for the chest to rise.



6. Continue compressions and breaths -- 30 compressions, two breaths -- until medical aid arrives.



WARNING ENERGY HAZARD



High levels of electrical energy are supplied by the AC/DC power supplies and distributed by the 27VDC supply inside the cabinet. Be careful not to contact the connectors supplying the 27VDC, or any component connected to the 27V DC, with any metallic object while servicing the cabinet.

Note that to fully remove 27VDC turn off mains AC/DC power supplies/Chargers and isolate the standby batteries if connected.

Only authorized maintenance personnel shall be given access to and perform maintenance on the cabinet.

PROTECTING ELECTRONIC EQUIPMENT AGAINST ELECTRO-STATIC DISCHARGE, ESD



This electronic equipment and its spare parts are built from semiconductor components, which are sensitive to ESD. The equipment may be damaged or suffer from reduced performance and lifetime if improperly handled during servicing and transportation.

WARRANTY

To retain the **Indra** warranty the following precautions must be taken:

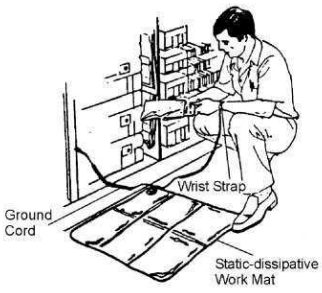
- All semiconductor components and modules containing semiconductors shall be handled and transported as ESD-sensitive.

HANDLING PROCEDURE

To achieve ESD-protection, the operator shall use a portable static-dissipative field kit containing dissipative mat, wrist strap and ground cord or equivalent protection connected to same potential as the equipment, see picture.

Nonconductive objects such as synthetic clothing, Styrofoam™ coffee cups, cigarette packs, vinyl work order envelopes or common plastics shall be removed from the work area as they may cause damage to semiconductor components.

- Connect the dissipative mat to the equipment via the ground cord and connect the wrist strap cord to the mat.
- The operator must wear the wrist-strap before modules are removed or components touched.
- Anytime a module must be laid down, it should be placed only on the grounded dissipative mat.
- All electronic equipment must be properly reinserted in the rack or protected by placing in ESD-shielding bags or boxes before the ground cord, wrist strap cord or wrist strap are removed.



TRANSPORTATION PROCEDURE

Electronic equipment, spare part modules or faulty modules removed from the equipment, to be returned for repair shall be stored and transported in ESD-shielding bags or equivalent.

The electrostatic shielding package shall not be opened without the operator and work area being properly protected as stated above.

SHIPPING PRECAUTIONS

All modules must be packed in electrostatic conductive (ESD) bags or boxes before shipping.

REVISION NUMBERS

Modules used in the system, which have the same type of designation, might in particular cases, have different revision numbers. This is due to the production of modules in different batches where changes have taken place from one batch to the next.

New revisions of modules, always replace the old revisions.

Documentation of the latest revision is enclosed in the manual.

Please contact us if information on older revisions of modules is needed for servicing purposes.

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1. SECTION 1 - GENERAL INFORMATION

1.1 PURPOSE AND SCOPE

The Ground Beacon NORMARC LDB-103 DME equipment is a radio navigation aid designed and manufactured to meet or exceed the specifications outlined in the ICAO, Annex 10, Volume 1 [AD.1] and Doc 8071 [AD.2], Volume I as well as in EUROCAE ED-57 [AD.3] and all European Directives applicable to radio navigation systems.

The DME (Distance Measuring Equipment) systems are navigation aids recommended by the ICAO and introduced internationally for short and medium range aircraft guidance.

The purpose of this document is to provide the reader with sufficient information to understand how the Ground Beacon NORMARC LDB-103 DME operates and is maintained. The handbook also contains equipment specific information for installation; general installation information is given in the Installation Handbook.

The handbook is written for personnel with a good prior knowledge of DME. Users should participate in a DME training course to get the required training.

The handbook covers all the version of the equipment. Where information is applicable only to a specific version, paragraphs are marked.

The corrective maintenance strategy supported is LRU (Line Replaceable Unit) replacement. Fault isolation to LRU level is supported by the RMM system, minimizing downtime caused by repairs.

Repair of LRUs require specialized training and equipment, and should be done by Indra or other authorized repair facilities.



Figure 1.1-1: FRONTAL VIEW OF THE NORMARC LDB-103 DME CABINET

1.2 DOCUMENT OVERVIEW

Section 1 - General Information (this section)

This section contains a general overview of this document, a general description of the DME system and a description of the Product Type number system.

Section 2 - Technical Description

This section introduces the Indra Distance Measuring Equipment (DME) series NORMARC LDB-103. It explains the DME operation and how the NORMARC LDB-103 implements these functions.

Section 3 - Detailed Description

This section gives a detailed technical description of the various modules and, sufficient to support operation, adjustment and repair of the system.

Section 4 - Operating and Use Instructions

This section gives instructions for operating the system by the Remote and Local Controls.

Section 5 – Maintenance Procedures

This section includes all data required for maintenance of the Model NORMARC LDB-103 DME.

Section 6 – Installation

This section contains installation information for the independently located NORMARC LDB-103 DME.

Annex A – Remote Control and Monitoring Facilities.

This annex gives details of the control inputs and status outputs for use by a Remote Management and Monitoring System (RMMS).

Annex B – RCSU and RSU Operating Instructions.

This section gives instructions for operating the system by the RCSU and RSU.

1.3 FUNCTIONAL DESCRIPTION

1.3.1 Introduction

This section introduces the Indra Distance Measuring Equipment (DME) series NORMARC LDB-103 type 0063400000100. It first explains the DME operation then how the NORMARC LDB-103 implements these functions. Next, special features of the NORMARC LDB-103 are described starting with mechanical description and ending with detailed specification.

The Distance Measuring Equipment (DME) Ground Beacon NORMARC LDB-103 series equipment is designed and manufactured to meet the specifications outlined in ICAO Annex 10 [AD.1], ICAO Doc 8071 [AD.2], EUROCAE ED-57 [AD.3] requirements. Its main function is to provide automatic answer to DME interrogators, giving precise distance information through the reply to interrogations from airplanes under its coverage area, tuned in its working channel. The NORMARC LDB-103 series equipment is capable of operating in the 252 possible X/Y DME/N channels.

1.3.2 Application

The DME system is a navigational system that provides slant-range distance information between aircraft and a ground station.

The system consists of a transmitter/receiver (interrogator) in the aircraft, and a receiver/transmitter (transponder) ground station. The interrogator transmits interrogation pulses to the transponder, which on receipt of the interrogation pulses, is triggered to transmit a sequence of reply pulses, which have a predetermined time delay. The time difference between interrogation and reply is measured in the interrogator and translated into a distance measurement, which is presented on a digital display in the aircraft cockpit; this display is continuously updated.

1.3.3 DME System Operation

1.3.3.1 Distance Measuring Function

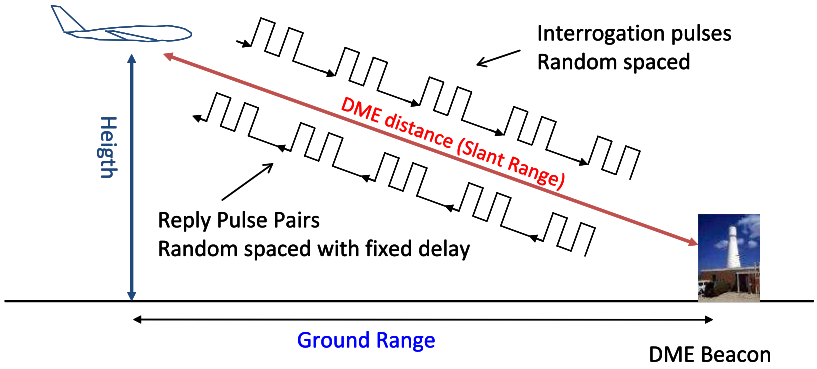
The DME system provides each aircraft with up-to-date information regarding the slant-range distance between the aircraft and the selected DME ground station. By using the correct airborne equipment, is also possible for the interrogating aircraft to establish the rate of closure and the flight time to a ground station.

The DME system has a transmitter/receiver (interrogator) in the aircraft and a receiver/transmitter (transponder) operating as the ground beacon. The UHF DME operates in the L band, from 962 MHz to 1213 MHz. This band is divided into 126 1-MHz channels for interrogations and 126 1-MHz channels for transponder replies with the interrogation frequency and reply frequency always differing by 63 MHz. The number of channels available is doubled by the use of X and Y channels which define the pulse separation for the interrogation and reply pulses.

Initially, the airborne equipment is set to the correct frequency for the desired ground station. The interrogator transmits pairs of pulses at the interrogation frequency at a repetition rate of approximately 120 pulse-pairs per second (pps) (this is called 'searching' mode). The transponder, having identified these pulses as valid interrogations, introduces a 50 µs delay after each interrogating pulse-pair and transmits reply pulse-pairs at the reply frequency. The airborne interrogator automatically compares the lapsed time between transmission and reception, subtracts the 50 µs delay, and displays the result in nautical miles. Once the interrogator receives replies to its interrogations, the interrogator 'locks' onto the reply pulses and reduces its transmitted repetition rate to approximately 30 pps (this is called 'tracking' mode).

Main activities performed by the DME equipment include the following:

- Detection and analysis of interrogation pulses.
- Signal processing related with receiver function.
- Reply generation and timing.
- Squitter generation.
- Identity transmission.
- Transmitted pulse shape control.
- Monitor functions.
- Exchange of data for Local and Remote access.



SR = (T-D)/12.36

SR: Slant Range (NM)
T: Total delay between interrogation and reply (µs)
D: Transponder fixed delay (µs)

Figure 1.3-1: DME PRINCIPLE

1.3.3.2 DME Pulse Generation

The RF pulses transmitted by both the interrogator and the ground transponder consist of a pair of 'Gaussian-shaped' pulses; the separation between pulses depends on whether an X channel or a Y channel has been selected. The duration of the pulses is in all cases a nominal 3.5 µs as measured at the half-amplitude point. The pulse separation for X channels, for both interrogation and reply pulses, is 12 µs; for Y channels the pulse separation is 36 µs for interrogation pulses, and 30 µs for reply pulses.

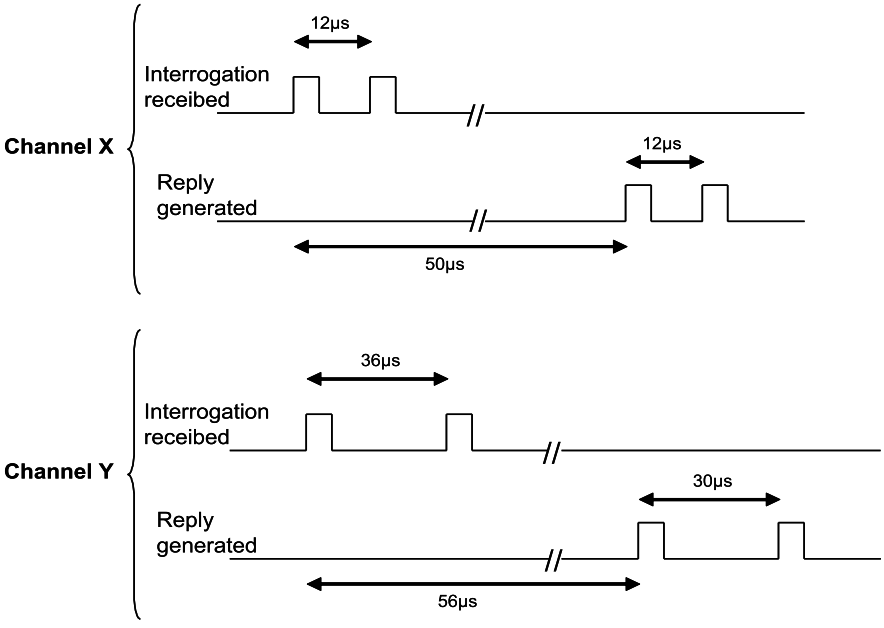


Figure 1.3-2: DME WAVEFORMS

1.3.3.3 System Squitter

Airborne DME receivers require a continuous stream of random pulses to ensure correct operation; however, unless there are interrogating aircraft present, the airborne receivers may not receive the required minimum pulse rate. To ensure that the airborne receivers always receive at least a minimum pulse rate, the DME transponder will generate 'extra' pulses in a random fashion at a minimum pulse rate of 700 pps. These extra random pulse-pairs are called squitters. At the time when no aircraft are interrogating, only the squitter is being transmitted; however, as the number of authentic interrogations increases the squitter rate is reduced.

1.3.3.4 Maximum Reply Rate

As the pulse rate of the interrogations increases, a limit is reached where the transponder will not allow further interrogations to be serviced. To avoid overloading, the transponder detects the high rate of replies and causes the receiver automatic gain control to limit the gain of the receiver until the weaker, more distant, aircraft are excluded from the transponder, thus lowering the transponder loading.

1.3.3.5 Identification Message

Each operational DME is identified by a 2-character or 3-character Morse (but NORMARC LDB-103 DME even supports 4-characters) code message, which is transmitted every 40 seconds. Each identification code (Ident) is unique and identifies a specific DME site. The identification message code is programmed by preset controls within the equipment, and can be readily altered if the Ident is required to be changed.

Frequently, DME is collocated with ILS or VOR equipment and, for this reason, the DME may operate either as a master or as a slave for the generation and transmission of the station identification message.

When the DME is operating as a slave unit, any failure of the external Ident generator will cause the DME to internally generate and transmit the Ident in place of the failed unit.

1.3.3.6 Range and Echo

The normal slant range for a DME system operating in the ultra-high frequency band is:

- En-route DME system approximately 200 nautical miles (370 km);
- Approach DME system approximately 60 nautical miles (111 km);

A major contributing factor to distance accuracy degradation is the effect of echoes on the interrogation pulses arriving at the transponder. The shortest path is the direct line between the aircraft and ground transponder and thus the wave front taking this path arrives first. Other wave fronts may reflect off the terrain, buildings, and other objects, and thus arrive at any indeterminate time after the arrival of the direct pulse. It is possible under these conditions for the second pulse of a pulse-pair to undergo distortion leading either to cancellation or to a shift in timing such that the transponder cannot recognize the receipt of a valid pulse-pair.

Short Distance Echo Suppression is included to minimize the problems associated with such reflections. As well, Long Distance Echo Suppression is included to eliminate recognition of echoes that are synchronized with the interrogation pulses but arrive in the order of up to 450 µs late.

1.4 CHANNEL FREQUENCY PLAN

The DME system transmits on a preselected channel among the 252 available ones. These channels are divided into 126 X channels and 126 Y channels providing a frequency ranging from 1025 to 1150 MHz for aircraft transmission (interrogation). For signal reception by the aircraft (ground beacon reply transmission), the frequency ranging is from 962 to 1213 MHz.

Interrogation and reply frequencies are assigned with 1 MHz spacing between channels.

Table 1.4-1: PULSE CODING CHARACTERISTICS.

X Channels (126)	Channel Number	Y Channels (126)
f_{INT} [MHz] = 1025 + (CH-1)	-	f_{INT} [MHz] = 1025 + (CH-1)
f_{REPLY} [MHz] = f_{INT} [MHz] - 63	1 ≤ CH ≤ 63	f_{REPLY} [MHz] = f_{INT} [MHz] + 63
f_{REPLY} [MHz] = f_{INT} [MHz] + 63	64 ≤ CH ≤ 126	f_{REPLY} [MHz] = f_{INT} [MHz] - 63

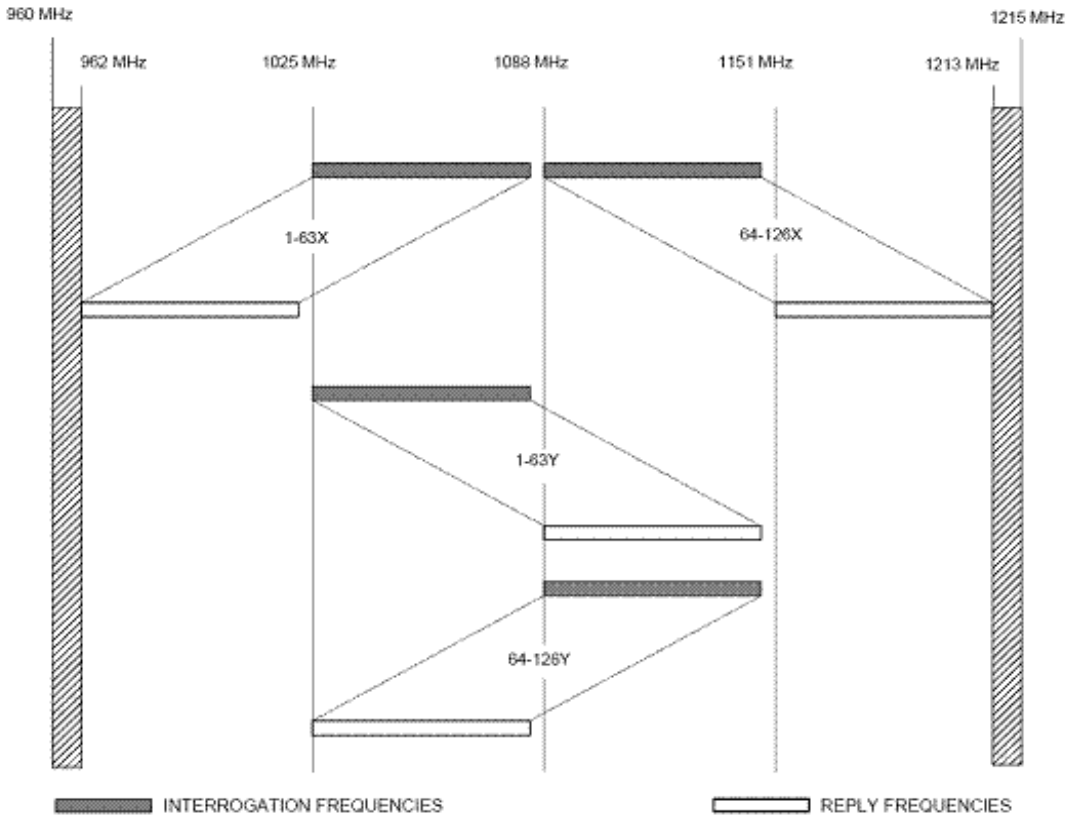


Figure 1.4-1: DME CHANNEL FREQUENCY PLANNING

Table 1.4-2: DME CHANNEL FREQUENCY AND CODE PULSES

CHANNEL PAIRING			DME PARAMETERS							
VHF FRECUENCY (MHz)	DME CHANNEL NUMBER		AIRBORNE INTERROGATION				GROUND REPLY			
			FREQUENCY (MHz)		PULSE CODE (µs)		FREQUENCY (MHz)		PULSE CODE (µs)	
-	1X		1025		12		962		12	
-		1Y		1025		36		1088		30
-	2X		1026		12		963		12	
-		2Y		1026		36		1089		30
-	3X		1027		12		964		12	
-		3Y		1027		36		1090		30
-	4X		1028		12		965		12	
-		4Y		1028		36		1091		30
-	5X		1029		12		966		12	
-		5Y		1029		36		1092		30
-	6X		1030		12		967		12	
-		6Y		1030		36		1093		30
-	7X		1031		12		968		12	
-		7Y		1031		36		1094		30
-	8X		1032		12		969		12	
-		8Y		1032		36		1095		30
-	9X		1033		12		970		12	
-		9Y		1033		36		1096		30
-	10X		1034		12		971		12	
-		10Y		1034		36		1097		30
-	11X		1035		12		972		12	
-		11Y		1035		36		1098		30
-	12X		1036		12		973		12	
-		12Y		1036		36		1099		30
-	13X		1037		12		974		12	
-		13Y		1037		36		1100		30
-	14X		1038		12		975		12	
-		14Y		1038		36		1101		30

Table 1.4-2: DME CHANNEL FREQUENCY AND CODE PULSES

CHANNEL PAIRING			DME PARAMETERS							
VHF FRECUENCY (MHz)	DME CHANNEL NUMBER		AIRBORNE INTERROGATION				GROUND REPLY			
			FREQUENCY (MHz)		PULSE CODE (µs)		FREQUENCY (MHz)		PULSE CODE (µs)	
-	15X		1039		12		976		12	
-		15Y		1039		36		1102		30
-	16X		1040		12		977		12	
-		16Y		1040		36		1103		30
108.00	17X		1041		12		978		12	
108.05		17Y		1041		36		1104		30
108.10	18X		1042		12		979		12	
108.15		18Y		1042		36		1105		30
108.20	19X		1043		12		980		12	
108.25		19Y		1043		36		1106		30
108.30	20X		1044		12		981		12	
108.35		20Y		1044		36		1107		30
108.40	21X		1045		12		982		12	
108.45		21Y		1045		36		1108		30
108.50	22X		1046		12		983		12	
108.55		22Y		1046		36		1109		30
108.60	23X		1047		12		984		12	
108.65		23Y		1047		36		1110		30
108.70	24X		1048		12		985		12	
108.75		24Y		1048		36		1111		30
108.80	25X		1049		12		986		12	
108.85		25Y		1049		36		1112		30
108.90	26X		1050		12		987		12	
108.95		26Y		1050		36		1113		30
109.00	27X		1051		12		988		12	
109.05		27Y		1051		36		1114		30
109.10	28X		1052		12		989		12	
109.15		28Y		1052		36		1115		30

Table 1.4-2: DME CHANNEL FREQUENCY AND CODE PULSES

CHANNEL PAIRING			DME PARAMETERS							
VHF FRECUENCY (MHz)	DME CHANNEL NUMBER		AIRBORNE INTERROGATION				GROUND REPLY			
			FREQUENCY (MHz)		PULSE CODE (µs)		FREQUENCY (MHz)		PULSE CODE (µs)	
109.20	29X		1053		12		990		12	
109.25		29Y		1053		36		1116		30
109.30	30X		1054		12		991		12	
109.35		30Y		1054		36		1117		30
109.40	31X		1055		12		992		12	
109.45		31Y		1055		36		1118		30
109.50	32X		1056		12		993		12	
109.55		32Y		1056		36		1119		30
109.60	33X		1057		12		994		12	
109.65		33Y		1057		36		1120		30
109.70	34X		1058		12		995		12	
109.75		34Y		1058		36		1121		30
109.80	35X		1059		12		996		12	
109.85		35Y		1059		36		1122		30
109.90	36X		1060		12		997		12	
109.95		36Y		1060		36		1123		30
110.00	37X		1061		12		998		12	
110.05		37Y		1061		36		1124		30
110.10	38X		1062		12		999		12	
110.15		38Y		1062		36		1125		30
110.20	39X		1063		12		1000		12	
110.25		39Y		1063		36		1126		30
110.30	40X		1064		12		1001		12	
110.35		40Y		1064		36		1127		30
110.40	41X		1065		12		1002		12	
110.45		41Y		1065		36		1128		30
110.50	42X		1066		12		1003		12	
110.55		42Y		1066		36		1129		30

Table 1.4-2: DME CHANNEL FREQUENCY AND CODE PULSES

CHANNEL PAIRING			DME PARAMETERS							
VHF FRECUENCY (MHz)	DME CHANNEL NUMBER		AIRBORNE INTERROGATION				GROUND REPLY			
			FREQUENCY (MHz)		PULSE CODE (µs)		FREQUENCY (MHz)		PULSE CODE (µs)	
110.60	43X		1067		12		1004		12	
110.65		43Y		1067		36		1130		30
110.70	44X		1068		12		1005		12	
110.75		44Y		1068		36		1131		30
110.80	45X		1069		12		1006		12	
110.85		45Y		1069		36		1132		30
110.90	46X		1070		12		1007		12	
110.95		46Y		1070		36		1133		30
111.00	47X		1071		12		1008		12	
111.05		47Y		1071		36		1134		30
111.10	48X		1072		12		1009		12	
111.15		48Y		1072		36		1135		30
111.20	49X		1073		12		1010		12	
111.25		49Y		1073		36		1136		30
111.30	50X		1074		12		1011		12	
111.35		50Y		1074		36		1137		30
111.40	51X		1075		12		1012		12	
111.45		51Y		1075		36		1138		30
111.50	52X		1076		12		1013		12	
111.55		52Y		1076		36		1139		30
111.60	53X		1077		12		1014		12	
111.65		53Y		1077		36		1140		30
111.70	54X		1078		12		1015		12	
111.75		54Y		1078		36		1141		30
111.80	55X		1079		12		1016		12	
111.85		55Y		1079		36		1142		30
111.90	56X		1080		12		1017		12	
111.95		56Y		1080		36		1143		30

Table 1.4-2: DME CHANNEL FREQUENCY AND CODE PULSES

CHANNEL PAIRING			DME PARAMETERS							
VHF FRECUENCY (MHz)	DME CHANNEL NUMBER		AIRBORNE INTERROGATION				GROUND REPLY			
			FREQUENCY (MHz)		PULSE CODE (µs)		FREQUENCY (MHz)		PULSE CODE (µs)	
112.00	57X		1081		12		1018		12	
112.05		57Y		1081		36		1144		30
112.10	58X		1082		12		1019		12	
112.15		58Y		1082		36		1145		30
112.20	59X		1083		12		1020		12	
112.25		59Y		1083		36		1146		30
-	60X		1084		12		1021		12	
-		60Y		1084		36		1147		30
-	61X		1085		12		1022		12	
-		61Y		1085		36		1148		30
-	62X		1086		12		1023		12	
-		62Y		1086		36		1149		30
-	63X		1087		12		1024		12	
-		63Y		1087		36		1150		30
-	64X		1088		12		1151		12	
-		64Y		1088		36		1025		30
-	65X		1089		12		1152		12	
-		65Y		1089		36		1026		30
-	66X		1090		12		1153		12	
-		66Y		1090		36		1027		30
-	67X		1091		12		1154		12	
-		67Y		1091		36		1028		30
-	68X		1092		12		1155		12	
-		68Y		1092		36		1029		30
-	69X		1093		12		1156		12	
-		69Y		1093		36		1030		30
112.30	70X		1094		12		1157		12	
112.35		70Y		1094		36		1031		30

Table 1.4-2: DME CHANNEL FREQUENCY AND CODE PULSES

CHANNEL PAIRING			DME PARAMETERS							
VHF FRECUENCY (MHz)	DME CHANNEL NUMBER		AIRBORNE INTERROGATION				GROUND REPLY			
			FREQUENCY (MHz)		PULSE CODE (µs)		FREQUENCY (MHz)		PULSE CODE (µs)	
112.40	71X		1095		12		1158		12	
112.45		71Y		1095		36		1032		30
112.50	72X		1096		12		1159		12	
112.55		72Y		1096		36		1033		30
112.60	73X		1097		12		1160		12	
112.65		73Y		1097		36		1034		30
112.70	74X		1098		12		1161		12	
112.75		74Y		1098		36		1035		30
112.80	75X		1099		12		1162		12	
112.85		75Y		1099		36		1036		30
112.90	76X		1100		12		1163		12	
112.95		76Y		1100		36		1037		30
113.00	77X		1101		12		1164		12	
113.05		77Y		1101		36		1038		30
113.10	78X		1102		12		1165		12	
113.15		78Y		1102		36		1039		30
113.20	79X		1103		12		1166		12	
113.25		79Y		1103		36		1040		30
113.30	80X		1104		12		1167		12	
113.35		80Y		1104		36		1041		30
113.40	81X		1105		12		1168		12	
113.45		81Y		1105		36		1042		30
113.50	82X		1106		12		1169		12	
113.55		82Y		1106		36		1043		30
113.60	83X		1107		12		1170		12	
113.65		83Y		1107		36		1044		30
113.70	84X		1108		12		1171		12	
113.75		84Y		1108		36		1045		30

Table 1.4-2: DME CHANNEL FREQUENCY AND CODE PULSES

CHANNEL PAIRING			DME PARAMETERS							
VHF FRECUENCY (MHz)	DME CHANNEL NUMBER		AIRBORNE INTERROGATION				GROUND REPLY			
			FREQUENCY (MHz)		PULSE CODE (µs)		FREQUENCY (MHz)		PULSE CODE (µs)	
113.80	85X		1109		12		1172		12	
113.85		85Y		1109		36		1046		30
113.90	86X		1110		12		1173		12	
113.95		86Y		1110		36		1047		30
114.00	87X		1111		12		1174		12	
114.05		87Y		1111		36		1048		30
114.10	88X		1112		12		1175		12	
114.15		88Y		1112		36		1049		30
114.20	89X		1113		12		1176		12	
114.25		89Y		1113		36		1050		30
114.30	90X		1114		12		1177		12	
114.35		90Y		1114		36		1051		30
114.40	91X		1115		12		1178		12	
114.45		91Y		1115		36		1052		30
114.50	92X		1116		12		1179		12	
114.55		92Y		1116		36		1053		30
114.60	93X		1117		12		1180		12	
114.65		93Y		1117		36		1054		30
114.70	94X		1118		12		1181		12	
114.75		94Y		1118		36		1055		30
114.80	95X		1119		12		1182		12	
114.85		95Y		1119		36		1056		30
114.90	96X		1120		12		1183		12	
114.95		96Y		1120		36		1057		30
115.00	97X		1121		12		1184		12	
115.05		97Y		1121		36		1058		30
115.10	98X		1122		12		1185		12	
115.15		98Y		1122		36		1059		30

Table 1.4-2: DME CHANNEL FREQUENCY AND CODE PULSES

CHANNEL PAIRING			DME PARAMETERS							
VHF FRECUENCY (MHz)	DME CHANNEL NUMBER		AIRBORNE INTERROGATION				GROUND REPLY			
			FREQUENCY (MHz)		PULSE CODE (µs)		FREQUENCY (MHz)		PULSE CODE (µs)	
115.20	99X		1123		12		1186		12	
115.25		99Y		1123		36		1060		30
115.30	100X		1124		12		1187		12	
115.35		100Y		1124		36		1061		30
115.40	101X		1125		12		1188		12	
115.45		101Y		1125		36		1062		30
115.50	102X		1126		12		1189		12	
115.55		102Y		1126		36		1063		30
115.60	103X		1127		12		1190		12	
115.65		103Y		1127		36		1064		30
115.70	104X		1128		12		1191		12	
115.75		104Y		1128		36		1065		30
115.80	105X		1129		12		1192		12	
115.85		105Y		1129		36		1066		30
115.90	106X		1130		12		1193		12	
115.95		106Y		1130		36		1067		30
116.00	107X		1131		12		1194		12	
116.05		107Y		1131		36		1068		30
116.10	108X		1132		12		1195		12	
116.15		108Y		1132		36		1069		30
116.20	109X		1133		12		1196		12	
116.25		109Y		1133		36		1070		30
116.30	110X		1134		12		1197		12	
116.35		110Y		1134		36		1071		30
116.40	111X		1135		12		1198		12	
116.45		111Y		1135		36		1072		30
116.50	112X		1136		12		1199		12	
116.55		112Y		1136		36		1073		30

Table 1.4-2: DME CHANNEL FREQUENCY AND CODE PULSES

CHANNEL PAIRING			DME PARAMETERS							
VHF FRECUENCY (MHz)	DME CHANNEL NUMBER		AIRBORNE INTERROGATION				GROUND REPLY			
			FREQUENCY (MHz)		PULSE CODE (µs)		FREQUENCY (MHz)		PULSE CODE (µs)	
116.60	113X		1137		12		1200		12	
116.65		113Y		1137		36		1074		30
116.70	114X		1138		12		1201		12	
116.75		114Y		1138		36		1075		30
116.80	115X		1139		12		1202		12	
116.85		115Y		1139		36		1076		30
116.90	116X		1140		12		1203		12	
116.95		116Y		1140		36		1077		30
117.00	117X		1141		12		1204		12	
117.05		117Y		1141		36		1078		30
117.10	118X		1142		12		1205		12	
117.15		118Y		1142		36		1079		30
117.20	119X		1143		12		1206		12	
117.25		119Y		1143		36		1080		30
117.30	120X		1144		12		1207		12	
117.35		120Y		1144		36		1081		30
117.40	121X		1145		12		1208		12	
117.45		121Y		1145		36		1082		30
117.50	122X		1146		12		1209		12	
117.55		122Y		1146		36		1083		30
117.60	123X		1147		12		1210		12	
117.65		123Y		1147		36		1084		30
117.70	124X		1148		12		1211		12	
117.75		124Y		1148		36		1085		30
117.80	125X		1149		12		1212		12	
117.85		125Y		1149		36		1086		30
117.90	126X		1150		12		1213		12	
117.95		126Y		1150		36		1087		30

1.5 MECHANICAL DESCRIPTION

A DME system model NORMARC LDB-103, consists of two sets of electronic equipments, one connected to its transmitting receiving antenna system, and a transfer relay unit. The antenna system includes monitoring couplers that sense the transmitted signal. The equipment rack is normally housed inside its equipment shelter that may be located at some distance away from the antenna.

A DME equipment is housed in one single 19' 33U high cabinet and fitted in two subracks, one of 3U high for common modules, and one of 6U high, for system #1 modules, on the Left Hand Side, and system #2 modules, on the Right Hand Side.

The modules, visible from the front face of the cabinet are, from left to right:

- DME Subrack 1: LCU - RCU.
- DME Subrack 2, for system #1: HPA - TXU - RXU - MTU 1 - Blank Panel - CMU.
- DME Subrack 2, for system #2: CMU - Blank Panel– MTU4 - RXU - TXU - HPA.

The two independent Power Supply Units (PSUs) for the 2 sets of equipment are placed below and the LCU with touch-screen control is located above the equipment sub-rack. There is enough space in the cabinet for standby battery of up 28 hours (100 W model) or 11.5 hours (1 kW model) of operation (27000 ppps) without AC power supply.

All of the LRUs are hot swappable and can be quickly diagnosed and replaced. Each module has its own LED status indicator and extensive built-in-test (BITE) circuitry providing simple and effective diagnostic of fault, both locally and remotely.

The equipment is operated from a mains power supply with a nominal output voltage of +24 VDC, which is also used as a float charger for a standby battery supply.

The equipment is designed for unattended operation and may be controlled and monitored from a remote location. Connection to the remote site can be accomplished by multiple means including dial-up modem, leased-lines, radio, IP-based virtual private network (VPN), Ethernet, and cellular networks. The management and control of the equipment is by standardized protocols HTTP and SNMP over encrypted channels.

1.5.1 Components Schedule: System Structure.

This Indra's code structure of the HW and/ or SW products consists of an Arabic number of thirteen digits, according to the "*Procedimiento General. Sistema de Codificación e Identificación de Indra*" (PRG-IDR-068) ("General Procedure. Code and Identification System of Indra") [RD.1].

For the particular case of the Navaid Programmes, two additional digits are added, whose object is the configuration control relating to the model and its compatibility.

The general code assigned to the Distance Measuring Equipment (DME) NORMARC LDB-103 Systems is:

0063400000100

The structure of the codes is as follow (without spaces):

00634	DEEEEE	FF	.	GG
(1)	(2)	(3)	.	(4)
13 digits code structure of Indra				*2 digit model code*

1) 00634 - Field (1): NORMARC LDB-103 DME General Code

2) DEEEEE - Field (2): The six numbers have a different meaning according to the class.

   a) For trade articles, the Coding department assigns a certain combination of numbers for each class, with relation to its characteristics.

   b) For HW and SW products of Indra design, the field (2) shall follow the following structure:

D	EEEEE
Range	Identifier

D - Range:

In an obligatory way, the digits to be assigned are:

0	Product object of a Project / System
1	Subsystems / Equipments
2	Subsets
3	Equipped Printed Circuit Boards
4	Non commercial equipped wires
5	Non commercial inductive components
6	Modified commercial elements
7	Printed Circuit Boards
8	Pieces / items of Indra design
9	Software / Firmware of Indra design

EEEEE - Identifier:

The 5 digits of the identifier are used in a sequential way and in chronological order, according to the codification requests arrival order.

3) FF - Field (3): These two digits mean:

   a) For commercial products: The quality or variety level that the manufactures offer for the same article.

   b) For HW and SW products of Indra design: The product version (understanding what affects the functionality or interchangeability), beginning from 00 to 79.

   c) GG - Field (4): Model field to control configuration state and identify functional capacities and parameters configuration of the DME beacon.

4) Any other configuration according to customer requirements shall be configured as a new model and included in this document by a revision.

1.5.2 Major Items

The major items of equipment supplied, as part of the DME series NORMARC LDB-103, are listed in the following table. The type number is shown for each item.

Table 1.5-1: NORMARC LDB-103 MAJOR ITEMS

ITEM	TYPE No.	PURPOSE
NORMARC LDB-103 rack	006342 00001 GG	Contains all modules: Generation and amplification, receiver stages, signal distribution, operation monitor, power supply.
DME CABINET	006342 00010 XX[1]	Contains couplers and splitters for injecting interrogations and receiving replies, motherboards, power supplies and internal distribution wiring.
LCU [Local Control Unit]	006342 00031 00	Provides a GUI, giving local access to status and alarm information and basic control functions.
RCU [Relay Control Unit]	006342 00032 00	Analyze alarms and selects active system
CMU [Control & Management Unit]	006342 00041 00	Collects and distributes status and performance information. Manages system database and communication network.
MTU [Monitor Transponder Unit]	006342 00042 00	Produces simulated interrogation pulses. Measures various DME parameters
RXU [Receiver Unit]	006342 00043 00	Detects valid DME interrogation pulses in the assigned CH.
TXU [Transponder Unit]	006342 00044 00	Generates reply pulses and amplifies to 100 W level.
HPA [High Power Amplifier]	006342 00045 00	Amplifies reply pulses from TXU to more than 1 kW level (Only HP models).
NMP/EIU [Network Management Processor /External Interface Unit]	006342 00061 00	Network Gateway for remote control and management. External Interface point. Only the most using connector are wired.
NMP/EIU FW [Network Management Processor/External Interface Unit Full Wire]	006342 00070 00	Network Gateway for remote control and management. External Interface point. In this version, all the connectors are wired.

[1] There are different models: 006342 00010 07, 006342 00010 08, 006342 00010 09, 006342 00010 10.

Table 1.5-1: NORMARC LDB-103 MAJOR ITEMS

DC Power Kit	006342 0006 600	Battery Reversal Protection.	
Output Sample Panel	006342 0008 000	Allows the capability to measure the antenna signals with external instruments.	
AC Input Box	006342 0001 30X[2]	AC Input Box.	
DME Antenna	00634 20000 300	Omnidirectional Antenna Assy	Radiates reply pulses and receives interrogation pulses. Receives a sample of the signal radiated by the transponder for purposes of monitoring.
	13001 06420 000	Directional Antenna	
Installation Accessories	00634 20000 400	Provides accessories that permit withdrawal of the individual rack modules for servicing.	

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[2] There are different models: 006342 0001 301, 006342 0001 302, 006342 0001 303, 006342 0001 304.

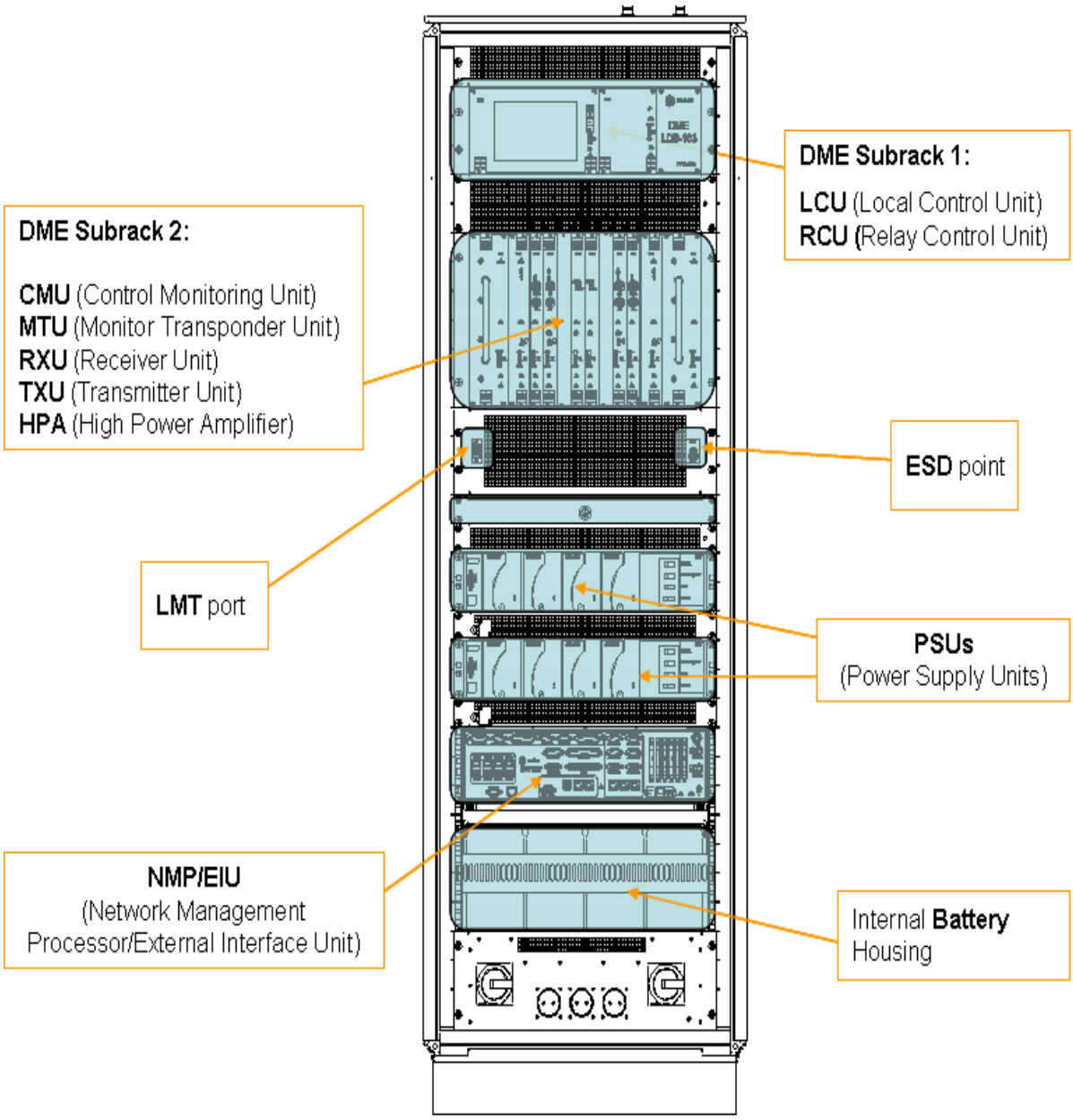


Figure 1.5-1: NORMARC LDB-103 DME CABINET LAYOUT - FRONT VIEW

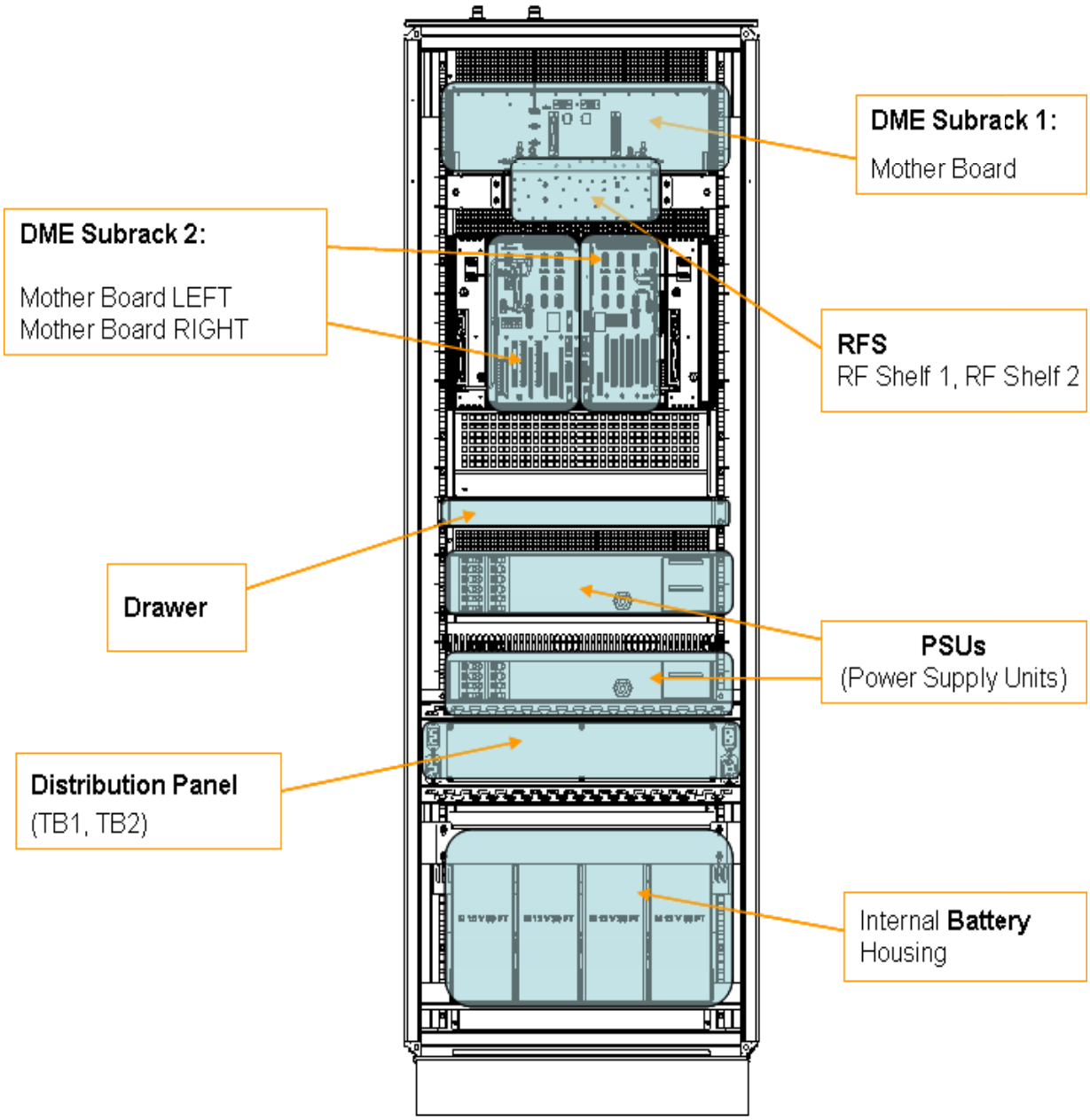


Figure 1.5-2: NORMARC LDB-103 DME CABINET LAYOUT - REAR VIEW

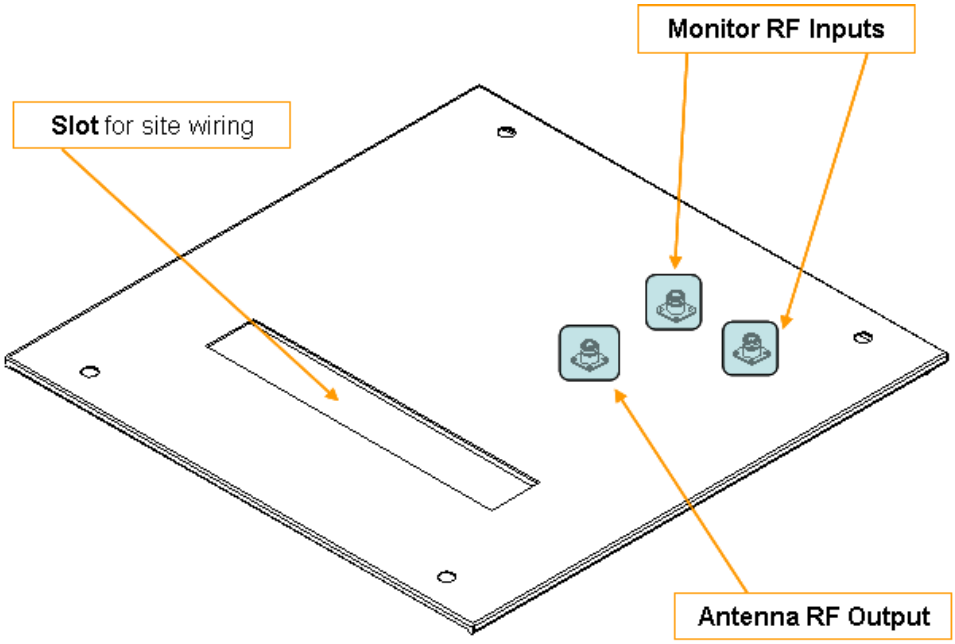


Figure 1.5-3: NORMARC LDB-103 DME CABINET LAYOUT - TOP VIEW

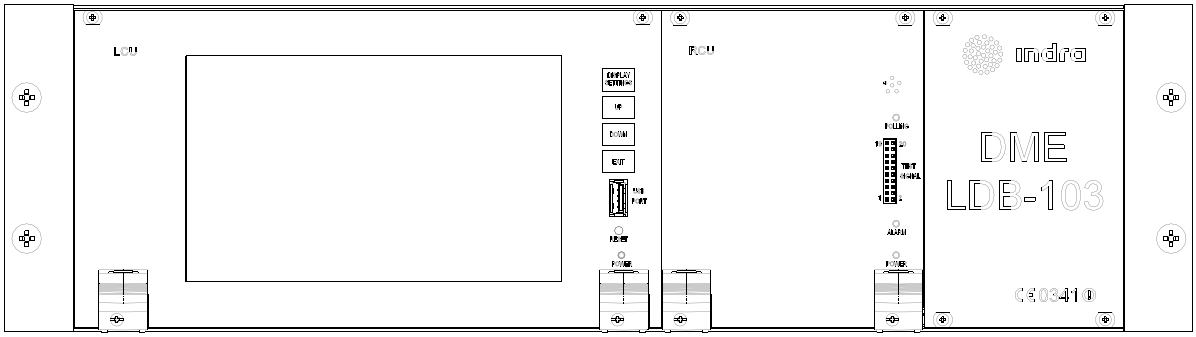


Figure 1.5-4: NORMARC LDB-103 DME- SUBRACK 1 LAYOUT

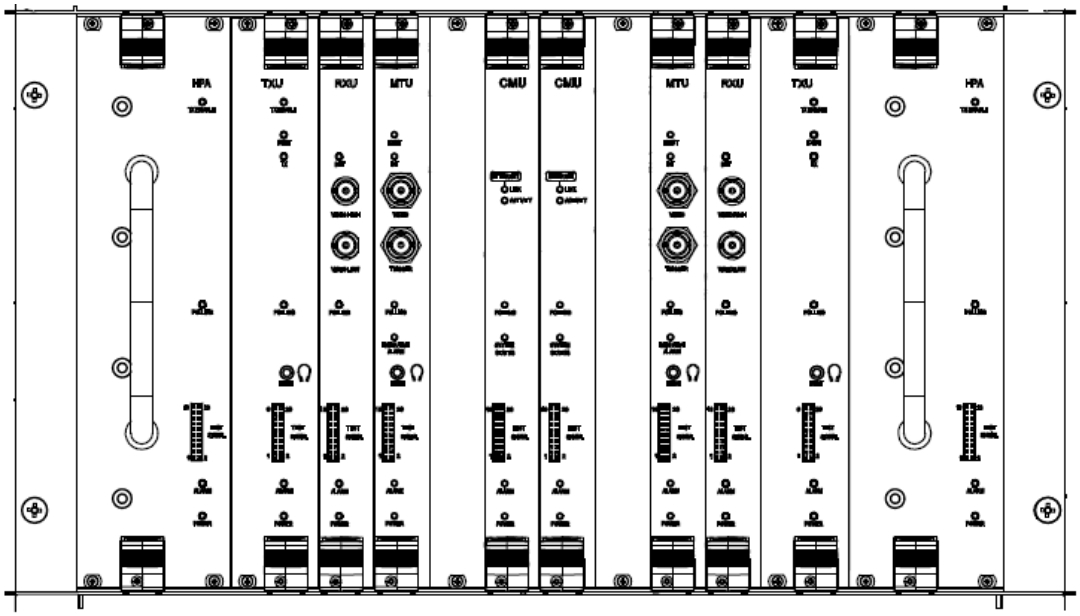


Figure 1.5-5: NORMARC LDB-103 DME HP- SUBRACK 2 LAYOUT

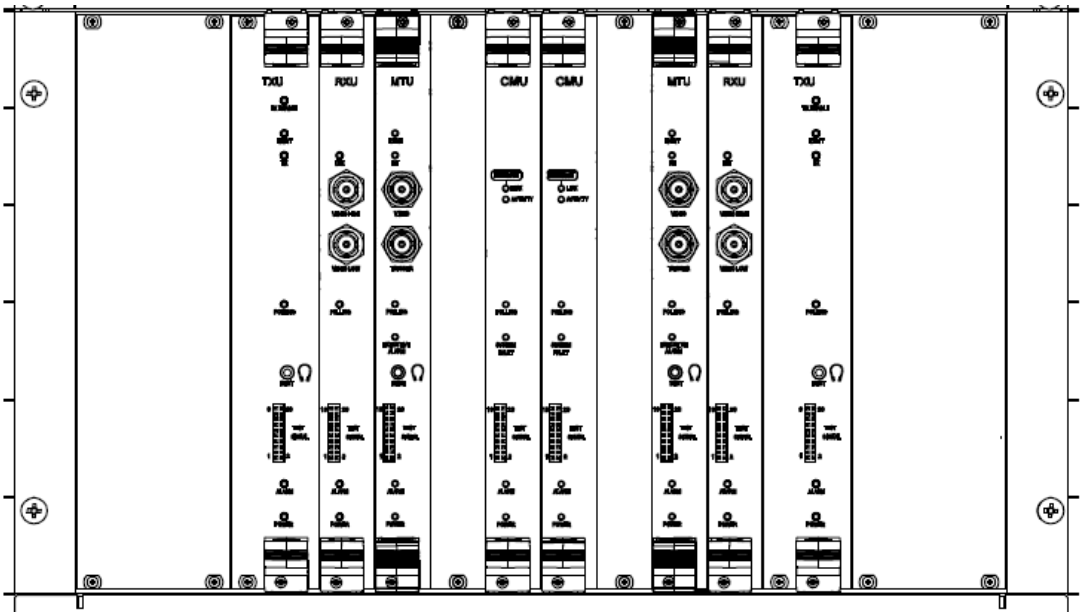


Figure 1.5-6: NORMARC LDB-103 DME LP- SUBRACK 2 LAYOUT

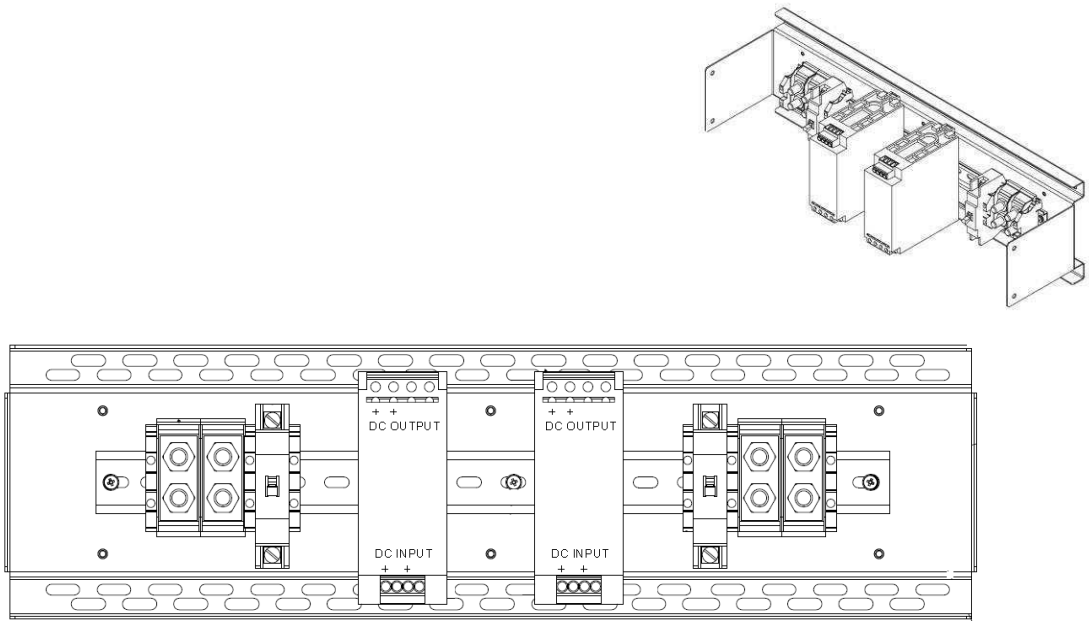


Figure 1.5-7: NORMARC LDB-103 DME - DC POWER KIT[3]

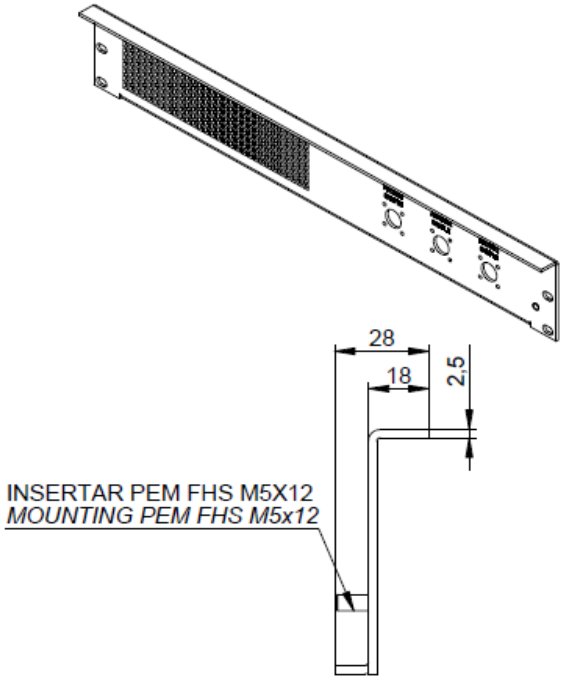


Figure 1.5-8: OUTPUT SAMPLES FRONT PANEL[4]

[3] Only for NORMARC LDB-103 DME Model .14 and Model .15

[4] Only for NORMARC LDB-103 DME Model .31 and Model .41

1.5.3 Dimensions and Masses

The dimensions and masses of the main items of the NORMARC LDB-103 DME system are listed in the table below. All dimensions are in millimeters.

Table 1.5-2: NORMARC LDB-103 DIMENSIONS AND WEIGHTS

ITEM	TYPE No.	HEIGHT (mm)	WIDTH (mm)	DEPTH (mm)	MASS (kg)
DME rack - 1kW [All modules and w/o batteries]	006342 00001 GG	1680	600	600	210

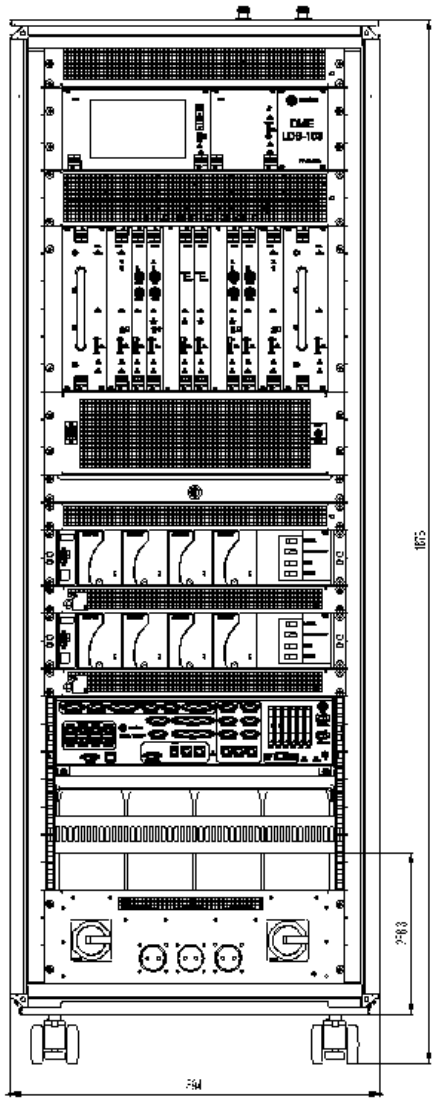


Figure 1.5-9: DME RACK - NORMARC LDB-103 SYSTEM

1.6 INTERFACES

This section describes the NORMARC LDB-103 main interfaces. For further details, refer to Indra document 'LDB-103 External Interface Document', Indra code 0063400000100IC00 [RD.2].

The DME LDB_103 equipment external interfaces are divided in the following functional groups:

- Power Supply:
  - Main Supply.
  - Battery Supply.
- Radiofrequency.
- Navaids interface:
  - Identification functions.
  - Relay / Optocoupled input/outputs.
- Testing.
- Communications.

1.6.1 Power Supply

The primary supply requirement for a NORMARC LDB-103 DME rack, which contains single set of equipment is:

- Input voltage: 90 to 275 VAC single phase.
  70 to 320 VAC with derated output at low end and power factor at high end.
- Input frequency: 50 / 60 Hz nominal, 45 to 70 Hz operational.
- DC voltage: +24 V nominal.
- DC current consumption:

	100W Model Dual Transponder Dual Monitor [per single TXP]	1kW Model Dual Transponder Dual Monitor [per single TXP]
Operating at squitter rate	2.2 A	4.0 A
Operating at 2700 pps	2.5 A	5.5 A
Operating at maximum reply rate	3.0 A	11.0 A
TXP with Transmitter Disabled	2.0 A	2.0 A
Battery charging (typical)	5.0 A	5.0 A

As an option, the NORMARC LDB-103 DME equipment can be powered by a nominal external DC source of +24 VDC [5].

A detailed description of how to connect these interfaces is given in Section 6.4.6 (Power Connections).

[5] Only for NORMARC LDB-103 DME Model .14 and Model .15

1.6.1.1 Main Supply

Considering an AC/DC efficiency conversion for PSU modules of 90% and a power factor for the electrical installation of 0.85, the typical consumption demands per NORMARC LDB-103 DME system:

100W Model [operating at]	Single Transponder Dual Monitor	Dual Transponder Dual Monitor [Cold Standby]	Dual Transponder Dual Monitor [Hot Standby]
Squitter rate	80.0 VA	150.0 VA	160.0 VA
2700 ppps	90.0 VA	160.0 VA	170.0 VA
Maximum rate	110.0 VA	180.0 VA	190.0 VA
2700 ppps charging 1 battery set*	270.0 VA	340.0 VA	350.0 VA
2700 ppps charging 2 battery sets*	- VA	525.0 VA	530.0 VA
Max. rate charging 1 battery set*	290.0 VA	360.0 VA	370.0 VA
Max. rate charging 2 battery sets*	- VA	540.0 VA	550.0 VA

(*)A battery set is composed of two 90 Ah batteries.

1 kW Model [operating at]	Single Transponder Dual Monitor	Dual Transponder Dual Monitor [Warm Standby]	Dual Transponder Dual Monitor [Hot Standby]
Squitter rate	145.0 VA	220.0 VA	290.0 VA
2700 ppps	200.0 VA	270.0 VA	340.0 VA
Maximum rate	400.0 VA	470.0 VA	540.0 VA
2700 ppps charging 1 battery set*	380.0 VA	450.0 VA	520.0 VA
2700 ppps charging 2 battery sets*	- VA	625.0 VA	700.0 VA
Max. rate charging 1 battery set*	580.0 VA	645.0 VA	720.0 VA
Max. rate charging 2 battery sets*	- VA	820.0 VA	900.0 VA

(*)A battery set is composed of two 90 Ah batteries.

1.6.1.2 Battery Supply

Assuming a maximum operational consumption of 11 Amps per single 1 kW equipment and due to each single equipment is configured with an independent battery set, the 80% DOD discharge time is estimated in more than 4 hours for the recommended battery model considered in any reply rate and output power scenario.

- Squitter rate consumption:
  - 100 W model: > 35.5 hrs for 80% DOD.
  - 1 kW model: > 13.9 hrs for 80% DOD.
- 2700 ppps consumption:
  - 100 W model: > 28.3 hrs for 80% DOD.
  - 1 kW model: > 11.5 hrs for 80% DOD.

- Maximum reply rate consumption:
  - 100 W model: > 23.5 hrs for 80% DOD.
  - 1 kW model: > 5.7 hrs for 80% DOD.

1.6.2 Radiofrequency Ports

This interface is a radiofrequency interface for the transmission/reception and monitoring of the DME signals through the DME Antenna subsystem.

The RF interface with the Antenna subsystem is composed of 3 coaxial ports:

- One transmission and reception port.
- Two monitor probes.

These three radiofrequency ports are 50 Ω N-type female coaxial connectors.

The main port (transmission/reception) is connected to the Relay Control Unit (RCU), which performs the ON AIR TXP selection. Monitor probes are connected to the RF Shelf, which split these signals obtaining four different monitor probes, one per Monitor Transponder Unit (MTU).

1.6.3 Identification Functions

The NORMARC LDB-103 DME series equipment has the following lines related with the identification interface.

- 2 Key inputs.
- 2 Key outputs.
- 1 Key Bypass input.

1.6.4 Relay/Optocoupled I/O

The NORMARC LDB-103 DME series equipment has the following optocoupled inputs and relay outputs that can be used for alarm extension:

- 2 inputs to CMU.
- 4 inputs to MTU.

All of these optocoupled inputs are configurable under software control.

- 5 NC relay outputs from CMU.
- 5 NO relay outputs from CMU.
- 4 NC relay outputs from MTU.
- 4 NO relay outputs from MTU.
- 1 Key relay output from MTU.

All of these relay outputs are configurable under software control. The relay outputs are based on solid-state devices.

1.6.5 Testing

Although they are not necessary for the recommended maintenance tasks, all LRU modules have test connectors for additional maintenance capabilities.

1.6.6 Communications

Site remote control can be performed by a connection accomplished by multiple means, including dial-up modem, leased lines, radio links, IP-based virtual private network, Ethernet, and cellular networks through the NMP/EIU.

There are two CAT5 Ethernet connections, which are used for local/remote access to control and monitorize the system.

One of the CAT5 Ethernet connector is placed in the front panel of the equipment allowing an easy connection with a Local Maintenance Terminal (LMT).

The Network management Processor/External Interface Unit (NMP/EIU) is fitted into the rack. It provides the network interface of the NORMARC LDB-103 DME equipment via an Ethernet connector.

These interfaces use standard HTTP and SNMP protocols over encrypted channels.

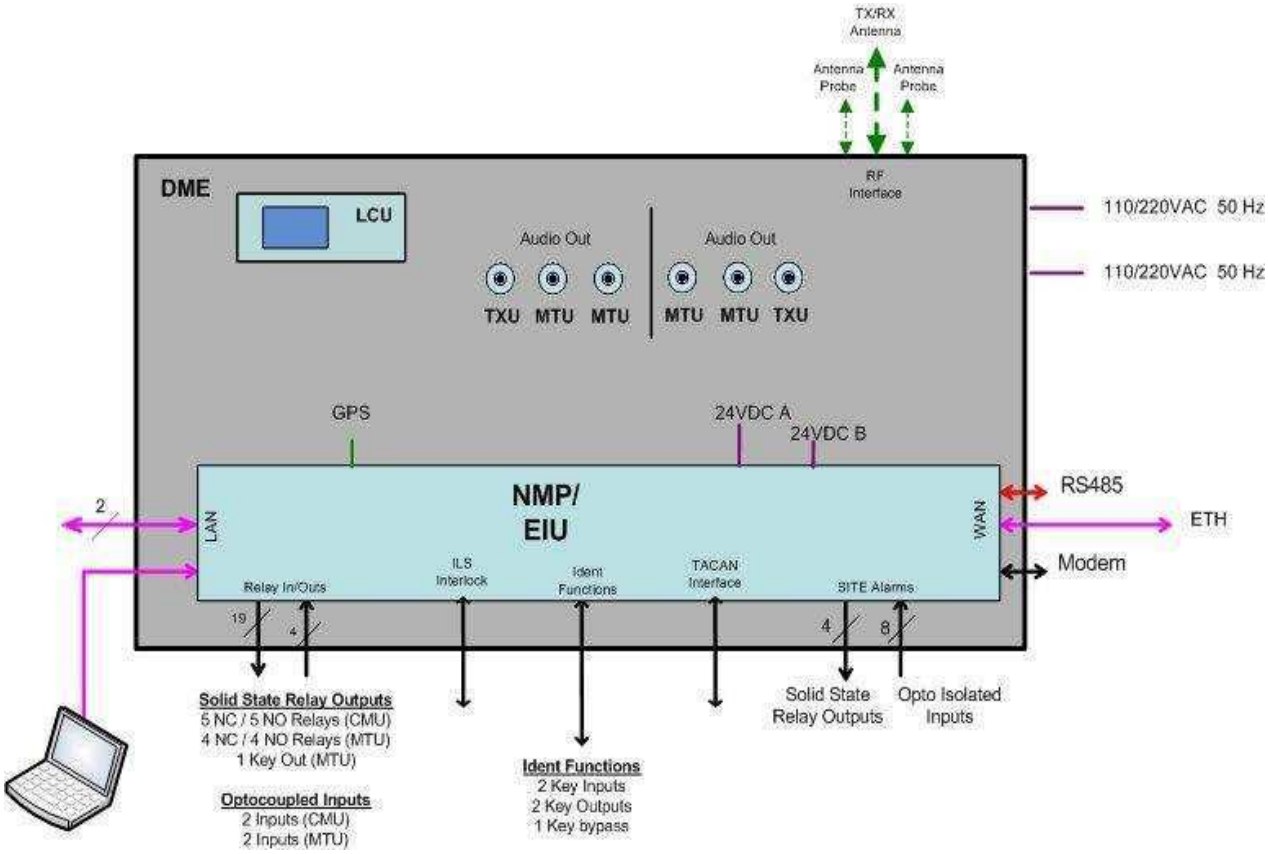


Figure 1.6-1: NORMARC LDB-103 DME EXTERNAL INTERFACES OVERVIEW

A detailed description of this interfaces and how to connect them is given in Section 6.4.7 (External Wiring) and Annex A.2 (NMP/EIU Facilities).

1.7 NORMARC LDB-103 DME PERFORMANCES

The performance parameters of the major system functions and the location and functions of all system controls and indicators are given in the following tables.

1.7.1 System Performance

Table 1.7-1: SYSTEM PERFORMANCES

PARAMENTER	VALUE
Model	NORMARC LDB-103
Coverage	100 W Model > 60 NM 1 KW Model > 200 NM
Standard Compliance	ICAO Annex 10 ICAO Doc 8071, EUROCAE ED-57 CE marking
Aircraft Handling Capacity	> 200 Interrogators
Module Hot Replacement	Yes
System Reply Delay	X Channel: Nominal: 50 µs Adjustable: 35 µs to 80 µs Step: 0.5 µs Y Channel: Nominal: 56 µs Adjustable: 51 µs to 80 µs Step: 0.5 µs
Reply Delay Time Stability (TXP Accuracy)	-10 to -79 dBm ± 0.25 µs (37.5 m; 0.02NM) -79 to -94 dBm ± 0.5 µs (75 m; 0.04 NM)
Operational Temperature	–20 °C to + 60 °C for indoor installed parts
Status Indication	Full Local and remote indication
System Monitoring (BITE)	Complete System and LRU Monitoring by microprocessor
Remote/Local Control Interface	Ethernet (RS-232 & RS485 as option)
Keyed LRUs	YES
Dimensions	600 mm wide 600 mm depth 1467 mm high (33U) 19” Standard rack

1.7.2 AC Power Supply Performances

Table 1.7-2: AC POWER SUPPLY CHARACTERISTICS

PARAMETER	VALUE
Configuration	Triple redundancy: Dual PSU; Dual internal AC/DC conversion; Dual battery banks.
Output Voltage Adjustment Range	+21 VDC to +30 VDC
Output Current Rating	28 A max at +27VDC
Input Voltage Range	+90 VAC to +276 VAC & Soft Start
Ambient Temperature Range	-20ºC to +60ºC
Input Frequency	45 Hz to 70 Hz
Line Regulation	< ± 0.1%
Load Regulation	< ± 2%, 10% - 90% load step
Noise and Ripple	< 100 mVp-p up to 100MHz
Temp Coefficient, Output Voltage	< 100 ppm/ºC
Temp Coefficient, Charging Voltage	Programmable
Transient Response	< 2 mS, 10% - 90% load step
Efficiency	> 90% at normal conditions
Cooling	Natural Convection
Protection **Over Current** **Over / Under Voltage** **Reverse Voltage** **Over Temperature**	 Fold Back Limit Current then Shutdown Fuse Reduce output then Shutdown
Management	HTTP, SNMP
Control	Programmable Limits: Output Voltages & Current Output Power Alarm Limits Start Mode & Start Delay
Alarms	Programmable Under & Over Voltages Current Limit & Power Limit

1.7.3 External DC Power Supply[6]

Table 1.7-3: EXTERNAL DC POWER SUPPLY CHARACTERISTICS

PARAMETER	VALUE
Configuration	Dual external DC source
Input Voltage Range	+21 VDC to +30 VDC
Minimum Intput Current Rating	30 A at +27VDC
Line Regulation	< ± 0.1%
Load Regulation	< ± 2%, 10% - 90% load step
Noise and Ripple	< 100 mVp-p up to 100MHz
Transient Response	< 2 mS, 10% - 90% load step
Protection **Over Current** **Over / Under Voltage** **Reverse Voltage** **Over Temperature**	 Fold Back Limit Current then Shutdown Breaker Reduce output then Shutdown
Control	Programmable Limits: Output Voltages & Current Output Power Alarm Limits Start Mode & Start Delay
Alarms	Programmable Under & Over Voltages Current Limit & Power Limit

[6] Only for NORMARC LDB-103 DME Model .14 and Model .15

1.7.4 Transmitter Performances

Table 1.7-4: TRANSMITTER CHARACTERISTICS

PARAMETER	VALUE
Power Output (at cabinet connector)	> 100W (Low Power Model) > 1KW (High Power Model)
Power Output Control	0 to -4 dB Step: 0.25 dB
Frequency Range	960 MHz to 1215 MHz
Frequency Stability	Better than ± 2 ppm (0.0002%)
Frequency Control	By synthesizer
Channels	252 (126 X and 126 Y) (spaced 1 MHz in accordance with ICAO Annex 10)
RF Pulse Spectrum	En-route (1KW): 47 dB @ 0.8 MHz 65 dB @ 2 MHz Terminal (100W): 37 dB @ 0.8 MHz 55 dB @ 2 MHz
Pulse Shape	Gaussian
Pulse Rise Time	2.50 (-1.00 +0.25) µs
Pulse Fall Time	2.50 (-1.00 +0.25) µs
Pulse Amplitude Stability	≥ 95%
Pulse Width	3.5 ± 0.5 µs
Pulse Pair Spacing	X Channel: 12 ± 0.1µs Y Channel: 30 ± 0.1µs
Peak power variation (between constituent pulses)	≤ 0.5 dB
Pulse Repetition Rate	up to 7000 pps
Spurious Radiation (between individual pulses)	< -80 dB of Peak Output Power
Spurious Radiation (out of band. 10 to 1800 MHz)	< -40 dBm/kHz
CW EIRP	≤ -10 dBm
Output Impedance	50 Ω
Squitter pulses	700 to 850 ppps
Squitter pulses with 90% load	< 5%
Reply Efficiency	≥ 70%
Reply Priority	1. Identification Pulses 2. Reply Pulses 3. Squitter Pulses

Table 1.7-5: IDENTIFICATION CHARACTERISTICS

PARAMETER	VALUE
IDENT Signal	ICAO Annex 10
Operation modes	Independent/associated
Associates operation modes	Master/Slave
IDENT Signal Pulse Rate	1350 ± 10 ppps
Transmission speed	≤ 8 words/minute
Number of characters	≤ 4
IDENT Transmission	adjustable from 30 to 45 s Step: 1 s
Dot length	Adjustable from 0.1 to 0.16 s Step: 0.01 s
Dash length	3 dots
Time between dots and/or dashes	1 dot ± 10%
Time between letters or numeral	≥ 3 dots
Identification code group	≤ 10 s
Keydown length	≤ 5 s

1.7.5 Receiver Performances

Table 1.7-6: RECEIVER CHARACTERISTICS

PARAMETER	VALUE
Frequency Range	1025 to 1150 MHz
Frequency Stability	Better than ± 2 ppm (0.0002%)
Frequency Control	By synthesizer
Input impedance	50 Ω
Input Maximum Level	Operational: -5 dBm Survival: +20 dBm(1025 to 1150 MHz)
Transponder Sensitivity	-94 dBm
Sensitivity variation **(Transponder rate: 0 - 90% maximum load)**	< 1dB
Automatic Sensitivity Variation (TXP load > 90%)	≥ 60 dB
Dynamic Range	-17 to -106 dBW/m^2 at TXP antenna
Adjacent Channel Rejection (900 KHz)	> 90 dB
Intermediate Frequency Rejection	> 85 dB
Image frequency Rejection	> 75 dB
Other Spurious Rejection **(960 to 1215 MHz)**	> 85 dB
Receiver Bandwidth	≥ 100 KHz (3 dB). Necessary to meet accuracy specification
Decoding	X Channel: 12 ± 1 µs Y Channel: 36 ± 1 µs
Decoder Rejection	± 2 µs
Sensitivity variation with pulse spacing	< 1 dB ±1 µs > 90 dB ±3 µs
TXP Dead Time	Adjustable from: 50 to 150µs Step: 0.05 µs
Recovery time **Sensitivity Threshold variation**	< 1 dB at 8µs of undesired pulses up to 60 dB above threshold
Sensitivity Reduction by CW	< 2 dB CW level 10 dB below sensitivity
Efficiency reduction by CW	< 10% CW level 6 dB below interrogation level
Short Distance Echo Suppression (SDES)	YES
Long Distance Echo Suppression (LDES)	YES

1.7.6 Monitor Performances

Table 1.7-7: MONITOR CHARACTERISTICS

PARAMETER	VALUE
Configuration	Two independent monitors with pulse generator
TXP triggering	≤ 120 ppps
Decision	Configurable: AND / OR
Alarm configuration	Configurable between primary and secondary
Alarm delay	< 10s
Alarms	Delay Pulse Pair Spacing Reply efficiency Transmission Rate Radiated Power Transmitted Power Receiver Frequency Transmitter Frequency Ident Sensitivity (by means of reply efficiency)
Alarm Thresholds	Configurable

Table 1.7-8: ALARM THRESHOLDS

PARAMETER	VALUE
Delay (deviation)	Nominal Value: 700 ns Adjustable margin: 0 to 1000 ns Step: 50 ns
Pulse Spacing (deviation)	Nominal Value: 0.7 µs Adjustable margin: 0 to 1000 ns Step: 50 ns
Reply efficiency	Nominal Value: < 70% Adjustable margin: 0 to 100 % Step: 1%
Transmission Rate	Nominal Value: < 700 ppps > 4500 ppps Adjustable margin: < 400 to 1000 ppps > 2000 to 5000 ppps Step: 5 ppps
Radiated Power	Nominal Value: -3 dB Adjustable margin: -1 to -6 dB (80/800W to 25/2500W) Step: 0.5 W

Table 1.7-8: ALARM THRESHOLDS

PARAMETER	VALUE
Transmitted Power	Nominal Value: -3 dB Adjustable margin: -1 to -6 dB (80/800W to 25/2500W) Step: 0.5 W
Receiver Frequency (deviation)	Nominal Value: 10 ppm Adjustable margin: 1 to 20 ppm Step: 1 ppm
Transmitter Frequency (deviation)	Nominal Value: 10 ppm Adjustable margin: 1 to 20 ppm Step: 1 ppm
Pulse Rise	Nominal Value: 1.5 µs Adjustable margin: 1 to 3.5 µs Step: 0.05 µs
Pulse Decay time	Nominal Value: 1.5 µs Adjustable margin: 1.5 to 3.5 µs Step: 0.05 µs
Pulse Width	Nominal Value: 3.5 µs Adjustable margin: 2.5 to 4.5 µs Step: 0.05 µs
Constituent Pulses Power variation	Nominal Value: 0.52 dB Adjustable margin: 0.52 to 2dB Step: 0.5 dB
IDENT. Frequency (deviation)	Nominal Value: < 725 Hz > 758 Hz Adjustable margin: < 745 to 800 Hz > 500 to 740 Hz Step: 1Hz
IDENT. Code groups length	Nominal Value: > 10s Adjustable margin: 1 to 120 s Step: 0.01 s
IDENT. Absence	Nominal Value: > 30 s Adjustable margin: 5 to 100 s s Step: 0.01 s
IDENT. Key down period	Nominal Value: < 5s > 0.2s Adjustable margin: < 0 to 0.9 s > 0 to 5 s Step: 0.01s
Sensitivity	Nominal Value: -91 dBm Adjustable margin: - 76 to -91 dBm Step: 1 dB

Table 1.7-9: MONITOR SIGNAL GENERATOR PERFORMANCES

PARAMETER	VALUE
Interrogation Signals	ICAO Annex 10
Pulse Shape	Gaussian
Pulse Rise Time	2.5 ±0.5 µs
Pulse Fall Time	2.5 (+0.5 µs; -1 µs)
Pulse Amplitude Stability	≥ 95%
Pulse Width	3.5 ± 0.5 µs
Pulse Pair Spacing	X Channel: 12 ± 0.2µs Y Channel: 30 ± 0.2µs
Peak power variation (between constituent pulses)	≤ 0.5 dB
RF Pulse Spectrum	> 90% within 0.5 MHz centred on the interrogation frequency Remaining energy equally distributed on both sides of 0.5 MHz band
Out of band spurious radiation (10 to 1800 MHz) (excluding 1039 to 1085 MHz)	< -40 dBm/kHz
Spurious Radiation (between pulses)	≤ -80 dBm
Power Output Control (at RXU connector)	-10 dBm to -111 dBm Step: 1 dB Accuracy: ±1dB
Pulse Spacing Control	Up to ± 3µs Step: 0.1 µs
Frequency Control	960 to 1215 MHz Step: 100 kHz
Transmission Rate (normal operation)	up to 120 pps per monitor
Transmission Rate Control	0 to 10000 pps Step: 10 ppps
CW capability	Yes
Frequency Stability	± 1 ppm

1.7.7 Control & Status Features

Table 1.7-10: LOCAL / REMOTE MONITORING FACILITIES

PARAMETER	VALUE / LIMITS
Local Monitoring	LCP and/or laptop
Remote Monitoring	Laptop (via NMP)
Connectivity (with NMP)	RS-232/RS485 RTC and cellular networks Leased Lines/ Fiber optic Radio links Ethernet/VPN
Management	HTTP / SNMP / SSH
Access Management	Five password level protection
Front Panel Status Indicators	Beacon status Maintenance Power status Battery status Alarm status Transmitter status
Control (including but not limited to)	Configuration settings On/Off – Changeover Monitor bypass RF Power level Ident code Ident code internal or external source. Fault levels and internal thresholds Alarm threshold levels Power supply controls Local/Remote
Monitored Parameters (system parameters)	Beacon delay Pulse pair spacing Transmitted power Efficiency TX & RF frequency Pulse characteristics Radiated power Transmission rate Identity code
Monitored parameters (module parameters)	VSWR Voltage Rails Temperatures Status Power Supply
Monitored Parameters (Static)	Hardware Built State Software Built-State Unit Status (Master or Slave) Calibration Information

1.7.8 Antenna Performances

Following, you can find the minimum recommended performances of antennas for the NORMARC LDB-103 DME.

1.7.8.1 Directional Antenna

Table 1.7-11: MINIMUN RECOMMENDED PERFORMANCE –DIRECTIONAL ANTENNA

PARAMETER	VALUE / LIMITS
Type	Directional
Inputs (antenna and monitoring probes)	N female connector (protected by a rubber cap)
Frequency range	960 – 1215 MHz
VSWR	< 1.6 (antenna input)
Gain	16 dBi
Impedance	50 Ω
Coupling attenuation	25 ± 3 dB (antenna/monitoring probes)
Beam tilt	+ 4° ± 0.5°
R. F. peak power	10 kW; duty cycle 2%
Polarization	Vertical
temperature range	–30 °C to + 60 °C ambient
Wind load	600 N (at 160 km/h)
Max. wind velocity	200 km/h (incl. 1/ 2'' radial ice)

1.7.8.2 Omnidirectional Antenna

Table 1.7-12: MINIMUN RECOMMENDED PERFORMANCE – OMNIDIRECTIONAL ANTENNA

PARAMETER	VALUE / LIMITS
Type	Omni-directional
Circularity	± 1 dB max on horizon
Frequency range	960 through 1215 MHz (no adjustments or tuning required)
Polarization	Vertically polarized
Gain, main beam	8 dBi, minimum
Gain, horizon	6 dBi, minimum
Main beam elevation location	Between 2° and 5° above horizon
Power Handling capability	Up to at least 10 kW peak RF power at 3% duty cycle
Impedance	50 ohm nominal
VSWR	Not greater than 2:1 (960-1215 MHz) measured at end of low loss cable not exceeding 5 feet in length.
Vertical field pattern	The radiation pattern of the antenna in the vertical plane has a lobe of energy not less than 10 degrees wide at the half-power points. The power gain at angles between 6 and 50 degrees below the horizon is lower than the power gain at the peak of the major lobe above the horizon by at least 8 dB. The power gain at angles between 6 and 15 degrees above the horizon is greater than a level that is 20 dB below the power gain at the peak of the major lobe above the horizon. The power gain at angles between 15 and 45 degrees above the horizon is greater than a level, which is 30 dB below the power gain at the peak of the major lobe above the horizon.
Weather proofing	Entire Antenna, including all cable connectors is weather proofed such that removal /replacement of radome is possible without sealing compounds.
Antenna mounting	The configuration of the antenna base is such that the antenna can be mounted directly or indirectly through use of optional adapter (s).
Wind loading	Withstands without damage 100 mile per hour gusts
Monitor ports	Two coupling probes for monitoring the signal radiated by the antenna. Located within the radome. 50 ohm nominal impedance.
Obstruction light (s)	Optional dual, red lamp obstruction light fixture. Connector is MS-3112E8-3P, 13 1/2'H x 12"W x 4"D 5.3 lbs.
Connectors RF	Type N Female, 3 each.
Environmental	• Temperature, -50 to +70° C • Humidity, 5 to 100% • Altitude, 0 to 10,000 Feet ASL • Ice Loading, 1/2" Radial Ice

1.8 NORMARC LDB-103 DME CONFIGURATIONS

The NORMARC LDB-103 DME equipment is available in several standard configurations, depending on RF power and primary power requirements.

. The basic transponder provides modulation and RF drive to a power amplifier assembly, which raises the power output to either 100 W or 1kW.

Currently, the following different base models for the NORMARC LDB-103 DME System are available:

- PN 0063420000105 (Model .05): NORMARC LDB-103 DME 1kW – CEE 7/4 Convenience Outlets.
- PN 0063420000106 (Model .06): NORMARC LDB-103 DME 1kW – AS 3112 Convenience Outlets.
- PN 0063420000107 (Model .07): NORMARC LDB-103 DME 100W– CEE 7/4 Convenience Outlets.
- PN 0063420000108 (Model .08): NORMARC LDB-103 DME 100W – AS 3112 Convenience Outlets.
- PN 0063420000114 (Model .14): NORMARC LDB-103 DME 100W – AS 3112 Convenience Outlets & DC Supply Option.
- PN 0063420000115 (Model .15): NORMARC LDB-103 DME 1kW – AS 3112 Convenience Outlets & DC Supply Option.
- PN 0063420000131 (Model .31): NORMARC LDB-103 DME 100W – CEE 7/4 Convenience Outlets & Frontal RF Measurement Panel.
- PN 0063420000141 (Model .41): NORMARC LDB-103 DME 1kW – CEE 7/4 Convenience Outlets & Frontal RF Measurement Panel.

2. SECTION 2 - TECHNICAL DESCRIPTION

2.1 INTRODUCTION

The Distance Measuring Equipment (DME) Ground Beacon NORMARC LDB-103 series equipmentis designed and manufactured to meet the specifications outlined in ICAO Annex 10 [AD.1], ICAO Doc 8071 [AD.2], EUROCAE ED-57 [AD.3] requirements. Its main function is to provide automatic answer to DME interrogators, giving precise distance information through the reply to interrogations from airplanes under its coverage area, tuned in its working channel. The NORMARC LDB-103 series equipment is capable of operating in the 252 possible X/Y DME/N channels.

The NORMARC LDB-103 DME series equipment has been designed using digital techniques in timing and waveform generation circuitry, and analogue techniques in power amplifying circuits. Timing and frequency generation by direct digital synthesizer are derived from a single stable temperature-compensated crystal clock circuit which ensures accurate clocking of all critical time-dependent pulse generation and measurement circuits.

The equipment employs state of the art technology ensuring high reliability in order to satisfy the highest requirements. Fundamental to the design concept of this unit are integrity, reliability, and maintainability. The equipment allows the access for control and status from local and remote terminals.

The NORMARC LDB-103 DME series equipment has been developed following a modular design based on logical functional block concepts. All the functionalities are grouped in different modules, being easy to follow the signal flow in the equipment. Its modular design plus its powerful BITE and intensive use of digital techniques make easier the operation and maintenance of the equipment.

The NORMARC LDB-103 DME is available in two different levels of nominal output power: a terminal DME with a 100W amplifier and an en-route DME with a 1 KW amplifier. In both configurations to control the output, power is possible by adding a gain from 0 to -4 dB with a 0.25 dB step.

It is possible to update a terminal DME (100W) to an en-route DME (1kW) plugging an extra module into the rack (high power amplifier) with its additional hardwires.

The DME beacon is configured for dual operation. A dual equipment configuration of two identical electronic equipment sets is housed in a single 19’ cabinet, operating into one antenna system via changeover relay. There is sufficient space within the 33U cabinet to store the backup batteries for up 28 hours (100 W model) or 11.5 hours (1 kW model) of operation (27000 ppps).

A DME system consists of the following different parts or blocks:

- NORMARC LDB-103 equipment cabinet (High Power or Low Power).
- DME Antenna.
- LMT (Local Monitoring Terminal).
- NMP (Network Management Processor).
- RMM (Remote Maintenance and Monitoring).

Main functions of the DME equipment are:

- Detection and analysis of interrogation pulses
- Signal processing related with receiver function
- Reply generation and timing
- Squitter generation
- Identity transmission
- Transmitted pulse shape control
- Exchange of data with NMP/EIU (Network Management Processor/External Interface Unit) for Local and Remote access
- Monitor functions

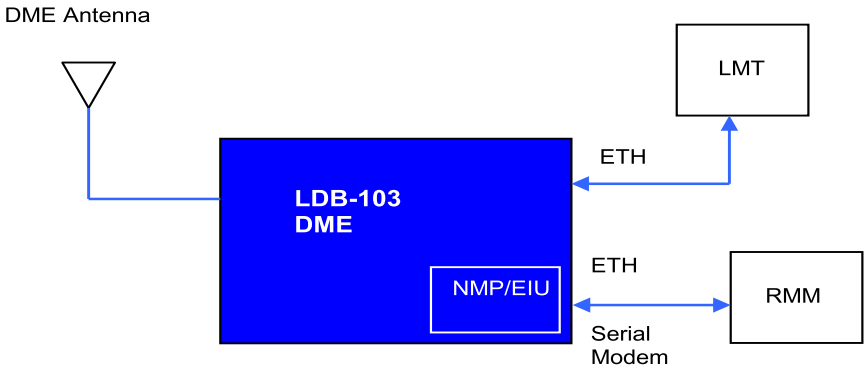


Figure 2.1-1: NORMARC LDB-103 DME SYSTEM BLOCK DIAGRAM

2.2 MAIN FEATURES

Among the salient characteristics of this new generation NORMARC LDB-103 DME series equipment are:

- State-of-the-art technology design philosophy.
- Generation, modulation and transmitter control totally performed in a FPGA (not need SW).
- Continuous integrity monitoring performed totally performed in a FPGA (not need SW).
- Integrity and Local alarms no need SW to interpret states and demodulated data.
- Extensive use of digital technology:
  - Digital Radio Techniques.
  - Digital Signal Processing.
  - Control and programming by FPGA technology.
- To control the output power is possible by adding a gain from 0 to -4 dB with a 0.25 dB step.

- High level of redundancy: receivers, transmitters, integrity monitors, control modules and power supplies.
- Operational modes: Hot and Warm standby both in operational state.
- Extensive Monitoring and BIT (Built-In-Test) facilities to allow continuous, automatic testing and fault diagnostic down to LRU level.
- All modules are hot swappable without damage.
- Compact and modular mechanical design.
- A cabinet 19' :
    - Rack height 33U max.
    - Subrack modules IEC 60297.
    - Internal battery allocation. The hours of operation for a system at 2700 ppps are at least:
        - 28.3 hours for 80% DOD (100 W model)
        - 11.5 hours for 80% DOD (1 kW model).
- CE marking certified product, fully compliance with the requirements of the applicable European Directives:
    - Directive 2014/53/EU Radio Equipment [AD.4].
    - EMC: ETSI EN 301 489-1 V1.9.2 [AD.5].
    - Safety:
        - EN 60950-1:2006 /CORR:2007/A11:2009 /A1:2010 /A2:2013 [AD.6].
        - AS/NZS 60950.1:2015 (IEC 60950-1:2005 Ed.2.2) [AD.7].
    - EMF: EN 50385:2002 [AD.8].
    - SW certification: ED-109A [AD.9].
- Three level redundant power Supply configuration: Dual Power Supply Units (PSU), one per each single DME equipment; two, up to four, redundant AC/DC converter modules per PSU in current sharing configuration; and dual battery banks with advanced battery facilities:
    - Battery type: +24VDC maintenance free.
    - Battery Temperature compensation.
    - Battery equalization and charging management.
    - Battery monitoring.
    - Advanced alarm management and power safe facilities allow improved operational efficiency when condition changes and rotate.

- Monitoring:
  - Standard configuration with 2 independent monitors.
  - Monitor auto-diagnosis test.
- High performances:
  - Accuracy (typical): 30 m.
  - Carrier frequency stability: ± 2 ppm, temperature and life without adjustment.
  - Solid-state amplifiers design, efficient and reliable.
  - Hardware based monitoring function.
- Automatic calibration and commissioning facilities.
- Non-specialized test equipment needed for installation.
- Environmental requirement based on MIL-810-F as guidance.
- Local LCD display and control panel for system status indication, basic controls and measurement data indication of transmitter and monitor.
- Open standard approach of Indra's RMM system allowing integration of the navaid elements into the operators existing or preferred management platform. The use of SNMP Version 3 in the navaid equipment provides reliable connection orientated notifications, as well as the enhanced security this version offers.
- Local and Remote Control and Monitoring Management facilities. HTTP/SNMP standards protocols facilities to integrate directly into a National monitoring network.
- Global Connectivity for Control and Management. Local/Remote Control Interface Ethernet, LAN connectivity RS-232 / RS485.
- User-friendly interface.

2.3 SIGNAL FLOW

Interrogation signals from an aircraft are received by the DME antenna, which is connected to the Relay Control Unit (RCU). The RCU has an internal radiofrequency relay that drives the signal to the proper TXP through the Radiofrequency Shelf (RFS). The Radiofrequency Shelf is a completely passive module based on radiofrequency couplers and splitters that interconnects all the modules in the equipment. The received signal from the RCU pass through the direct path of two internal couplers of the RFS and goes directly to the input of the High Power Amplifier - HPA (in case of a High Power DME) or to the input of the Transmitter Unit - TXU (in case of a Low Power DME). HPA and TXU implement the duplexer functionality enabling the connection of the receiver and the transmitter to the main antenna. Once the signal passes though the duplexer it feeds directly the input of the Receiver Unit (RXU).

The Receiver Unit (RXU) detects and decodes the received interrogations and sends a trigger signal to the Transmitter Unit (TXU) as a result of a valid interrogation decoding. Also, the RXU is responsible of the Local Oscillator (LO) generation, sending a Carry Wave (CW) signal to the Transmitter Unit (TXU). This CW signal matches the reply frequency.

With the trigger signal and the CW received from the RXU, the Transmitter Unit (TXU) generates a 100 W valid DME reply that matches the reply delay of the selected channel on the equipment. The TXU also adds squitters and identity pulses to the transmitted signal.

In case of a High Power DME the HPA has to be fitted in the subrack and it amplifies the 100W output signal of the TXU to nominal power of 1 KW. In this case, the TXU acts as a driver of the High Power Amplifier (HPA). This output signal (100W for a Low power DME or 1 KW for a High Power DME) is again transmitted to the Radio Frequency Shelf (RFS) and pass through the direct path of two internal couplers. This signals travels through the RF relay of the RCU and feeds the antenna sending the reply signal to the air.

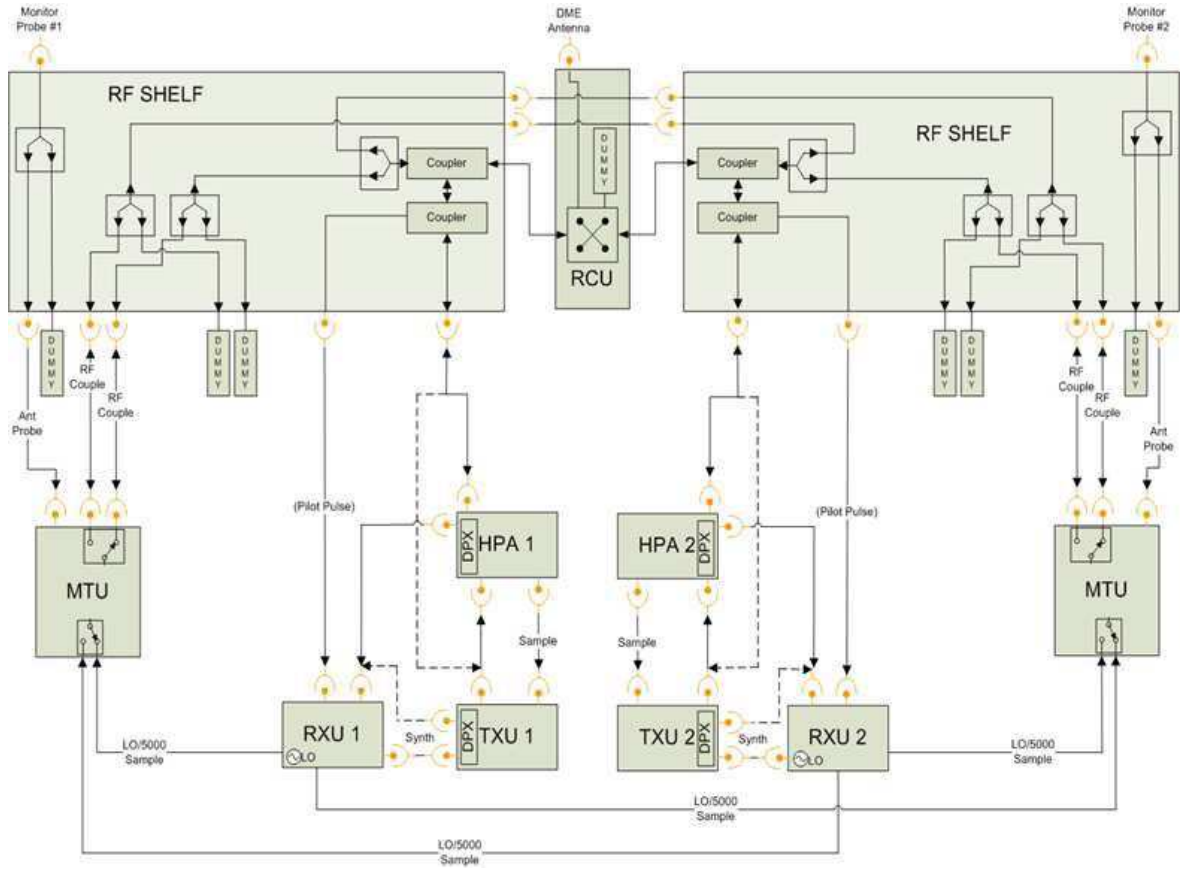


Figure 2.3-1: NORMARC LDB-103 DME SIGNAL FLOW DIAGRAM

2.4 CABINET DESCRIPTION

The NORMARC LDB-103 DME is designed to be mounted in a standard 483 mm (19-inch) rack type rack. The dimensions of the rack for DME racks are 1600 mm (33U) high by 560 mm wide by 600 mm depth. The 33U high and 19'' wide cabinet has lockable front and back doors (both doors perforated for optimum airflow).

The cabinet together with locations for modules is shown in Figure 1.5-1 and Figure 1.5-2.

2.4.1 Modules Arrangement

The arrangement of the NORMARC LDB-103 rack fully fitted with electronics equipment is shown in the Table 2.4-1. The modules that are contained in the cabinet are listed from top to bottom, left to right.

The LCU subrack located at the top, houses the Local Control Unit itself on the LHS and the Relay Control Unit (RCU) on the RHS. The LCU subrack is screwed to the rack and is 3 rack units (267 mm) high. Behind the LCU subrack, there are two RF Shelf, including all directional coupler(s), dividers and other RF circuitry. The HPA module is deployed only in the 1kW transponders. Unused space in the 6U subrack is covered with blank panels in the 100W transponder.

The AC power supply/battery charger each occupies 2 rack units (89 mm) height, and is 240 mm depth. If standby batteries are used, there is sufficient space within the cabinet for dual 24Volt supply each having 90AH capacity. These are designed to operate a warm stand-by system for up 28 hours (100 W model) or 11.5 hours (1 kW model) of operation (27000 ppps) without AC support. For higher capacity, the batteries are housed in a separate, ventilated enclosure, which may be either inside or outside the main equipment shelter.

Table 2.4-1: NORMARC LDB-103 DME MODULES ARRANGEMENT

LOCATION	MODULE	PART NUMBER	NOTE
3U SubRack from L to R	LCU	0063420003100	Local Control Interface
	RCU	0063420003200	Relay Control Unit
	OUTPUT SAMPLES FRONT PANEL[7]	0063420008000	Output Samples Front Panel
6U SubRack from L to R	HPA A (only High Power configuration)	0063420004500	System #1 (LHS group) Default Main DME equipment
	TXU A	0063420004400	
	RXU A	0063420004300	
	MTU 1	0063420004200	
	CMU 1	0063420004100	
	CMU 2	0063420004100	System #2 (RHS group) Default Stand-By DME equipment
	MTU 4	0063420004200	
	RXU B	0063420004300	
	TXU B	0063420004400	
	HPA B (only High Power configuration)	0063420004500	
	Utility Space	N/A	
	PSU A System #1	0063420005000	Power Supply System #1
	PSU B System #2	0063420005000	Power Supply System #2

[7] Only for NORMARC LDB-103 DME Model .31 and Model .41

	NMP/EIU	0063420006100	Network Management Processor/External Interface Unit
	AC Input Box	006342000130X	Main Power Supply Interface
	Battery Compartment	N/A	
	DC Power Kit[8]	0063420006600	Battery Reversal Protection.

2.5 MODULE INTERCONNECTION

An asynchronous Master/Slave RS485 bus interconnects the different modules to set, extract and upload configuration and/or operating data. There is only one RS485 bus between all modules.

The Control and Monitoring Unit (CMU) primary role is to gather information from each module in the system. There is only one Master device on the bus, with all other modules being Slaves. By this, it is meant that only one device is able to initiate data transfers, and all other devices wait to be 'polled' by the master.

In a DME system there are two CMUs. Which CMU becomes the Master device on the RS485 bus is resolved in the following way:

- Upon power-up, or after a reset, each CMU determines if it is inserted into the Left, or the Right side. The CMU on the Left sub-rack waits a user-defined period. The CMU in the right sub-rack also waits for a higher user-defined period.
- If no poll-requests are observed on the RS485 bus by the CMU at the end of its timeout, the CMU automatically becomes the Master device by initiating poll requests. Thus if both CMUs were powered on, or reset, at the same time, the Left CMU becomes the Master device if these timeouts are left in their default states.
- The Master CMU stays as the bus Master until it fails to get responses from more than 50% of the modules in both systems. In this instance, it stops polling for one second (user settable) before starting the normal timeouts mentioned in the previous paragraph. If poll requests are observed in this period, the CMU assumes it is no longer the Master CMU, but instead the Standby CMU.
- A Standby CMU automatically becomes Master CMU, if it sees an absence of poll-requests for more than 1 second (by default). This period is also user-settable.

[8] Only for NORMARC LDB-103 DME Model .14 and Model .15

2.6 MODULE IDENTIFICATION

Each physical module in the equipment has a unique identification code.

This code is labeled on the module and also is able to be accessed by poll requests on the RS485 bus that interconnects all the units in a system.

Each poll response in the bus includes the module's unique identification code, and in this manner, the Control and Monitoring unit always knows if a module in a system has been swapped by a new one.

2.7 BUILT-IN-TEST (BIT) AND ALARMAS OUTPUTS

The NORMARC LDB-103 is provided with auto-diagnosis capability. Each part of the DME system is provided with a diagnosis system (BIT) for a rapidly identification of malfunctions and faulty elements.

The BIT (Built-In-Test) consists of the following three levels:

- *Power-up BIT (PBIT)*. After being energized, the DME starts the PBIT, ignoring any command to change to other mode of operation. When finished, the DME operates as commanded.
- *Continuous BIT (CBIT)*. Automatically performed when PBIT finishes, it does not interfere in the normal operation of the system. The CBIT does not require to be commanded.

Every module plugged into the system is capable of generate alarm signals. The kind of alarms generated depends on the module.

Every module plugged in the 6U subrack is able to generate both primary and secondary alarms, with the exception of the Control and Monitoring Unit (CMU), which is only able to generate Secondary Alarms. These alarms are read by the Relay Control Unit (RCU) to select the transponder connected the antenna (On air transponder).

There are three kind of primary and secondary alarm signals:

- TXP alarm
- Local Monitor Alarm
- Executive Alarm.

The TXP Primary Alarm signals are implemented by connecting a single data line to each module of the transponder (HPA, TXU and RXU). A TXP Primary alarm is generated by driving this data line to ground. If the TXP primary alarm is not asserted, the line is leave in an undriven state.

The Relay Control Unit (RCU) has a pull-up on the TXP Primary Alarm signal and is the one that read the status of the signal.

The TXP Secondary Alarm signal is implemented in exactly the same way.

As part of the Monitor Transponder Unit's (MTU) Built-In-Test facilities, the MTU module is capable of generate an independent LOCAL Primary Alarm or Secondary Alarm. It does this by pulling one or both of these lines to ground in the same way as TXP alarm signals. These alarm signals are independent, not being connected in an or-wired bus like the TXP alarm.

As well, the Monitor Transponder Unit (MTU) is able to generate EXECUTIVE Primary and Secondary Alarms based on the radio signal that it is monitoring.

Consequently, the EXECUTIVE Primary and Secondary Alarms that are produced as a result of the problems detected in the TXP generated signals are separated from the alarm signals that arise from the TXPs. These signals have the same characteristics that the Local Monitor Alarms.

The Relay Control Unit (RCU) reads all the primary and secondary alarm signals described above and makes the decision of which transponder connect to the antenna. This unit also is able to generate primary and secondary alarm signals, connecting them to the TXP or-wired alarm bus.

Note that in a DME system there are two independent TXP alarm buses, formed by two different signal. Each transponder have its own primary TXP alarm bus and its independent secondary TXP alarm bus.

2.8 LOCAL AND REMOTE CONTROL

The beacon has been designed for unattended operation and is able to be controlled and monitored from a local or a remote location.

The management and control of the equipment are done by standardized protocols HTTP and SNMP over encrypted channels.

Control of the parameters can be performed in these ways:

- Local Control
  - Basic Control
  - Extended Control
- Remote Control
  - Extended Control

Local Control is done in front of the equipment and can be basic or extended. Remote Control is performed from remote and is extended.

Basic control is done through buttons on the Local Control Unit (LCU) touch screen display. For more information see LCU description (3.4). These buttons performs basic control functions (for example the switch on and switch off of each transponder in an equipment) to the user in an easy an intuitive way. These buttons are focused to facilitate maintenance works and to supply high-level control of the equipment.

To make a more powerful control of the equipment is necessary to make use of the extended control. An extended control of the beacon is performed through a laptop connected by a network cable to the front panel of the equipment (Local Control), or by network connections thru the NMP/EIU module.

Remote control can be performed by a connection accomplished by multiple means including dial-up modem, leased-lines, radio, IP-based virtual private network (VPN), Ethernet, and cellular networks.

A control access management based on five access levels is implemented so that only one user at once obtains the equipment control.

2.9 TESTABILITY

Each module has been designed for testability.

Where possible, each pin of relevant components can be tested for Stuck at One or a Stuck at Zero fault.

An extensive BITE system is incorporated into each module.

All relevant parameters including rail voltages, temperatures, current values of parameters, are measured and compared to preset limits.

Appropriate alarms are next flagged as needed. Information thus available are reported either when polled periodically or whenever requested.

At a higher level, polled or reported information is logged to provide operational history of the equipment over a period of time.

2.10 PRODUCT LIFE SPAN

The Indra DME has been designed for supported operation until at least the year 2030.

Where single-sourced critical components have been used, certificates have been obtained from the manufacturers to guarantee availability through to 2030, or that an obsolescence plan is provided.

2.11 STATIC DISCHARGE INMUNITY

All backplane and front panel connections involving signals (not power) have static discharge immunity according to EN61000-4-2 [RD.3].

2.12 ACCESS SECURITY POLICY

The equipment operation is guarded against inadvertent changes to its intended operation with password security. There are five levels of password accessibility to the equipment.

These are:

- Viewer
- Operator
- Manager
- Installer
- Administrator

At each of the five operation levels, one of the four levels of password complexity may be invoked.

As the equipment is accessible via communication network, the concept of local or remote control is no longer clear-cut.

For example, an operator may be physically present at the site but may get access to the equipment via a WAN terminal, while another operator may be located at the Control Room, many kilometers away, but may access the equipment via a LAN terminal using dedicated cable or a radio link.

To eliminate the possibility of having more than one operator modifying operational parameters at the same time, the user simply select the 'single user' option.

The allocation of priority to a particular operator whether local (LAN) or remote (WAN), has user-settable automatic time-out.

These are explained in more details in Section 4.5 OPERATION INFORMATION.

2.13 SUSBSYSTEMS DESCRIPTION

2.13.1 Introduction

To enable an easier understanding of the NORMARC LDB-103 DME system, the description is split into six subsystems:

- Transponder subsystem.
- Relay control subsystem.
- Antenna subsystem.
- Monitoring subsystem.
- Management & Control subsystem.
- Power Supply subsystem.

Figure below provides an overview of the NORMARC LDB-103 functional block diagram.

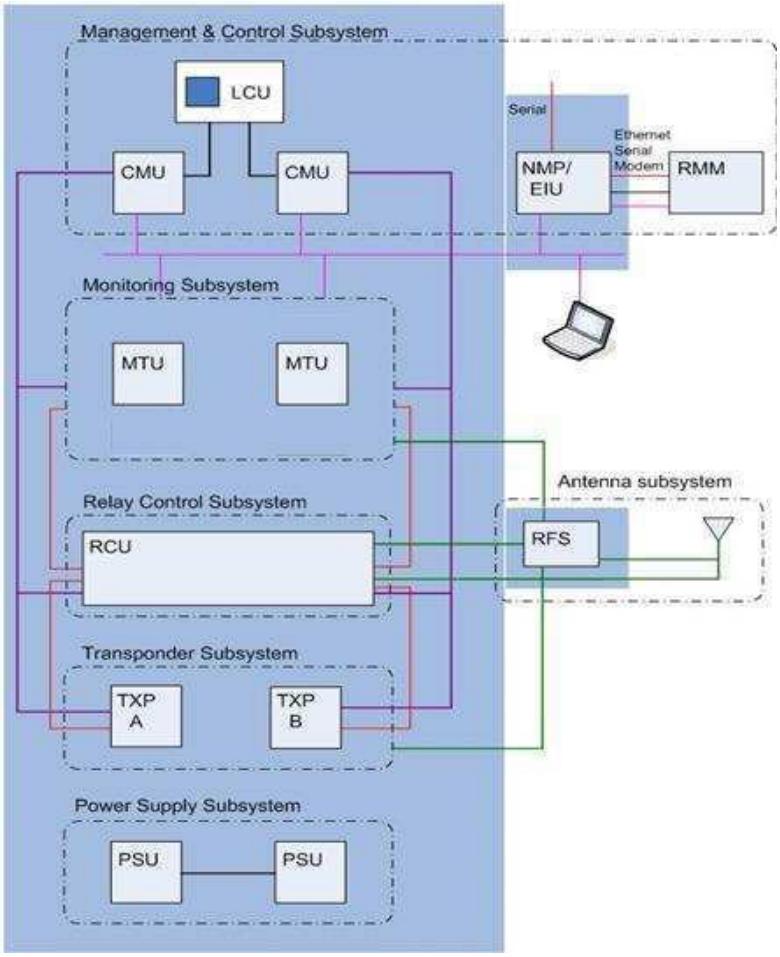


Figure 2.13-1: NORMARC LDB-103 DME FUNCTIONAL BLOCK DIAGRAM

2.13.2 Transponder Subsystem

The transponder subsystem is the core of the DME. It is responsible for the reception and decoding of the interrogation signal as well as generation and amplification of the navigational signals up to the required power levels to distribute them through the antenna subsystem.

The transponder functional block is divided into three different modules:

- Receiver Unit (RXU) which manages all reception processes, making use of digital techniques as FPGA and DDS technology.
- Transmitter Unit (TXU) which manages pulse generation processes, assuring the correct pulse shape characteristics and amplification up to 100 W. This module also makes use of digital techniques as FPGA and DDS technology.
- High Power Amplifier (HPA), which amplifies the TXU output signal up to 1 kW (only in high power models).

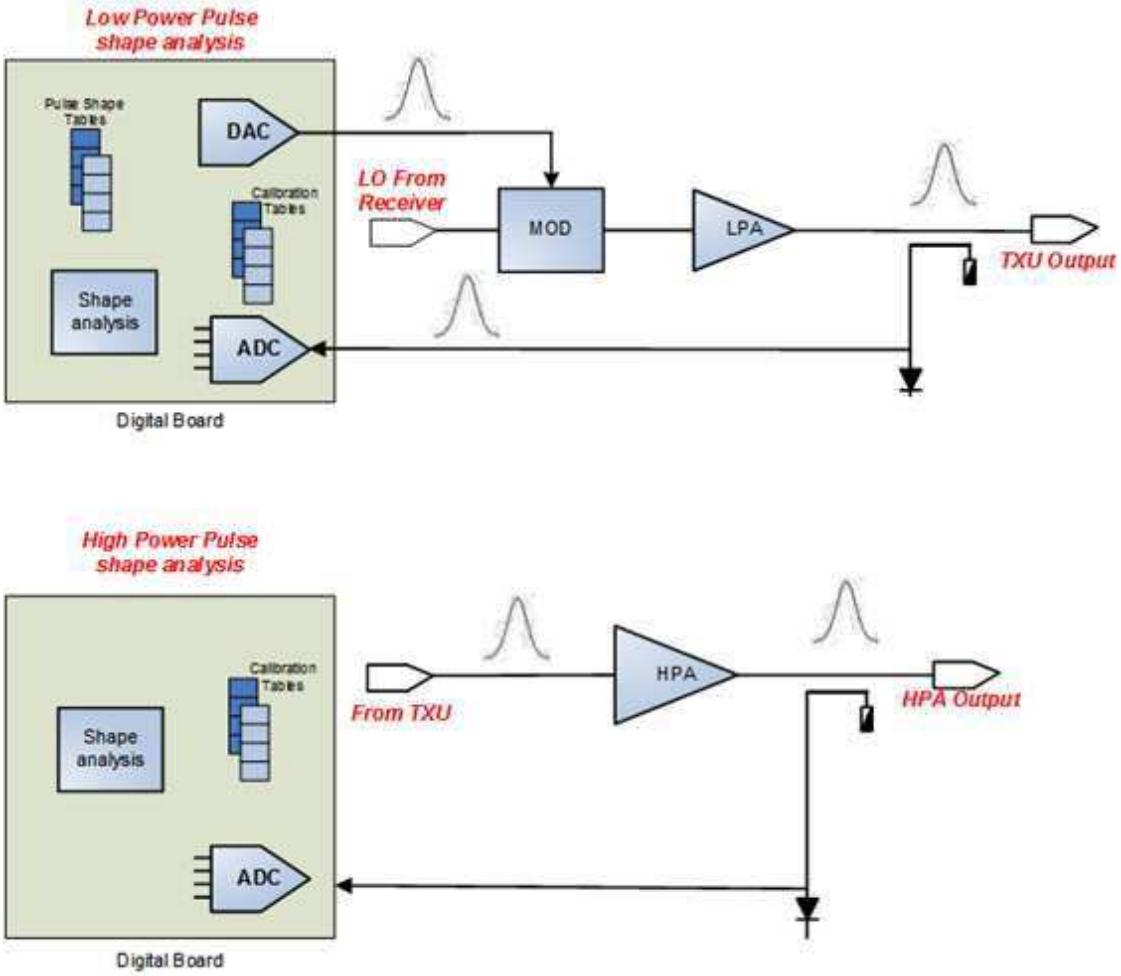


Figure 2.13-2: TRANSPONDER SUBSYSTEM - GENERATION AND AMPLIFICATION

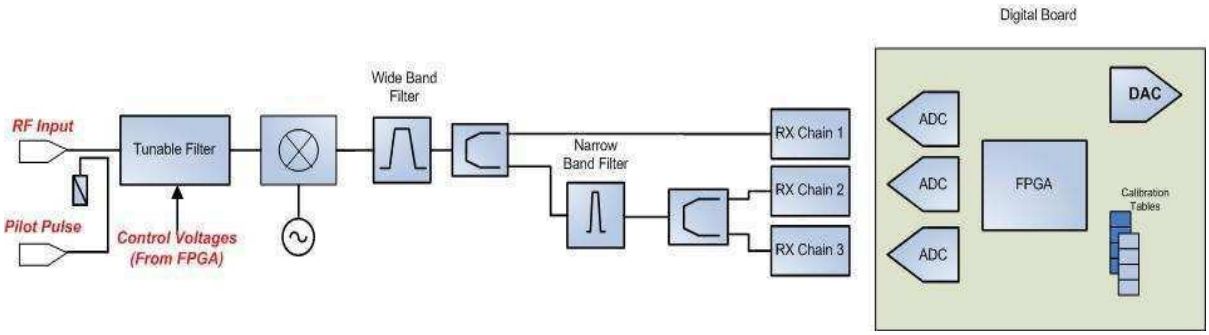


Figure 2.13-3: TRANSPONDER SUBSYSTEM - RECEIVER CHAIN

2.13.3 Relay Control Subsystem

The relay control subsystem consists of only one module: the Relay Changeover Unit (RCU).

In a DME, the Relay Control Unit (RCU) primary role is to analyze local alarms from each DME system, as well as the alarms from the Monitor Transponder Units (MTUs), and based on that information decide which, if any, system should be connected to the antenna.

This subsystem is based on a FPGA HW platform, not making use of any software in the changeover and shutdowns processes.

The RCU module can be set:

- To changeover between channels in a periodic fashion, configured by the user;
- To inhibit alarms, preventing system from changing over or from shutting down due to a persistent fault;
- To evaluate AND / OR user-selected combinations in assessment of fault conditions;
- To enable maintenance mode.

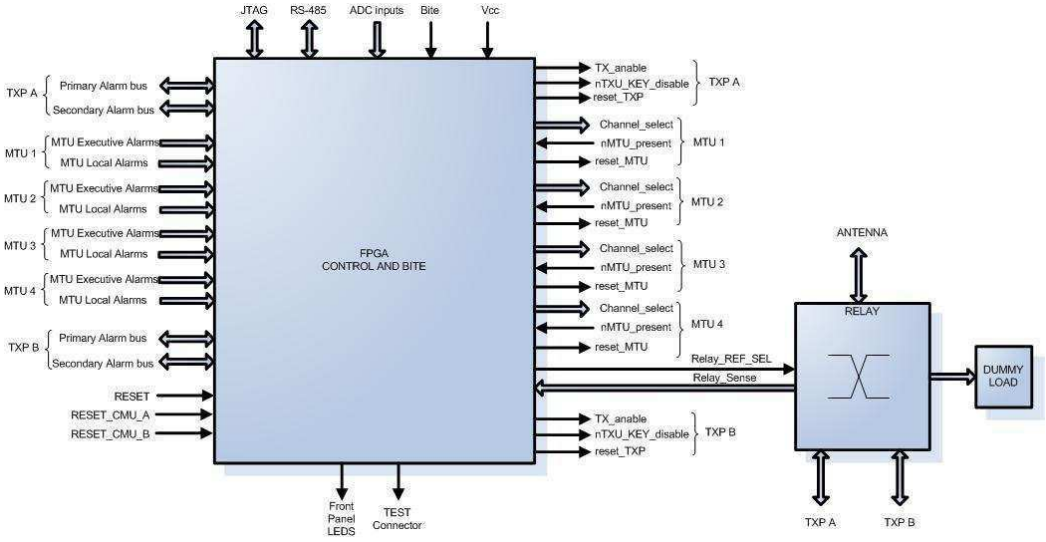


Figure 2.13-4: RELAY CONTROL SUBSYSTEM

NOTE: MTU2 and MTU3 are not presented in the default configuration

2.13.4 Antenna Subsystem

The NORMARC LDB-103 Antenna subsystem composes of two modules, the Radiofrequency Shelf (RFS) and the DME Antenna.

The Radiofrequency Shelf (RFS) is a completely passive module, which supplies radiofrequency connectivity between the different subsystems.

The DME antenna allows the reception and transmission of the DME navigational signals with the proper radiation pattern as well as it supplies two monitor probe ports.

2.13.5 Monitoring Subsystem

The Monitoring subsystem consists of a number of Monitor Transponder Units (MTUs) which is dependent on the DME configuration. A DME is able to accommodate up to two independent monitors.

This subsystem first simulates a distant aircraft sending DME interrogation signals. It then analyzes the subsequent replies of the DME beacon, determining whether the main parameters of the transmitted signal are within pre-set tolerances. A dedicated alarm signal is driven in response to this result as well as other conditions. This signal disables the power supply to the final radiofrequency amplifiers in the Transmitter Unit (TXU) and High Power Amplifier (HPA) and hence stops the radiation of signal into space. Combinations of AND/OR voting settings are also allowed.

The monitoring capabilities form parts of the elements that ensure the safety of the navigation signal. The processing involved in order to determine if a navaid signal is invalid, is performed using only digital hardware FPGA technology. It is implemented by means of independent hardware. No processors or software is used in this part of the processing.

The Monitor Transponder Units (MTUs) makes use of the coupled signals provided by the radiofrequency shelf and the DME antenna.

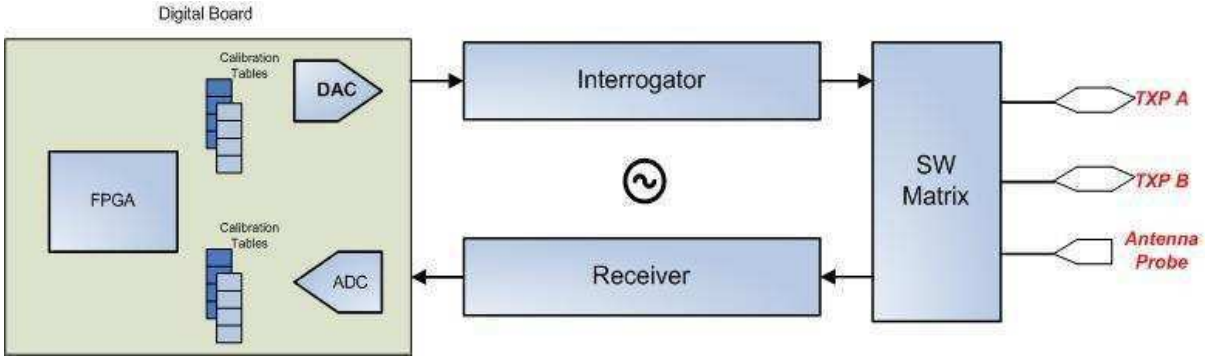


Figure 2.13-5: MONITORING SUBSYSTEM

2.13.6 Power Supply Subsystem

The power supply distribution is performed by two Power Supply Units (PSU). A PSU with two rectifiers provides enough power in a DME system, while only one rectifier is needed for each transponder.

The Power Supply Unit has these major functions:

- To provide power to the system;
- To monitor the voltage rails produced as well as mains power status.
- To control the charge state on the backup bank of sealed lead-acid batteries;
- To automatically drain power from the battery bank when mains power is removed;
- To generate the signals required for BIT purposes (monitored processes include rectifier status and communication, battery capacity and charge, battery temperature, charge current, output voltage and load current).

The PSU module arrangement is a N+1 parallel configuration to share the load of each single DME TXP. The standard configuration for a PSU module provides one (1) (but up to four (4)) redundant hot-swappable rectifiers. Each one of this rectifier modules is capable of supply enough power to operate each single TXP.

Thus, the power supply subsystem provides a high level of reliability due to its design redundancy.

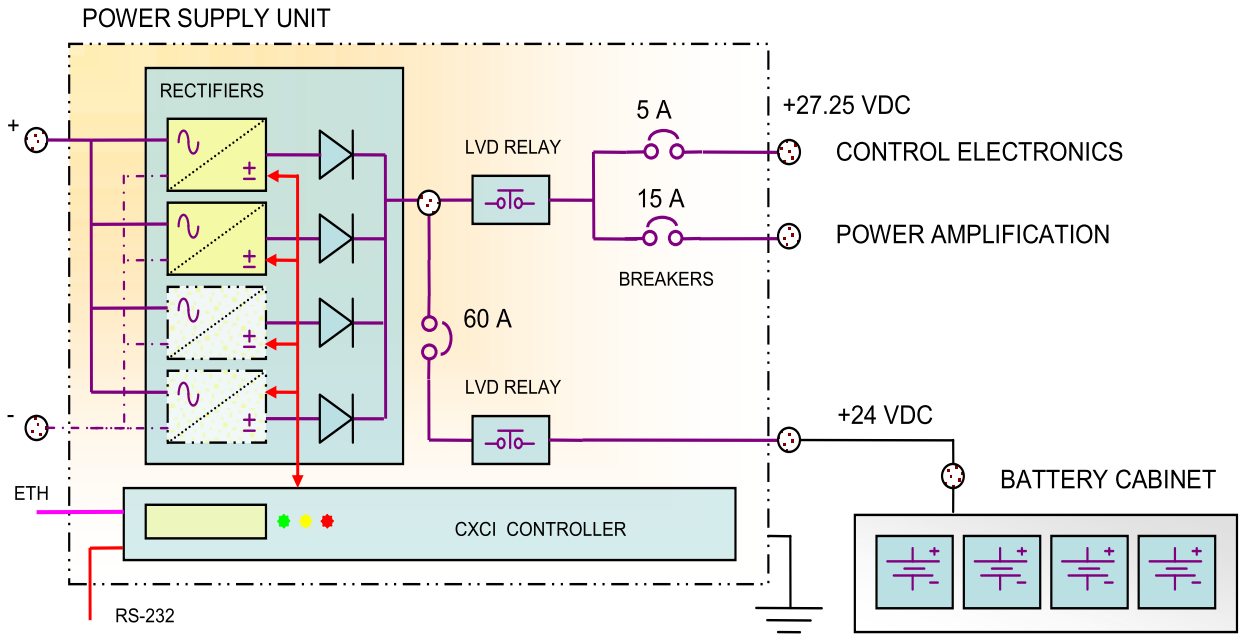


Figure 2.13-6: POWER SUPPLY UNIT (PSU) FUNCTIONAL BLOCK DIAGRAM

A network (Ethernet) interface allows external management and control of the power supply units by utilizing TCP/IP technology through a Network Web Server or a Simple Network Management Server (SNMP).

The PSUs also control the charge state on a backup bank of sealed lead-acid batteries.

2.13.7 Management & Control Subsystem

This functional block is subdivided into two subparts, unit or blocks, hardware and software, to configure the system and also, monitor its performance for either Local or Remote Management Monitoring (RMM):

- The Control and Monitoring Unit, the CMU.
- The Remote Management Monitoring, named as RMM.

The CMU is the principal access point for the other subsystems.

The primary function of the CMU, when a system powers up, is to gather (and possible distribute) configuration and status data from each module in the system. It also allows local and remote access to operating parameters. The CMU polls performance data from each module in the system regardless is on operational or on standby status.

Although a CMU fails, this fact does not impact the DME system's ability to generate the appropriate signals for guidance operation, nor in the ability of the Monitor and Relay control subsystem to detect faults and shut-down the system upon a failure.

The CMU is duplicated for redundancy: One CMU acts as default master assuming the responsibility for monitoring both Main system and Standby system, including the other CMU. The other CMU listens to all polling activity and record all data observed on the common serial bus.

The CMU also support monitoring, calibration and installation activities, because Software in the CMU is able to enable the Monitor Transponder Unit (MTU) to generate custom test signals. The CMU processes and/or reads the data extracted by the MTU as a consequence of the signals being generated by the transponder as a reply to the MTU interrogation signals.

The Management and Control subsystem allows command and control of all navaids at a specific site. Likewise, It regularly collects operational and equipment status information to be stored and analyzed in order to detect parameters varying outside drift and alarm limits (and if so, to provide notification to the Monitoring Centre).

This functional block includes:

- The managed elements in the LDB-103, which support both SNMP and HTTP servers as the management protocols, inside the CMU modules.
- The Local Control Unit (LCU) to provide a Human Machine Interface.
- The Network Management Processor/External Interface Unit (NMP/EIU), to provide the gateway between the navaid equipment and the remote site communications as well as protocol support for legacy navaids.
- The Local Monitoring Terminal, when used, located at the Navaid Site.
- The Remote Management and Maintenance subsystem (RMM), including Remote Control and Status Unit(s) (RCSU) and Remote Status Unit(s) (RSU) which, may be located in the ATC area, to provide control, status and availability of the navaids.

The Communications Subsystem consisting in modems at both sites, if needed, including optional line terminators against transients.

The purpose of the NMP/EIU is to provide a common management interface to various equipments. The range of equipment includes:

- Existing equipment mostly managed using proprietary protocols access via serial port.
- New equipment managed using standard protocols accessed by Ethernet interface where possible.
- Third party equipment managed with either standard or proprietary protocols accessed by either serial or Ethernet interfaces.

The NMP/EIU can also collect site-specific alarms and provides the multiple communication interfaces for remote connection, such as traditional leased-line, radio and dial-up modems as well as cellular modems and direct Ethernet connection. The NMP/EIU module communication interface can be considered as the Wide Area Network (WAN) interface.

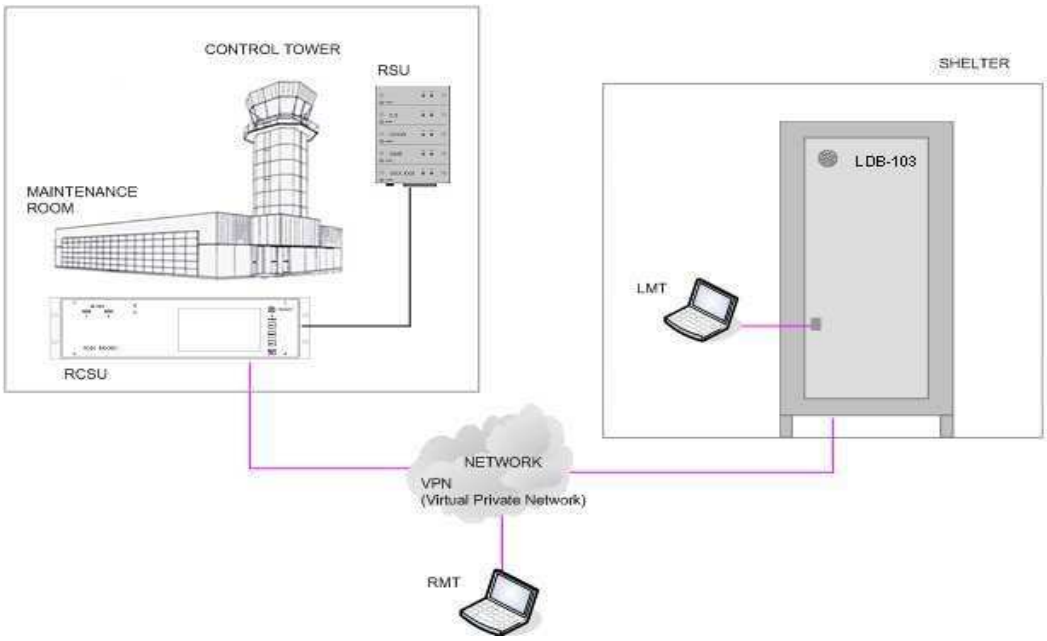


Figure 2.13-7: MANAGEMENT AND CONTROL

3. SECTION 3 - DETAILED DESCRIPTION

3.1 INTRODUCTION

Each single DME beacon consists of a Control and Monitoring Unit (CMU), one or two Monitor Transponder Units (MTU), a Receiver Unit (RXU), a Transmitter Unit (TXU) and a Power Supply Unit (PSU). In case of an en-route DME (1KW), space in the cabinet is available to fit a High Power Amplifier (HPA) to provide the additional RF amplification.

Two single DME beacon are used to build up a dual redundant system, both fitted within one cabinet that still has space for the back-up batteries.

Common parts for both single beacons consist of three other modules:

- The RFS (Radiofrequency Shelf) supplies radiofrequency connectivity between modules.
- The RCU (Relay Control Unit) makes the decision of perform a changeover between TXPs and includes the transfer switch.
- The LCU (Local Control Unit) which provides a Human Machine Interface, giving access to status information and basic control functions.

There are no physical differences between the Main System and the Standby System in a NORMARC LDB-103 DME, and the user is able to assign either system to be the 'Main' system.

The Radio Frequency Shelf (RFS) provides RF connectivity between the antenna and the two transponders, and radiofrequency connection between transponder and monitors.

The Relay Control Unit (RCU) is responsible of deciding which transponder is the better one in order to connect it to the antenna, assuring a continuous operation of the system with the better signal in every moment. The RCU accepts alarm information from both transponders and based on this alarm information connects either the Main or Standby transponder to the antenna.

While Receiver Unit (RXU) performs the reception tasks of the transponder, like filtering and amplification of the received signal and digital signal processing, Transmitter Unit (TXU) performs all the tasks related with signal generation, pulse shape control and radiofrequency amplification up to 100W.

In case of an en-route DME, it is necessary to add an extra module namely the HPA (High Power Amplifier) which amplifies the radiofrequency signal up to 1 KW with the TXU in this case acting as a driver.

Two Monitor Transponder Units (MTUs) are used, to ensure the proper operation of the system.

Association between MTUs and transponders is soft, with all the monitors being able to make a supervision of both transponders. Each monitor receives signal from both transponders. With this configuration, it is possible to improve the reliability and continuity of service for the system with judicious management of this functionality.

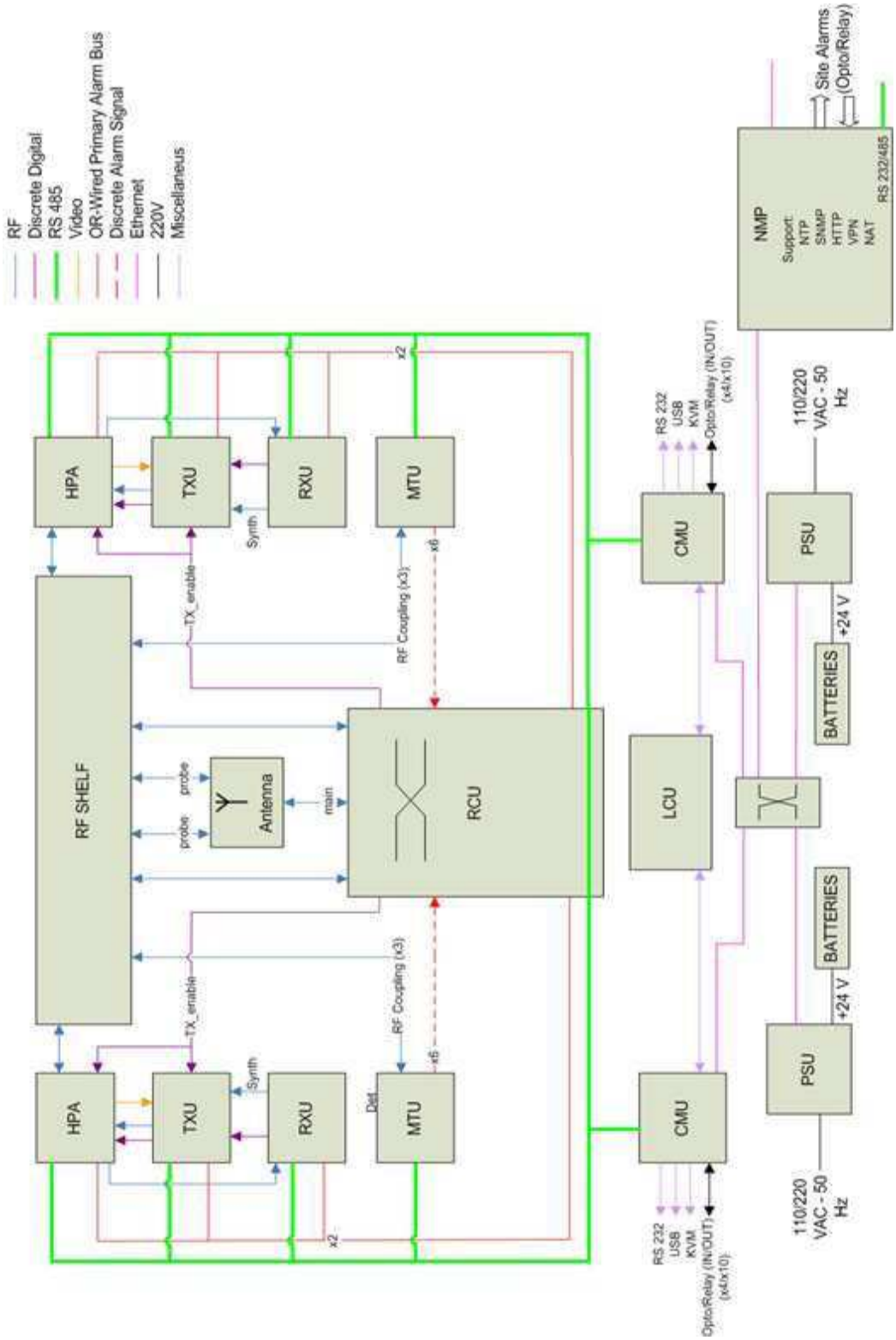


Figure 3.1-1: DETAILED FUNCTIONAL BLOCK DIAGRAM

The Relay Control Unit (RCU) makes the decision of performing a changeover between transponders, using a predetermined combination of monitor alarm evaluations with an AND or an OR logical function.

The Control & Monitoring Unit (CMU) acts as the master in the RS 485 bus, which interconnects most of the DME modules and gathers module information. In addition to this functionality, the CMU is the main door for the system, acting as the external interface for Local and Remote access (in this case via the NMP/EIU).

3.2 RADIOFREQUENCY SHELF (RFS)

3.2.1 Functional Description

Radio Frequency Shelf (RFS) primary function is to provide radiofrequency connectivity between the antenna/dummy load and the modules of the transponder.

The RFS unit performs the following functions:

- RF connectivity between the antenna/dummy load and the modules of the transponders.
- Radiofrequency connection between transponder and monitors.

This module is completely passive and do not have any intelligence. It is formed by radiofrequency couplers and splitters.

Figure below shows the functional block diagram of the Radiofrequency Shelf (RFS with all their radiofrequency ports.

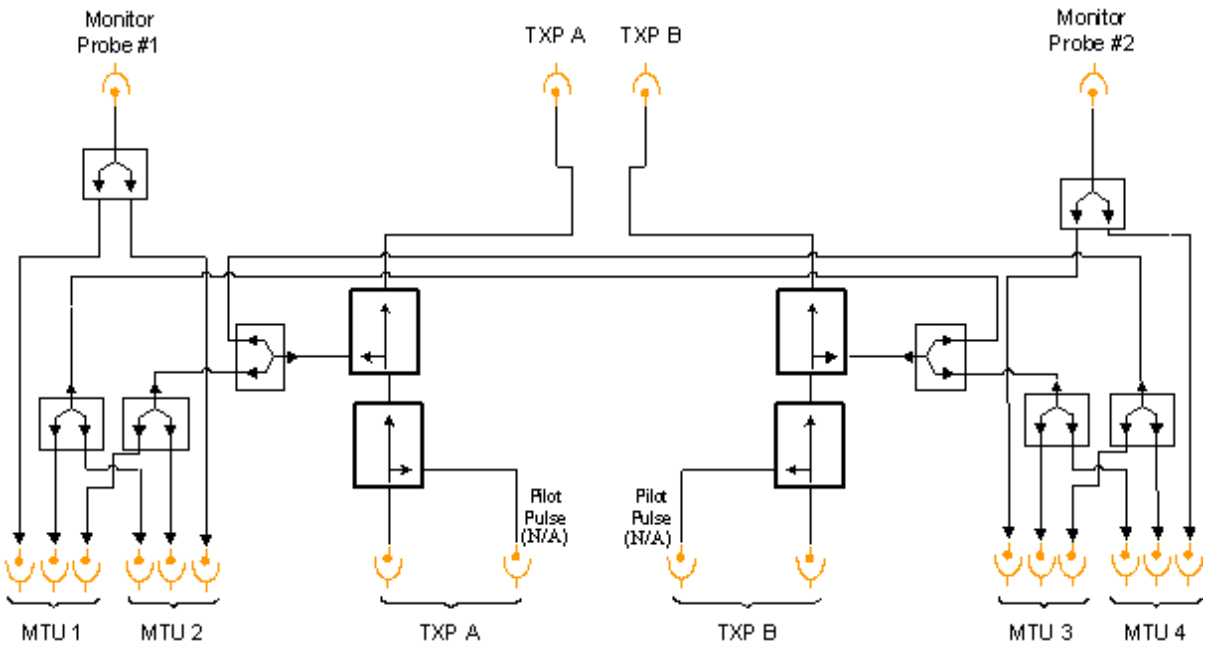


Figure 3.2-1: RFS FUNCTIONAL BLOCK DIAGRAM

Radiofrequency connection between monitors and transponders is done through the RF shelf, connecting both transponders to the four possible monitors plugged into the system.

External radiofrequency ports of the RF Shelf are:

- RCU/Antenna Ports
  - TXP A
  - TXP B
- Monitor Probes (x2) (connected to antenna)
- TXP ports (x2)
  - TXP
- Monitor ports (x4)
  - Antenna monitor probes
  - TXP A
  - TXP B

NOTE: MTU2 and MTU3 are not presented in the default configuration, so its corresponding inputs and outputs are unused and should be terminating with 50 ohms.

3.2.2 BIT Facilities and Alarm Management

Since the RF Shelf is a completely passive module, it is unable to assert any alarm and it does not generate any BIT signal.

3.2.3 Programming and Control Information

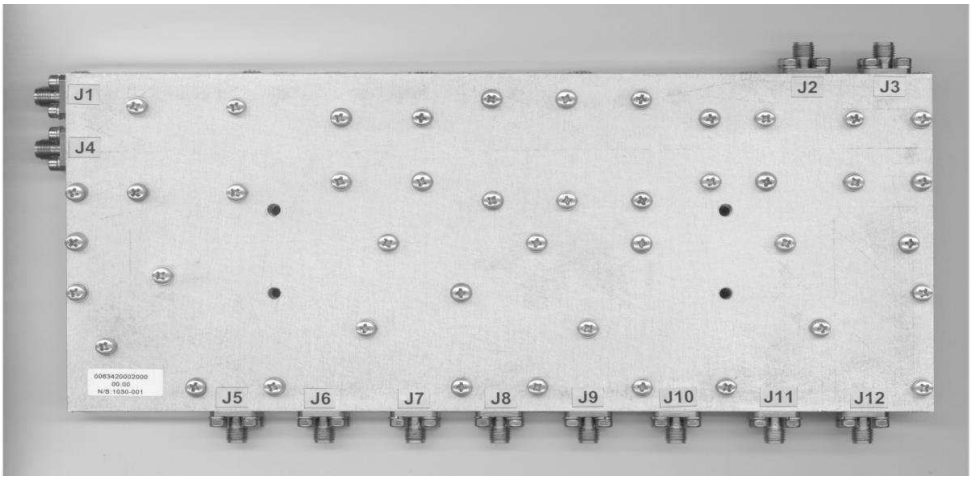
RF Shelf is not connected to the RS485 bus.

3.2.4 Mechanical Details

Radiofrequency Shelf circuit is based in strip line technology. Strip line technology uses a flat strip of metal, which is sandwiched between two parallel ground planes. The insulating material of the substrate forms a dielectric. The width of the strip, the thickness of the substrate and the relative permittivity of the substrate determine the characteristic impedance of the strip, which is a transmission line.

In RFS unit, substrate used is AD255A, two layers of which are sandwich clamped between two aluminum carriers. Twelve SMA coaxial launches are edge fitted to the aluminum housing.

Next Figures shows the DME RFS module.



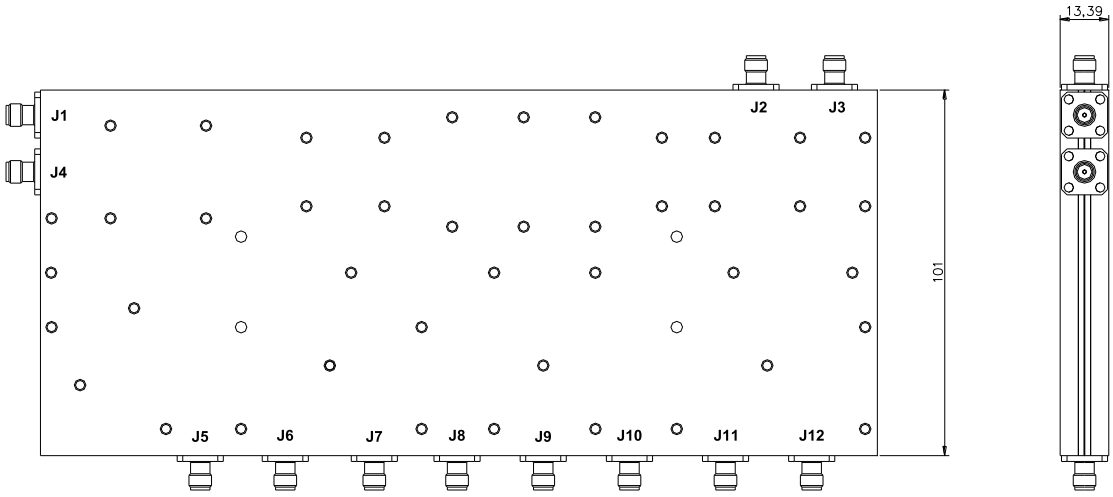


Figure 3.2-2: RFS ASSEMBLY

Dimensions: 230 x 100 x 13 mm, approximately

Weight: 0.7 Kgs, approximately.

Allocation of connectors is given the following table:

Table 3.2-1: RFS CONNECTORS ALLOCATION

REF	SIGNAL NAME	I/O	ORIGIN	DESTINATION
J1	PILOT	O	RFS	RXU
J2	TRANSFER_SWITCH	O/I	RFS/RCU	RCU/RFS
J3	ANTENNA_PROBE	I	ANTENNA	RFS
J4	TX	I	TXU	RFS
J5	RFS_I/O_1	I/O	RFS A/RFS B	RFS B/RFS A
J6	MTU2_A	O/I	RFS/MTU2	MTU2/RFS
J7	MTU1_A	O/I	RFS/MTU2	MTU2/RFS
J8	MTU2_B	O/I	RFS/MTU1	MTU1/RFS
J9	RFS_I/O_2	I/O	RFS A/RFS B	RFS B/RFS A
J10	MTU1_B	O/I	RFS/MTU1	MTU1/RFS
J11	MTU2_ANTENNA	O	RFS	MTU2
J12	MTU1_ANTENNA	O	RFS	MTU1

NOTE: The transfer switch and dummy load for a DME are not part of the RFShelf Module. They are allocated into the Relay Control Unit (RCU).

3.2.5 Front Panel Details

N/A

3.2.6 Hardware Implementation

Radiofrequency Shelf (RFS) is fitted at the back of the cabinet where it is readily accessible to the RF I/O ports of the MTU, RXU, TXU and HPA.

It does not have any front panel.

3.3 OUTPUT SAMPLES FRONT PANEL[9]

3.3.1 Functional Description

The sample panel offers the possibility to monitor the antenna signal and the two-probe antenna signal through a signal analyzer.

[9] Only for NORMARC LDB-103 DME Model .31 and Model .41

3.3.1.1 Antenna sample

This sample is obtained directly from the DME antenna output. The signal goes thought a directional coupler of 30 dB and an attenuator of 10dB, being the obtained sample attenuated 40 dB.

Therefore, on the one hand if the equipment is a NORMARC LDB-103 DME 1 kW, the obtained samples have values around 20 dBm, but on the other hand for a NORMARC LDB-103 DME 100 W the samples are around 10 dBm.

Table 3.3-1: SIGNAL LEVELS

TYPE OF DME	SIGNAL LEVEL (dBm)	ATENUATTION (dB)	SAMPLE LEVEL (± 3 dBm)
1 kW	+60	30+10	20
100 W	+50	30+10	10

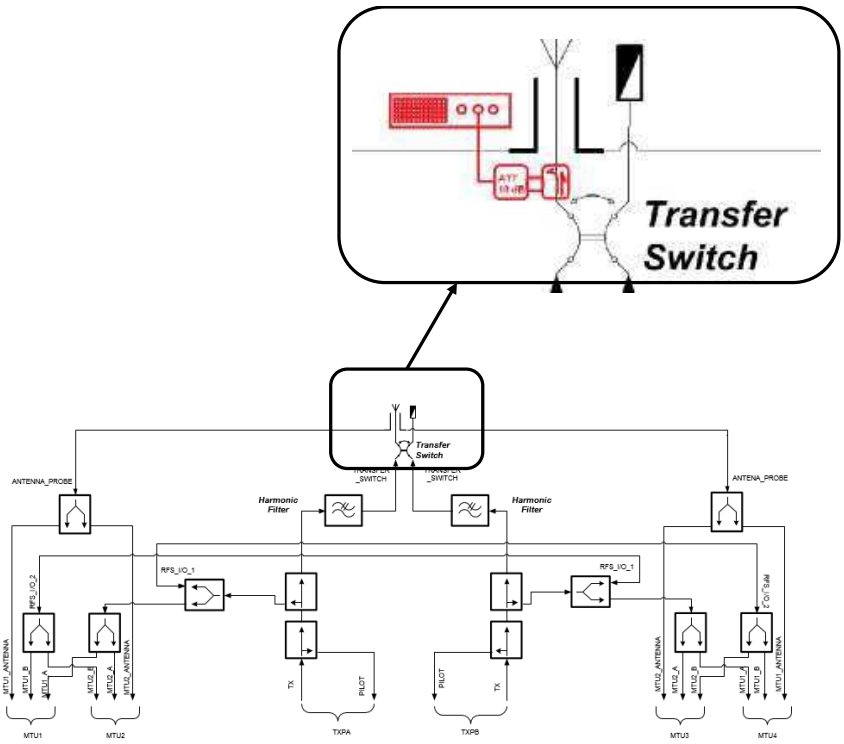


Figure 3.3-1: BLOCK DIAGRAM OF ANTENNA SAMPLE



Figure 3.3-2: COUPLER AND ATTENUATOR PLACEMENT

3.3.1.2 Probe 1 sample and Probe 2 Sample

Both signals have the same characteristics. They are the result of both couplers, which extract a sample from the RADIOFREQUENCY SHELF (see section 3.2).

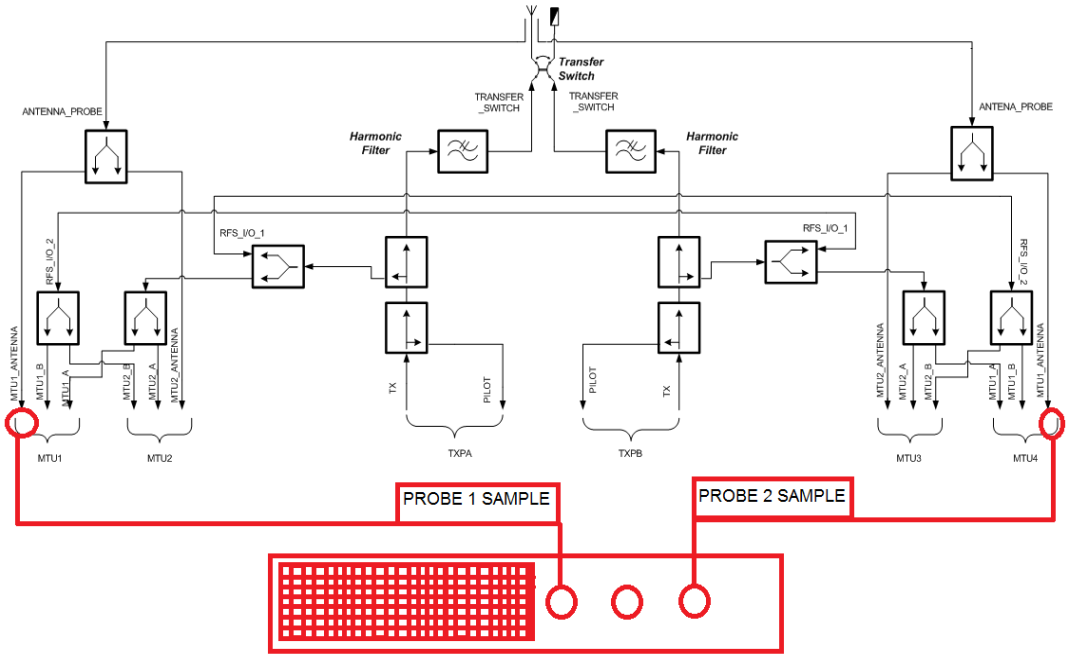


Figure 3.3-3: BLOCK DIAGRAM OF PROBE 1 SAMPLE AND PROBLE2 SAMPLE

To assure the required signal level, two attenuators of 15dB are used.



Figure 3.3-4: 15 DB ATTENUATORS PLACEMENT

3.3.2 BIT Facilities and Alarm Management

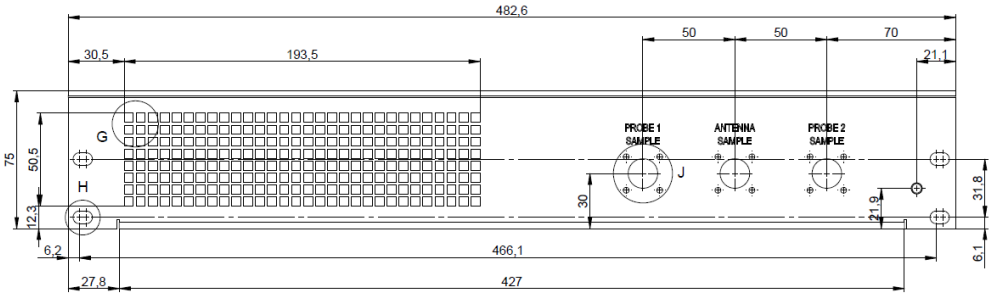
Output samples Front Panel is a completely passive module, it is unable to assert any alarm and it does not generate any BIT signal.

3.3.3 Programming and Control Information

Output samples Front Panel is not connected to the RS485 bus.

3.3.4 Mechanical Details

The following figures show the mechanical description.



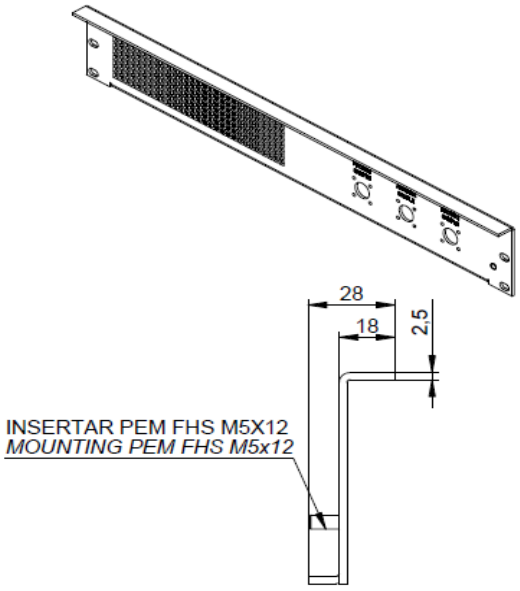


Figure 3.3-5: 15 OUTPUT SAMPLE FRONT PANNEL ASSEMBLY

3.3.5 Front Panel Details

See figure below.



Figure 3.3-6: 15 OUTPUT SAMPLES FRONT PANNEL

3.4 LOCAL CONTROL UNIT (LCU)

3.4.1 Functional Description

The NORMARC LDB-103 DME series equipment includes a Local Control Unit (LCU) with a Thin Film Transistor (TFT) Color Liquid Crystal Display Module with a touch panel. This unit provides a Human Machine Interface, giving access to status and alarm information and basic control functions in local environment in which the operator is situated at where the equipment cabinet is.

This unit acts as a slave of the Control and Monitoring Units (CMUs) present in the equipment, not having any internal intelligence. The information showed in the display is managed by the master CMU of the equipment. It also receives the commands introduced by the user through the touch screen. This unit transmits and receives information from the master CMU by means of VGA and USB serial connections.

Since the equipment can fit two CMUs, the Local Control Unit (LCU) have connectivity with both of them (2 VGA and 2 USB connectors), making an internal selection by means of a chip select signal sent by the Relay Control Unit (RCU), which knows which is the master CMU in the system.

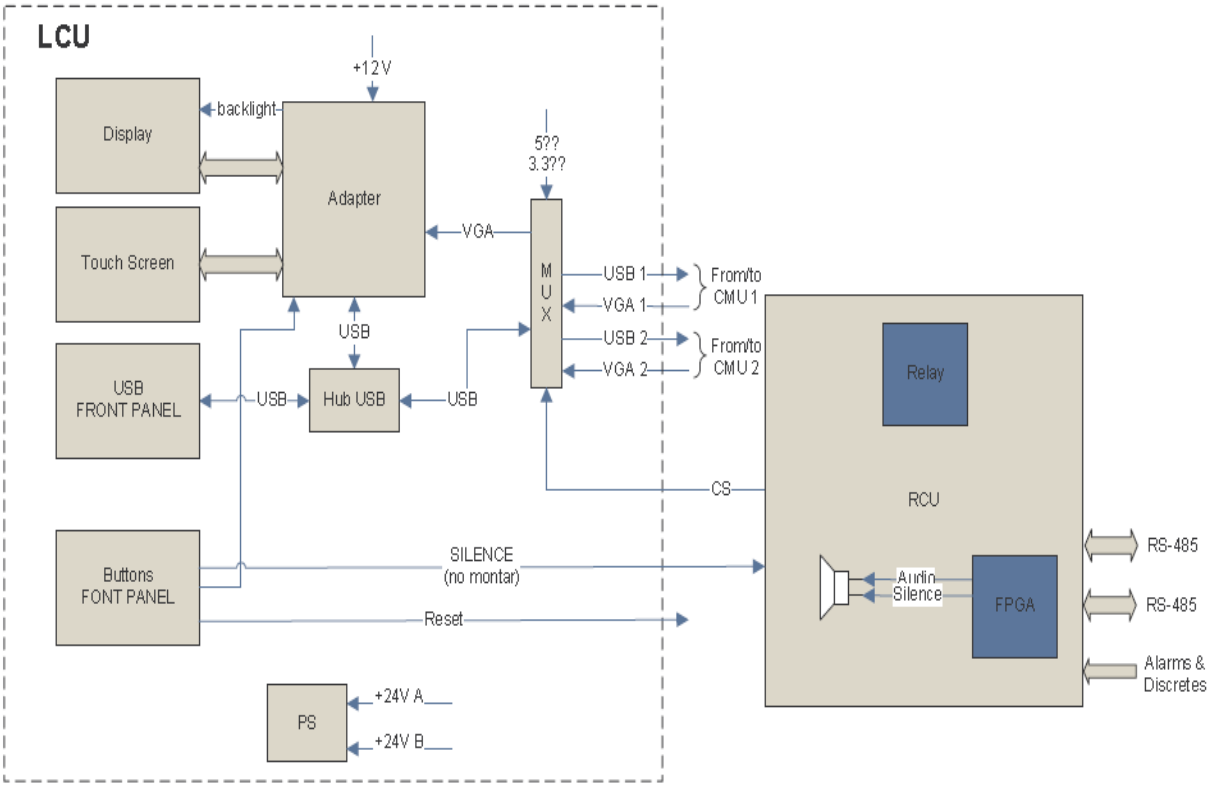


Figure 3.4-1: LCU FUNCTIONAL BLOCK DIAGRAM

The LCU shows:

- Basic Information: high-level status.
- General system status: DME monitored parameters.
- Module status to some details.
- Alarm status.

The LCU conduits selected commands entered through its touch screen to appropriate module for execution. These include:

- Mode selection: LOCAL/ REMOTE/ MAINTENANCE
- Change-Over
- MAIN/STANDBY selection
- ON/ OFF/ Reset
- Alarm Inhibit
- Silence
- Lamp test

Status and alarm information are always visible, regardless of which the display screen the user is watching.

The local reset is a hardware reset button. This button resets all the modules of the equipment except the power supplies and the Ethernet switch.

3.4.2 LCU Software

The LCU software operates under Linux Hielos Operating System.

HIELOS operating system is designed to support LCU GUI without any other software component required apart from the already present in the system.

The LCU GUI is developed in C++ using the tools and libraries from the QT working environment. To simplify the software architecture, the QT components needed for the application execution are integrated in the HIELOS distribution.

In the same way, the libraries needed for the control of the touch panel are included in the operating system. HIELOS is a Linux distribution designed and maintained by Indra. It is specifically developed for the control and monitoring of a system.

The operating system architecture assures a steady, reliable and dynamic performance with the requirements of hardware components. The system integrates the libraries needed for the proper execution of the user interface applications.

3.4.3 Application Components

The application consists of four different software blocks within the LCU GUI, as shown in figure below:

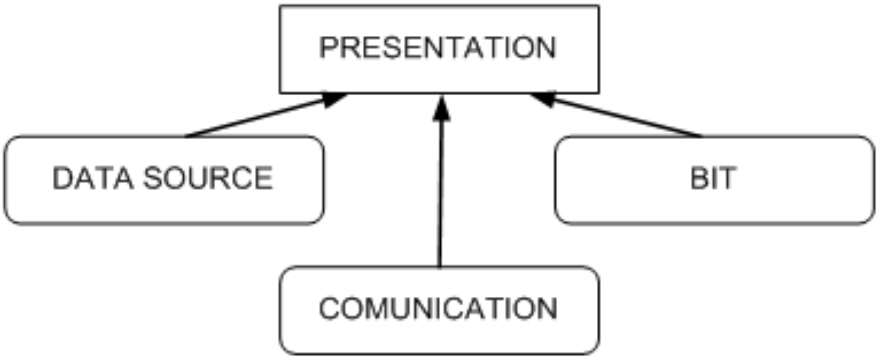


Figure 3.4-2: SOFTWARE BLOCK DIAGRAM FOR LCU GUI

The block diagram applies to all classes of equipment, all type of display panels and all applicable equipment parameters. Within the display screen, the status panel is located in the left side and the maintenance panel in the central part.

In the maintenance section, the selection panel is established where branching into deeper levels of maintenance can be accessed. In the DME LCU, tabs for GENERAL, DETAILED and ALARMS tabs are provided to access more intensive level of detailed information in the system.

3.4.4 BIT Facilities and Alarm Management

Since the Local Control Unit (LCU) is a slave unit of the master Control and Monitoring Unit (CMU) of the system, it is not able to assert any alarm and it does not generate any BIT signal.

This unit does not take part on the regular work of the equipment, only showing status information and sending commands to the CMU.

A failure of this unit does not imply any system fault.

3.4.5 Programming and Control Information

All the information showed by the Local Control Unit (LCU) through the display, is managed by the master Control and Monitoring Unit (CMU).

The communication between the LCU and the CMU is performed by means of VGA and USB ports.

3.4.6 Mechanical Details

The Local Control Unit (LCU) module has the following dimensions:

- Height: 3 U or 133.35 mm.
- Width: 240 mm
- Depth: 320 mm

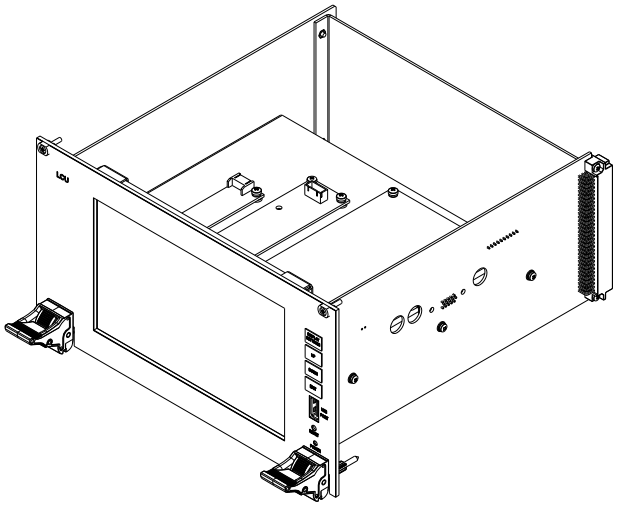


Figure 3.4-3: LCU ASSEMBLY

This module has sliding rails at top and bottom, allowing an easy insertion.

The LCU has one rear connector (P1) type DIN41612 Type C (96 pins).

3.4.7 Front Panel Details

The Local Control Unit (LCU) has a 7' wide screen Thin Film Transistor (TFT) color Liquid Crystal Display Module with a touch panel.

The resolution of the display is 800x480.

In addition to the display, the LCU has a hardware reset button, which resets all the modules of the equipment, except the power supplies and the Ethernet switch.

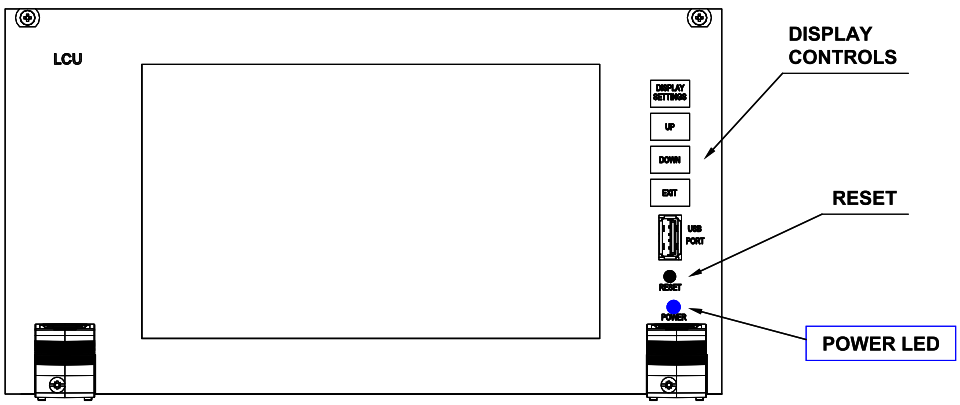


Figure 3.4-4: LCU - FRONT PANEL

3.4.8 Hardware Implementation

The LCU module occupies the LH half of a 3U high housing in the 19' racking system. It consists of a Back Plane PBA at the back, a main LCU PBA lying vertically at the side of the housing and a display unit in its front. Hardwares associated with the display panel are fitted in a horizontal carrier.

3.5 RELAY CONTROL UNIT (RCU)

3.5.1 Functional Description

The primary role of the RCU is to analyze the local alarms from each transponder (RXU, TXU and HPA), as well as the integrity alarms (executive alarms) from the two possible Monitor Transponder Units (MTUs), and based on that information decide which, if any, system has to be connected to the antenna.

The Relay Control Unit (RCU) supports the transfer switch and is able to command a changeover to the transfer switch and it produces a status indication, indicating which channel is currently connected to the antenna. This status indication is used for BITE purposes.

RCU configures both monitors to perform surveillance tasks over both transponders. Monitors are able to split its time base, performing monitoring task over both transponders. After detecting a Monitor Transponder Unit (MTU) failure (BITE primary alarm), the RCU switches off the faulty module.

The Relay Control Unit (RCU) is also responsible for generating enable signal for each single transponder, based on the alarm information it receives. If there is a primary alarm in any module of the transponder, the RCU disables the whole transponder (RXU, TXU and HPA), independently of the changeover function, assuring a safe operational condition.

Since monitoring tasks are perform in a dual way, alarm generation for changeover purposes is configurable between AND or OR mode of operation.

The Relay Control Unit (RCU) also is able to reset all the modules related with transponder, monitor and control functions. In order to perform this functionality, the RCU has the following reset outputs:

- TXP A reset.
- TXP B reset.
- MTU 1 reset.
- MTU 4 reset.
- CMU A reset.
- CMU B reset.

All these reset signals are independent, being possible to set only one of them or combine them in all the possible ways. To ensure the right operation of the beacon, the RCU issues a reset command to all the modules during its startup process.

The RCU receives the following alarm signals:

- From TXP (x2):
  - TXP Primary Alarm.
  - TXP Secondary Alarm.
- From MTU (x2):
  - Monitor Primary Alarm.
  - Monitor Secondary Alarm.
  - Executive Primary Alarm TXP A.

- Executive Secondary Alarm TXP A.
- Executive Primary Alarm TXP B.
- Executive Secondary Alarm TXP B.

- From CMU (x2)
  - CMU Secondary Alarm.

The RCU can be configured:

- To swap automatically Main and Standby systems at user-settable periodic rates.
- To wait a programmable time after the recycle count has reached a terminal value before automatically clearing the recycle count and initiating a start-up.
- To disable the transmitters of the standby unit to save power.

The Relay Control Unit (RCU) finds out which CMU is the master in the RS485 bus, by means of the address of the polling packets. Once the RCU knows which CMU is the master, it issues a Chip Select signal to the Local Control Unit (LCU). With this signal the LCU selects one of the sets of input/output signals (VGA/USB) it has, giving them the control of the LCU front panel (Touch screen).

The Relay Control Unit (RCU) also has a buzzer to raise an audio alert for an alarm condition.

The RCU further performs the following functions:

- Generation of suitable voltage rails from both main +24VDC supplies.
- Management of calibration and identification parameters.
- Generation of required signals for BIT functions.

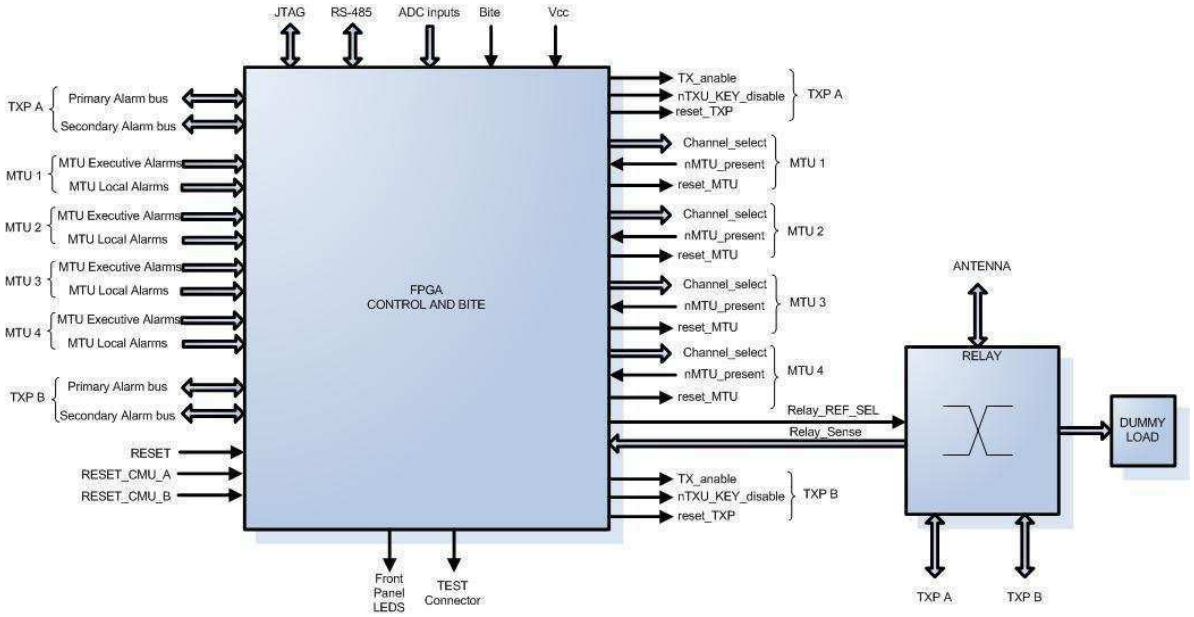


Figure 3.5-1: FUNCTIONAL BLOCK DIAGRAM

NOTE: MTU2 and MTU3 are not presented in the default configuration

3.5.2 BIT Facilities and Alarm Management

The monitored processes include +24VDC rail voltage coming from both sides of the equipment and main relay voltage rails.

The RCU includes multi-channel A/D converters to sense and monitor above mentioned magnitudes and processes for BIT purposes.

The A/D converters sample all of their inputs cyclically and continuously. The latest conversion results are accessible by poll requests from the system RS485 bus.

All operating voltages and/or the DC levels produced by these monitoring processes are presented on the front panel connector for test purposes.

The RCU asserts Local Primary and Secondary alarms on both, or either, system in the following scenarios:

- Any voltage rail out of user specified ranges.
- A failure of the FPGA configuration.
- Failure in transfer switch.
- No poll requests for a user-definable period.

3.5.3 Programming and Control Information

The RCU contains a non-volatile FLASH memory, which holds information about voltage thresholds, operating parameters and calibration data as well as internal FPGA configuration.

The RCU has an RS485 interface to poll all these static and dynamic data.

RS485 registers are divided in two different categories, status registers and configuration registers. First ones are ‘read only’ registers on the RS485 bus, while configuration registers are ‘read/write’ registers.

Status registers, which are available by polling, include the following parameters:

- Board ID
- FPGA revision
- Board revision
- Status
- Alarm Status
- Detected voltages on each system
- Internal voltage rails
- Number of monitors plugged into the system
- Monitor 1 Configuration (which TXP is monitoring to)
- Monitor 4 Configuration (which TXP is monitoring to)
- TXP on antenna

- TXP A and B status (enable/disable)
- Transfer switch status

Configuration registers include the following parameters:

- Internal voltage rail thresholds to generate LOCAL Primary and Secondary Alarms (High and Low)
- MAIN TXP definition
- Changeover
- Modules reset

3.5.4 Mechanical Details

The Relay Control unit (RCU) has the following dimensions:

- Height: 3U.
- Width: 21 HP.
- Length: based on euroboard 280mm length standard.

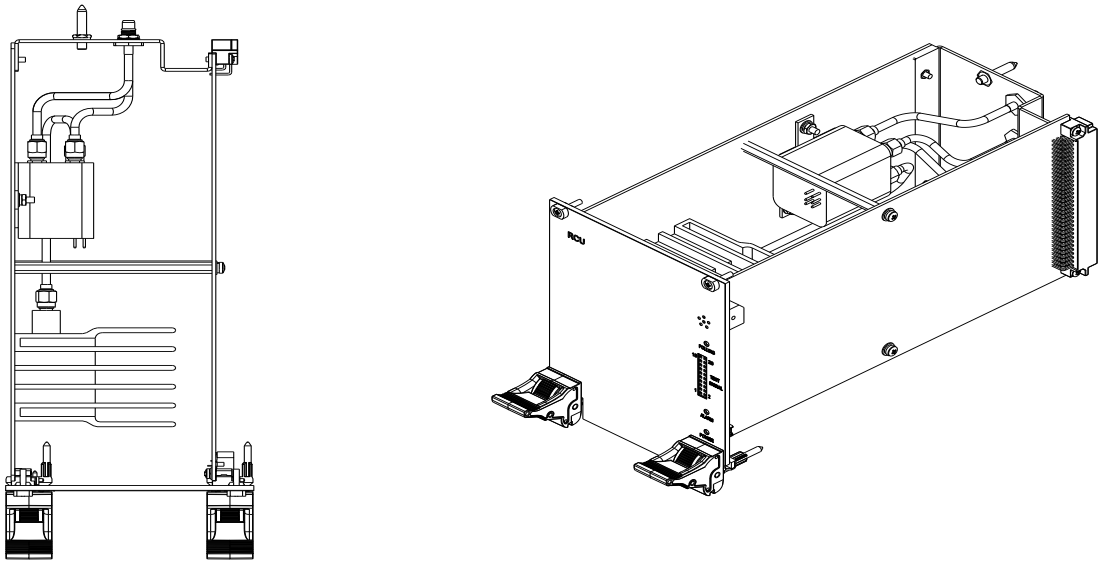


Figure 3.5-2: RCU ASSEMBLY

This module has rails at top and bottom, allowing an easy insertion.

The RCU has one rear connector (P1) type DIN41612 Type C (96 pins).

The module has insertion/extraction levers, allowing its easy insertion and extraction. The levers also provide ESD protection (automatic connection with the rack ground) and hot swappable operation (automatic power supply disabled before extraction of the module).

3.5.5 Front Panel Details

On the front panel, the Relay Control Unit (RCU) has a 20 pin connector and three LEDs indicators.

The 20 pin connector gives access to critical analogue and digital signals such as alarm indications and internal voltage rails for test purposes. Digital signals present in test connector are selectable under software control.

The indicator LEDs are SMD, and make use of light pipes to direct the light through the front panel, as follows:

- POWER [Blue]: indicates that the unit has power.
- ALARM [Red-Amber-Green]: indicates Primary and Secondary Alarm status; the LED is red to indicate a Primary Alarm, amber to indicate a Secondary Alarm and green when no alarm is being asserted.
- POLLING [Yellow]: indicates polling requests.

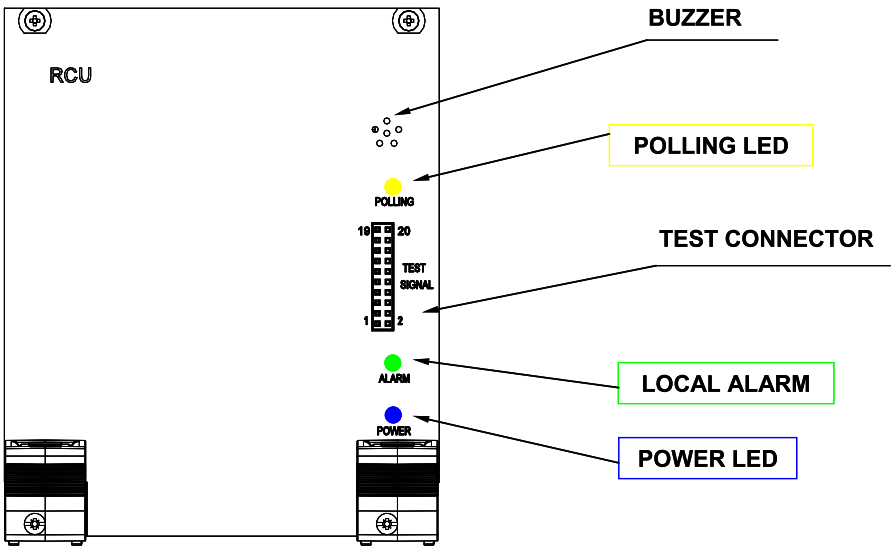


Figure 3.5-3: RCU - FRONT PANEL

3.5.6 Hardware Implementation

The RCU module occupies the RH half of a 3U high housing in the 19’ racking system.

It consists of a Back Plane PBA at the back, a main RCU PBA lying vertically at the side the housing and an electromechanical transfer switch also at its side, near the center of the housing.

3.6 CONTROL & MONITORING UNIT (CMU)

3.6.1 Functional Description

The Control and Monitoring Unit (CMU) is the principal access point to the NORMARC LDB-103 DME system.

The CMU performs the following functions:

- To gather and distribute performance data from each module in the system.
- To allow local and remote access to operating parameters.
- System pre-alarm checking.
- Remote communications management.
- Generation of suitable voltage rails from main +24VDC supply.
- Generation of required signals for BIT functions.
- Secondary local alarms generation and management.
- Coordination of automatic calibration and installation functionalities.
- Manage of Monitor performance tests.

The CMU does not take any role in detection, generation and monitoring processes of the DME once the latter have been set-up and configured.

The CMU contains a CPU that runs a Linux operating system and which runs on a standard industrial Single Board Computer (SBC). The industrial CPU card has an Industrial temperature range and requires no fan.

The embedded Operating System acts as a Simple Network Management Protocol server that gives network access to the all the items, in all the modules, that have been defined above.

To support the embedded processing platform there is a main I/O card.

The main I/O board has a circuitry capable of interfacing with two different remote temperature sensors.

The Control and Monitoring Unit (CMU) is responsible for status indications to the remote management system. This unit is able to be configured so as to send information to the remote management system at least in the following scenarios:

- Local Control request
- Maintenance
- Primary or secondary alarm condition
- Pre-alarm condition
- Periodic status report

The Control and Monitoring Unit (CMU) is able to make a log of the status parameters of the equipment with a user-defined periodicity.

3.6.2 BIT Facilities and Alarm Management

The CMU does not assert a Local Primary Alarm.

The CMU generates a local Secondary Alarm if:

- Any module in the system does not have a valid Module identification.
- A module is not responding to poll requests.
- Main and Standby systems had conflicting set-ups, e.g. the frequency of one was different to the other, the ident codes were different, the power levels were different, etc.
- Its own power rails were outside user-defined thresholds.
- The temperature sensors were measuring temperatures outside user-specified thresholds.

The CMU also implements pre-alarm checking in all the parameters that can trigger an alarm condition (both executive and local alarms). These parameters are defined in the previous paragraphs.

The CMU polls all the modules connected to the RS 485 bus, gathering the current values of the parameters. Then it compares the current value of the parameters with a user defined pre-alarm threshold. If the current value of the parameter is out of the range defined by the thresholds, the CMU triggers a pre-alarm signal. Note that pre-alarm signals do not have any effect on the changeover function of the transponder.

Pre-alarm thresholds are defined inside the CMU, not affecting the rest of the modules.

When a pre-alarm signal is triggered, the CMU makes a log of this condition, storing the hour, the module and the value of the parameter that has trigger the pre-alarm.

It is possible to configure the CMU so as to send an indication to the remote control system upon a pre-alarm trigger. Pre-alarm signals are used as maintenance alerts.

3.6.3 Programming and Control Information

The CMU acts as the master of the RS485 bus gathering the value of all the parameters of each of the modules.

The CMU has a non-volatile memory, which holds information about pre-alarm thresholds and operating parameters of the system.

3.6.4 Mechanical Details

The Control and Monitoring Unit (CMU) has the following dimensions:

- Height: 6 U.
- Width: 5 HP.
- Length: based on euroboard 280 mm length standard.

This module has single card slides at top and bottom.

The CMU has 2 rear connectors.

- P1: DIN41612 Type C (96 pins)
- P2: DIN41612 Type C (96 pins)

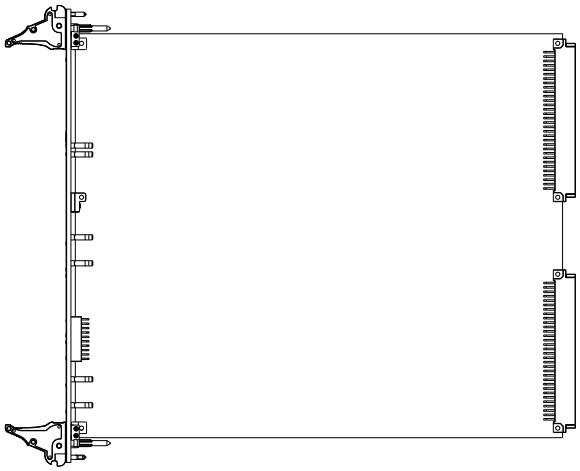


Figure 3.6-1: CMU ASSEMBLY

3.6.5 Front Panel Details

On the front panel, the Control & Monitoring Unit (CMU) has a 20 pin connector and six LEDs indicators.

The 20 pin connector gives access to critical analogue and digital signals such as internal voltage rails for test purposes. Digital signals present in test connector are selectable by software control.

The USB connector gives access to a USB port of the PC inside the module.

The LEDs are SMD, and use light pipes to direct the light through the front panel, as follows:

- POWER [Blue]: indicates that the unit has power.
- ALARM [Amber-Green]: indicates Secondary Alarm status; the LED turns to amber to indicate a Secondary Alarm, and green when no alarm is being asserted.
- SYSTEM STATUS [Red-Amber-Green]: indicates Primary and Secondary Alarm status of the beacon. The LED is red to indicate a Primary Alarm, amber to indicate a Secondary Alarm and green when no alarm is being asserted.
- POLLING [Yellow]: indicates polling requests.
- ETHERNET LINK [Yellow].
- ETHERNET ACTIVITY [Green].

This module has two insertion/extraction handles (one at the top and one at the bottom of the front panel), allowing an easy insertion and extraction of the module. This handles supplies ESD protection (automatic connection with the rack ground) and hot swappable operation (automatic power supply disable before extraction of the module).

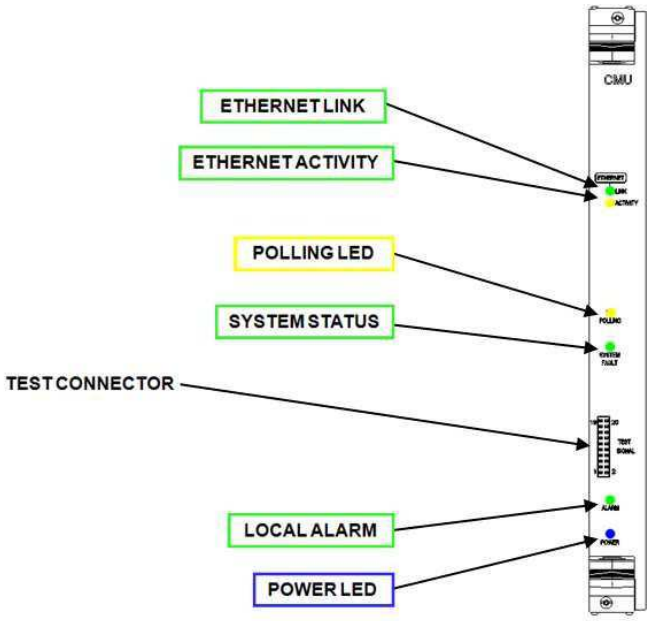


Figure 3.6-2: CMU - FRONT PANEL

3.6.6 Hardware Implementation

The CMU module occupies the central vertical slots of the subrack, counting from either outside edge of the subrack. CMU1 is at the Left Hand side and CMU2 at the Right Hand side of the subrack.

3.7 MONITOR TRANSPONDER UNIT (MTU)

3.7.1 Functional Description

To ensure the correct operation and integrity of the transponder at all times, an embedded instrument, Monitor Transmitter Unit (MTU), is used to constantly measure various parameters of the DME including, but not limited to, reply pulse characteristics, identification code group characteristics, transmit and receive frequencies, etc.

The monitor unit is able to interrogate the DME associated with, and determine its working status. It does this by simulating a distant aircraft interrogator unit, sending regular interrogation pulses. Monitor unit looks for the DME reply pulses, knowing the programmed reply delay of the DME transponder. If reply pulse parameters fall within user-defined thresholds, then no action is taken. If however, there is an absence of valid reply pulses or its characteristics are invalid, the monitor unit flags up an alarm indicating that there is a fault.

The Monitor Transponder Unit (MTU) performs all its digital signal processing with an FPGA based platform ensuring safety requirements.

The Monitor Transmitter Unit (MTU) is failsafe: failure of any part of the Monitor Unit that is associated with alarm parameter checking results in the alarm being triggered for that same parameter.

With the exception of identification alarms, delay between a fault condition and monitor alarm indication is as low as possible, but not exceeding 10 seconds in any case.

In case of absence of identification, the delay between the occurrence of a fault condition and monitor action is always below 40 seconds.

The Monitor Transponder Units (MTUs) does not have hard-association with transponders, being possible to perform monitoring tasks over both transponders fitted in a DME cabinet. Relay Control Unit (RCU) configures the association between monitors and transponders, with dedicated lines to each MTU.

Monitor Transponder Unit (MTU) is able to manage the following configurations:

- TXP A monitoring
- TXP B monitoring
- TXP A + TXP B monitoring
- OFF

The Monitor Transponder Units (MTUs) also is able to coordinate with other MTUs (they are synchronized) so as to generate complex interrogation patterns as echoes or interfering signals, being possible to measure the performances of the transponder.

The Unit has the following radiofrequency ports:

- TXP A (RF shelf coupling)
- TXP B (RF shelf coupling)
- Probe Antenna

TXP A and TXP B ports are used both to inject interrogation signal to transponders and to receive a sample of the transmitted signal. Generated signals by the MTU have the suitable level, frequency and pulse shape characteristics to measure the performance of the system. For detailed information, see NORMARC LDB-103 DME PERFORMANCES.

Probe antenna port is only used to receive a sample of the radiated signal not being possible to inject any signal in this port.

TXP A and TXP B radiofrequency ports shares the same transmission and reception circuitry. The MTU connects only one of them to the circuitry through a RF switch depending on the configuration given by the Relay Control Unit (RCU). Probe antenna port has its own independent circuitry.

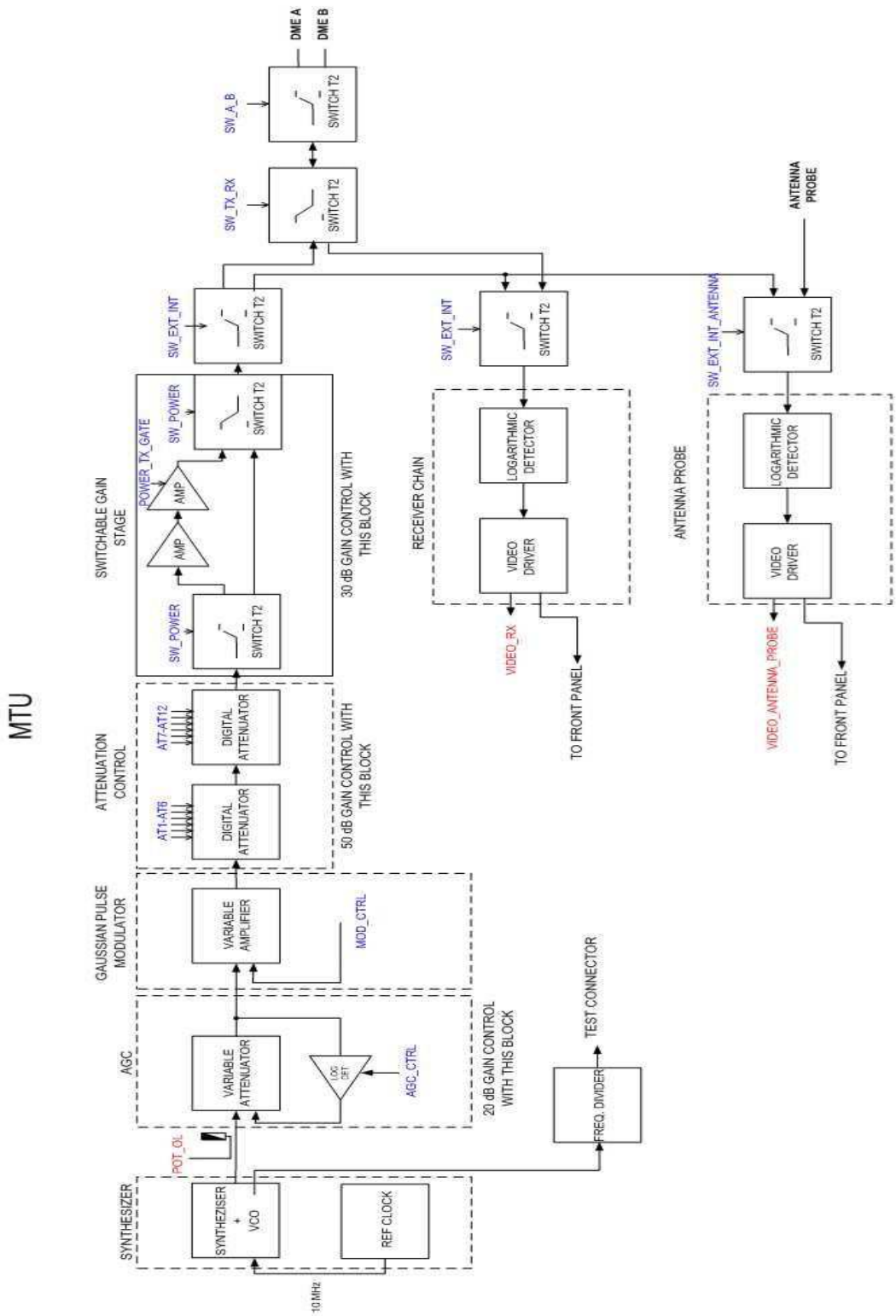


Figure 3.7-1: MTU - Block Diagram

The Monitor Transponder Unit (MTU) arises the following output alarms:

- TXP A executive primary alarm.
- TXP A executive secondary alarm.
- TXP B executive primary alarm.
- TXP B executive secondary alarm.
- Local primary alarm.
- Local secondary alarm.

Monitor Transponder Unit (MTU) performs the following kind of tests:

- Executive test.
- Auto diagnosis test.

During normal operation of transponders, monitor units perform executive and auto diagnosis tests.

In executive test, Monitor Transponder Unit (MTU) generates interrogations with fixed parameters (ICAO Annex 10 parameters [AD.1]) and analyzes transponder replies, checking if it is necessary or not to set any Executive alarm. In this period, monitors ensure proper operation of the transponder, measuring critical parameters of the system. All alarm thresholds are configurable by the RS485 bus and it is possible to set an alarm condition as primary or secondary alarm. Executive test injects test interrogation signals to the transponder with a maximum rate of 120 pair of pulses per second per transponder regardless of the number of MTUs plugged in the system.

Monitor Transponder Units (MTUs) checks its own threshold levels during auto diagnosis test, generating signals out of specification and injecting them to its own receiver. Replay delay and pulse pair spacing primary alarm thresholds are tested. In this case, the MTU measures its own alarm thresholds, checking them both in upper and lower limits. If the measured value falls out of the user-defined range, the MTU generates a LOCAL primary alarm and hence an EXECUTIVE primary alarm.

Thanks to the programmable internal signal generator and to the switching matrix present in the Monitor Transponder Unit (MTU), it is possible to measure the real alarm thresholds of the MTU. During auto diagnosis test, the switching matrix connects directly the signal generator with the receiver, so the MTU received signal comes from the internal signal generator instead of the transponder. In order to measure the real threshold, the MTU starts generating an interrogation with nominal values and performing exactly the same analysis algorithm over the received signal (in this case the signal generated by the MTU). Since the generated signal has nominal values, no alarm is going to be declared. Then the MTU starts to decrease step by step one of the parameters of the generated signal (delay or pulse pair spacing) until the monitor receiver algorithm detects the associated alarm. In this moment, the auto diagnosis algorithm stops and stores the value of the parameter that has been changed. This value is the real alarm threshold of the MTU. After that, the internal signal generator returns to the nominal signal and performs exactly the same process increasing the parameter value until the receiver algorithm detects the same alarm, so the real upper threshold is measured. The alarm generated during the alarm threshold measurement is not propagated out of the FPGA, it is only used to stop the auto diagnosis algorithm and store the measured alarm threshold.

For replay delay alarm threshold check, the MTU internal signal generator generates directly a reply instead of an interrogation. In this case, the nominal replay is the one that is in the middle of the reply window of the MTU receiver algorithm.

Thanks to the auto diagnosis test of the MTU, any malfunction on the MTU circuitry that affects the real alarm thresholds is detected.

Note that autodiagnosis test does not increase transponder load.

The Monitor Transponder Unit (MTU) is based on an FPGA platform. Note that all the monitor functions related with EXECUTIVE and AUTO-DIAGNOSIS test are performed on a FPGA based platform not making use of the embedded processor.

MTU also performs the following functions:

- Generation of suitable voltage rails from main +24VDC supply.
- Management of calibration and identification parameters.
- Generation of required signals for BIT functions.

MTU does not need any hardware adjustment depending on the output power configuration and the channel of operation.

3.7.2 BIT Facilities and Alarm Management

MTU is able to monitor the following parameters to set an EXECUTIVE primary or secondary alarm:

- Measuring the RF Shelf coupling signal:
  - Beacon delay.
  - Pulse pair spacing.
  - Transmitted power.
  - Efficiency.
  - Transmitter and receiver frequency.
  - First and second pulse characteristics:
    - Rise time (10% to 90%).
    - Decay time (90% to 10%).
    - Pulse width (50%).
    - Power variation (constituent pulses).
- Measuring the probe antenna signal:
  - Radiated power.
  - Transmission rate.
  - MORSE code:
    - Absence (excessive time between identification periods).
    - Code transmitted.
    - Continuous keying.
    - Dash/dot/space length.

The above-mentioned parameters are monitored during normal operation of the transponder. Any value out of the specified range triggers an EXECUTIVE alarm signal.

There are two different set of thresholds related with the above parameters.

- Fixed thresholds
- Configurable thresholds

The first set of thresholds (fix thresholds) is stored in the Non Volatile Memory of the Monitor Transponder Unit (MTU). These values are accessible only in read mode to the RS485 bus, not being possible to change them. The only way to change these thresholds is through the JTAG port of the module. These thresholds match the ICAO Annex X [AD.1], and ED-57 [AD.3] defined alarm thresholds. Regardless of the threshold value, it is possible to configure all these parameters as primary or secondary alarms through the RS485 bus. Since it is not possible to change the value of these thresholds through the RS485 bus, an erroneous configuration and hence a not-fulfilment of the normative is avoided.

The second set of thresholds is configurable through the RS485 bus. In this case, it is possible to program both the thresholds and the alarm level (primary, secondary, no alarm). With this set of thresholds, it is possible to configure a more restrictive condition to set primary and secondary alarms.

Having both kinds of thresholds, it is ensured the fulfillment of the normative in every moment and it is possible to configure a more restrictive condition.

In regular working of the monitor, it triggers an alarm with the most restrictive condition of both mentioned above. Note that it is possible to configure one fixed threshold as a primary alarm and its equivalent configurable threshold as a secondary alarm, implementing a dual threshold for the same parameter.

The Monitor Transponder Unit (MTU) is able to set a LOCAL primary or secondary alarm in the following conditions:

- Mismatch in monitor configuration between hardware dedicated lines and RS485 registers.
- Any voltage rail out of user specified ranges.
- Failure of the FPGA configuration.
- An absence of poll requests from the CMU.
- Failure detected with Auto diagnosis test (thresholds):
    - Beacon delay threshold.
    - Pulse pair spacing threshold.

The MTU includes multi-channel A/D converters to sense and monitor above mentioned magnitudes and processes for BIT purposes. The A/D converters sample all of their inputs cyclically and continuously. The latest conversion results are accessible by poll requests from the system RS485 bus.

All operating voltages and/or the DC levels produced by these monitoring processes are presented on the front panel connector for test purposes.

In performance test, the Monitor Transponder Unit (MTU) is able to measure:

- One MTU alone:
  - Reply delay vs. interrogation power level.
  - Through reply efficiency:
    - Sensibility.
    - Receiver bandwidth.
    - Adjacent channel rejection.
    - Pulse pair spacing acceptance threshold.
    - Pulse pair spacing rejection threshold.
    - Simple pulse rejection.
- And in collaboration with another MTU:
  - Through reply efficiency:
    - Death time.
    - Long distance echo suppression performance.

There is another kind of alarm (in this case secondary alarm) which will be produced when synchronization between both MTUs is lost. When the slave MTU losses the coordination with the master, a new way to synchronize is created making the MTU slave to generate its own timing. This synchro alarm is showed in the slave MTU.

3.7.3 Programming and Control Information

MTU contains a non-volatile FLASH memory, which holds information about thresholds, operating parameters, calibration and compensation data as well as its internal FPGA configuration.

MTU has a RS485 interface to poll all these static and dynamic data.

RS485 registers are divided in two different categories, status registers and configuration registers. First ones are ‘read only’ registers on the RS485 bus, while configuration registers are ‘read/write’ registers.

Among status registers, which are available by polling, are the following parameters:

- Board ID.
- FPGA revision.
- Board revision.
- Status (enabled/disabled).
- Local alarm status.
- Executive alarm status.
- Monitored transponder (A, B or both).

- Internal voltage rails.
- Fixed alarm thresholds:
  - High and low beacon delay alarm threshold.
  - High and low pulse pair spacing alarm threshold.
  - Transmitted power alarm threshold.
  - Efficiency alarm threshold.
  - High and low frequency difference alarm threshold.
  - High and low transmission rate alarm threshold.
  - Radiated Power threshold.
- MORSE code:
  - Absence threshold (time without identification signal).
  - Continuous keying threshold.
- Measured TXP parameters (executive test):
  - Beacon delay.
  - Pulse pair spacing.
  - Transmitted power.
  - Efficiency.
  - Transmitter and receiver frequency.
  - First and second pulse characteristics:
    - Rise time (10% to 90%).
    - Decay time (90% to 10%).
    - Pulse width (50%).
    - Power variation (constituent pulses).
  - Radiated power.
  - Transmission rate.
  - MORSE code.
    - Identification status (present/not-present).
    - Absence.
    - Code transmitted.
    - Continuous keying.
    - Dash/dot/space length.

- Identity code length.
- Time between identification periods.

- Measured MTU thresholds (auto diagnosis test):
  - High and low beacon delay alarm threshold.
  - High and low pulse pair spacing alarm threshold.
- Measured value in performance test:
  - Efficiency.
  - Reply delay.

Configuration registers have the following parameters:

- Primary/Secondary alarm selection for fixed thresholds (executive alarm).
- Primary/Secondary alarm selection for configurable thresholds (executive alarm).
- Operating channel.
- Calibration data.
- Identity Code.
- Monitor configuration.
- Test modes enable.
- Interrogation rate in executive test.
- Thresholds to generate EXECUTIVE primary or secondary alarm (configurable thresholds):
  - High and low beacon delay alarm threshold.
  - High and low pulse pair spacing alarm threshold.
  - Transmitted power alarm threshold.
  - Efficiency alarm threshold.
  - High and low frequency difference alarm threshold.
  - First and second pulse shape characteristics:
    - High and low rise time threshold (10% to 90%).
    - High and low decay time threshold (90% to 10%).
    - High and low pulse width threshold (50%).
    - Power variation threshold (constituent pulses).
- High and low transmission rate alarm threshold.
- Radiated Power threshold.

- MORSE code:
  - Absence threshold (time without identification signal).
  - Continuous keying threshold.
  - Dash/dot/space length threshold.
  - Identity code length threshold.
- Thresholds to generate LOCAL primary and/or secondary alarm:
  - Internal voltage rail thresholds (High and Low).
  - Auto diagnosis test thresholds:
    - High and low beacon delay alarm threshold.
    - High and low pulse pair spacing alarm threshold.

Note that there is no need for configuration registers to be available in local or remote control. It depends on Control & Monitoring Unit (CMU) configuration policy to give access to one or another parameter in local or remote control or let that parameter as only factory set parameter. All the parameters are accessible by the RS485 bus.

This unit has a JTAG port plus an enable signal accessible through the backplane connector, so as to be able to program the FPGA inside the module from the Control & Monitoring Unit (CMU).

3.7.4 Mechanical Details

The Monitor Transponder Unit (MTU) has the following dimensions:

- Height: 6U.
- Width: 5 HP.
- Length: based on euroboard 280 mm length standard.
- Weight: 700 g.

This module has single card slides at top and bottom.

The MTU has 4 rear connectors.

- P1: DIN41612 Type C (96 pins);
- P2: RF BMA plug connector;
- P3: RF BMA plug connector;
- P4: RF BMA plug connector.

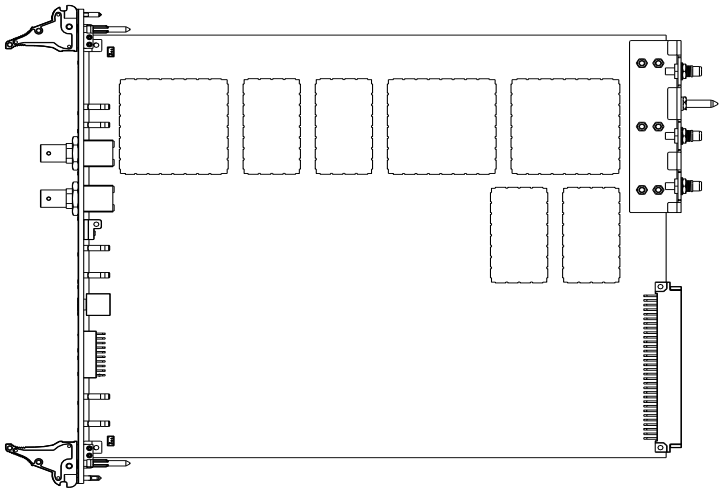


Figure 3.7-2: MTU ASSEMBLY

3.7.5 Front Panel Details

On the front panel, the Monitor Transponder Unit (MTU) there are a 20 pin connector, one jack socket, two 50 Ω BNC connectors and seven LEDs indicators.

The 20 pin connector gives access to critical analogue and digital signals, such as synchronization signals and internal voltage rails for test purposes. Digital signals present in test connector are selectable by software control.

There is one female jack socket, where the user is able to hear the IDENT code detected by the monitor. If the MTU is monitoring the standby equipment, this connector does not have use (Standby TXU does not generate IDENT signal).

Front panel supports two 50 Ω BNC connector:

- VIDEO. Video waveform corresponding in shape and time to the envelope of received RF signal.
- TRIGGER. Output pulse for triggering test equipment, providing accurate pulse timing.

LEDs are SMD, and use light pipes to direct the light through the front panel, as follows:

- POWER [Blue]: indicates that the unit is powered.
- ALARM [Red-Amber-Green]: indicates Primary and Secondary Alarm status. This LED refers to Local Alarm of the MTU. The LED lights red to indicate a Primary Alarm, amber to indicate a Secondary Alarm and green when no alarm is being asserted.
- MONITOR ALARM [Red-Amber-Green]: indicates Primary and Secondary Alarm status of the beacon. This LED refers to beacon's alarms detected by the Monitor. The LED lights red to indicate a Primary Alarm, amber to indicate a Secondary Alarm and green when no alarm is being asserted
- POLLING [Yellow]: indicates polling requests.
- INT [Green]: this LED turns on each time the MTU transmits a test interrogation to the TXP. In normal operation, users will see this LED active on all the time.

- IDENT [Yellow]: indicates the presence of the IDENT tone; it turns on and off in cadence with the dashes and dots of the Morse representation of the identification code detected by the MTU.

This has two insertion/extraction handles (one at the top and one at the bottom of the front panel), allowing an easy insertion and extraction of the module. This handles supplies ESD protection (automatic connection with the rack ground) and hot swappable operation (automatic power supply disable before extraction of the module).

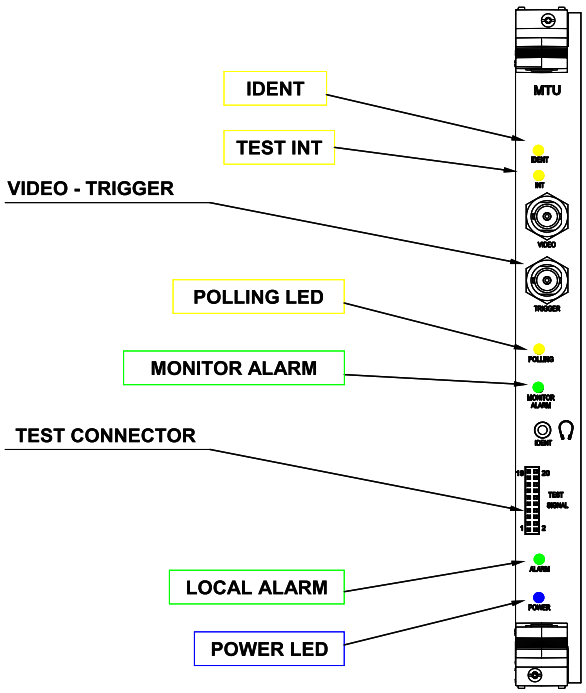


Figure 3.7-3: MTU - FRONT PANEL

3.7.6 Hardware Implementation

The MTU module can occupy the four and fifth vertical slots of the subrack after the HPA. MTU A at the Left Hand side and MTU B at the Right Hand side of the subrack.

3.8 RECEIVER UNIT (RXU)

3.8.1 Functional Description

The main function of the Receiver Unit (RXU) is to detect DME valid interrogations in its assigned channel under its coverage area.

To perform this functionality, Receiver Unit (RXU) makes the following processes:

- Select the working channel.
- Amplify the received signal.
- Down conversion to 63 MHz (intermediate frequency).

- Logarithmic envelope detection.
- Video digitalization.
- Digital signal processing.

Channel selection is made by electronic means, not being necessary to perform any physical adjustment on the module to change the operating channel. The module is able to work all over the DME reception band from 1025 to 1150 MHZ, giving service to the 252 possible X and Y DME channels without adjustments.

The module generates the suitable Local Oscillator (LO) signal to perform the down conversion to an intermediate frequency of 63 MHZ, according to the selected channel, and sends it to the Transmitter Unit (TXU), so as to it generates the transmission signal.

A sample of this signal (divided by an N factor) is also sent to the Monitor Transponder Units (MTUs), so they can perform monitoring tasks over reception and transmission frequency of the beacon.

Once the signal has been converted to the intermediate frequency, the Receiver Unit (RXU) performs all the necessary filtering to achieve the sensitivity level indicated in Table 1.7-6.

The module is also able to manage the input dynamic range shows in Table 1.7-6.

Receiver Unit (RXU) performs a logarithmic envelope detection of the received signal, ensuring reception characteristics of the system all over the dynamic range. It uses a Ferris discriminator to perform the adjacent channel rejection, achieving the desired values.

Received signal after logarithmic envelope detection is digitalized to perform the suitable digital signal processing.

All this digital signal processing is performed on a FPGA based platform ensuring safety requirements. Among these processes are:

- Simple pulse detection.
- Short Distance Echo Suppression (SDES).
- Pulse pair validation.
- Dead time implementation.
- Long Distance Echo Suppression (LDES).
- Automatic sensitivity control.
- CW detection.

Echo suppression is configurable, being possible to adjust its values and enable or disable its functionality.

Receiver Unit (RXU) performs an automatic sensitivity control in function of the measured load of the beacon. When the number of detected interrogations is above 90% of the maximum load of the beacon, the Receiver Unit limits its own sensibility, ensuring the service to the interrogators that are closer to the beacon.

Receiver Unit (RXU) also performs the following functions:

- Generation of suitable voltage rails from main +24VDC supply
- Management of calibration and identification parameters
- Generation of required signals for BIT functions

Receiver Unit (RXU) has the following RF ports:

- Radiofrequency input (from TXU or HPA).
- Pilot Pulse (from RF Shelf).
- Local Oscillator sample (To TXU).

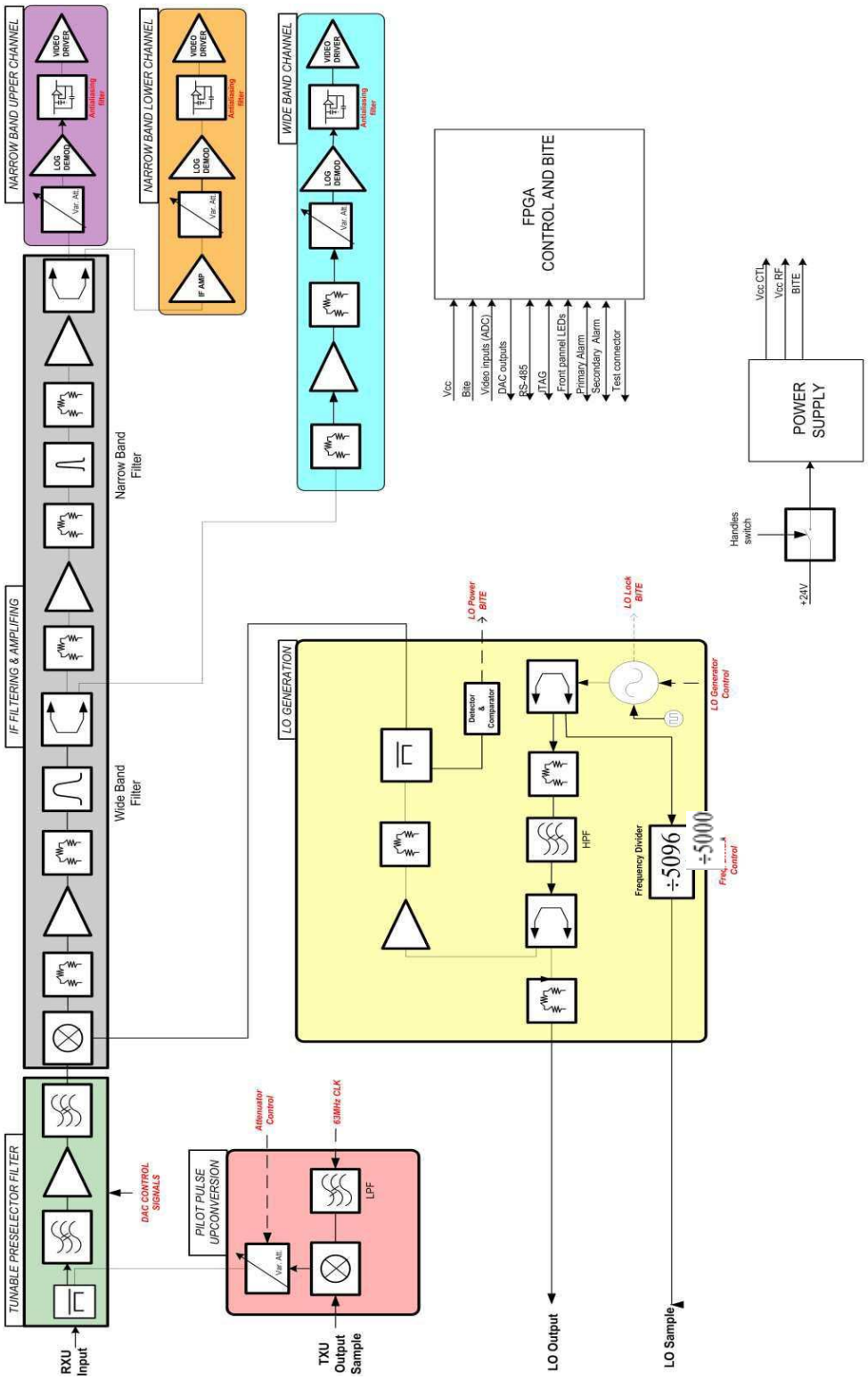


Figure 3.8-1: RXU FUNCTIONAL BLOCK DIAGRAM

3.8.2 BIT Facilities and Alarm Management

Receiver Unit (RXU) is able to generate the signals required for BIT purposes.

The following processes are monitored:

- Local Oscillator radiofrequency signal.
- All the important voltage rails.

RXU includes multi-channel A/D converters to sense and monitor above mentioned magnitudes and processes for BIT purposes. The A/D converters sample all of their inputs cyclically and continuously. The latest conversion results are accessible by poll requests from the system RS485 bus.

All operating voltages and/or the DC levels produced by these monitoring processes are presented on the front panel connector for test purposes

RXU asserts Local Primary and Secondary alarms in the following scenarios:

- Any voltage rail out of specified ranges.
- A failure of the FPGA configuration.
- Local Oscillator radiofrequency signal out of user defined ranges.
- An absence of poll requests from the CMU.

3.8.3 Programming and Control Information

The RXU contains a non-volatile FLASH memory, which holds information about thresholds, operating parameters, calibration and compensation data as well as internal FPGA configuration.

The RXU has a RS485 interface to poll all these static and dynamic data.

RS485 registers are divided in two different categories, status registers and configuration registers. First ones are ‘read only’ registers on the RS485 bus, while configuration registers are ‘read/write’ registers.

Among status registers, which are available by polling, are the following parameters:

- Board ID.
- FPGA revision.
- Board revision.
- Status (Enabled/Disabled).
- Alarm Status.
- CW input level and internal associated alarm.
- Local Oscillator (LO) current level.
- Number of received pulses per second.
- Number of erase pulses due to Short Distance Echo Suppression (SDES).
- Number of received interrogations per second.
- Number of erase interrogations due to death time.

- Number of erase interrogations due to Long Distance Echo Suppression (LDES).
- Number of decoded interrogations per second.
- Automatic sensitivity reduction indication.
- Current sensitivity level.

Configuration registers have the following parameters:

- Operating channel.
- Calibration data.
- Internal voltage rail thresholds to generate LOCAL Primary and Secondary Alarms (high and low).
- Local Oscillator (LO) level threshold to generate Primary and Secondary Alarms (high and low).
- Dead time configuration.
- Short Distance Echo Suppression (SDES) configuration.
- Long Distance Echo Suppression (LDES) configuration.
- Sensitivity level.
- Automatic sensitivity reduction configuration.
- CW level threshold to generate an internal Alarm.

Note that there is no need for configuration registers to be available in local or remote control. It depends on Control & Monitoring Unit (CMU) configuration policy to give access to one or another parameter in local or remote control or let that parameter as only factory set parameter. All the parameters are accessible by the RS485 bus.

This unit has a JTAG port plus an enable signal accessible through the backplane connector, so as to be able to program the FPGA inside the module from the Control & Monitoring Unit (CMU).

3.8.4 Mechanical Details

The Receiver Unit (RXU) has the following dimensions:

- Height: 6 U.
- Width: 5 HP.
- Length: based on euroboard 280 mm length standard.
- Weight: < 1 kg.

This module has single card slides at top and bottom.

The RXU has 4 rear connectors.

- P1: DIN41612 Type C (96 pins)
- P2: RF BMA plug connector;
- J20: RF BMA plug connector;

- J21: RF BMA plug connector.

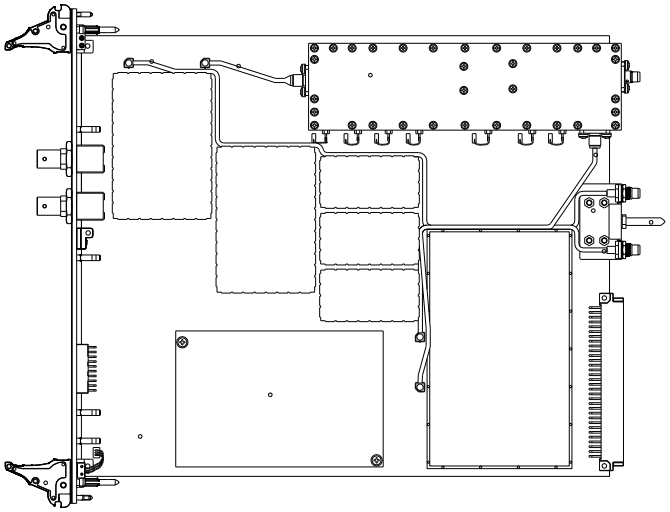


Figure 3.8-2: RXU ASSEMBLY

3.8.5 Front Panel Details

On the front panel, the Receiver Unit (RXU) have a 20 pin connector, two BNC connector and four LEDs indicators.

The 20 pin connector gives access to critical analogue and digital signals such as synchronization signals and internal voltage rails for test purposes. Digital signals present in test connector are selectable by software control.

BNC connectors in RXU front panel gives access to received pulse video signal. The impedance is 50 Ω.

- VIDEO HIGH: high part of the receiver dynamic range.
- VIDEO LOW: low part of the receiver dynamic range.

LEDs are SMD, and use light pipes to direct the light through the front panel, as follows:

- POWER [Blue]: indicates that the unit has power.
- ALARM [Red-Amber-Green]: indicates Primary and Secondary Alarm status; the LED lights red to indicate a Primary Alarm, amber to indicate a Secondary Alarm and green when no alarm are being asserted.
- POLLING [Yellow]: indicates polling requests.
- DET [Green]: this LED turns on each time the TXP detects a valid interrogation.

This module has two insertion/extraction handles (one at the top and one at the bottom of the front panel), allowing an easy insertion and extraction of the module.

This handles supplies ESD protection (automatic connection with the rack ground) and hot swappable operation (automatic power supply disable before extraction of the module).

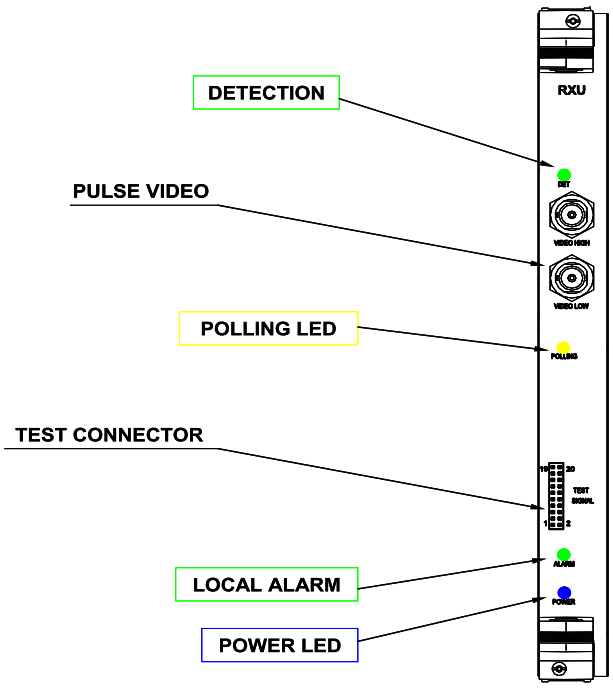


Figure 3.8-3: RXU - FRONT PANEL

3.8.6 Hardware Implementation

The RXU module occupies the third vertical slot of the subrack after the HPA. RXU1 at the Left Hand side and RXU2 at the Right Hand side of the Subrack.

3.9 TRANSMITTER UNIT (TXU)

3.9.1 Functional Description

The Transmitter Unit (TXU) is in charge of all processes related with pulse generation.

In case of a terminal DME (100W), the TXU power amplifier provides RF output at a level suitable for connecting to the antenna.

In case of an en-route DME (1 KW), the TXU acts as a driver amplifier feeding the HPA. Upon reception of a pulse from the Receiver Unit (RXU) indicating a valid interrogation has been detected, the TXU generates a Gaussian shape pair of pulses, with the appropriate pulse pair spacing according to ICAO. All reply signals are comprised of pairs of pulses with a defined spacing between the constituent pulses of each pair, depending on the channel suffix selected (X or Y).

The Transmitter Unit (TXU) generates a base band pre-distorted pulse pairs, which then modulate the Local Oscillator signal received from the Receiver Unit (RXU) before driving the amplifier stages with this signal.

The TXU amplifies pulse pairs up to the required level to transmit them through the antenna, keeping Gaussian pulse characteristics at its output.

Nominal output power for this unit is >100 W at output cabinet connector.

In order to maintain Gaussian shape for the pulses regardless of temperature, frequency and operation conditions, the TXU implements a feedback loop recalculating the pre-distorted base band pulses from the output pulse of the module.

In case of a high power DME, the TXU acts as a driver of the High Power Amplifier (HPA) keeping the responsibility of maintaining Gaussian pulse shape at the antenna input. In this case, the TXU calculates the pre-distorted base band pulses from the output of the High Power Amplifier, maintaining in every moment Gaussian shape characteristics of the transmitted pulses. Feedback information from the HPA is received as a digitalized video signal from the backplane connector.

The TXU knows operation frequency and DME power configuration through dedicated registers of the RS485 bus.

Table 3.9-1:PULSE CODING CHARACTERISTICS

CHANNEL SUFFIX	OPERATING MODE	PULSE PAIR SPACING (µs)		TIME DELAY (µs)
		INTERROGATION	REPLY	
X	DME/N	12	12	50
Y	DME/N	36	30	56

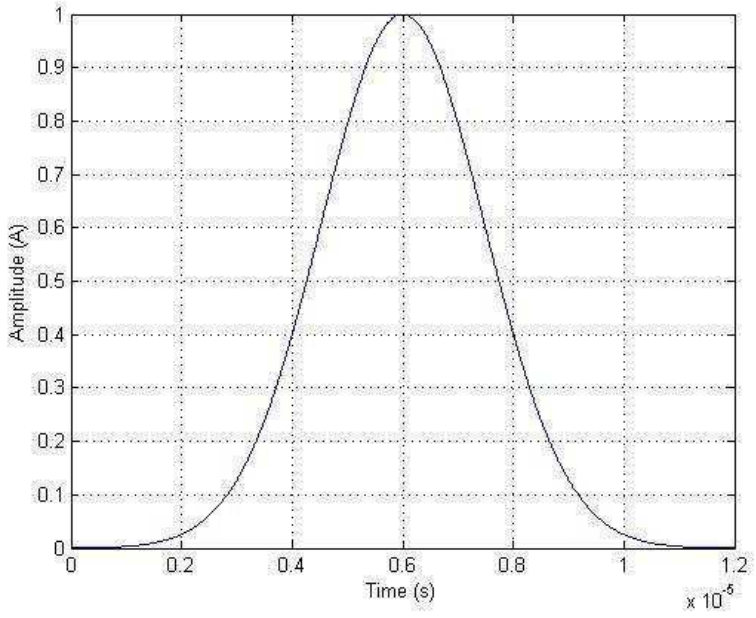


Figure 3.9-1: NOMINAL GAUSSIAN DME PULSE

The Transmitter Unit (TXU) provides means to permit continuous adjustment of the RF output power in 0.25 dB steps from a preset level of 100 W over the range of 0 to –4 dB.

This unit also implements duplexer functionality, allowing transmission/reception switching.

Output signal characteristics are maintained all around the whole transmission frequency band from 962 to 1213 MHz without need any extra adjustment.

The NORMARC LDB-103 DME is able to serve, simultaneously, more than 200 interrogators with a maximum transmission rate of 5000 ppps.

Transmitter Unit (TXU) has the following RF ports:

- Main connector (connected to RF Shelf or HPA).
- Local oscillator (from RXU).
- Received signal (To RXU; duplexer output).

Transmitter Unit (TXU) is also in charge of squitter generation, so when the reply rate is insufficient to maintain a transmission rate of at least 700ppps, pulse pairs are added at random basis to ensure that the minimum rate is maintained. In no case, maximum squitter rate exceeds 850 ppps (programmable value).

The number of generated squitter pulses depends on the number of interrogations decoded by the Receiver Unit (RXU), being the total amount of transmitted reply pulses as close as possible to 700 ppps.

If reply rate due to decoded interrogation signal is above the range of 700 to 850 ppps, no squitter pulses are added.

Transmitter Unit (TXU) is responsible of identity pulse generation. The identity signal consists of the transmission of the beacon code in the form of dots and dashes (International Morse Code) of identity pulses.

The signal for the identification coding consists of the transmission of a series of paired pulses transmitted at a rate of 1350 (± 10) ppps and temporarily replaces all other pulses. Identity pulses have the same characteristics that reply pulses, having the same shape and pulse pair spacing.

During the identification key down periods, reply pulses are not transmitted, but between keydowns, replies are transmitted.

The TXU includes circuitry so that it can either work as an independent beacon or associated to a VHF equipment (facilities are available to support connection to two different VHF facilities). When working as an associated beacon, the TXU is able to work as master or slave. When working as an associated master, the TXU is able to drive the associated VHF equipment with a synchronization pulse indicating the moment of identity transmission (trigger) or directly sending the keying signal (MORSE code).

In the same way, when the DME is configured as a slave of a VHF equipment, TXU is able to manage an input signal indicating the identity code transmission trigger or an input signal acting as a keyer.

The following summarizes all possible configurations:

- Independent operation
- Associated operation
    - Master equipment
        - Trigger output signal
        - Keyed output signal (MORSE code)
    - Slave equipment
        - Trigger input signal
        - Keyed input signal (MORSE code)

In independent operation, TXU transmits the beacon MORSE code at least once every 30 seconds.

In associated operation, each 30 seconds interval is divided into 4 equal periods with the transponder identification transmitted during one period only, and the associated VHF facility identification transmitted during the remaining periods.

When the DME is operating as a slave unit, any failure of the external Ident generator causes the DME to internally generate and transmit the transponder identity code in place of the failed unit and that triggers an alarm (Ident synchro fail).

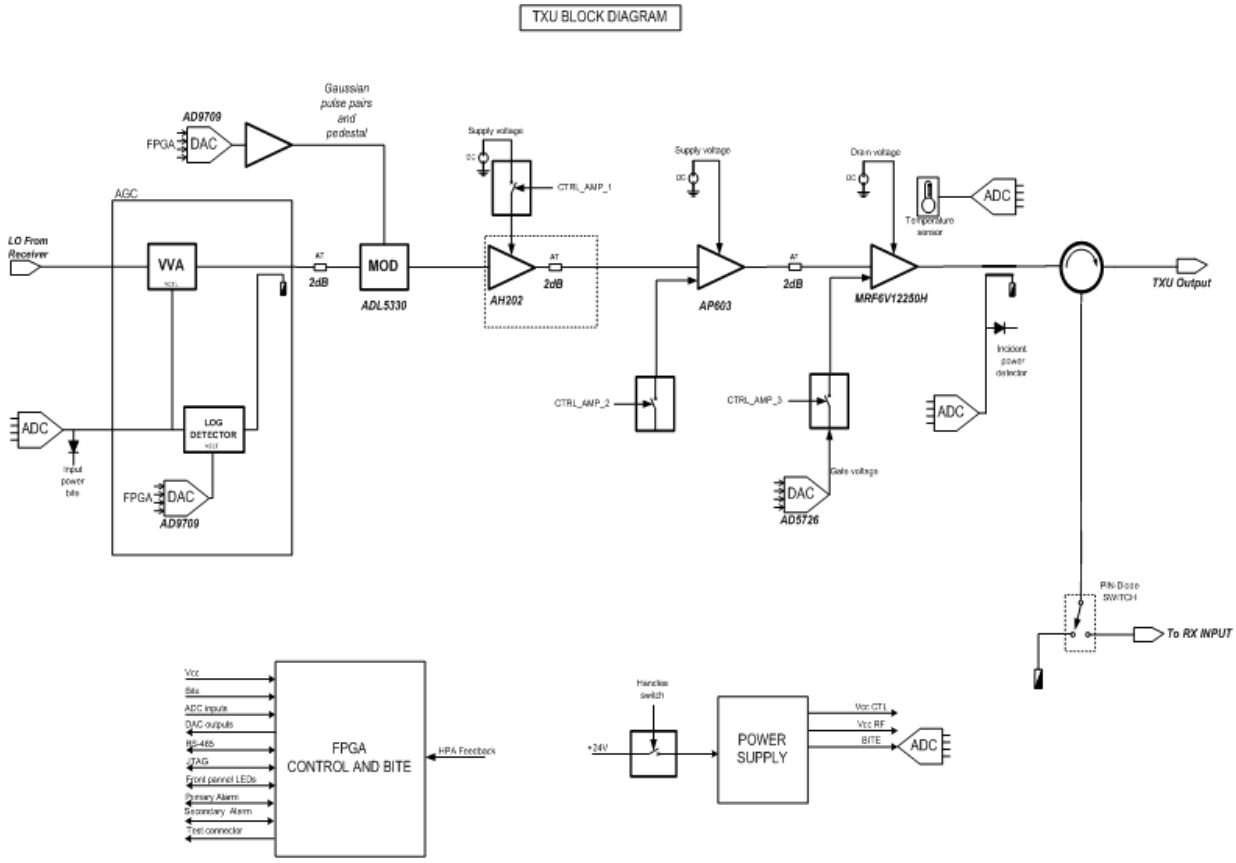


Figure 3.9-2: TXU FUNCTIONAL BLOCK DIAGRAM

The unit allows storing two 4-character different identification codes. Characters are letters (must be capital letters) or numbers, being the maximum length of a letter 4 symbol (combination of dots and dashes) and 5 symbols for numbers. Depending on the number of characters of the identity code and the periodicity of identity code transmission, the beacon transmits with a different word rate, being 8 words per minute the maximum rate.

MORSE code identification signal fulfills the following characteristics:

- The dot length is user configurable between 0.1 and 0.16 second.
- The dash length is 3 times the duration of a dot.
- The time duration between dots and/or dashes is equal to 1 dot.
- The time duration between letters or numeral is not less than one dash (three dots).

- The total period of transmission of an identification code group does not exceed 10 seconds.
- The total key down time does not exceed 5 seconds.

The TXU is responsible for code length checking, calculating the key down length and the identification code group length depending on the programmed code and dot length, ensuring the user defined characteristics match the specification of the system.

Facilities are provided for selecting the following identification conditions:

- NORMAL identification.
- Identification OFF.
- TEST.
- Continuous key down.

During alarm inhibit mode, TXU automatically suppresses the transmitted identity coded.

TXU unit also performs the following functions:

- Generation of suitable voltage rails from main +24VDC supply.
- Management of calibration and identification parameters.
- Generation of required signals for BIT functions.

3.9.2 BIT Facilities and Alarm Management

The TXU generates the essential signals required for BIT purposes.

The following processes are monitored:

- Transmitted RF power.
- Forward power.
- Temperature.
- Local Oscillator radiofrequency signal.
- All the important voltage rails.
- Ident Synchro.

The TXU internally includes a set of directional couplers, power detectors and multi-channel A/D converters to sense and monitor above mentioned magnitudes. It then processes the gathered information for BIT purposes.

The A/D converters sample all of their inputs cyclically and continuously. The latest conversion results are accessible by poll requests from the system RS485 bus.

All operating voltages and/or the DC levels produced by these monitoring processes are presented on the front panel connector for test purposes.

The TXU asserts Local Primary and Secondary alarms in the following scenarios:

- Any voltage rail out of specified ranges.
- A failure of the FPGA configuration.

- Output power out of defined thresholds.
- Temperature out of defined thresholds.
- Local Oscillator radiofrequency signal out of user defined ranges.
- An absence of poll requests from the CMU.
- A failure of the external Ident generator.

The module protects itself against temperature, switching off in case the measured temperature is above a defined threshold kept in a register. Once it has shut down, the temperature needs to drop to another, lower, register set level before the transmitter can resume operation. Temperature primary alarm threshold matches with the switching off threshold.

When a failure of the external Ident generator occurs, it causes the DME to internally generate and transmit the transponder identity code in place of the failed unit.

3.9.3 Programming and Control Information

The TXU contains a non-volatile FLASH memory, which holds information about thresholds, operating parameters, calibration and compensation data as well as internal FPGA configuration.

For internal communication, the TXU has an RS485 interface to poll all these static and dynamic data.

RS485 registers are divided in two different categories, status registers and configuration registers. The first group contains ‘read only’ registers on the RS485 bus, while the second group, the configuration registers, are the ‘read/write’ registers.

The following parameters contained in the status registers, are available by polling:

- Board ID.
- FPGA revision.
- Board revision.
- Status (Enabled/Disabled).
- Alarm status.
- Internal voltage rails.
- Current temperatures.
- Mean forward power levels.
- Mean reverse power levels.
- Recent peak reverse powers.
- Local Oscillator (LO) level
- Number of pair of pulses transmitted per second.
- Number of squitters transmitted per second.
- Number of replies transmitted per second.

Parameters contained in configuration registers include the following:

- Operating channel.
- Calibration data and offsets for forward and reverse power detectors.
- Internal voltage rail thresholds to generate LOCAL Primary and Secondary Alarms (High and low).
- Temperature thresholds to generate LOCAL Primary and Secondary Alarms.
- Number of restart attempts after shutdown due to temperature.
- Reverse power detector thresholds to generate LOCAL Primary and Secondary Alarms.
- Restart timer after shutdown due to reverse power.
- Number of restart attempts after shutdown due to reverse power.
- Local Oscillator (LO) level threshold to generate Primary and Secondary Alarms.
- Independent/Associated Operation.
- Master/Slave when in associated operating mode.
- Key Input and Key output selection and control.
- Identity Code.
- Identity control (Normal, OFF, TEST, Continuous).
- Dot/Dash/Space length.
- Squitter generation enable.
- Squitter threshold.

Note that there is no need for configuration registers to be available in local or remote control. It depends on Control & Monitoring Unit (CMU) configuration policy to give access to one or another parameter in local or remote control or let that parameter as only factory set parameter. All the parameters are accessible by the RS485 bus.

The TXU also has a JTAG port plus an enable signal accessible through the backplane connector, to enable programming the FPGA inside the module from the Control & Monitoring Unit (CMU).

3.9.4 Mechanical Details

Dimensions of the TXU module are as follows:

- Height: 6 U.
- Width: 8 HP.
- Length: based on euroboard 280 mm length standard.
- Weight: < 5 kg.

The module has single card slides at top and bottom.

The TXU has four rear connectors.

- P1: DIN41612 Type C (96 pins).
- P2: RF BMA plug connector.
- P3: RF BMA plug connector.
- P4: RF BMA plug connector.

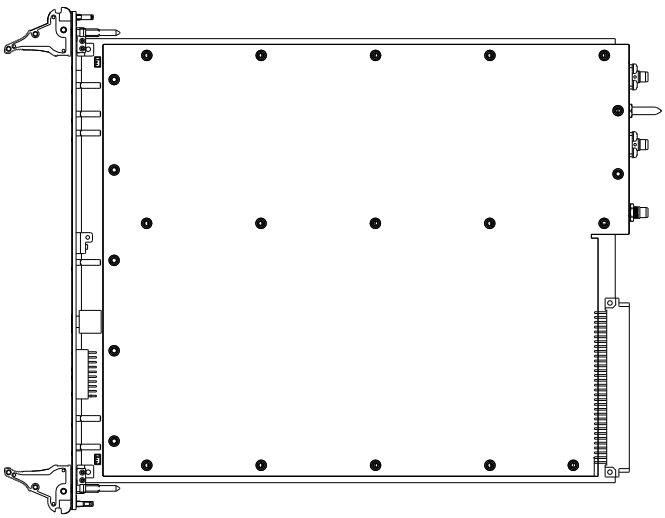


Figure 3.9-3: TXU ASSEMBLY

3.9.5 Front Panel Details

On the front panel, the Transmitter Unit (TXU) has a 20 pin connector, one jack socket, and six LEDs indicators.

The 20 pin connector provides access to critical analogue and digital signals such as synchronization signals and internal voltage rails for test purposes. Digital signals present in test connector are selectable by software control.

There is a female jack socket, where user can hear the IDENT code being transmitted by the beacon. When the TXU is in standby mode no signal is present at this connector (Standby TXU does not generate IDENT signal).

The LEDs used are SMD, and light pipes are used to direct the light through the front panel, as follows:

- POWER [Blue]: indicates that the unit has power.
- ALARM [Red-Amber-Green]: indicates Primary and Secondary Alarm status; the LED lights red to indicate a Primary Alarm, amber to indicate a Secondary Alarm and green when no alarm is being asserted.
- POLLING [Yellow]: indicates polling requests.
- TX [Green]: this LED turns on each time the TXP transmits a pair of pulses. In normal operation, users will see this LED active on all the time.

- IDENT [Yellow]: indicates the presence of the IDENT tone; it turns on and off in cadence with the dashes and dots of the Morse representation of the identification code.
- TX_ENABLE [Red-Green]: this LED is green when transmit enable is asserted and red when it is not.

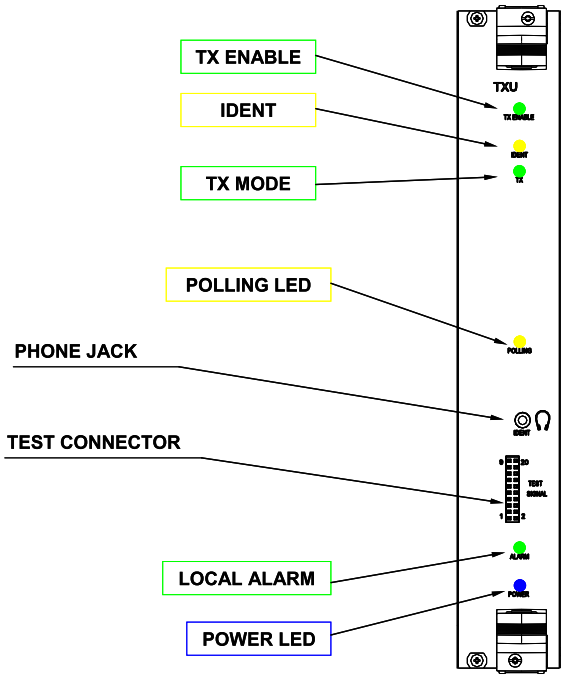


Figure 3.9-4: TXU - FRONT PANEL

This module has two insertion/extraction levers (one at the top and one at the bottom of the front panel), allowing easy insertion and extraction of the module.

The handles supplies ESD protection (automatic connection with the rack ground) and hot swappable operation (automatic power supply disable before extraction of the module).

3.9.6 Hardware Implementation

The TXU module occupies the second vertical slot of the subrack after the HPA. TXU1 at the Left Hand side and TXU2 at the Right Hand side of the subrack.

3.10 HIGH POWER AMPLIFIER (HPA)

3.10.1 Functional Description

A High Power Amplifier (HPA) is fitted into the equipment system to provide higher output power for an en-route DME.

This module amplifies the radiofrequency signal provided by the Transmitter Unit (TXU) up to the required level to be transmitted through the antenna. Nominal output power for an en-route DME is more than 1 KW measured at cabinet connector.

Adjustment facility is provided to permit continuous variation of the RF output power in 0.25 dB steps from a preset level of 1KW over the range of 0 to –4 dB. The adjustment needs the collaboration from the TXU.

The High Power Amplifier (HPA) receives the pre-distorted Gaussian shape pulses from the Transmitter Unit (TXU) and amplifies them up to the nominal value. A sample of the transmitted signal is sent to the Transmitter Unit (TXU) as digital video through a backplane connector in order to implement a feedback loop, which controls the output pulse shape. This loop ensures that the Gaussian shape characteristics of the transmitted pulses are maintained over the transmission frequency band from 962 to 1213 MHz, and over the specified temperature range of operation.

The High Power Amplifier (HPA) contains the duplexer functionality on high power DMEs, allowing transmission/reception switching.

The High Power Amplifier (HPA) is capable of working with a transmission rate of up to 5000 ppps. This is sufficient to provide DME services to more than 200 interrogators simultaneously.

The High Power Amplifier (HPA) has the following RF ports:

- Main connector (connected to RF Shelf).
- Radiofrequency input (from TXU).
- Received signal (To RXU; duplexer output).

The HPA also performs the following functions:

- Generation of suitable voltage rails from main +24VDC supply.
- Management of calibration and identification parameters.
- Generation of required signals for BIT functions.

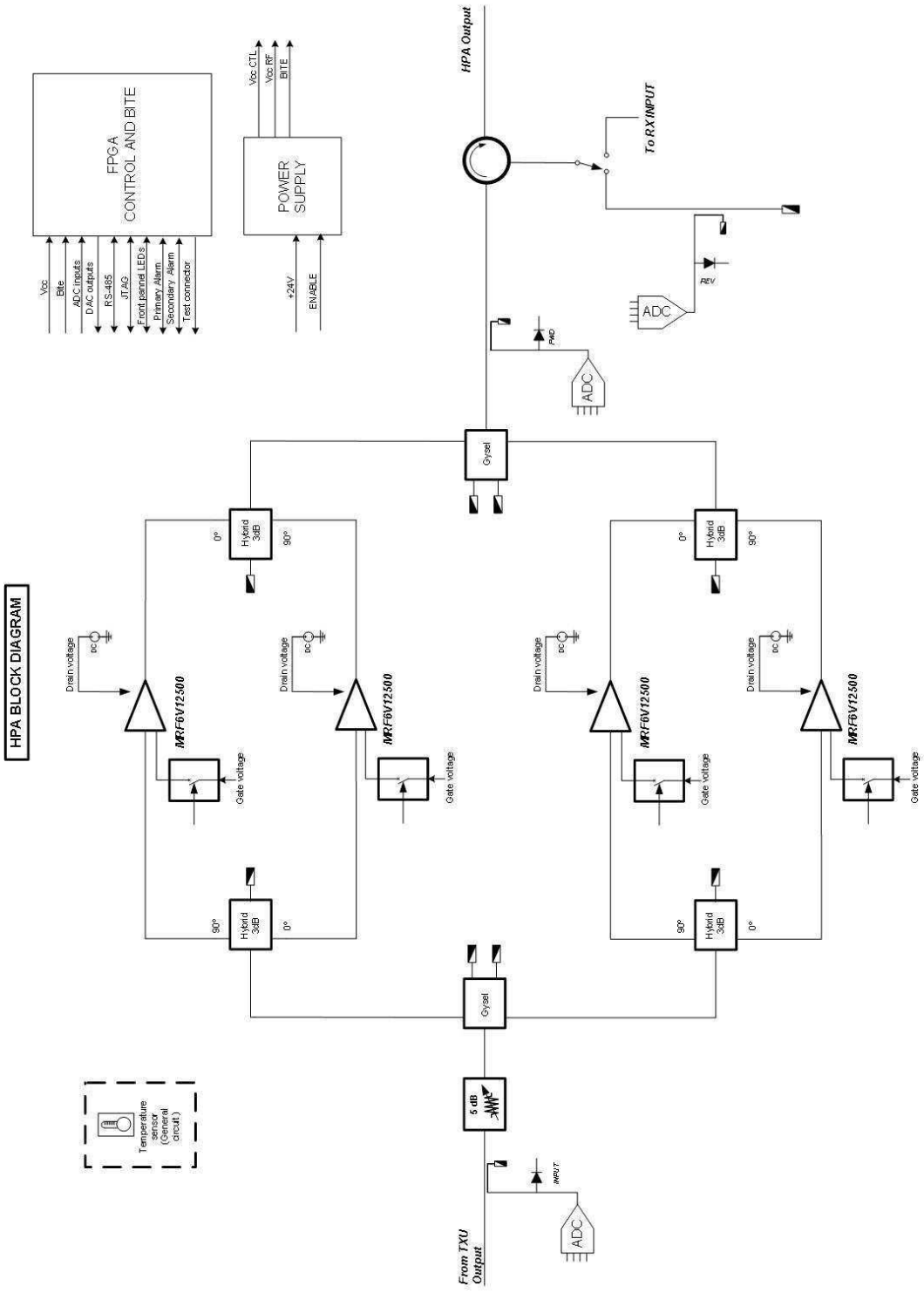


Figure 3.10-1: HPA FUNCTIONAL BLOCK DIAGRAM

3.10.2 BIT Facilities and Alarm Management

The HPA generates all essential signals required for BIT purposes.

The processes that are monitored include the following:

- Transmitted RF power.
- Forward and reverse power.
- Input power from TXU.
- Temperature.
- All the important voltage rails.

The HPA includes a set of directional couplers, power detectors and multi-channel A/D converters to sense and monitor the above-mentioned magnitudes and processes for BIT purposes.

The A/D converters sample all of their inputs cyclically and continuously. The latest conversion results are accessible by poll requests from the system RS485 bus.

All operating voltages and/or the DC levels produced by these monitoring processes are available on the front panel connector for test purposes.

The HPA asserts the Local Primary and Secondary alarms in the following scenarios:

- Any voltage rail out of specified ranges.
- A failure of the FPGA configuration.
- Output power out of defined thresholds.
- Reverse power above defined threshold.
- Temperature out of defined thresholds.
- Input power form TXU out of threshold.
- An absence of poll requests from the CMU.

The module protects itself against reverse power at main connector, switching off automatically if the measured value is above a threshold defined in a register. The module tries to re-start a number of times (pre-defined in a register) before switching itself off permanently until reset manually.

The module also protects itself against extreme temperature, switching off in case the measured temperature is above a register defined threshold. Once it has shut down, the temperature needs to drop to another, lower, register set level before the transmitter can resume operation. In the same way for reverse power, temperature primary alarm threshold matches with the switching off threshold.

3.10.3 Programming and Control Information

The HPA contains a non-volatile FLASH memory, which holds information about thresholds, operating parameters, calibration and compensation data as well as internal FPGA configuration.

The HPA has an RS485 interface to poll all these static and dynamic data.

RS485 registers are divided in two different categories, status registers and configuration registers. The first group includes ‘read only’ registers on the RS485 bus, while the second group contains the configuration registers, which are ‘read/write’ registers.

The status registers that are available by polling include the following ones:

- Board ID.
- FPGA revision.
- Board revision.
- Status (Enabled/Disabled).
- Alarm status.
- Internal voltage rails.
- Current temperatures.
- Mean forward power levels.
- Mean reverse power levels.
- Recent peak reverse powers.
- Mean radiofrequency input level.
- Number of pair of pulses transmitted per second.

Parameters contained in the configuration registers include the following:

- Operating channel.
- Calibration data and offsets for forward and reverse power detectors.
- Internal voltage rail thresholds to generate LOCAL Primary and Secondary Alarms (high and low).
- Temperature thresholds to generate LOCAL Primary and Secondary Alarms.
- Number of restart attempts after shutdown due to temperature.
- Reverse power detector thresholds to generate LOCAL Primary and Secondary Alarms.
- Restart timer after shutdown due to reverse power.
- Number of restart attempts after shutdown due to reverse power.
- Input power threshold to generate Primary and Secondary Alarm.

Note that there is no need for configuration registers to be available in local or remote control. It depends on Control & Monitoring Unit (CMU) configuration policy to give access to one or another parameter in local or remote control or let that parameter as only factory set parameter. All the parameters are accessible by the RS485 bus.

The HPA also has a JTAG port together with an enable signal accessible through the backplane connector. This enables programming of the FPGA inside the module from the Control & Monitoring Unit (CMU).

3.10.4 Mechanical Details

Dimensions of the HPA module are as follows:

- Height: 6 U.
- Width: 14 HP.
- Length: based on double euroboard 400 mm length standard.
- Weight: < 10 kg.

It is supported from underneath with 3 rails, and two rails at the top.

The module requires a heat sink for its thermal management.

The HPA has 4 rear connectors:

- J7: RF BMA plug connector.
- J8: RF BMA plug connector.
- J9: D-Sub 37p.
- J10: D-Sub 9p mixed 3W3 configuration.

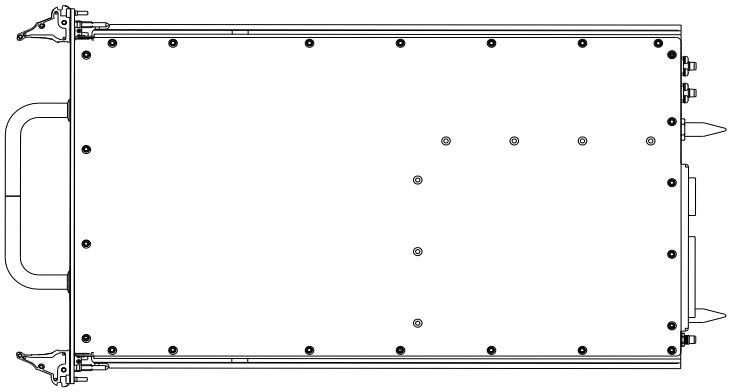


Figure 3.10-2: HPA ASSEMBLY (I)

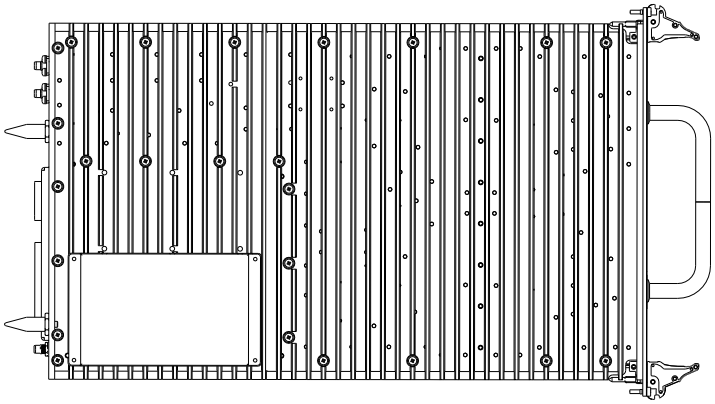


Figure 3.10-3: HPA ASSEMBLY (II)

3.10.5 Front Panel Details

On the front panel, the High Power Amplifier (HPA) has a 20 pin connector and four LEDs indicators.

The 20 pin connector provides access to critical analogue and digital signals such as synchronization signals and internal voltage rails for test purposes. Digital signals present in test connector are selectable by software control.

LEDs used are SMD, and use light pipes to direct the light through the front panel, as follows:

- POWER [Blue]: indicates that the unit has power.
- ALARM [Red-Amber-Green]: indicates Primary and Secondary Alarm status; the LED lights red to indicate a Primary Alarm, amber to indicate a Secondary Alarm and green when no alarm is being asserted.
- POLLING [Yellow]: indicates polling requests.
- TX_ENABLE [Red-Green]: this LED is green when transmit enable is asserted and red when it is not.

The module has one solid vertical handle allowing an easy insertion and extraction of the module. This handles supplies ESD protection (automatic connection with the rack ground) and hot swappable operation (automatic power supply disable before extraction of the module).

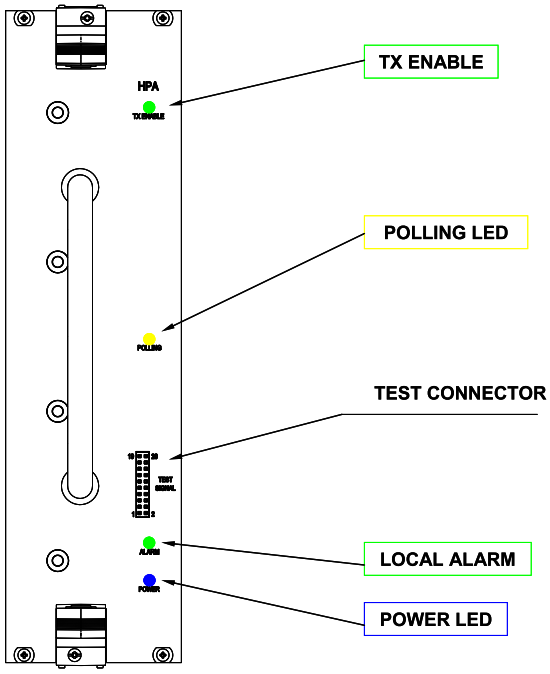


Figure 3.10-4: HPA - FRONT PANEL

3.10.6 Hardware Implementation

The HPA module occupies the first vertical slot, at the outside edge of the subrack. HPA1 is at the Left Hand side and HPA2 at the Right Hand side of the subrack.

3.11 POWER SUPPLY UNIT (PSU)

3.11.1 Functional Description

The equipment is operated from a mains power supply with a nominal output voltage of +24VDCs, which is also used as a float charger for a standby battery supply.

The input voltage of this Unit is 90 VAC to +276 VAC.

There is an option for powering the DME from an external DC power source. This option is explained in details in the section 3.11.7 (‘External DC Power Supply’). In this configuration Rectifiers are removed, but the mainframe of the power supplied is used (controller module and breakers).So, operation by external DC is similar to operation on batteries.

The Power Supply Unit performs these three major functions:

- To provide power to each TXP DME.
- To control the charge state on the backup bank of sealed lead-acid batteries.
- To automatically drain power from the battery bank when mains power is removed.

Every PSU is composed of two but up to four hot-swappable rectifiers, a controller module and three circuit breakers. The rectifiers are capable of supplying at least 400 W at +28VDC that is 14 A each without the need for a fan, although there is a derating over the whole temperature range.

The controller activates alarm outputs when a fault is discovered in one of the rectifiers, a circuit breaker is tripped, an over-voltage occurs, an output voltage is below a user-specified level etc. In addition, the PSU is failsafe on the failure of the controller itself. In this case, the rectifiers continue to operate at their last set point. Thus any single failure in the power supply is a secondary alarm and shouldn't require a switchover.

The controller is able to apply temperature compensation to the output voltage for the battery output and/or the main output. The slope of the compensation is programmable.

There are three circuit breakers and they are rated as follows:

- 5 A for the digital control electronics.
- 15 A for the radiofrequency power amplifiers.
- 60 A for the battery bank, due to these breaker must support the full-load when the batteries are supplying power, else 5 A where the return power from the battery bypasses the battery breaker.

Other PSU features are:

- Battery Temperature Compensation.
- Battery Monitor and Change Current Control.
- Low Voltage Disconnect operation.
- Cooling and protection adjustments.
- Alarm and signals management.
- Statistics and historical data, user definable alarms, data logging and event logging.
- Control and monitor via Internet Explorer browser (integrated SNMP).

The PSU arrangement is an N+1 parallel configuration to share the load of each single DME TXP equipment, see Figure 3.11-1, so the battery charging period could be increased.

The standard configuration provides two (but up to four) redundant hot-swappable rectifiers.

Each one of this rectifier modules is capable of supply enough power to operate a single DME TXP.

A system is based on two PSU, one per single DME TXP equipment, two rectifier modules each. Thus, a fully equipped dual DME beacon has the following power supply levels of redundancy, increasing its reliability:

- AC redundancy: dual PSU modules run of dual AC sources, one per Single DME TXP.
- AC/DC redundancy: every PSU has, at least, two rectifier modules, hence any faulty rectifier still means that the transmitters continue to operate.
- Battery redundancy: dual PSU allow dual battery banks and advanced battery charging options.

Table 3.11-1: POWER SUPPLY UNIT (PSU) DEFAULT PARAMETERS

SETTING	RANGE / NOTE	DEFAULT
Float Voltage (FL)	23.75 – 29.10 V	27.20 V
Equalize Voltage (EQ)	24.90 – 30.10 V	27.50 V
Battery Test Voltage (BT)	22.00 – 26.00 V	23.00 V
OverVolt Protect (OVP)	25.70 – 31.50 V	28.50 V
Current Limit (CL)	23 – 100%	100%
Power Limit (PL)	0 – 100%	100%
Module Start Delay	0 – 250 S	1 S
System Start Delay	0 – 600 S	0 S
Low Volt Alarm (LVA)	21.00 – 26.00 V	22.00 V
High Volt Alarm (HVA)	26.00 – 31.50 V	27.75 V
EQ Timeout	1 – 2399 h	30 h
BT Timeout	1 – 250 h	8 h
SoftStart Ramp Rate	Normal / Fast	Normal
CL/PL/Alarm	Enable / Disable	Enable
Remote ShutDown	Enable / Disable	Enable
Ramp Test	Enable / Disable	Enable
Battery Capacity		86 Ah
Temperature Coefficient		5.5 mV/C/cell
Charge Current Limit		10 A
K1 for internal LVD		NO
System Minor (K2) for batt charger		NO
System Major (K3) for Load Voltage	Available at EIU (nc/c/no)	NO
AC Fail (K4) for Mains OK	Available at EIU (nc/c/no)	NO

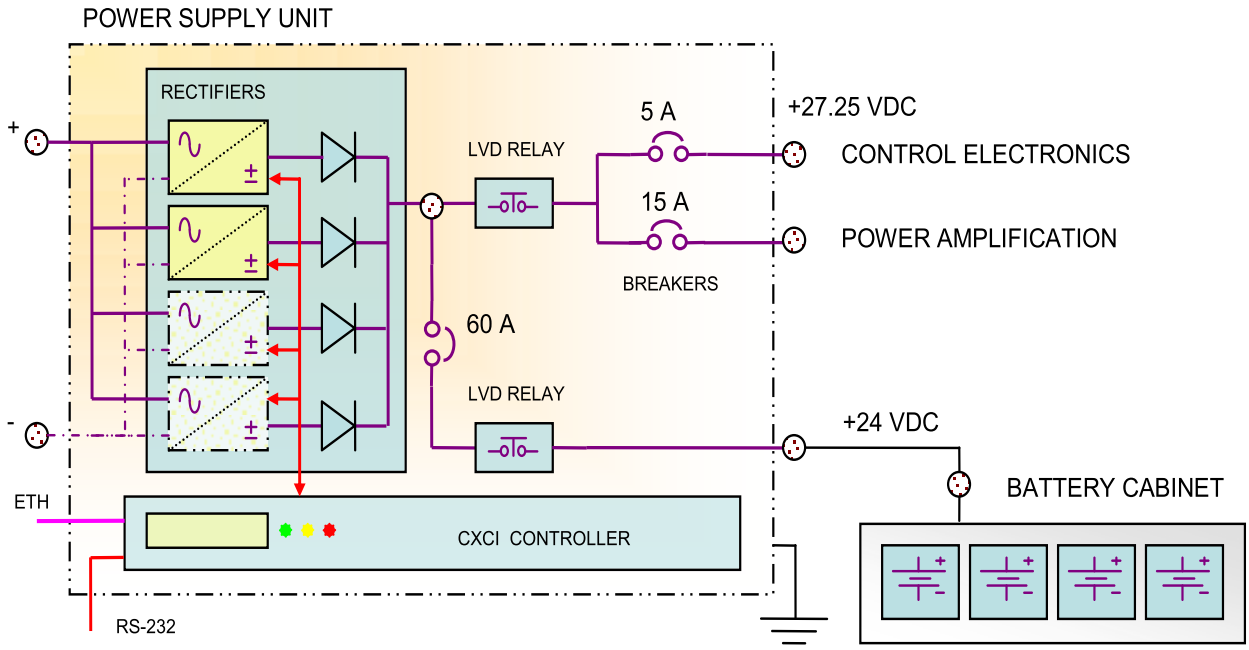


Figure 3.11-1: PSU - FUNCTIONAL BLOCK DIAGRAM

3.11.2 BIT Facilities and Alarm Management

The PSU is able to generate the signals required for BIT purposes.

The monitored processes include rectifier status and communication, battery capacity and charge, battery temperature, charge current, output voltage and load current.

The PSU asserts Local Primary (Major) and Secondary (Minor) alarms when there are conditions that are considered an immediate threat to the service, in the first case, or to be of a less serious nature in the second.

These alarms can be classified in:

- Rectifier alarms.
- Current alarms.
- Voltage alarms.
- Battery alarms.
- Temperature alarms
- Miscellaneous.
- Battery over temperature.
- Fuse alarm.
- High voltage and any voltage and rail out of user specified ranges.

3.11.3 Programming and Control Information

The power supply system has a network (Ethernet) accessible port so that it can be controlled and monitored externally by utilizing TCP/IP technology through a Network Web Server or a Simple Network Management Server (SNMP).

3.11.4 Mechanical Details

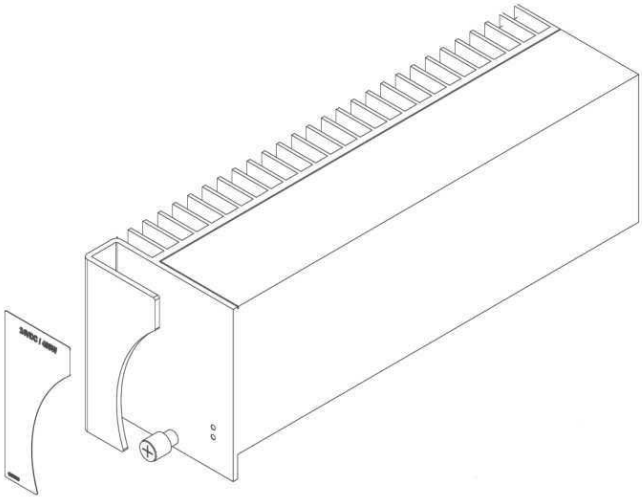


Figure 3.11-2: PSU - RECTIFIER MODULE

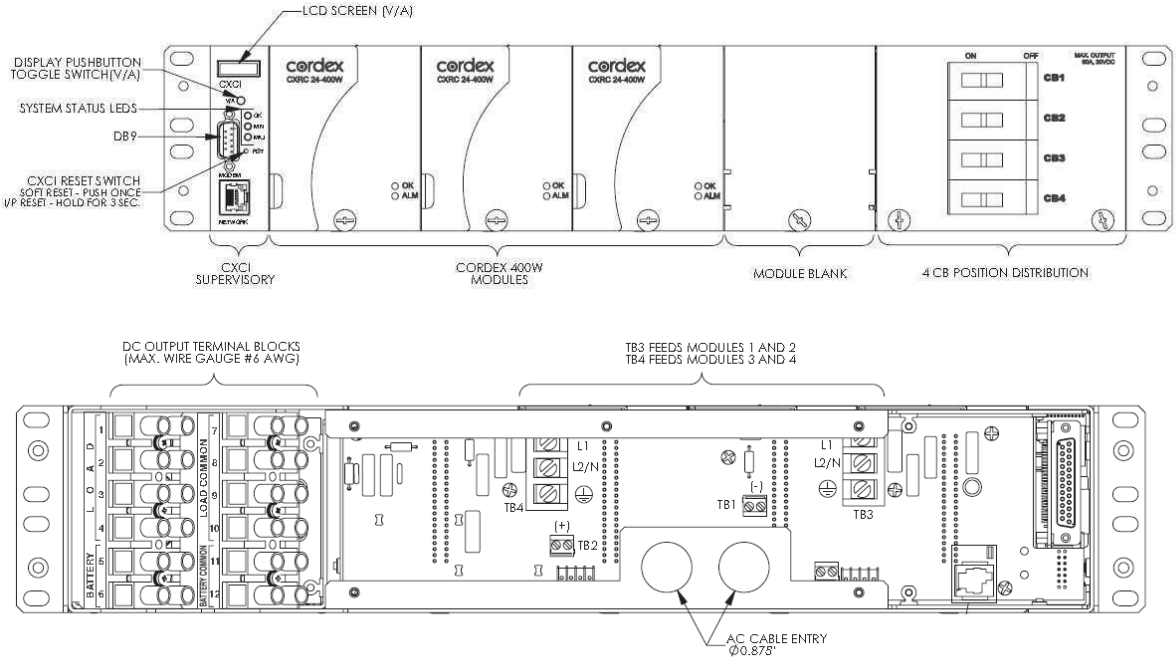


Figure 3.11-3: PSU - FRONT AND REAR VIEW

3.11.5 Front Panel Details

On the front panel, the PSU has seven LEDs, a small LCD display, a RJ45 connector and a DB9 connector for network and serial communications ports, respectively.

The LEDs indicators show the operating and alarm status of the power supply system.

3.11.6 Hardware Implementation

N/A

3.11.7 External DC Power Supply[10]

A universal problem in battery-operated devices is the threat of damage when an end user (never an engineer) inserts or reconnects the battery backward during installation or maintenance work. During this event, it is possible that the polarity of the battery could be applied in reverse direction causing critical damage. In the NORMARC LDB-103 DME, although the battery terminals are marked with colours, the possibility for reverse battery is still present, so the DC POWER KIT ensures protection for NORMARC LDB-103 DME equipment in order to survive without damage.

A simple effective circuitry providing this functionality is depicted in Figure 3.11-4 and Figure 3.11-5.

In normal operation the protection diode is in open circuit, reverse biased and only when a reverse polarity connection is applied at battery terminals the protection diode is forward biased, conducting high current only until the safety fuse clears.



Figure 3.11-4: DC POWER KIT GENERAL VIEW

[10] Only for NORMARC LDB-103 DME Model .14 and Model .15

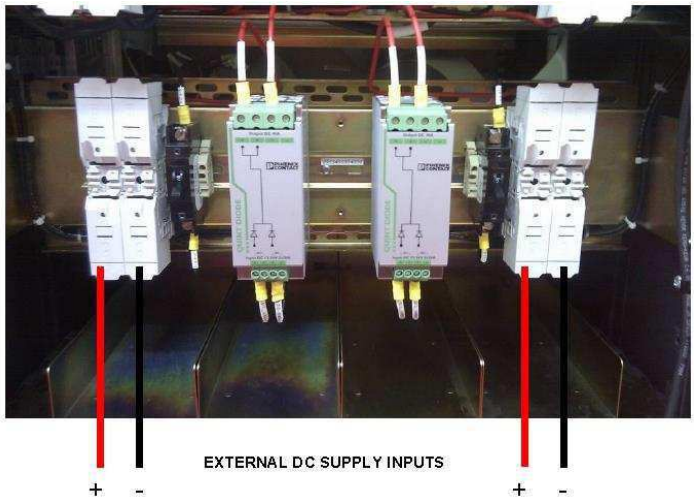


Figure 3.11-5: DC POWER KIT - EXTERNAL INPUT INTERFACE

3.12 NETWORK MANAGEMENT PROCESSOR / EXTERNAL INTERFACE UNIT (NMP/EIU)

3.12.1 Functional Description

The Network Management Processor/External Interface Unit (NMP/EIU) provides the gateway between the navaid equipment and the remote control and monitoring centre as well as supports the internal Local Area Network (LAN) of the DME beacon or protocol translation for legacy navaids.

The NMP/EIU collects site and auxiliary signals or alarms providing multiple communication interfaces for remote connection, such as traditional leased-line, radio and dial-up modems as well as cellular modems and direct Ethernet connection.

The communication interface can be considered as the Wide Area Network (WAN) interface of the NMP/EIU module.

The NMP/EIU uses standard TCP/IP routing technology, allowing no only Indra navaids to be connected to the site LAN, but third party elements can also be easily integrated. LAN interfaces include multiple 10/100BaseT Ethernet ports as well as multiple RS232/485 interfaces. The NMP/EIU element itself can be managed using HTTP and SNMP.

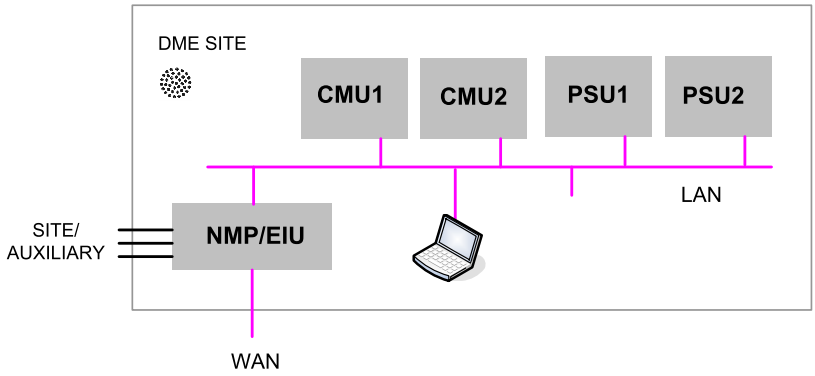


Figure 3.12-1: NMP/EIU MODULE - DME INTERNAL LAN

For legacy navaid equipment, the NMP/EIU module will proxy and convert any HTTP or SNMP requests to the proprietary legacy protocol, to ensure the network of navaids are open standards compliant. This allows for seamless management of networks of navaids, whether consisting only new models, legacy models or a mixed network of both.

The range of equipment includes:

- Existing equipment mostly managed using proprietary protocols access via serial port.
- New equipment managed using standard protocols accessed by Ethernet interface where possible.
- Third party equipment managed with either standard or proprietary protocols accessed by either serial or Ethernet interfaces.

I/O front panel connectors provide a common location for the termination of external wiring to the DME installation and EMC protection.

3.12.2 BIT Facilities and Alarm Management

The Ethernet Switch has generic functionalities and can be a Commercial Off The Shelf (COTS) item.

A suitable Ethernet switch provides eight 10/100BaseT(X) store-and-forward network ports. The unit uses redundant dual 24 VDC and has relay output warning for power failure and port break alarm.

3.12.3 Programming and Control Information

The NMP/EIU element can be managed using HTTP and SNMP protocols from a conventional browser.

3.12.4 Mechanical Details

Dimensions of the NMP/EIU module are as follows:

- Height: 108.5 mm.
- Width: 449.0 mm.
- Depth: 305.6 mm.
- Weight: 3.6 kg.

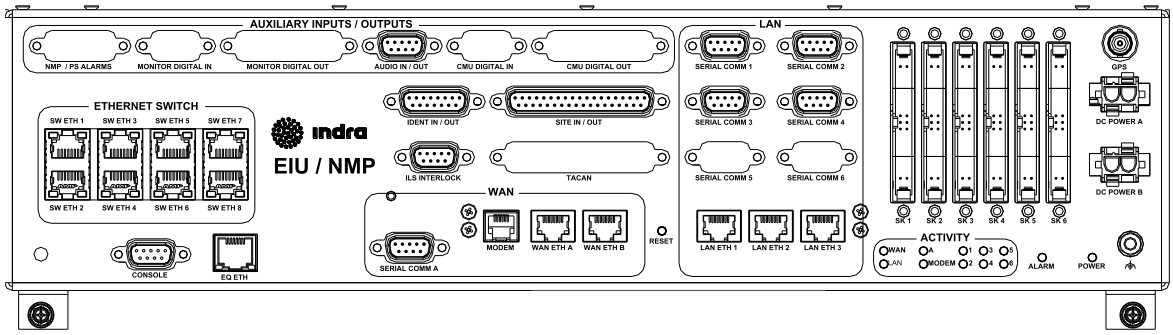


Figure 3.12-2: NMP/EIU ASSEMBLY

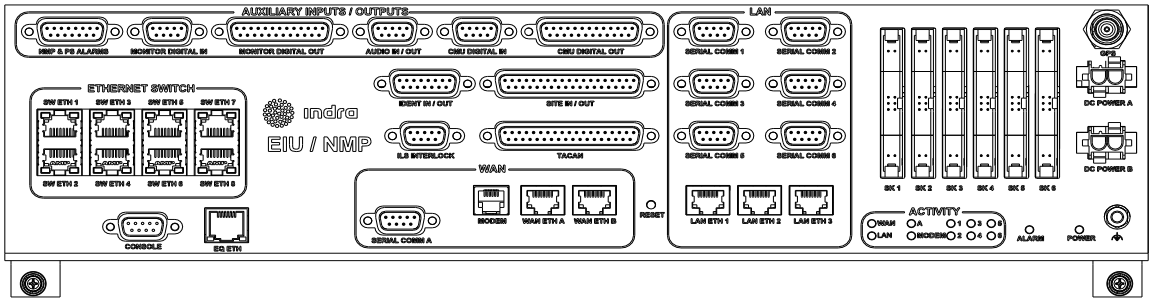


Figure 3.12-3: NMP/EIU ASSEMBLY (FULL WIRED VERSION)

3.12.5 Front Panel Details

On the front panel, the NMP/EIU, apart from all interface connectors, has fourteen LEDs indicators. Figure 3.12-3 shows a diagram to identify all elements NMP/EIU front panel is composed of.

The NMP/EIU has, in its standard version, the following connectors, all accessible at the front panel:

- Interconnection and Power Supply area composed of 9 connectors as follows:
  - 6 IDC 40p plug connectors [SK1 to SK 6].
  - DC power supply connectors [DC A, DC B].
  - 1 BNC connector for an optional GPS antenna.
- ETHERNET SWITCH area composed of 8 RJ45 connectors to create the internal DME LAN.
- AUXILIARY INPUTS/OUTPUTS area composed as follows:
  - D-Sub 37p for SITE IN/OUT signals and alarms.
  - D-Sub 15p for IDENT IN/OUT functionalities.
  - 1 D-Sub 9p for ILS INTERLOCK functionalities.
  - 1 D-Sub 9p for AUDIO IN/OUT signals.
- LAN area:
  - 4 D-Sub 9p (up to 6) for serial communications [COMM 1 to COMM 6].
  - 3 RJ45 for ethernet network communications [LAN ETH 1 to ETH 3].
- WAN area:
  - 1 RJ45 for standar network communications [WAN ETH A].
  - 1 RJ11 for direct PTSN communications [MODEM].
  - 1 D-Sub 9p for serial communications [COMM A].

The Auxiliary Input/Output connectivity can be extended upon customer request. The NMP/EIU in its full-wired version (see Figure 3.12-3), upgrade the connectors accessible at the front panel as follows:

- AUXILIARY INPUTS/OUTPUTS area composed as follows:
  - 1 D-Sub 37p for AUXILIARY signals.
  - 1 D-Sub 15p for power supply monitoring functionalities.
  - 2 D-Sub 9p for remote control functionalities.
  - 2 D-Sub 25p for remote status monitoring functionalities.

LEDs are SMD, and use light pipes to direct the light through the front panel, as follows:

- POWER [Blue]: indicates that the unit has power.
- ALARM [Red-Amber-Green]: indicates Primary and Secondary Alarm status; the LED turns red to indicate a Primary Alarm, amber to indicate a Secondary Alarm and green when no alarm is being asserted.
- ACTIVITY [Green]: indicating activity in the following situations:
  - WAN by ETH.
  - LAN by ETH.

3.12.6 Hardware Implementation

The NMP/EIU module occupies the shelf behind the second PSU.

4. SECTION 4 – OPERATION AND USE INTRUCTIONS.

4.1 INTRODUCTION

This section provides instructions to operate the Indra NORMARC LDB-103 DME for use by Viewers, Operators, Managers, Installers and Administrators.

The procedures of this section detail the steps required to place a DME beacon into operation. Moreover, the operating instructions of its different interfaces are described separately.

4.2 INDRA NORMARC LDB-103 DME ACCESS RIGHT

Each user needs an ID and password to log on. The operations domains for the NORMARC LDB-103 are defined for the following roles:

- Viewer.
- Operator.
- Manager.
- Installer.
- Administrator.

The Administrator manages other users and assigns a role, with a corresponding ID and password. To enhance security, passwords can be chosen one of the four different levels of complexity.

Viewer

As a viewer, user has minimum access rights and can view limited monitored information such as those in the following pages:

- Home.
- General Device Information.
- Configuration Summary.
- Active Alarm Status.

Operator

The operator has limited access rights and can view additional monitored information such as:

- Operation Control: Select Main / Changeover.
- Operation Control: Switching: ON / OFF / Reset / Reboot.
- Operation Control: Alarm Inhibit Enable.
- In addition to Viewer Rights.

Manager

User has extended rights to edit the following parameters and facilities:

- Operation Control: Squitters, Monitor Interrogation Rate.
- Alarm Configuration (Setting of Limits).
- In addition to Operator Rights.

Installer

User has advanced rights to edit the following control parameters and facilities:

- Operation Control: frequency and mode channels, power level adjustment.
- Operation Control: SDES and LDES modes.
- Site Parameters: reply delay offset, dead time.
- Installation Facilities: to fine tune site specific parameters relating to system transmitter and receiver characteristics. As it is described in section 4.7.4 System Configuration , the user can adjust the Transmitted Pulse Width, Transmitter Power Offset and the MTU Transmitted Power Measurement Offset between others.
- In addition to Manager Rights.

Administrator

User has all the higher rights level, to edit the following control parameters and facilities:

- Access and Security Configuration.
- LCU Layout View Configuration.
- Network Configuration.
- In addition to Installer Rights

4.2.1 Managing Eligible Users

Equipment leaving the factory has the following users imbedded:

Table 4.2-1: DEFAULT USERS (FACTOTY SETTINGS)

USER NAME	LEVEL	PASS WORD
administrator	administrator	nav
rest	installer	nav

The first task for an end-user administrator is to log in and implement the site and network operation policies including that applicable for user accessibility. The following steps may be taken.

- Log In.
- Configure accessibility policy.
- Add or Delete permitted users and their passwords to the user inventory.
- Establish allowable I/O access mode.

Consult 4.7.2 Accessing GUI for detailed guidance.

4.3 SWITCH-ON & SWITCH-OFF PROCEDURES

4.3.1 Switch-On Procedure

The equipment rack should not yet be connected to any power source, including the battery. Ensure that the AC power switch at the bottom of the cabinet is OFF. Ensure that the switches at the PSU's circuit breaker panel are all OFF (this is located on the right side).

1. STANDBY POWER SOURCE

- Connect the black power cable terminated with suitable lugs to the BATT1- terminal of the power distribution bar (located at the back of the cabinet).
- Connect the other end of the black power cable to the negative terminal of the standby battery.
- Cover battery end of the red power cable with insulation tape.
- Connect the red power cable to the BATT1+ terminal. Route the two cables neatly toward the battery.
- Taking care not to short the battery terminals, undo the insulation tape and connect the battery end of the red cable to the battery. The two cables are to be of appropriate gauge for 20 Amperes and are terminated with suitable size lugs.

2. APPLICATION OF POWER

- Ensure that there is suitable AC power source at the mains.
- Connect the AC mains to the AC socket on the AC Input Box.
- Set the AC POWER switch to ON. After a short delay the rectifiers units turn on, with their steady green LEDs illuminated. The red LEDs flash until links with the controller are established.
- The controller, located at the LHS of the PSU, powers up and performs a self-check, which is indicated by flashing LEDs. There may also be an audible warning siren lasting up to 6 seconds.
- Read the voltage and current at the PSU's LED display. This should be 27.2 +/- 0.3 V and less than 0.2 A.
- Turn the switch for battery charger at the PSU's circuit breaker panel to ON.
- Verify that the battery is fully charged by checking the total current is not excessive (less than 1.5 A). If the battery is not fully charged, leave the charger on until battery is fully charged.

3. APPLICATION OF POWER TO RF SYSTEM

- Turn the switch for RF voltage VRF on the PSU's circuit breaker panel to ON. This switch is located at the second top location of the 4-switch panel.
- Check that total current drawn is less than 12.0 A.

4. APPLICATION OF POWER TO CONTROL SYSTEM

- Turn the switch for control voltage VCTL at the PSU's circuit breaker panel to ON. This switch is located at the top location of the 4-switch panel.
- Check that the following front panel indicators are on:
  - Power.
  - Alarm.
  - Polling (flashing).
- Check that the total current drawn is less than 5 A.
- Check that the front panel indicators are all on or flashing of the intended colour for normal operation.

4.3.2 Switch-Off Procedure

Raw 24V supply can then be switched off by turning off the switches on the circuit breaker panel of the PSU and then switching off the mains.

4.4 CONNECTING TO THE DME

As it is explained in the section 2.8, to make a more powerful control of the equipment is necessary to use the extended control. The extended control of the beacon is performed through a laptop connected by a network cable to the front panel of the equipment (Local Control), or by network connections thru the NMP/EIU module.

For the NORMARC LDB-103 DME, network managed identities include the CMU A, PSU A, and the CMU B, PSU Band the NMP/EIU module.

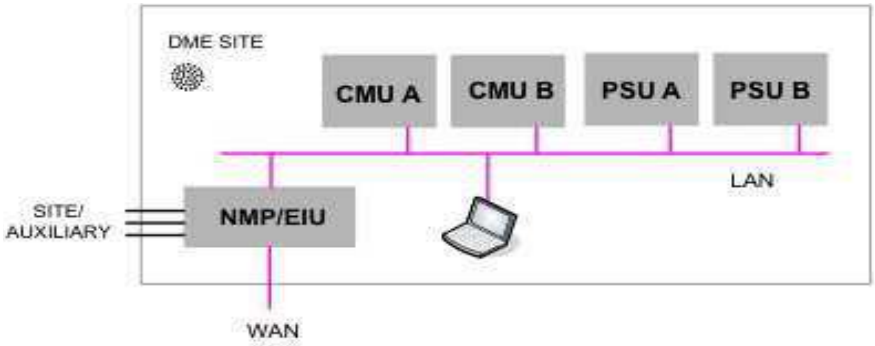


Figure 4.4-1: DME SITE LOCAL SUBNET LAYOUT

4.4.1 Network Settings

Set up a computer terminal having resident web browser to ensure its net mask, gateway and address are appropriate for the equipment which is connected to.

4.4.1.1 Local IP Network Layout

The following table list the local IP addresses layout:

Table 4.4-1: LOCAL IP ADDRESS TABLE

DESCRIPTION	IP ADDRESS	USER / PASSWORD
Master CMU	10.6.0.132	rest / nav
Slave CMU	10.6.0.133	rest / nav
CMU A (Left Hand Side)	10.6.0.138	rest / nav
CMU B (Right Hand Side)	10.6.0.146	rest / nav
PSU A (upper)	10.6.0.139	/ 1234
PSU B (lower)	10.6.0.147	/ 1234
NMP/EIU	10.6.0.97	rest / nav

4.4.1.2 Remote IP Access

The following table shows an example of how the IP addresses can be allocated.

Site name: Indra Lab network (username: ‘rest’, authority: installer).

Table 4.4-2: REMOTE IP ADDRESS TABLE

DESCRIPTION	IP ADDRESS	USER / PASSWORD
Master CMU	192.168.120.27:34080	rest / nav
Slave CMU	192.168.120.27:38080	rest / nav
CMU A (Left Hand Side)	192.168.120.27:32080	rest / nav
CMU B (Right Hand Side)	192.168.120.27:36080	rest / nav
PSU A (upper)	192.168.120.27:33580	/ 1234
PSU B (lower)	192.168.120.27:37580	/ 1234

Direct connection to the PSU requires a cross-over network cable.

4.4.2 Connecting Instructions

Step 1: Open network settings (Example for Windows Vista)

1. Click the Windows orb and select **Control Panel.**
2. Double-click Network and Sharing Center.
3. Select **Manage Network** Connection from the list of options on the left.
4. Double-click Local Area Connection.

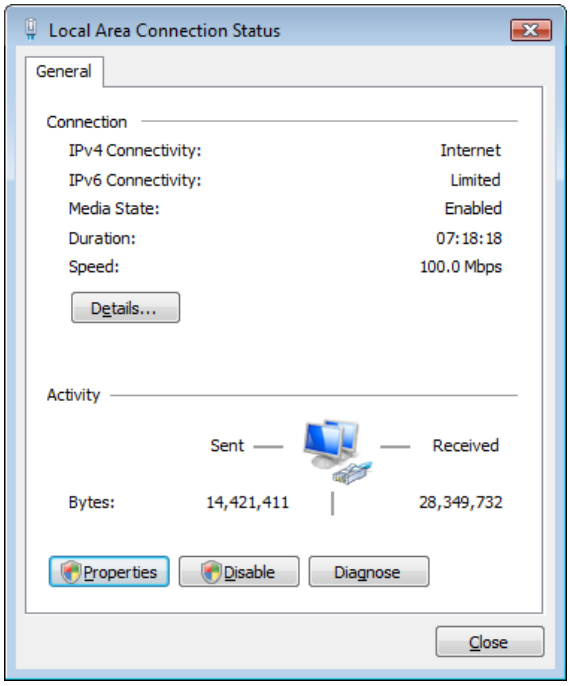


Figure 4.4-2: LOCAL AREA CONNECTION STATUS

5. Click **Properties**.

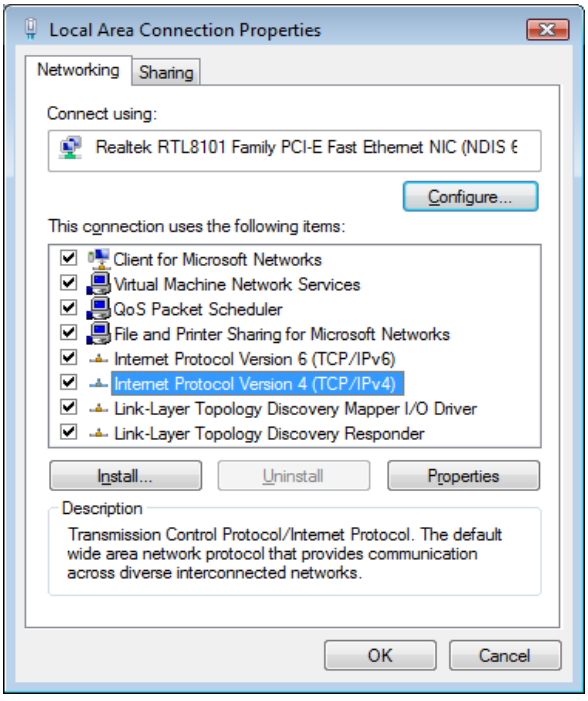


Figure 4.4-3: LOCAL AREA CONNECTION PROPERTIES

6. Select Internet *Protocol Version 4 (TCP/IPv4)* and click **Properties.**

Step 2: Set IP address

1. Select the option for *Use the following IP address,* if it is not already selected.
2. Enter the following settings

   IP address: 10.6.0.90

   Subnet mask: 255.255.255.0
3. Optional: set the default gateway if necessary. This is the IP address of your firewall or network switch.

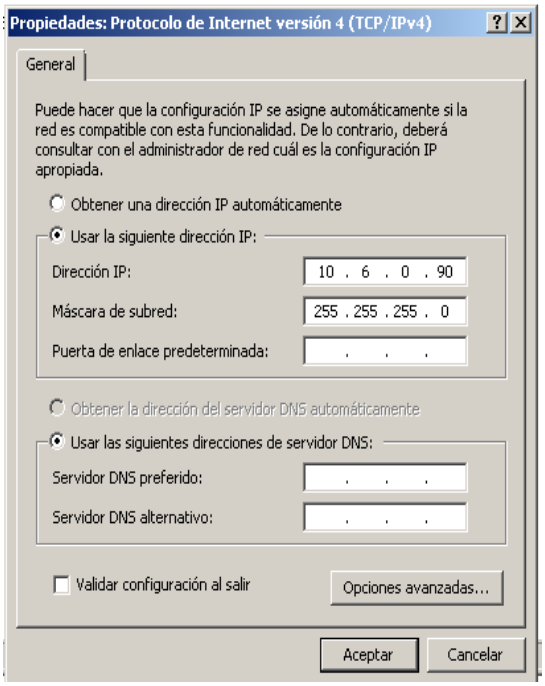


Figure 4.4-4: PROPERTIES - DEFAULT GATEWAY

4. Click **OK.**

Step 3: Log on to the selected module (CMU A, CMU B, PSU A, PSU B or NMP/EIU module)

1. Connect your PC to the power supply using a crossover LAN cable.
2. Open Windows Internet Explorer and enter the following address (in this example we are connecting to PSU A):

   http:// 10.6.0.139

   You are prompted to log in.
3. Enter the your normal network user ID and the following password: 1234
4. Click **OK.**

4.5 OPERATION INFORMATION

The operation of the Indra NORMARC LDB-103 DME is controlled by a system of local and remote controls and status display that provides the following general capabilities:

1. Basic control: it is made through buttons supplied by the Local Control Unit (LCU) touch screen display.
2. An extended control of the beacon: it is performed through network connections. In this case there are other two possibilities:

   A laptop connected by a network cable to the front panel of the equipment (LMT).

   A laptop connected by a network cable to the NMP/EIU module (RMT).
3. Remote control can be performed by a connection accomplished by multiple means including dial-up modem, leased-lines, radio, IP-based virtual private network (VPN), Ethernet, and cellular networks.

So, it is possible to operate though four different interfaces:

1. **LCU**: It supplies basic control functions to the user in an easy an intuitive way, for example switch on and off each transponder in an equipment in alarm inhibit mode. The operating instructions through LCU are described in 4.6 LCU OPERATING INSTRUCTIONS.
2. **LMT/RMT**: The browser-based Graphical User Interface resident in the CMU is the primary operator interface to the NORMARC LDB-103 DME. All of the DME monitor, control, telesignaling and test functions can be accessed. A detailed description of operating instruction can be found in *4.7* GUI OPERATING INSTRUCTIONS.
3. **RCSU:** Optionally, as a part of the Remote Management and Monitoring system (RMMS), the Remote Control and Supervision Unit is normally placed in the equipment room of the control tower or in the equipment room of the maintenance centre responsible of the Navaid site. As it is explained in the Annex B – RCSU AND RSU OPERATING INSTRUCTION, the RCSU allows a similar control and a similar parameters view to the LCU's.
4. **RSU:** the Remote Supervision Unit (RSU) can be installed optionally in the air traffic control area, in the control tower or at any point of the remote control center. Its main function is to report information about the state and availability of the navaid systems to the operator. More information about the RSU and how to operate is explained in Annex B – RCSU AND RSU OPERATING INSTRUCTION.

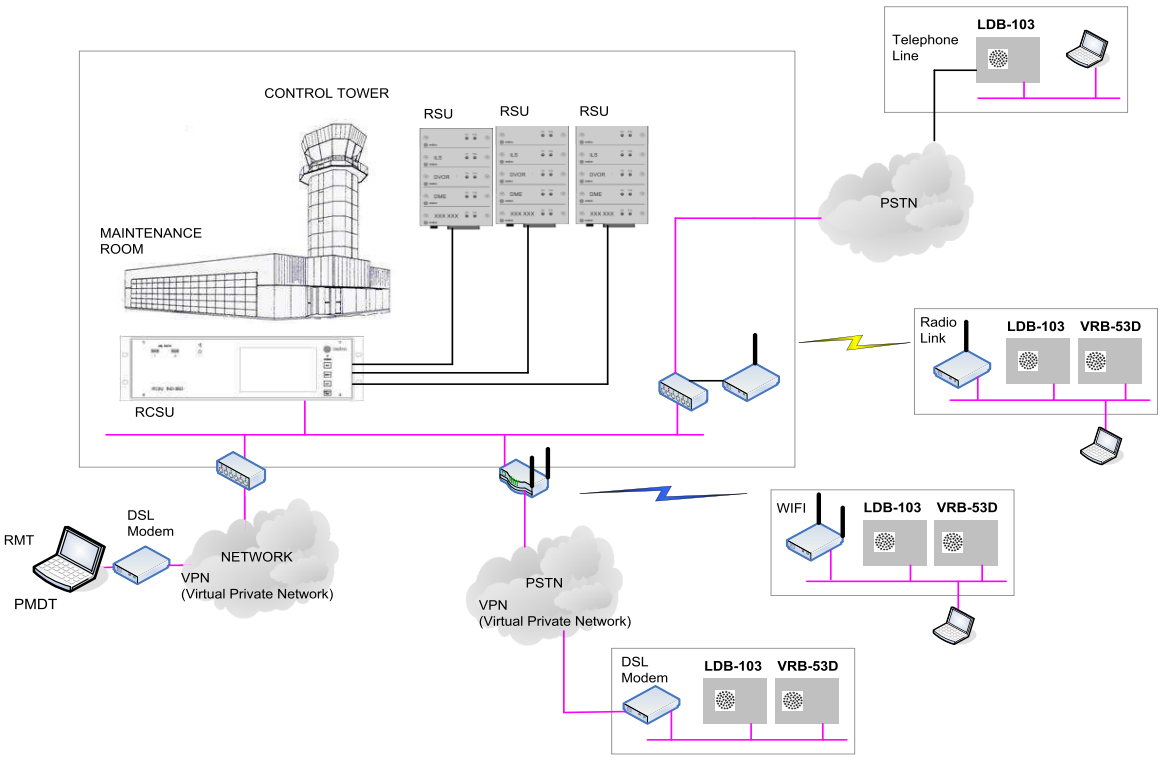


Figure 4.5-1: LDB SERIES CONTROL SUBSYSTEM OVERVIEW

4.6 LCU OPERATING INSTRUCTIONS

4.6.1 Commands

The management of the control access is performed according to the configured policy.

Once the control has been granted, the user can command just a limited number of actions from the LCU. The rest are available through the LMT.

The Local Control Unit (LCU) allows the system configuration control in the following way:

- Request/Release the control of the system.
- Select which transmitter works as Main and which one remains in Standby.
- Change-over transmitters.
- Enable/Disable Inhibit alarm.
- Enable/Disable RF module in transmitter TX 1 / TX 2 in Alarm Inhibit Mode.
- Disable/silence audible alarm.
- Local Mode.

There are two possible views of the LCU. The user can choose which interface to use by the extended control. The route is the following:

Table 4.6-1: LCU LAYOUT

LMT/RMT GUI Path	Default
Administration > Policies> SYSTEM Controls. **LCU Layout (*)**	Original

The two possible views are presented below. Note that in the following sections, the figures always show the Original Layout, but the functionality is exactly the same.

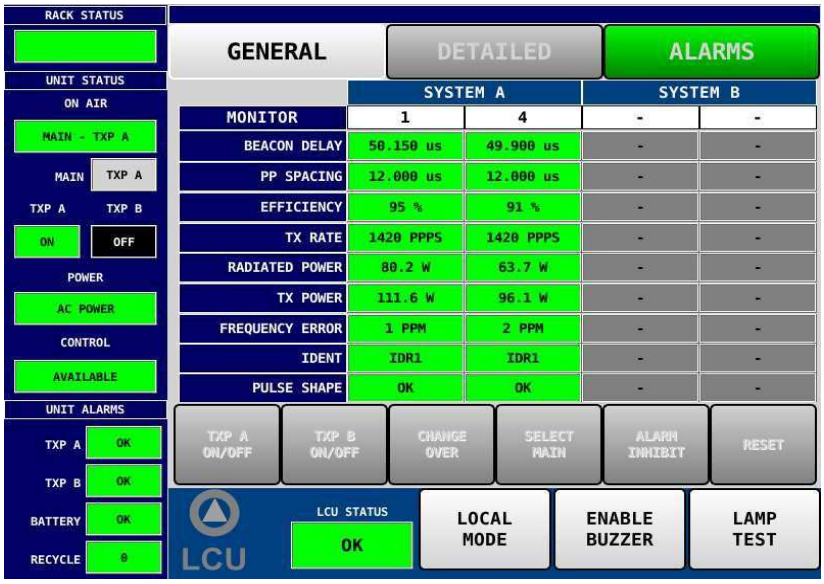


Figure 4.6-1: COMMANDS ORIGINAL LAYOUT

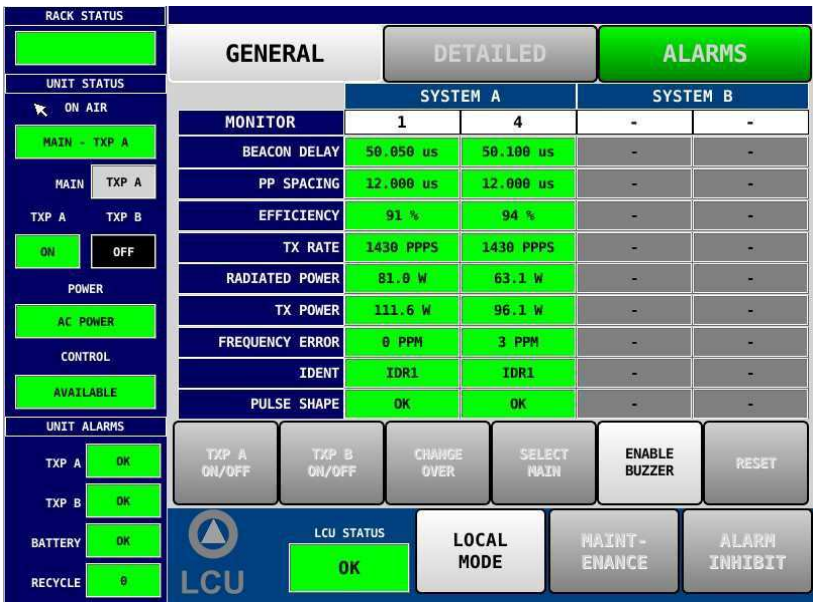


Figure 4.6-2: COMMANDS ALTERNATIVE LAYOUT

4.6.2 General Information Area

The LCU display screen contains four areas:

- The vertical column on the left are is the basic information block. This is a sliding panel.
- The top horizontal panel contains tab selection for general information, detailed information and alarm details.
- The bottom horizontal block contains the sliding panel for the LCU status.
- The remaining area contains the selected information for the navaid equipment.

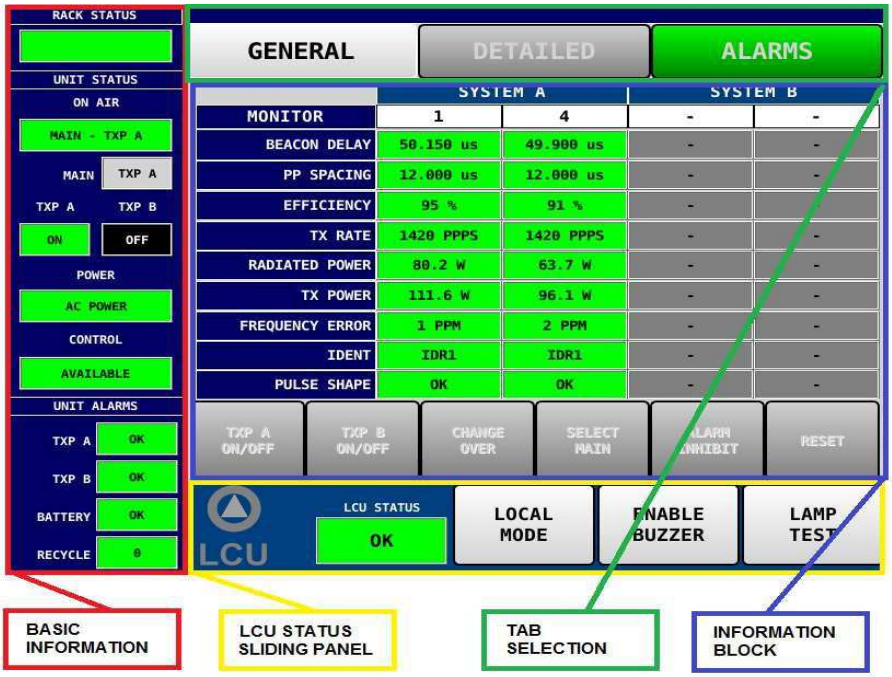


Figure 4.6-3: GENERAL INFORMATION

At least the next general signals are showed at any time in the front panel of the LCU:

- [Operational status (MAIN, STANDBY, SHUTDOWN)].
- [Transmitter On air / Transmitter status (ON/OFF, OK/WARNING/ALARM, BYPASS)].
- [Power supply status (AC POWER/BATTERY, LOW BATTERY)].
- Recycle count [GREEN, YELLOW, RED].
- [Control availability (MULTIPLE, AVAILABLE, REMOTE LOCK)].

4.6.3 Detailed Information Area

4.6.3.1 General Status Panel

This screen provides a global vision of the system status by monitoring basic parameters such as:

- System status.
- Beacon Delay.
- Pulse Pair Spacing.
- Efficiency.
- Transmission rate.
- Radiated Power.
- Transmitted Power.
- Frequency Error.
- Ident.
- Pulse Shape.

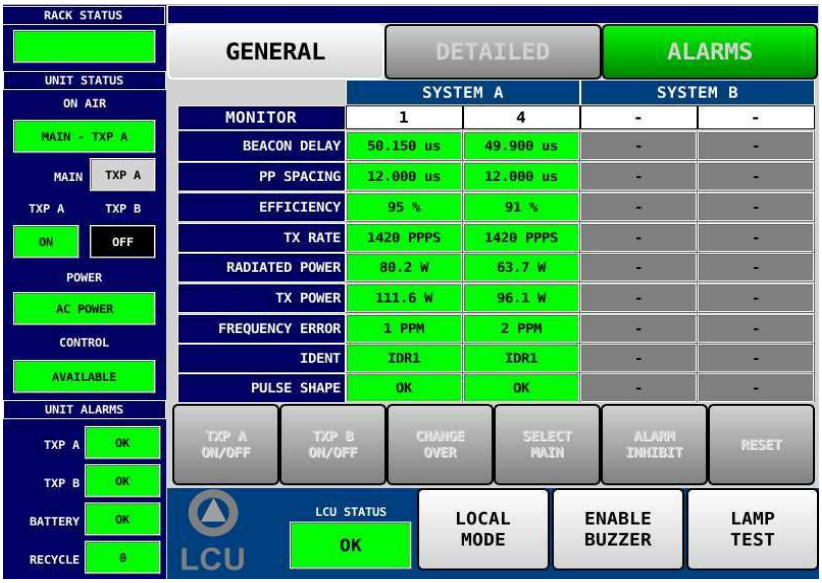


Figure 4.6-4: GENERAL INFORMATION PANEL

4.6.3.2 Detailed Status Panel

All the parameters from each module are shown on screen. The GUI employs a pages and tabs to organize the parameters in systems and modules, allowing the user to easily navigate through the parameters.



Figure 4.6-5: DETAILED STATUS PANEL

4.6.4 Alarms Status Panel

The alarms have a clear indication on the LCU to inform the any incidence in the equipment. They also have a dedicated tab to show detailed information of the cause of alarm. The distribution is similar to the one employed by the detailed status panel.



Figure 4.6-6: ALARM INFORMATION PANEL



Figure 4.6-7: ALARM INFORMATION PANEL – ALARM STATE

4.6.5 LCU Configuration Section

This section allows the configuration and monitoring of the LCU module:

- Language selection.
- Error report.
- Touch Screen Calibration.

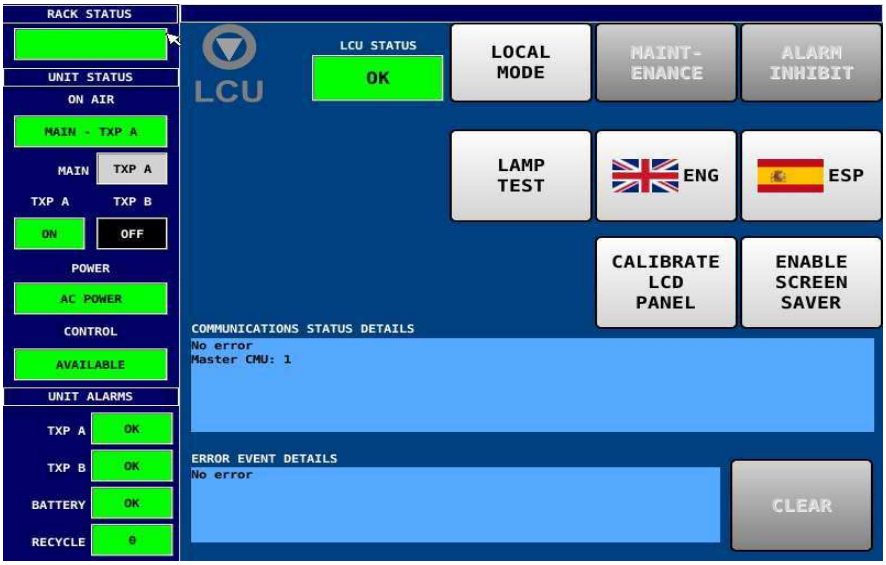


Figure 4.6-8: LCU STATUS SLIDING PANEL INFORMATION

4.6.6 Unit Status Sliding Panel

This screen provides a global vision of the system status. The showed information is the same than in the small size version, but the slinding panel allows an easier visualization.

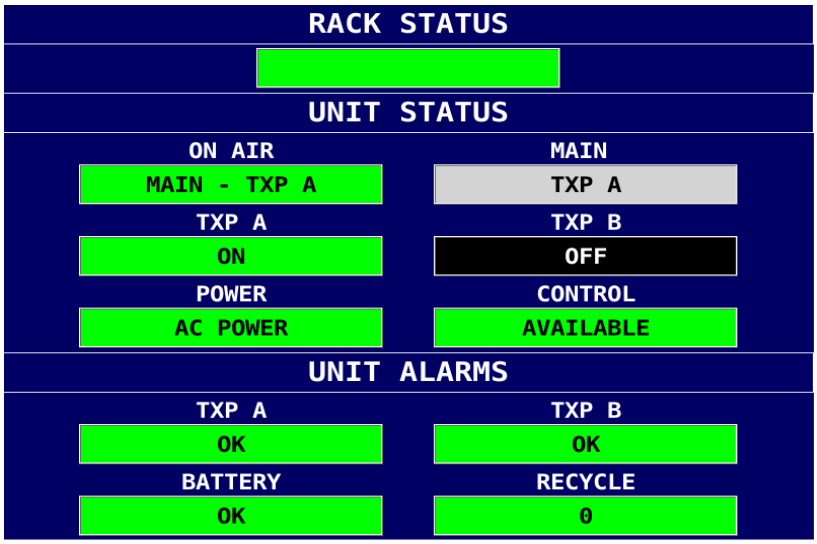


Figure 4.6-9: DME SLIDING STATUS PANEL

4.7 GUI OPERATING INSTRUCTIONS

4.7.1 General

The browser-based Graphical User Interface (GUI) resident in the CMU is the primary operator interface to the NORMARC LDB-103 DME. All of the DME monitor, control, telesignalling and test functions can be accessed.

The browser pages include the following six groups:

- Alarms.
- Status.
- Configuration.
- Thresholds.
- Administration.
- Logs.
- Test.

For operation activities at system level, the front pages are organised generally into four groups:

- Display of System Status including Monitor Alarms (Alarms and Status).
- System Equipment Control (Configuration, Status).
- System Test Facility (Status and Test).
- Management Facility (Logs and Administration).

4.7.2 Accessing GUI

To access the CMU's windows (see section 4.4 for a detailed description):

1. Connect a computer with web browser installed to the LAN/Ethernet Connector (either on local Ethernet port or on the front of NMP/EIU).
2. Manually set the network address within the subnet range.
3. Configure each CMU. To access the DME:
   - Type http://10.6.0.138 into browser for CMU A.
   - Type http://10.6.0.146 into browser for CMU B.

   Or
   - Type http://10.6.0.132 into browser for master CMU.
   - Type http://10.6.0.133 into browser for slave CMU.

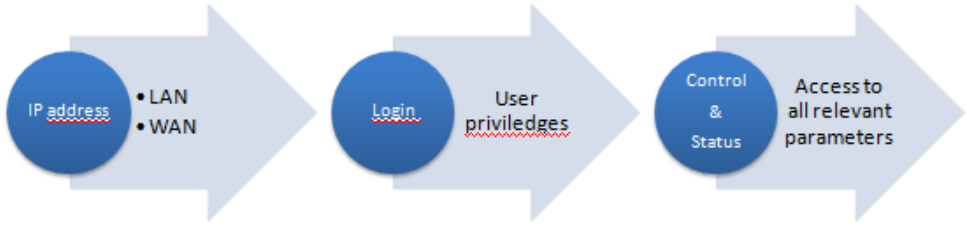


Figure 4.7-1: LMT/RMT ACCESS

A screen similar to the following should be displayed:

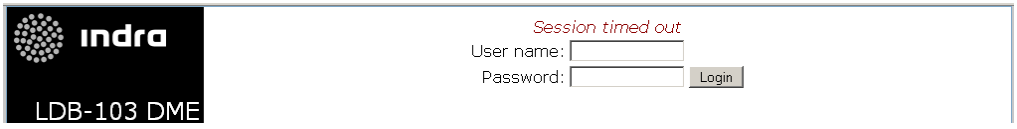


Figure 4.7-2: LMT LOG IN

1. Log into CMU – username: ***administrator*** / password: ***nav.***

An initial screen similar to the following should appear:

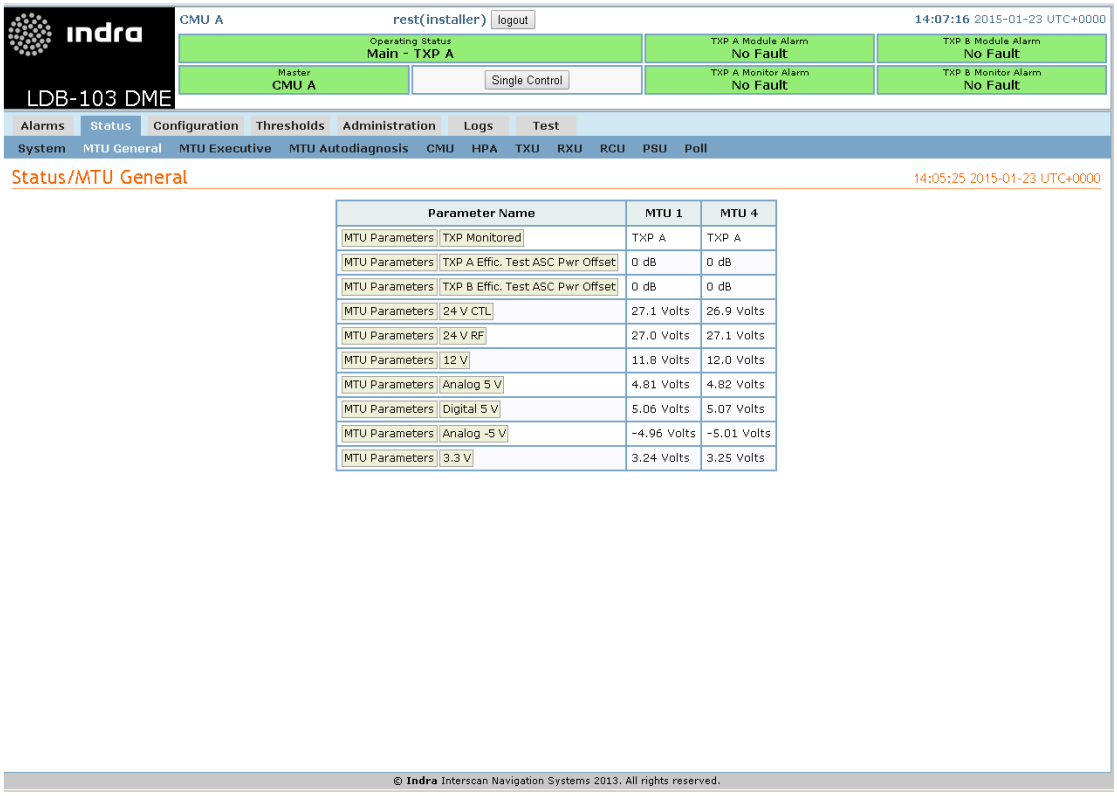


Figure 4.7-3: LMT MAIN SCREEN

2. Navigate to the Administration > Policies.

3. Set up the policies for Navaid installations. All Navaids should initially be configured for the same policy settings, so that operators are presented with a consistent interface for all equipment.

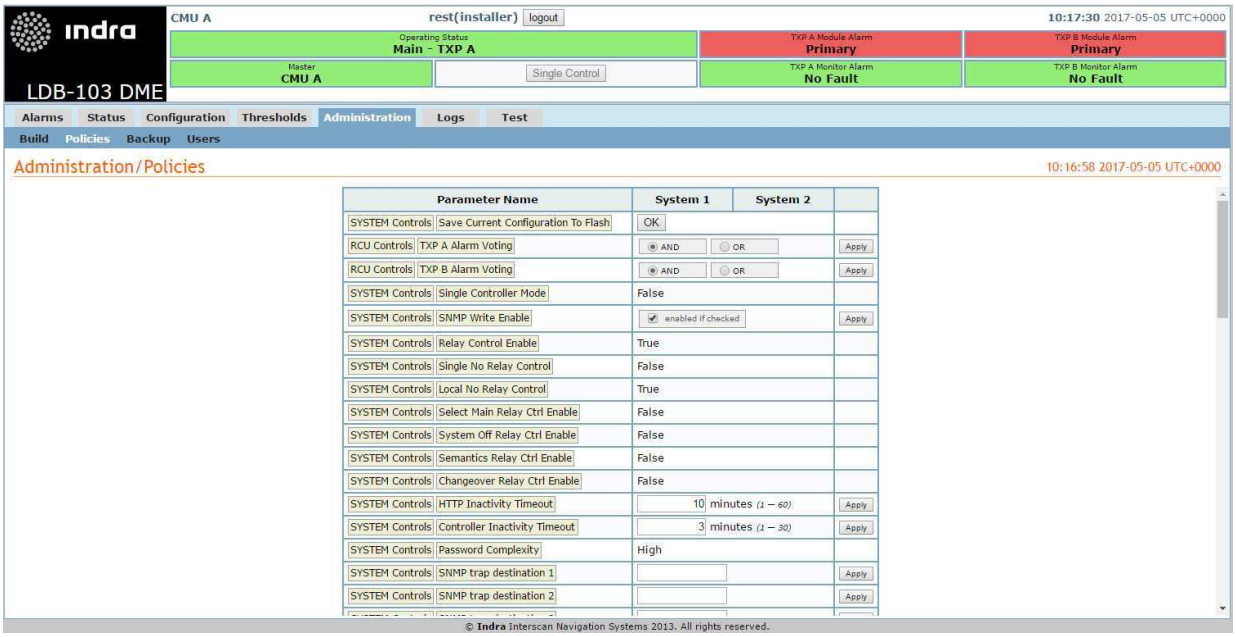


Figure 4.7-4: LMT POLICIES

4. Add users and modify the default passwords. Review the Password Complexity setting to ensure that it complies with the policy of your organization.

> **NOTE:** Save Current Configuration To Flash
>
> All system settings apply to both CMU A and CMU B regardless of the CMU the user is connected to.
>
> When the system settings need to be persistent, *Administration/Policies/SYSTEM Controls/Save Current Configuration To Flash* command is required. The saving process takes 20 seconds. During this period, the CMU (or CMUs) should not be extracted and the DME should not be turned off.
>
> To synchronize User Names and Passwords between CMUs, a *Save Current Configuration To Flash* command is required and, after the 20 seconds safe period, a CMU Reset (Configuration > CMU) has to be commanded to the other CMU, i.e. if the accounts are created on CMU A, the reset should be commanded to CMU B.

5. Navigate to the Administration > Users page. This is only viewable by those logged in with Administration privileges.

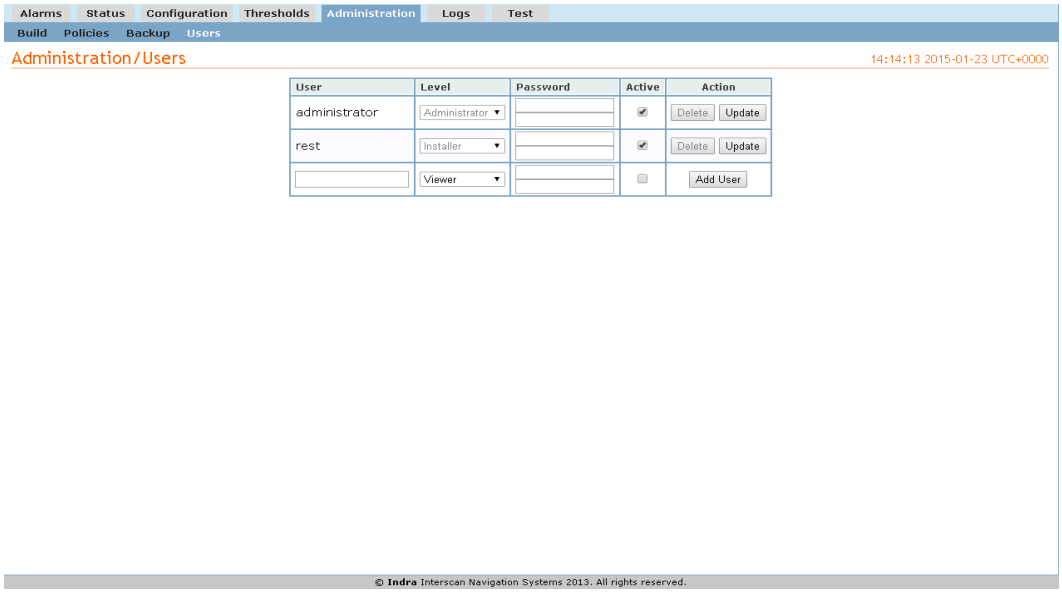


Figure 4.7-5: LMT USERS 1

6. Change passwords for the default users (optional, but recommended). It is not possible to remove or disable these users.

Additional users can be assigned. You can create individual user accounts, or use generic accounts for each user level.

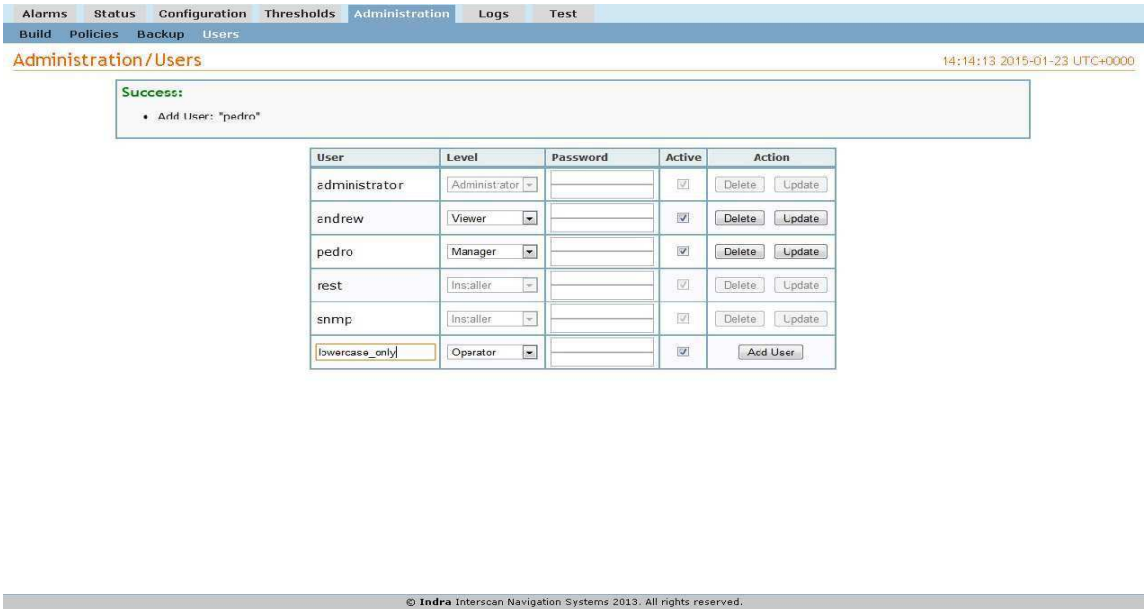


Figure 4.7-6: LMT USERS 2

NOTE: Usernames must be lowercase and rules on password complexity are set on the Policies page.

The 'Administrator Level' has control over System Configuration, Policies and Users, however, it is advised not to use this account to configure or monitor the equipment. The higher user level recommended for managing the equipment configuration is Installer. If the system administrator also intends to operate, install or maintain the equipment, they should assign themselves another username for that purpose and give it Installer privileges. The Administrator should then check and modify policies according to the organizations plan for Navaid management. After setting users and policies on one CMU, the information can be synchronized with the other CMU following the procedure explained for Save Current Settings.

4.7.3 Menu Overview

General Navaid Status:

- Refresh period configurable:
  - Only the DME GUI STATUS BAR is refreshed.
  - This parameter is configurable in Administration > Policies > SYSTEM CONTROL **HTTP Status Area Update Period**.
- Available Information:
  - User connected and access level.
  - Time and Date.
  - Master CMU and current CMU.
  - Operative Status.
  - Module Alarms of both systems.
  - Monitor Alarms of both systems.
  - Navaid Control State.

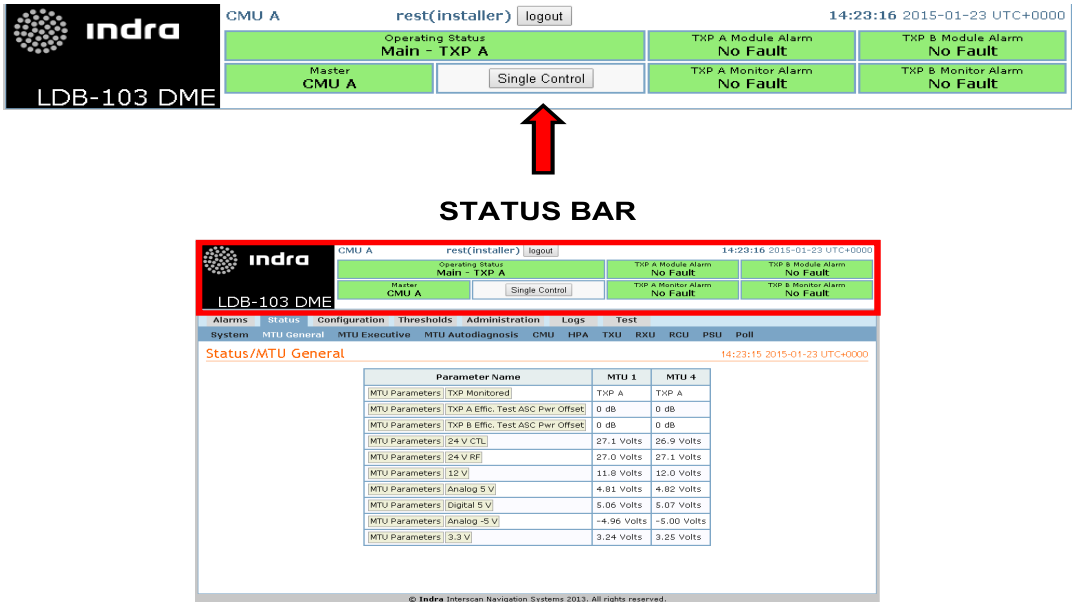


Figure 4.7-7: GENERAL DME GUI STATUS BAR

Tabs and terminal map:

- 2 Tab Levels.
- Parameters distributed by purpose and module.

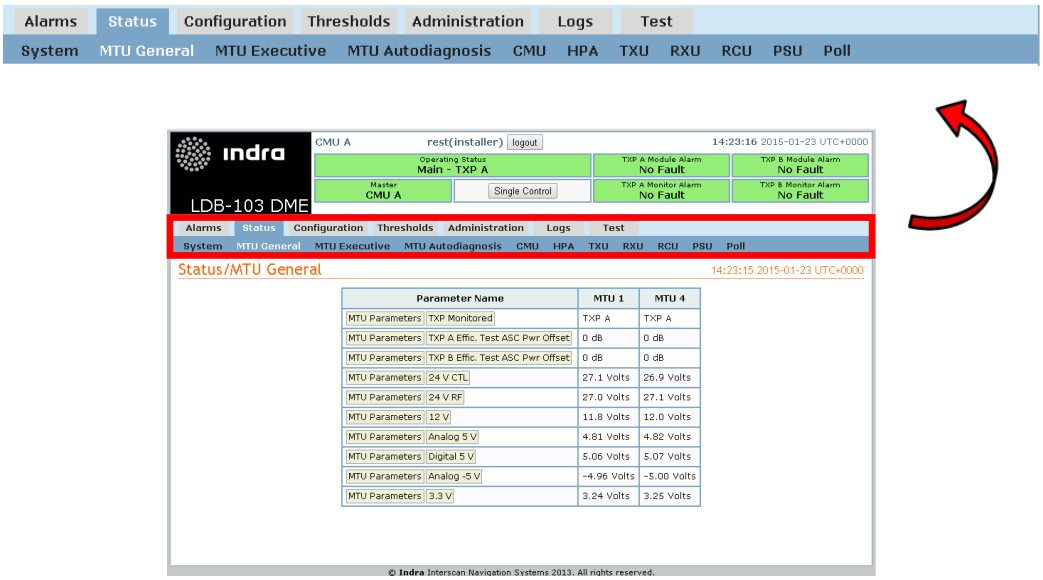


Figure 4.7-8: TABS AND TERMINAL BAR

Parameter table:

- Parameter Name and Value.
- System Selection.

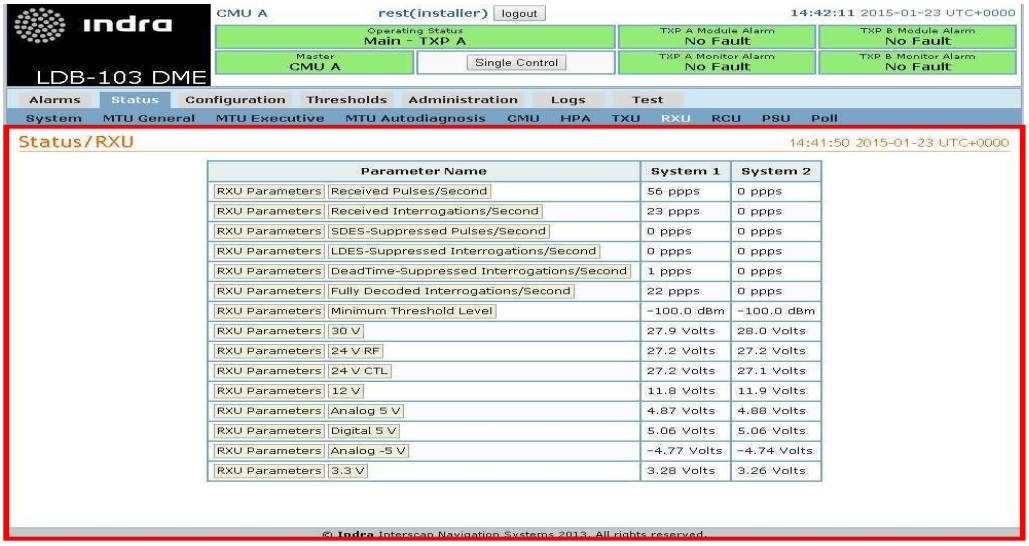


Figure 4.7-9: PARAMETERS TABLE

Navaid control:

- Changes applicable to:
  - Single parameters: pressing the Apply button on the right side of each row.
  - Set of parameters: pressing the Apply button off the last row.
- All changes commanded are verified and confirmed.

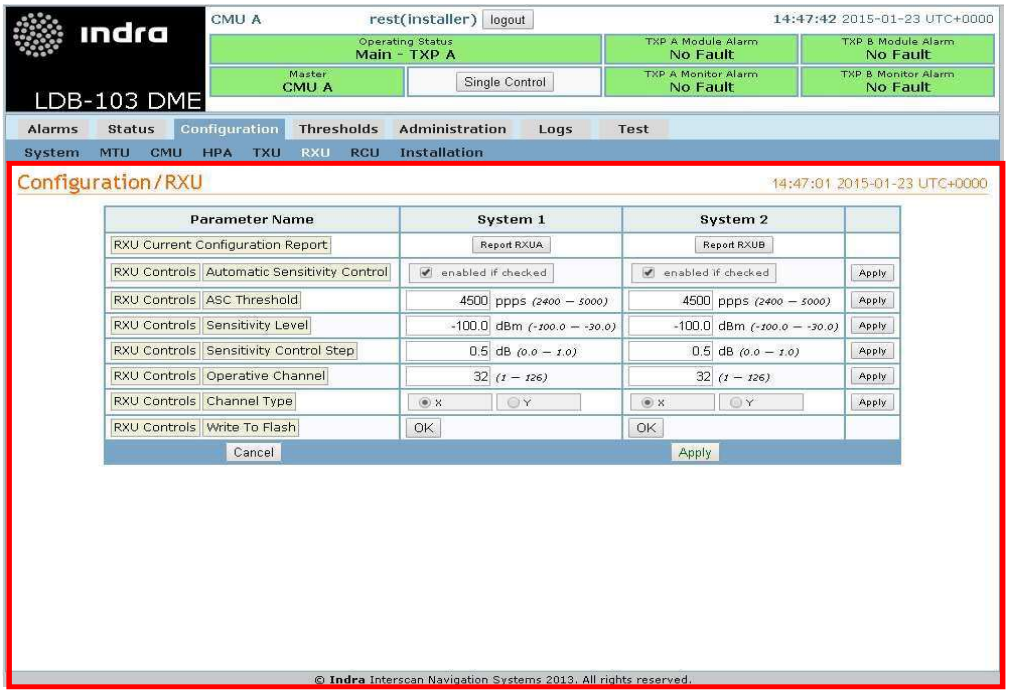


Figure 4.7-10: NAVAIDS CONTROL

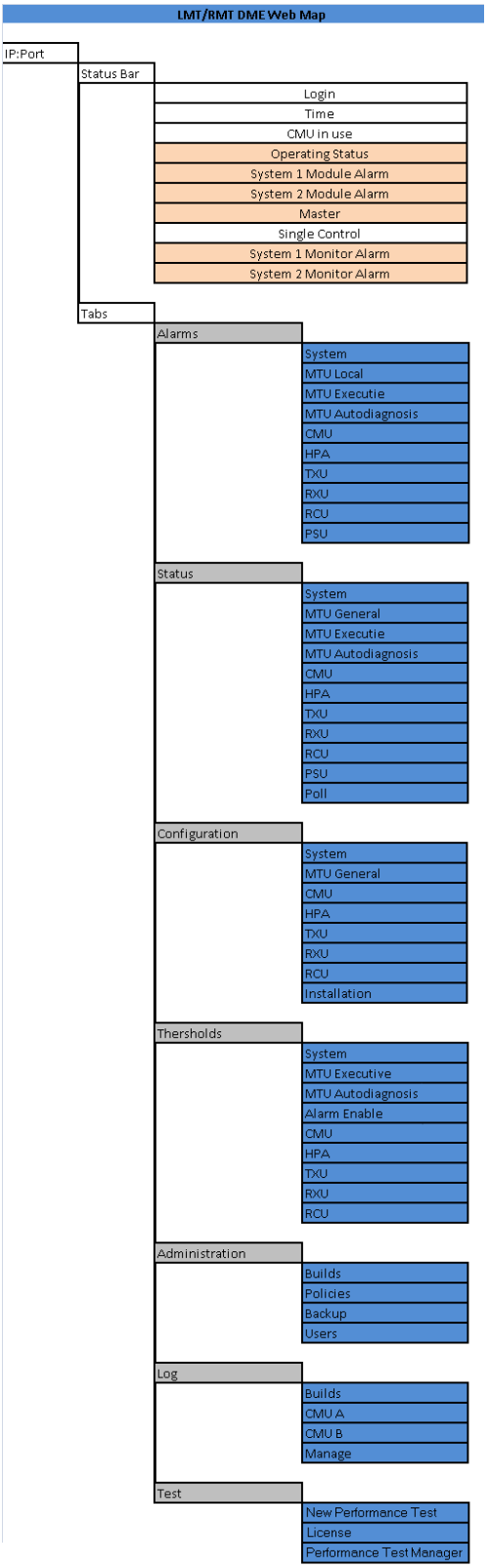


Figure 4.7-11: LMT/RMT DME WEB MAP

4.7.4 System Configuration Starting-up

At **Installation**, after powering up and a communication link with the new equipment has been established, the first steps include the inspection of the alarm pages and the status pages. At the absence of any hardware anomalies as shown in those pages, the equipment is next configured by following the procedure contained herein.

Configuration of the equipment includes setting up and verification of operational parameters, measuring and adjusting of site-specific parameters and archiving of all operating parameters. User must use the web interface to modify configuration. Note that the configuration and checking must be done in the order as they are listed below.

These parameters include:

- Site name.
- Verify the LRU fitted.
- Ident code.
- Operative channel and type.
- Transmitted Power Offset.
- Pulse Width.
- Transmitted/Radiated Power measurement Offset.
- Configure the transmitted and radiated power thresholds.
- Other Configuration options.
- Interlock option.
- Configure the Antenna Cable Losses Parameter for the probe Antenna.
- Equipment Control Policies.
- Display Filter.

This information, specific to the site at installation (and after successful commissioning), is to be archived. So, If changed, click ***'Write To Flash'*** to enter the new parameter values into persistent memory. The instructions to configure and modify all this parameters all described in section 4.7.5 Control Instruction.

4.7.5 Control Instruction

In this section how to configure the most import parameters and characteristics of the NORMARC LDB-103 DME is explained in detailed.

4.7.5.1 Site Name

To configure to Site Name follow the next path:

LMT/RMT GUI Path	Options	Default
Administration > Policies > SYSTEM CONTROL. **Navaid Name**	-	-

4.7.5.2 Verify the LRU fitted

A DME Ground Beacon NORMARC LDB-103 is composed by different LRUs.

So, after the DME is installed is necessary to verify and configure which LRU are fitted.

LMT/RMT GUI Path	Options	Default
Administration > Policies> SYSTEM Controls. **CMU 1 Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **CMU 2 Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **RXU A Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **RXU B Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **TXU A Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **TXU B Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **HPA A Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **HPA B Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **MTU 1 Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **MTU 2 Fitted**	Yes/No	No
Administration > Policies> SYSTEM Controls. **MTU 3 Fitted**	Yes/No	No
Administration > Policies> SYSTEM Controls. **MTU 4 Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **PSU A Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **PSU B Fitted**	Yes/No	Yes

4.7.5.3 Ident Code

The settings to configure are described in the tables below.

To indicate the operation mode:

LMT/RMT GUI Path	Options	Default
Configuration > Installation > TXU Controls. **Ident Association Mode**	Independent / Code Sender / Trigger Sender / Code Receiver / Trigger Receiver	Code Receiver
Configuration > Installation > TXU Controls. **Select Ident Trigger Control**	Falling Edge/ Rising Edge	Falling Edge

Note: in section 3.9 TRANSMITTER UNIT (TXU) the different Ident Modes are explained in detail.

To define which code is labeled as *ID Code 1, ID Code 2* and *ID Code Test.*

LMT/RMT GUI Path	Options	Default
Configuration > Installation > TXU Controls. **ID Code 1**	-	-
Configuration > Installation > MTU Controls. **ID Code 1**	-	-
Configuration > Installation > TXU Controls. **ID Code 2**	-	-
Configuration > Installation > MTU Controls. **ID Code 2**	-	-
Configuration > Installation > TXU Controls. **ID Code TEST**	-	-
Configuration > Installation > MTU Controls. **ID Code TEST**	-	-

Note: Each code could be up to four letters (must be capital letters) or numerals.

To select the code to be used by the TXU and the MTU.

LMT/RMT GUI Path	Options	Default
Configuration > Installation > TXU Controls. **ID Code Selection**	First / Second	First
Configuration > Installation > MTU Controls. **ID Code Transmission**	Code1 / Code 2/ Test Code	Code1

Finally, modify the *symbol length* is possible.

LMT/RMT GUI Path	Options	Default
Configuration > Installation > MTU Controls. **Symbol Length**	[100-160] ms	120

4.7.5.4 Operative Channel

The user can select the operative channel frequency (see Table 1.4-2). The following parameters must be configured:

LMT/RMT GUI Path	Options	Default
Configuration > Installation > TXU Controls. **Operative Channel**	[1-126]	74
Configuration > Installation > TXU Controls. **Chanel Type**	X or Y	X
Configuration > Installation > HPA Controls. **Operative Channel**	[1-126]	74
Configuration > Installation > HPA Controls. **Chanel Type**	X or Y	X
Configuration > Installation > RXU Controls. **Operative Channel**	[1-126]	74
Configuration > Installation > RXU Controls. **Chanel Type**	X or Y	X
Configuration > Installation > MTU Controls. **Operative Channel**	[1-126]	74
Configuration > Installation > MTU Controls. **Chanel Type**	X or Y	X

4.7.5.5 Transmitted Power Offset

The NORMARC LDB-103 DME allows adjusting the transmitted Power introducing losses between 0 and 4 dB. Note that the procedure to follow must be:

- Firstly, adjust the transmitted power.
- Secondly, modify the *Power Pulse Width Adjustment* parameter to get the more suitable width.
- Finally, check and adjust the reply Delay of the TXU.

LMT/RMT GUI Path	Options	Default
Configuration > TXU > TXU Controls. **Output Power Offset**	[-4-0] dB	0 dB

4.7.5.6 MTU Transmitted Power Measurement Offset

To adjust the TX power value and RD power value read by the MTU during commissioning is possible. These adjustments are intended to be used for fine-tuning of the MTU. With no adjustment, the MTU shows a correct value but now it is possible to enhance manually the accuracy of the measurement.

LMT/RMT GUI Path	Options	Default
Configuration> Installation>MTU Controls. **Transmitted Power Offset.**	[-2.0 – 2.0] dB	0
Configuration> Installation>MTU Controls. **Radiated Power Offset.**	[-2.0 – 2.0] dB	0.2

4.7.5.7 Pulse Width and Output Power Adjustment

One of the capabilities of the equipment is a fine adjustment of the transmitted pulse width and the output power. With no adjustment, the equipment transmits a valid pulse (ICAO compliant) using its own calibration tables, but it's possible to adjust manually the pulse width in order to have a value more close to the nominal. In the same way, a non-significant less output power can be read in some channel due to the tolerances, but it’s possible a fine adjustment in order to get the nominal value.

The right sequence to adjust the output power and pulse width must be the following:

- Firstly, adjust the transmitted power.
- After, modify the *Power Pulse Width Adjustment* parameter to get the more suitable width.
- Finally, check and adjust the reply Delay of the TXU.

LMT/RMT GUI Path	Options	Default
Configuration > Installation> TXU Controls. **Operative Channel Power Adjustment**	[0 to 1.5] dB	0
Configuration > Installation> TXU Controls. **High Power Pulse Width Adjustment** (only applied for HP equipment)	[-42-42] %	0
Configuration > Installation> TXU Controls. **Low Power Pulse Width Adjustment** (only applied for LP equipment)	[-40-40] %	0

4.7.5.8 Configure the transmitted and radiated power thresholds

Configure the transmitted and radiated power thresholds according the type of equipment: High Power or Low Power.

Note: As reference the standard values are:

- HP: 800 W secondary alarm / 500 W primary alarm.
- LP: 80 W secondary alarm / 50 W primary alarm.

LMT/RMT GUI Path	Options	Default
Thresholds/MTU Executive/MTU Parameter Limits. **Transmitted Power Secondary Alarm Threshold**	[25 – 1500] W	80(LP)/800(HP)W
Thresholds/MTU Executive/MTU Parameter Limits. **Transmitted Power Primary Alarm Threshold**	[25 – 1500] W	50(LP)/500(HP) W

4.7.5.9 Display Filter

Allows seeing the Transmission Zeros due to losses in a detection of parameters; Beacon Delay, Pulse Pair Spacing, Radiated Power and Transmitted Power.

LMT/RMT GUI Path	Options	Default
Configuration> Installation> MTU Controls. **Display Filter**	Enabled/ Disabled	Enabled

4.7.5.10 Other Configuration Parameters

Besides the parameters explained before, when a DME is installed, it would be interesting check others features. The following settings allow users to easily configure the DME to suit their needs.

4.7.5.10.1 System Select Control

By default, the system on the left is the main system, and the one on the right is the standby. If no fault is present, the main equipment is always operating and connected to the radiating system. Nevertheless, selection of the main system for active system is user-selectable.

LMT/RMT GUI Path	Options	Default
Configuration > RCU > **Main TXP**	TXP A/TXP B	TXP A

The policy to decide when alarms in MTU1 and MTU4 produce a changeover is configurable. It is possible to produce a changeover when an alarm happens (whatever MTU) or only when both MTUs produce the alarm at the same time.

LMT/RMT GUI Path	Options	Default
Administration > Policies > **TXP B Alarm Voting**	AND/OR	AND
Administration > Policies > **TXP B Alarm Voting**	AND/OR	AND

Moreover, the user can modify the *Changeover Sequencing Policy:*

- System Off: Not valid.
- In Hot Main-Standby-Shutdown and Warm Main-Standby-Shutdown the sequence is Main-Standby-Shutdown in both cases. The difference is in the radiofrequency amplifiers state:
  - In the 'Hot' mode, both sets of radiofrequency amplifiers are kept active and the energy from the redundant amplifiers is dissipated into 50 ohm loads enclosed in the Relay Control Unit (RCU).
  - In the 'Warm' mode, the Relay Control Unit is configured to disable or left power down the Low and High Power Amplifiers in the unit that is acting as Standby DME. This saves power and extends the time that the NORMARC LDB-103 can operate off back-up batteries.

LMT/RMT GUI Path	Options	Default
Configuration > RCU > **Changeover Sequencing Policy**	System Off/ /Hot Main-Standby-Shutdown/ /Warm Main-Standby-Shutdown	Warm Main-Standby-Shutdown

The *MTU Assignment Policy* is configurable too.

LMT/RMT GUI Path	Options	Default
Configuration > RCU > **MTU Assignment Policy**	Dynamic/Static	Dynamic

Pressing the *Changeover Sequencing Policy* button causes the DME to changeover from the active TXP to the next step in the *Changeover Sequencing Policy*.

LMT/RMT GUI Path	Options	Default
Configuration > RCU > **TXP Changeover**	OK button	

4.7.5.10.2 Alarm Inhibit Key

Alarm Inhibit operation prevents a transfer from main to standby if an alarm occurs. This allows one system to be tested while the other system operating.

The *Alarm Inhibit* key toggles between two settings: Enabled/Disabled. When *Alarm Inhibit* is set to disabled, the DME is able to transfer ('*Changeover*') or shutdown in response to alarm signals. When this key is set to enabled, transfer and shutdown are prevented and the RCU ignore any fault inputs from the monitors.

LMT/RMT GUI Path	Options	Default
Configuration > RCU > **Alarm Inhibit**	Enabled/Disabled	Disabled

When the *Alarm Inhibit* key is set to enabled, Ident code is not transmitted from the DME.

Alarm Inhibit key is also available as a software button located at the general panel of the LCU (see 4.6.3 Detailed Information Area).

If the Alarm Inhibit Mode is active, is possible to enable/disable the transmitters and configuration parameter HOT/WARM/STANDBY is updated consequently. In case both transmitters are disabled SHUTDOWN mode will be activated. Besides, if a Changeover is set, the TXP on-air must be automatically turned on. In the opposite way, this option is not available.

LMT/RMT GUI Path	Options	Default
Configuration > RCU > **TXP A Enable**	Enabled/Disabled	Enabled
Configuration > RCU > **TXP B Enable**	Enabled/Disabled	Disabled

4.7.5.10.3 Surrender Bus

This command changes the Master CMU to the other one, and stops the polling 700ms.

LMT/RMT GUI Path	Options	Default
Configuration > MTU> CMU Controls Effic. **Surrender Bus**	OK Button	-

4.7.5.10.4 Recycle Control

The recycling facility allows the beacon to automatically restart after a failure. There are two recycling policies: absolute or relative. Moreover, both policies could be enabled simultaneously.

The following parameters are user settable in the NORMARC LDB-103 DME:

- **Enable Relative Recycle Limit:** activate the Relative Recycling mode policy.
- **Enable Absolute Recycle Limit:** activate the Absolute Recycling mode policy.
- **Recycle Delay Period:** The time that the beacon remains out of service before a restart is attempted.
- **Recycle Count Limit:** The maximum number of recycling attempts (only if absolute policy is enabled).
- **Reset Recycle Count:** The Recycle Count is a variable, which counts the number of recycles. If this button is pressed, the Recycle Count Variable is restarted to zero.
- **System Reset:** In this case, reset the Recycle Count (*Reset Recycle Count*) and all the system.

The user can access to the parameters in the following path:

LMT/RMT GUI Path	Options	Default
Configuration > RCU > **Recycle Delay Period**	[5 – 300] s	30 s
Configuration > RCU > **Recycle Count Limit**	[0-10]	10
Configuration > RCU > **Reset Recycle Count**	OK Button	
Configuration > RCU > **Enable Relative Recycle Limit**	Enabled/Disabled	Enabled
Configuration > RCU > **Enable Absolute Recycle Limit**	Enabled/Disabled	Enabled
Configuration > System > **System Reset**	OK Button	

The count of restart attempts is displayed in the general panel of the LCU. See (see 4.6.2 General Information Area).

4.7.5.10.4.1 ABSOLUTE ONLY POLICY

If the absolute policy is enabled, following a shutdown due to an alarm, the beacon attempts ten (default *Recycle Count Limit*) restarts, each at 30 seconds (default *Recycle Delay Period*) after the previous one. If it is able to start normal operation, the beacon remains on.

For each recycle, the *Recycle Count* increases, when it reaches the *Recycle Count Limit* value the beacon remains off until either:

- The *Reset Recycle Count* button is pressed. Therefore, the *Recycle Count* is cleared and the beacon starts up again. (Unless *Recycle Count Limit* is set to 0, in which case, *System Reset* must be used.)
- The *Recycle Count Limit* is changed to a higher value; the beacon automatically restarts until the recycle count reaches the new limit.

An example of how the DME works in absolute recycling mode is shown in the following diagram:

- Recycle Count Limit: **4**
- Enable Relative Recycle Limit: **Disabled**
- Enable Absolute Recycle Limit: **Enabled**

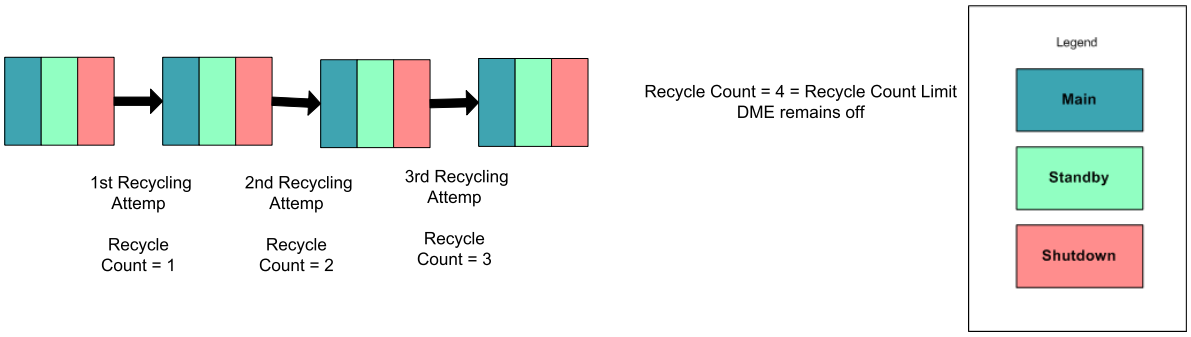


Figure 4.7-12: ABSOLUTE RECYCLING MODE

4.7.5.10.4.2 RELATIVE ONLY POLICY

If the relative mode is enabled, when the DME transponder undergoing four shutdowns within eight minute period, there is no further restart attempts regardless of the *Recycle Count* value. It ignores the recycle count limit.

Therefore, if four shutdowns happen within an eight minutes period, the equipment workflow will be:

1. Main/ Standby/ Shutdown: first recycling attempt.
2. Main/ Standby/ Shutdown: second recycling attempt.
3. Main/ Standby/ Shutdown: third recycling attempt.
4. Main/ Standby/ Shutdown: no further restart attempts. The beacon remains off until a user presses the *System Reset* button or front panel *Reset* button.
5. Although not required to restart the beacon, to clear the recycle counter on the LCU use the *Reset Recycle Count* button.

An example is shown in the next figure:

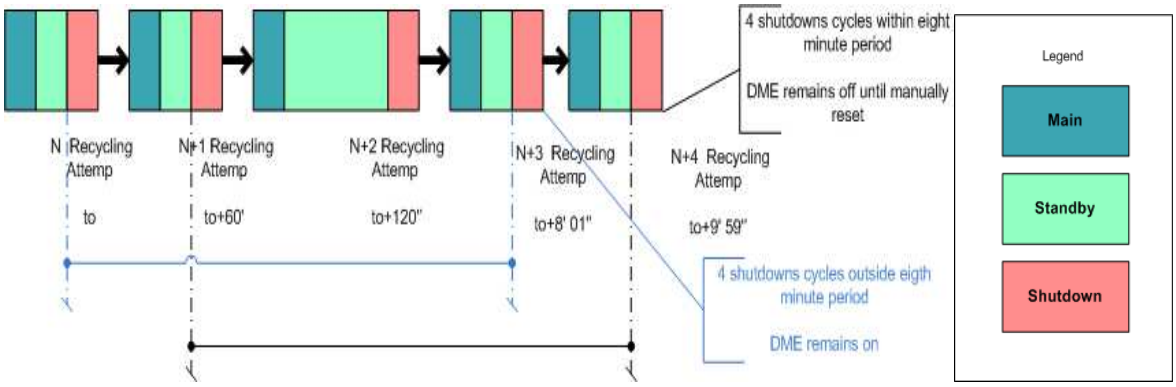


Figure 4.7-13: RELATIVE RECYCLING MODE

4.7.5.10.4.3 BOTH POLICIES ENABLED

NORMARC LDB-103 DME equipment allows us to enable both policies simultaneously.

In this case, if a failure happens, the beacon restarts automatically and each time a reset happens, the Recycle Count increases in a unit. The DME transponder remains off if one the following events happens:

- The *Recycle Count* reaches the *Recycle Count Limit* value (absolute policy condition). To clear the *Recycle Count* or increase the *Recycle Count Limit,* is needed getting the beacon restarts.
- The beacon undergoing four shutdowns within an eight minutes period (relative policy condition). In this case, the beacon remains off until manually reset.

4.7.5.10.4.4 BOTH POLICIES DISABLED

In this case, there is no limit to the number of recycle attempts. Thus, the DME will recycle continuously.

4.7.5.10.4.5 RECYCLE IN LCU UNIT STATUS SLIDING PANEL

- When the value of *Recycle Count* is zero, RECYCLE unit in the LCU Front Panel is “green”.
- If the *Recycle Count* is greater than zero but smaller than *Recycle Count Limit* value, in this case, RECYCLE turns on to “yellow”.
- When the *Recycle Count* reaches the *Recycle Count Limit* value (absolute policy condition) or the equipment shuts down for relative policy condition, RECYCLE is shown in “red”.

4.7.5.10.5 Power-On Settling Time

The *Power-On Settling Time* selects the delay, in seconds, from the time power is applied to the system until fault reporting is considered valid. This avoids anomalous reporting during starting with the associated power surges and so on. It has 96 choices from 1 to 20 seconds.

The default value for the delay is 10 seconds.

LMT/RMT GUI Path	Options	Default
Configuration > RCU > **RCU Star Up Time**	[0 – 90] s	30 s

4.7.5.10.6 Monitor Alarm Delay Switch

The *Exec Alarm Delay* selects the delay from the time that a Monitor fault is reported to the CMU until action is taken. It provides 8 choices from 0.5 to 12 seconds. The default value is 3 seconds. The fault must be present for the duration of this period in order for the CMU to take action at the end of the delay.

LMT/RMT GUI Path	Options	Default
Configuration > RCU > **Exec Alarm Filter Time**	[0.5 – 12.6] s	3 s

4.7.5.10.7 BITE Alarm Delay Switch

The *BIT Alarm Delay* selects the delay from the time that a BITE fault is reported to the CMU until action is taken. It provides 8 choices from 0.5 to 12 seconds. The default value is 3 seconds. The fault must be present for the duration of this period for the CMU to take action at the end of the delay.

LMT/RMT GUI Path	Options	Default
Configuration > RCU > **BITE Alarms Filter Time**	[0.5 – 12.6] s	3 s

4.7.5.10.8 Echo Suppression

To use echo suppression is necessary to configure the following settings.

LMT/RMT GUI Path	Options	Default
Configuration > Installation > RXU Controls. **SDES**	Enabled/Disabled	Enable
Configuration > Installation > RXU Controls. **LDES**	Enabled/Disabled	Disable
Configuration > Installation > RXU Controls. **Minimum LDES Level**	[-100,-30] dBm	-100
Configuration > Installation > RXU Controls. **LDES MTL Offset**	[0.0, 100.0] dBm	0.3
Configuration > Installation > RXU Controls. **LDES Timer**	[0, 350] us	150

- **SDES:** Short Distance Echo Suppression only can be enabled or disabled, no configuration is needed or possible. If the SDES is enabled, RXU will be able to discard pulses between constituent pulses of an interrogation.
- **LDES:** Enable of Long distance Echo Suppression. Moreover, it is necessary to configure the next three parameters.
- **Minimum LDES Level:** When LDES is enabled, the echo suppression function shall be triggered whenever a pulse pair, with a signal level that exceeds the “minimum LDES level”, is decoded. Desensitization window shall start at the time of the interrogation decoding.
- **LDES Timer:** Length of the desensitization window.

- **LDES MTL Offset:** Offset applied to the level of the interrogation signal that has triggered the LDES. When active, the echo suppression function shall be re-triggered whenever a pulse pair, with a signal level that exceeds the level of the previous interrogation plus the LDES MTL offset, is decoded.

4.7.5.11 Interlock Option

It is possible to enable/disable the Interlock signals coming from the ILS. How to produce the interlock is configurable too:

- Combined: the interlock happens when one of the signals is active.
- Single: then interlock happens only when the active signal is the same than the selected code.

LMT/RMT GUI Path	Options	Default
Configuration > Installation > TXU Controls. **ILS 1 Interlock Enable**	Yes/No	No
Configuration > Installation > TXU Controls. **ILS 2 Interlock Enable**	Yes/No	No
Configuration > Installation > TXU Controls. **ILS 1 Interlock Action**	Combined/Single	Combined

4.7.5.12 Configure the Antenna Cable Losses Parameter for the Probe Antenna

There is a parameter to calibrate the losses of the cables, the antenna and the couplers.

LMT/RMT GUI Path	Options	Default
Configuration > Installation > MTU Controls. **Antenna Cable Losses**	[0-150]	33.5

There are two possibilities to calibrate the system:

- Refer the transmitter power to the antenna. Adjust the Antenna Cable Losses parameter in order to the transmitted power and received power showed by the DME would be the same.
- Calibrate the true radiated power. In this way, the coupler and cable losses must be measured and the parameter is calculated as: Antenna Cable Losses = $Losses_{COUPLER}$ + $Losses_{CABLE}$.

4.7.5.13 Equipment Control Policies

Equipment policies should be determined by the organizations management plan for Navaids and set in a similar fashion on all Navaids.

Options and elaborations for policy settings are described below:

- **TXP X Alarm Voting:** Monitor AND / OR Configuration to determine alarms. It's the responsible of changeover sequence happens.
- **Single Controller:** Force a user to acquire Single User Control before allowing changes to settings via the web interface. The control can be taken over by a higher-level user or a local user. In section 4.7.5.13.1 this concept is explained in more details.

- **SNMP Write Enable:** Enables or disables the use of the SNMP protocol to modify settings. If enabled, correct authorization including username and password is still required.
- **Relay Control Enable:** External hardwire control via the EIU panel is enabled or disabled.
- **Single No Relay Control:** If Single Controller is enabled, then the external hardwire control via the EIU panel is disabled during the period that the user has control.
- **Local No Relay Control:** If a Local Only Mode is enabled, then the external hardwire control via the EIU panel is disabled.
- **Select Main Relay Ctrl Enable:** Allows main TXP selection through EIU relays.
- **System Off Relay Ctrl Enable:** Allows turning TXP off through EIU relays.
- **Semantics Relay Ctrl Enable:** Allows selecting the information indicated via status relays through EIU relays.
- **Changeover Relay Ctrl Enable:** Allows switching to the currently off-air transponder through EIU relays.
- **HTTP Inactivity Timeout:** Any user logged into the equipment is automatically logged out after this period of inactivity.
- **Controller Inactivity Timeout:** A user who has acquired Single User Control is automatically logged out of control after this period of inactivity.
- **Password Complexity:** Passwords must meet this complexity setting to be created or changed.
    - *None*: minimum length 1 character.
    - *Low:* minimum length 6, must have lower or upper case.
    - *Medium:* minimum length 6, must have lower or upper case, must have digits or punctuation characters.
    - *High:* minimum length 6, must have lower case a-z, must have upper case A-Z, must have digits or punctuation characters.
- **SNMP Trap Destination X:** TCP/IP Address for SNMP trap notifications.
- **XXX X Fitted:** Indicates the modules the DME should expect to find fitted in the rack.
- **Local Only On Startup:** Indicates if the equipment is configured to start up in Local Only Mode.
- **HTTP Status Area Update Period:** Webserver client status area update period.
- **Require USB Key For Write:** Write Access only permitted when an authorized USB key is inserted into the LCU plug. It is only available for the Administrator user.
- **Maintenance & Local Mode Coupling:** Automatically turn off Maintenance Mode when Local Only Mode is turned off.
- **Alarm Inhibit & Local Mode Coupling:** Automatically turn off Alarm Inhibit when Local Only Mode is turned off.

- **Full Menu Names:** Use full descriptive name or abbreviated name for menu bar.
- **Display Hover Text:** Adds support for hover descriptions at the expense of performance.
- **Status Relay Enable:** Enables indication of current system state via status relays.
- **Status Relay Semantics:** Determines the information indicated via configurable status relays.
- **Status Relay Enable On Startup:** Indicates if system is to start up with status relays enabled.
- **LCU Layout:** Select which view the LCU shows.
- **Select Main Relay Control Type (Status/Edge):** Indicates how to select the main TXP. By status relay (opened or closed/GND) or whether an edge is produced.
- **System Off Relay Control Type (Status/Edge):** Indicates how to select System Off: By status relay (opened or closed/GND) or whether an edge is produced.

LMT/RMT GUI Path	Options	Default
Administration > Policies > RCU Controls. **TXP B Alarm Voting**	AND/OR	AND
Administration > Policies > RCU Controls. **TXP B Alarm Voting**	AND/OR	AND
Administration > Policies >SYSTEM Controls. **Single Controller Mode**	True/False	False
Administration > Policies> SYSTEM Controls. **SNMP Write Enable**	Enabled/Disabled	Enabled
Administration > Policies> SYSTEM Controls. **Relay Control Enable**	True/False	True
Administration > Policies> SYSTEM Controls. **Single No Relay Control (*)**	True/False	False
Administration > Policies> SYSTEM Controls. **Local No Relay Control (*)**	True/False	True
Administration > Policies> SYSTEM Controls. **Select Main Relay Ctrl Enable (*)**	True/False	False
Administration > Policies> SYSTEM Controls. **System Off Relay Ctrl Enable (*)**	True/False	False
Administration > Policies> SYSTEM Controls. **Semantics Relay Ctrl Enable (*)**	True/False	False
Administration > Policies> SYSTEM Controls. **Changeover Relay Ctrl Enable (*)**	True/False	False
Administration > Policies> SYSTEM Controls. **HTTP Inactivity Timeout**	[1-60] minutes	10 minutes
Administration > Policies> SYSTEM Controls. **Controller Inactivity Timeout**	[1-30] minutes	3 minutes
Administration > Policies> SYSTEM Controls. **Password Complexity (*)**	None/ Low/ Medium/ High	High
Administration > Policies> SYSTEM Controls. **SNMP trap Destination1**	-	-

Administration > Policies> SYSTEM Controls. **SNMP trap Destination2**	-	-
Administration > Policies> SYSTEM Controls. **SNMP trap Destination3**	-	-
Administration > Policies> SYSTEM Controls. **SNMP trap Destination4**	-	-
Administration > Policies> SYSTEM Controls. **SNMP trap Destination5**	-	-
Administration > Policies> SYSTEM Controls. **SNMP trap Destination6**	-	-
Administration > Policies> SYSTEM Controls. **CMU 1 Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **CMU 2 Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **RXU A Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **RXU B Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **TXU A Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **TXU B Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **HPA A Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **HPA B Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **MTU 1 Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **MTU 2 Fitted**	Yes/No	No
Administration > Policies> SYSTEM Controls. **MTU 3 Fitted**	Yes/No	No
Administration > Policies> SYSTEM Controls. **MTU 4 Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **PSU A Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **PSU B Fitted**	Yes/No	Yes
Administration > Policies> SYSTEM Controls. **Local Only On Startup**	Enabled/Disabled	Disabled
Administration > Policies> SYSTEM Controls. **HTTP Status Area Update Period**	[2-60] s	10 s
Administration > Policies> SYSTEM Controls. **Require USB Key For Write (*)**	True/False	False
Administration > Policies> SYSTEM Controls. **Maintenance & Local Mode Coupling**	Enabled/Disabled	Disabled
Administration > Policies> SYSTEM Controls. **Alarm Inhitbit & Local Mode Coupling**	Enabled/Disabled	Disabled
Administration > Policies> SYSTEM Controls. **Full Menu Names (*)**	True/False	False
Administration > Policies> SYSTEM Controls. **Display Hover Text (*)**	True/False	True
Administration > Policies> SYSTEM Controls. **Status Relay**	Enabled/Disabled	Enabled

Administration > Policies> SYSTEM Controls. **Status Relay Semantics**	Mode And Alarm/ TXP Info	Mode And Alarm
Administration > Policies> SYSTEM Controls. **Status Relay Enable On Startup**	Enabled/Disabled	Enabled
Administration > Policies> SYSTEM Controls. **LCU Layout (*)**	Original/Asa	ASA
Administration > Policies> SYSTEM Controls. **Navaid Name**	-	
Administration > Policies> SYSTEM Controls. **Select Main Relay Control Type**	Edge/Status	Status
Administration > Policies> SYSTEM Controls. **System Off Relay Control Type**	Edge/Status	Status
Administration > Policies> DME Trap Control. **dmesysSystemAlarmTrap Enable**	Enabled/Disabled	Enabled
Administration > Policies> DME Trap Control. **dmesysSystemStatusTrap Enable**	Enabled/Disabled	Enabled
Administration > Policies> DME Trap Control. **dmesysAlarmInhibitTrap Enable**	Enabled/Disabled	Enabled
Administration > Policies> DME Trap Control. **dmesysMaintenanceModeTrap Enable**	Enabled/Disabled	Enabled

(*) This setting is allowed to modify only by the administrator user.

4.7.5.13.1 Single Controller

This functionality avoids others users making any change to settings or taking control in the interface web. It is based in the following rules:

a) Basic Customer Requirements

- The Originating Region of the request.
- The sub region within the Originating Region.
- The Requesting User.

Region is defined as the Navaid proximity and is in the following order:

LOCAL, Region1 (RCSU), Region2 (RMM) and Region 3 (SIRA)

In addition, each region must also support a hierarchy based on the sub region location. For example, a number of RCSUs may be available in a region and each of these must be configurable to have a controlling priority.

Single controller override must be possible based on a combination of Region, subregion and requesting user. Region must override user, which effectively means a lower class of user can take control from a higher class of user provided that he is in a more privileged region.

b) Mode of operation

Write permission will only be allowed subjected to the correct user and originating location of the request. Single control will have to be previously obtained for that same user or any potential updates to be successful.

The location of the user will be determined by matching the requesting TCP/IP address against configuration details defined in the Navaid as shown in the highlighted parameter section below:

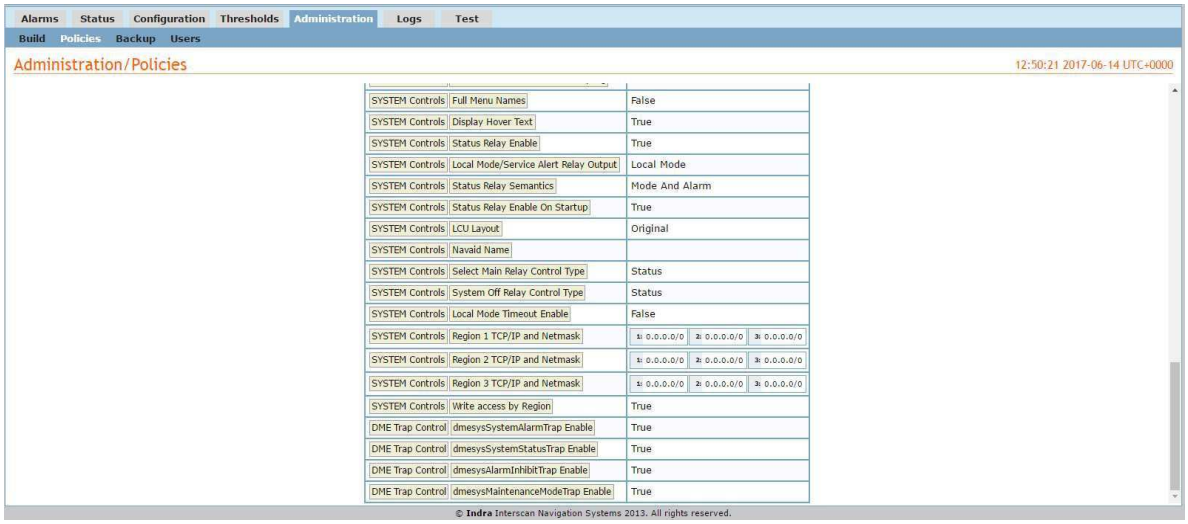


Figure 4.7-14: SINGLE CONTROLLER REGIONS

The navaid will support four regions and three sub region definitions per region.

Each configurable region will allow up to three subregion TCP/IP addresses and a subnet masks (0 to 32) to be defined. The LOCAL definition will always be assumed to be 10.6.0.0/24 and 127.0.0.1/32 and this region will not be changeable or viewable by the user. Each of the other three regions and subregions will be fully user configurable. The full TCP/IP address range is possible by using the 0.0.0.0/0 definition and each parameter will be loaded with this value as a default. Priority will be given first by overall region and then individual subregion configurations.

Modification of these region parameters will only be possible from an ‘administrator’ class of user. Field entry will be validated against incorrectly defined TCP/IP addresses and subnet mask.

c) Obtaining a single controller write lock

The region based checking is not active by default and must be enabled from the “Write access by Region” checkbox.

By default, when “Write access by Region” is disabled, single controller locking will only be associated with a requesting userID alone. The userID configuration in the Navaid has a privilege level and only users of higher level can override the lock of a user with a lower level. In this instance, the lower level user would lose the lock.

When “Write access by Region” is enabled, a regional hierarchy will be used to determine whether to allow or disallow the lock override request.

Region privilege will override user privilege level functionality, although user privilege will still operate as before for requests that originate from the same region and sub region.

For example, an ‘administrator’ class of user may have obtained a single controller lock from a Region 3 based application. An ‘installer’ class of user from a Region 2 application can then take control since the Region 2 privilege is higher than that of Region 3. The Region 3 lock would then be automatically released.

The highest privilege level is considered the LOCAL area and this takes precedence over any other regions.

Note that HTTP web based requests and SNMP requests are treated in the same way. Each request would be associated with an originating TCP/IP address and this forms the basis of the transaction hierarchy.

The web based LMT would be typically configured on the Region 2 privilege level.

4.7.5.13.2 Policy examples

Examples of different control policies are given in this section:

The following examples show various types of policy that are appropriate for organizations of different sizes and complexity. For example, consider the possibility of multiple users trying to modify the same parameter simultaneously. This is balanced against the possible need to restore a service if a user, inadvertently or maliciously, fails to release control of the equipment.

There are some aids in managing the single controller control policy.

The notifications section in the web interface indicates:

- If single control is available.
- If you currently have control.
- If you do not have control, which user does.
- If logged on as administrator you can force control to be relinquished.

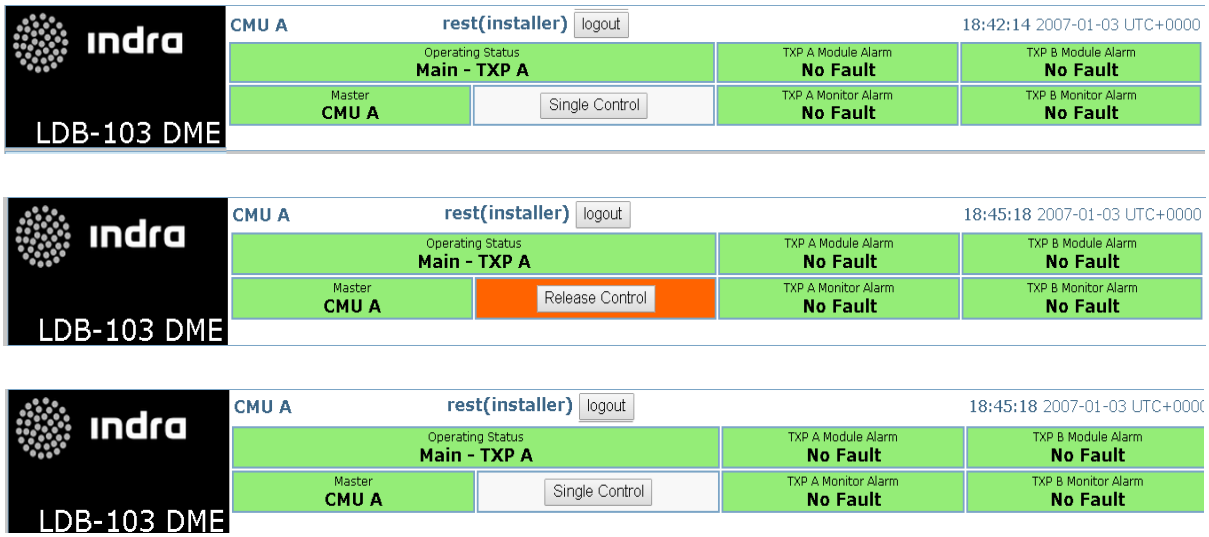


Figure 4.7-15: GENERAL STATUS BAR - POLICY NOTIFICATIONS

Multiple Managers: Administration>Policies

- Relay Control Enable: **Enabled**.
- SNMP Write Enable: **Enabled**.
- Single Controller Mode: **Disabled**.
- Single No Relay Control: **Disabled**.
    - Multiple users (with the correct authorization) can modify configuration simultaneously.
    - The equipment automatically resolves requests by queuing in the order they are received.
    - The control inputs may come from any of the web interface (local or remote), the SNMP interface (typically the Management Centre), the hardwired external interface via the NMP/EIU or the local control panel.
    - A user may still take 'Single Control' of the web interface, if they wish to exclude other users from modifying the equipment via the web interface.
    - If the user is at the equipment, they can also disable remote control via the web and SNMP by using the local/remote switch.

Single Web Control: Administration > Policies

- Relay Control Enable: **Enabled.**
- SNMP Write Enable: **Disabled.**
- Single Controller Mode: **Enabled.**
- Single No Relay Control: **Disabled.**
    - Only a single user can modify the configuration at a time – by using the web interface.
    - The Management Centre can use SNMP for monitoring, but must use the web interface for configuration.
    - The hardwired external interface via the NMP/EIU may still be used at the same time as the web interface for basic control only.
    - A user at the equipment can use the local control panel simultaneously with the web interface. However, they can also disable remote control via the web by using the local/remote switch, if needed.

Full Single Control: Administration > Policies

- Relay Control Enable: **Enabled.**
- SNMP Write Enable: **Disabled.**
- Single Controller Mode: **Enabled.**
- Single No Relay Control: **Enabled.**

- A user must use the web interface to modify configuration, even if at the equipment. Only a single user can modify the configuration at a time – by using the web interface.
- The Management Centre can use SNMP for monitoring, but must use the web interface for configuration.
- The control inputs may come from the web interface (local or remote) and the hardwired external interface via the NMP/EIU. However, the basic external NMP/EIU control is disabled while a user has 'Single Control'.
- A user at the equipment can disable remote control via the web by using the local/remote switch, if needed.

4.7.5.14 Write to flash

This instruction enters the new parameter values into persistent memory. So, when some parameter is changed or after a successful commissioning, to be archived, click ***'Write To Flash'***.

LMT/RMT GUI Path	Options	Default
Configuration > HPA> HPA Controls. **Write To Flash**	OK Button	-
Configuration > TXU> TXU Controls. **Write To Flash**	OK Button	-
Configuration > RXU> RXU Controls. **Write To Flash**	OK Button	-
Configuration > MTU>MTU Controls. **Write To Flash**	OK Button	-
Configuration > RCU> RCU Controls. **Write To Flash**	OK Button	-

4.7.5.15 Reset Instructions

It is possible to send reset instructions to the different modules.

HW Reset

LMT/RMT GUI Path	Options	Default
Configuration > System> SYSTEM Controls. **System Reset**	OK Button	-

SW Reset

LMT/RMT GUI Path	Options	Default
Configuration > RCU> RCU Controls. **TXP Changeover**	OK Button	-
Configuration > RCU> RCU Controls. **CMU A Reset**	OK Button	-
Configuration > RCU> RCU Controls. **CMU B Reset**	OK Button	-
Configuration > RCU> RCU Controls. **TXP A Reset**	OK Button	-
Configuration > RCU> RCU Controls. **TXP B Reset**	OK Button	-

Configuration > RCU> RCU Controls. **MTU 1 Reset**	OK Button	-
Configuration > RCU> RCU Controls. **MTU 2 Reset**	OK Button	-
Configuration > RCU> RCU Controls. **MTU 3 Reset**	OK Button	-
Configuration > RCU**>** RCU Controls. **MTU 4 Reset**	OK Button	-
Configuration > CMU> CMU Controls. **CMU Reset**	OK Button	-

LCU Configuration Reset.

LMT/RMT GUI Path	Options	Default
Configuration > CMU> **Restore LCU Touchscreen Calibration**	OK Button	-

4.7.6 System Alarms/Status

Pages associated with the Test Facility are contained in the **Alarm** and the **Status** groups. In the Status group, the details of following modules/units are measured and displayed.

Within each module, relevant parameters may contain values of its voltage rails, the presence (or absence) of particular connection specific to the module, status of relevant inputs.

The NORMARC LDB-103 DME has a built-in test facility to allow the easy measurement of all important DME performance parameters and signals as listed in Table 4.7-1 and Table 4.7-2.

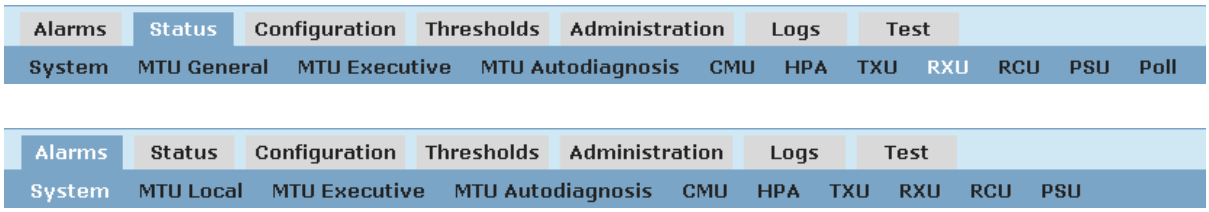


Figure 4.7-16: ALARMS AND STATUS MENUS

Table 4.7-1: DME TEST FACILITY - STATUS PARAMETERS

LMT/RMT GUI Path	Group	Parameter
Status >System >	**System Parameter**	Single Control Taken Single Controller Username Operating State TXP On Air System Alarm Inhibit Control Timeout Countdown Controller User Level Controller Local CMU A Software Healthy CMU B Software Healthy Security USB Key Present Semantics Control Relay Changeover Control Relay Select Main Control Relay System Off Control Relay
Status >MTU General >	**MTU Parameters**	TXP Monitored TXP A Effic. Test ASC Pwr Offset TXP B Effic. Test ASC Pwr Offset 24 V CTL 24 V RF 12 V Analog 5 V Digital 5 V Analog -5 V 3.3 V

Table 4.7-1: DME TEST FACILITY - STATUS PARAMETERS

LMT/RMT GUI Path	Group	Parameter
Status >MTU Executive >	**MTU Parameters**	TXP A Beacon Delay TXP A Pulse Pair Spacing TXP A Transmitted Power TXP A Efficiency TXP A TX Frequency Deviation TXP A RX Frequency Deviation TXP A P1 Rise Time TXP A P2 Rise Time TXP A P1 Fall Time TXP A P2 Fall Time TXP A P1 Width TXP A P2 Width TXP A Pulse Power Variation TXP B Beacon Delay TXP B Pulse Pair Spacing TXP B Transmitted Power TXP B Efficiency TXP B TX Frequency Deviation TXP B RX Frequency Deviation TXP B P1 Rise Time TXP B P2 Rise Time TXP B P1 Fall Time TXP B P2 Fall Time TXP B P1 Width TXP B P2 Width TXP B Pulse Power Variation Radiated Power Transmission Rate Ident Status Ident Code 1350 Hz ID Tone Period (741 us) ID Keydown Length Ident Length Ident Period Dash Length Dot Length
Status >Autodiagnosis >	**MTU Parameters**	Beacon Delay High Threshold Beacon Delay Low Threshold Pulse Pair Spacing High Threshold Pulse Pair Spacing Low Threshold

Table 4.7-1: DME TEST FACILITY - STATUS PARAMETERS

LMT/RMT GUI Path	Group	Parameter
Status >CMU >	**CMU Parameters**	Bus Control Role Time Since Power-Up 24 V 5 V 3.3 V 2.5 V 1.2 V
Status >HPA >	**HPA Parameters**	RF Operation Enabled Forward Power Current Temperature TXed Pulse Pairs Per Second P1 Rise Time P1 Fall Time P1 Width P2 Rise Time P2 Fall Time P2 Width Amplifier 1 Vgate Amplifier 2 Vgate Amplifier 3 Vgate Amplifier 4 Vgate 48 V 24 V RF 24 V CTL 3.3 V 5 V

Table 4.7-1: DME TEST FACILITY - STATUS PARAMETERS

LMT/RMT GUI Path	Group	Parameter
Status >TXU >	**TXU Parameters**	RF Operation Enabled HPA Present Forward Power Amplifier Current Temperature Replies Per Second Squitter Pulses Per Second Total TXed Pulse Pairs Per Second Ident Mode P1 Rise Time P1 Fall Time P1 Width P2 Rise Time P2 Fall Time P2 Width Current Vgate 48 V 24 V RF 24 V CTL 12 V Analog 5 V Digital 5 V Analog -5 V ILS 1 Interlock Status ILS 2 Interlock Status
Status >RXU >	**RXU Parameters**	Received Pulses/Second Received Interrogations/Second SDES-Suppressed Pulses/Second LDES-Suppressed Interrogations/Second DeadTime-Suppressed Interrogations/Second Fully Decoded Interrogations/Second Minimum Threshold Level 30 V 24 V RF 24 V CTL 12 V Analog 5 V Digital 5 V Analog -5 V 3.3 V

Table 4.7-1: DME TEST FACILITY - STATUS PARAMETERS

LMT/RMT GUI Path	Group	Parameter
Status >RCU >	**RCU Parameters**	System Status System On Antenna Recycle Count TXP A Enabled TXP B Enabled MTU 1 Present MTU 1 Channel Select MTU 2 Present MTU 2 Channel Select MTU 3 Present MTU 3 Channel Select MTU 4 Present MTU 4 Channel Select 24 V Combined 24 V System A 24 V System B Relay Voltage 5 V 3.3 V 2.5 V 1.2 V Side A ILS Interlock Side B ILS Interlock ILS Interlock Status
Status >PSU >	**PSU Parameters**	AC Voltage DC Load Voltage DC Load Current Battery Voltage Battery Current Battery Temperature Rectifiers Battery Runtime Battery Capacity Battery DOD

Table 4.7-1: DME TEST FACILITY - STATUS PARAMETERS

LMT/RMT GUI Path	Group	Parameter
Status >Poll >	**Poll**	RCU Last Poll HPA A Last Poll TXU A Last Poll RXU A Last Poll MTU 1 Last Poll MTU 2 Last Poll CMU A Last Poll CMU B Last Poll MTU 3 Last Poll MTU 4 Last Poll RXU B Last Poll TXU B Last Poll HPA B Last Poll PSU A Last Poll PSU B Last Poll

Table 4.7-2: DME TEST FACILITY - ALARMS PARAMETERS

LMT/RMT GUI Path	Group	Parameter
Alarms >System >	**System Parameter**	DME Rack DME System TXP Sub-System Monitor Sub-System Management & Control Sub-System Relay Control Sub-System PSU Sub-System TXP A Overall TXP B Overall TXP A BITE TXP B BITE TXP A Integrity TXP B Integrity
	MTU Alarms Status	Basic BITE Primary Alarm Basic BITE Secondary Alarm Autodiagnosis BITE Primary Alarm Autodiagnosis BITE Secondary Alarm
	CMU Alarms Status	BITE Primary Alarm BITE Secondary Alarm
	RXU Alarms Status	Primary Alarm Secondary Alarm

Table 4.7-2: DME TEST FACILITY - ALARMS PARAMETERS

LMT/RMT GUI Path	Group	Parameter
	TXU Alarms Status	Primary Alarm Secondary Alarm
	HPA Alarms Status	Primary Alarm Secondary Alarm
	RCU Alarms Status	Primary Alarm Secondary Alarm
	PSU Alarms Status	Primary Alarm Secondary Alarm
Alarms >MTU Local>	**MTU Alarms Status**	Internal Voltage LO Power LO Not Locked Flash Integrity Polling Synchronization
Alarms >MTU Executive >	**MTU Alarms Status**	On-Air TXP Primary Alarm On-Air TXP Secondary Alarm TXP A Primary Alarm TXP A Secondary Alarm TXP B Primary Alarm TXP B Secondary Alarm TXP A Beacon Delay TXP A Pulse Pair Spacing TXP A Efficiency TXP A Frequency Difference TXP A Pulse Shape TXP B Beacon Delay TXP B Pulse Pair Spacing TXP B Efficiency TXP B Frequency Difference TXP B Pulse Shape Transmission Rate ID Process Ident Absence ID Code alarm 1350 Hz ID Tone Period (741 us) Ident Length Beacon Ident Keydown TXPA Transmitted Power TXPB Transmitted Power Radiated Power

Table 4.7-2: DME TEST FACILITY - ALARMS PARAMETERS

LMT/RMT GUI Path	Group	Parameter
Alarms >Autodiagnosis >	**MTU Alarms Status**	Beacon Delay Pulse Pair Spacing
Alarms >CMU >	**CMU Alarms Status**	BITE 24 V BITE 5 V BITE 3.3 V BITE 2.5 V BITE 1.2 V BITE Power Good BITE LO Not Locked BITE Watchdog Timeout Boot Failure
Alarms >HPA >	**HPA Alarms Status**	Internal Voltage Input Power Forward Power Reverse Power Temperature Flash Integrity Polling
Alarms >TXU >	**TXU Alarms Status**	Internal Voltage LO Input Power Forward Power Reverse Power Temperature Flash Integrity Polling Ident Synchro
Alarms >RXU >	**RXU Alarms Status**	Internal Voltage LO Power LO Not Locked Flash Integrity Polling
Alarms >RCU >	**RCU Alarms Status**	Internal Voltage Relay Status MTU Availability Flash Integrity Polling TXP A Executive Primary Alarm TXP A Executive Secondary Alarm TXP B Executive Primary Alarm TXP B Executive Secondary Alarm

Table 4.7-2: DME TEST FACILITY - ALARMS PARAMETERS

LMT/RMT GUI Path	Group	Parameter
Alarms >PSU >	**PSU Alarms Status**	AC Fail AC Supply DC Supply Rectifier Fail PSU Alarm Status Distribution Fuse/Circuit Breaker Alarm

4.7.7 Alarm Hierarchy

This table shows the alarm tree used to be able to understand better how operates the LMT and LCU when alarms occur.

Table 4.7-3: DME TEST FACILITY – ALARM HIERARCHY

DME ALARM LEVEL STRUCTURE			
LEVEL: HIGH			**LEVEL: LOW**
DME System Alarm	**TXP A Alarm**	**HPA A Alarm**	Internal Voltage Input Power Forward Power Reverse Power Temperature Flash Integrity Polling
		TXU A Alarm	Internal Voltage LO Input Power Forward Power Reverse Power Temperature Flash Integrity Polling Ident Synchro
		RXU A Alarm	Internal Voltage LO Power LO Not Locked Flash Integrity Polling

		TXP A MTU1 Alarm	Executive TXP A Beacon Delay Executive TXP A Pulse Pair Spacing Executive TXP A Efficiency Executive TXP A Frequency Difference Executive TXP A Pulse Shape TXP A Transmitted Power
		TXP A MTU4 Alarm	Executive TXP A Beacon Delay Executive TXP A Pulse Pair Spacing Executive TXP A Efficiency Executive TXP A Frequency Difference Executive TXP A Pulse Shape TXP A Transmitted Power
	TXP B Alarm	**HPA B Alarm**	Internal Voltage Input Power Forward Power Reverse Power Temperature Flash Integrity Polling
		TXU B Alarm	Internal Voltage LO Input Power Forward Power Reverse Power Temperature Flash Integrity Polling Ident Synchro
		RXU B Alarm	Internal Voltage LO Power LO Not Locked Flash Integrity Polling
		TXP B MTU1 Alarm	Executive TXP B Beacon Delay Executive TXP B Pulse Pair Spacing Executive TXP B Efficiency Executive TXP B Frequency Difference Executive TXP B Pulse Shape

			TXP B Transmitted Power
		TXP B MTU4 Alarm	Executive TXP B Beacon Delay
			Executive TXP B Pulse Pair Spacing
			Executive TXP B Efficiency
			Executive TXP B Frequency Difference
			Executive TXP B Pulse Shape
			TXP B Transmitted Power
	Monitor Subsystem Alarm	**MTU 1 Alarm**	Basic BITE Internal Voltage
			Basic BITE LO Power
			Basic BITE LO Not Locked
			Basic BITE Flash Integrity
			Basic BITE Polling
			Basic BITE Sychronization
			Autodiagnosis BITE Beacon Delay
			Autodiagnosis BITE Pulse Pair Spacing
			BITE Radiated Power
			BITE Efficiency
			BITE Transmission Rate
		MTU 4 Alarm	Basic BITE Internal Voltage
			Basic BITE LO Power
			Basic BITE LO Not Locked
			Basic BITE Flash Integrity
			Basic BITE Polling
			Basic BITE Sychronization
			Autodiagnosis BITE Beacon Delay
			Autodiagnosis BITE Pulse Pair Spacing
			BITE Radiated Power
			BITE Efficiency
			BITE Transmission Rate
	Management and Control Subsystem Alarm	**CMU A Alarm**	BITE 24V
			BITE 5V
			BITE 3.3V
			BITE 2.5V
			BITE 1.2V
			BITE Power Good
			BITE LO Not Locked
			BITE Watchdog Timeout

			Boot Failure
		CMU B Alarm	BITE 24V
			BITE 5V
			BITE 3.3V
			BITE 2.5V
			BITE 1.2V
			BITE Power Good
			BITE LO Not Locked
			BITE Watchdog Timeout
			Boot Failure
	RCU Alarm	Internal Voltage	
		Relay Status	
		MTU Availability	
		Flash Integrity	
		Polling	
	Power Supply Alarm	**PSU 1 Alarm**	AC Fail
			AC Supply
			DC Supply
			Rectifier Fail
		PSU 2 Alarm	AC Fail
			AC Supply
			DC Supply
			Rectifier Fail

This hierarchy operates horizontally, from the daughter classes affecting the father classes listed from the right column (the lowest level) to the left one (the highest level) respectively.

In the lowest level, Alarm Parameters in darker colour represent Primary Alarms (BITE or EXECUTIVE) in their next higher level modules. Likewise, Secondary Alarms are represented by white colour, and the others coloured in grey depends on the customer specification to cause primary or secondary alarms.

The higher echelons are also grey coloured because of the way alarms affect them.

DME System will normally show a Secondary Alarm unless both redundant TXP modules fail and present a Primary Alarm (in Alarm Inhibit Mode On or the system will shut down), and/or a non-redundant element, as Monitor Subsystem or RCU, generates a Primary Alarm; only in this cases, DME System triggers a Primary Alarm.

It must be mentioned that any type of alarm and/or any parameter alarm may occur and even simultaneously, however, Primary Alarms are always given top priority.

The parameter affected by any type of alarm, as well as the subsystem where it is happening a failure and hence, the whole DME System will change colours according to the type of alarm occurred. Primary Alarms will be represented in red and Secondary Alarms in orange.

4.7.8 Default Configuration

4.7.8.1 Default Configuration Parameters

In this section all the DME system configuration parameters and its default values are listed.

4.7.8.1.1 System Parameters

LMT/RMT GUI Path	Options	Default
Configuration > System> **Resync DataBase**	OK Button	
Configuration > System> SYSTEM Controls. **Local Only**	Enabled/Disabled	Disabled
Configuration > System> SYSTEM Controls. **SNMP Trap Suppression**	Enabled/Disabled	Disabled
Configuration > System>SYSTEM Controls. **System Reset**	OK Button	

4.7.8.1.2 MTU Parameters

LMT/RMT GUI Path	Options	Default
Configuration > MTU> MTU Controls. **Interrogation Rate**	[20-60] ppm	20
Configuration > MTU> MTU Controls. **Effic. Test User Pwr Offset**	6dB/15dB	6
Configuration > MTU> MTU Controls. **ID Volume Control**	[0-10]	3
Configuration > MTU> MTU Controls. **Operative Channel**	[1-126]	74
Configuration > MTU> MTU Controls. **Channel Type**	X or Y	X

4.7.8.1.3 CMU Parameters

LMT/RMT GUI Path	Options	Default
Configuration > CMU> CMU Controls. **JTAG Source**	Local/ CMU/ Backplane	Local
Configuration > CMU> CMU Controls. **JTAG Target**	HPAA/TXUA/RXUA/MTU1/MTU2/CMUA/RCU CMUB/ MTU3/ MTU4/ RXUB/ TXUB/ HPAA	CMUA/CMUB

4.7.8.1.4 HPA Parameters

LMT/RMT GUI Path	Options	Default
Configuration > HPA> HPA Controls. **Operative Channel**	[1-126]	74
Configuration > HPA> HPA Controls. **Channel Type**	X or Y	X

4.7.8.1.5 TXU Parameters

LMT/RMT GUI Path	Options	Default
Configuration > TXU> TXU Controls. **Ident TX Enable**	Enabled/Disabled	Enabled
Configuration > TXU> TXU Controls. **Squitter Status**	Enabled/Disabled	Enabled
Configuration > TXU> TXU Controls. **Squitter Rate**	[0-1270] ppps	850
Configuration > TXU> TXU Controls. **Output Power Offset**	[-4.00, 0.00]	0
Configuration > TXU> TXU Controls. **Operative Channel**	[1-126]	74
Configuration > TXU> TXU Controls. **Channel Type**	X or Y	X

4.7.8.1.6 RXU Parameters

LMT/RMT GUI Path	Options	Default
Configuration > RXU> RXU Controls. **Automatic Sensitivity Control**	Enabled/Disabled	Enabled
Configuration > RXU> RXU Controls. **ASC Threshold**	[]2400-5000] pps	4500
Configuration > RXU> RXU Controls. **Sensitivity Level**	[-100.0, -30.0] dBm	-100
Configuration > RXU> RXU Controls. **Sensitivity Control Step**	[0.0, 1.0]	0.5
Configuration > RXU> RXU Controls. **Operative Channel**	[1-126]	74
Configuration > RXU> RXU Controls. **Channel Type**	X or Y	X

4.7.8.1.7 RCU Parameters

LMT/RMT GUI Path	Options	Default
Configuration > RCU> RCU Controls. **TXP Changeover**	OK Button	
Configuration > RCU> RCU Controls. **Main TXP**	TXPA/TXPB	TXPA
Configuration > RCU> RCU Controls. **Changeover Sequencing Policy**	System Off/ HotMain-Standby-Shutdown/ Warm Main-Standby-Shutdown	Warm Main-Standby-Shutdown
Configuration > RCU> RCU Controls. **Alarm Inhibit**	Enabled/Disabled	Disabled
Configuration > RCU> RCU Controls. **TXP A Enable**	Enabled/Disabled	Enabled
Configuration > RCU> RCU Controls. **TXP B Enable**	Enabled/Disabled	Disabled
Configuration > RCU> RCU Controls. **Recycle Delay Period**	[5-300] s	30
Configuration > RCU> RCU Controls. **Recycle Count Limit**	[0-10] s	10

Configuration > RCU> RCU Controls. **MTU Assignment Policy**	Dynamic/Static	Dynamic
Configuration > RCU> RCU Controls. **MTU 1 Static Assignment**	Off/ TXPA/ TXPB/ Both	TXPA
Configuration > RCU> RCU Controls. **MTU 2 Static Assignment**	Off/ TXPA/ TXPB/ Both	TXPA
Configuration > RCU> RCU Controls. **MTU 3 Static Assignment**	Off/ TXPA/ TXPB/ Both	TXPB
Configuration > RCU> RCU Controls. **MTU 4 Static Assignment**	Off/ TXPA/ TXPB/ Both	TXPB
Configuration > RCU> RCU Controls. **Exec Alarms Filter Time**	[0.5-12.6] s	3
Configuration > RCU> RCU Controls. **Reset Request Duration**	[0.01-3.27] s	2.5
Configuration > RCU> RCU Controls. **Buzzer Enable**	Enabled/Disabled	Disabled
Configuration > RCU> RCU Controls. **Primary Alarm Buzzer Duration**	[0-255] s	15
Configuration > RCU> RCU Controls. **Secondary Alarm Buzzer Duration**	[0-255] s	3
Configuration > RCU> RCU Controls. **RCU Start Up Time**	[0-90] s	30
Configuration > RCU> RCU Controls. **BITE Alarms Filter Time**	[0.5-12.6] s	3
Configuration > RCU> RCU Controls. **Secondary BITE Alarm Inhibit**	Enabled/Disabled	Enabled
Configuration > RCU> RCU Controls. **Secondary EXEC Alarm Inhibit**	Enabled/Disabled	Enabled
Configuration > RCU> RCU Controls. **Enable Relative Recycle Limit**	Enabled/Disabled	Enabled
Configuration > RCU> RCU Controls. **Enable Absolute Recycle Limit**	Enabled/Disabled	Enabled

4.7.8.1.8 Installation Parameters

LMT/RMT GUI Path	Options	Default
Configuration > Installation > MTU Controls. **Antenna Cable Losses**	[0-150] dBm	33.5
Configuration > Installation > TXU Controls. **Ident Mode**	Normal/ Test/ Continuous	Normal
Configuration > Installation > HPA Controls. **Operative Channel**	[1-126]	74
Configuration > Installation > HPA Controls. **Chanel Type**	X or Y	X
Configuration > Installation > TXU Controls. **Operative Channel**	[1-126]	74
Configuration > Installation > TXU Controls. **Chanel Type**	X or Y	X
Configuration > Installation > RXU Controls. **Operative Channel**	[1-126]	74
Configuration > Installation > RXU Controls. **Chanel Type**	X or Y	X

Configuration > Installation > MTU Controls. **Operative Channel**	[1-126]	74
Configuration > Installation > MTU Controls. **Chanel Type**	X or Y	X
Configuration> Installation >TXU Controls. **X Channel Reply Delay Offset**	[0-70] us	23
Configuration> Installation >TXU Controls. **Y Channel Reply Delay Offset**	[0-70] us	5
Configuration> Installation >MTU Controls. **Reply Delay Offset**	[-15, 30] us	0
Configuration > Installation > TXU Controls. **ILS 1 Interlock Enable**	Yes/No	No
Configuration > Installation > TXU Controls. **ILS 2 Interlock Enable**	Yes/No	No
Configuration > Installation > TXU Controls. **ILS 1 Interlock Action**	Combined/Single	Combined
Configuration > Installation > TXU Controls. **Ident Association Mode**	Independent / Code Sender / Trigger Sender / Code Receiver / Trigger Receiver	Code Receiver
Configuration > Installation > TXU Controls. **Select Trigger Ident Control**	Falling Edge / Rising Edge	Falling Edge
Configuration > Installation > TXU Controls. **ID Code 1**	-	IDR1
Configuration > Installation > MTU Controls. **ID Code 1**	-	IDR1
Configuration > Installation > TXU Controls. **ID Code 2**	-	IDR2
Configuration > Installation > MTU Controls. **ID Code 2**	-	IDR2
Configuration > Installation > TXU Controls. **ID Code TEST**	-	TEST
Configuration > Installation > MTU Controls. **ID Code TEST**	-	TEST
Configuration > Installation > TXU Controls. **ID Code Selection**	First / Second	First
Configuration > Installation > MTU Controls. **ID Code Transmitted**	Code1 / Code 2/ Test Code	Code1
Configuration > Installation > TXU Controls. **Symbol Length**	[100,160] ms	120
Configuration > Installation > TXU Controls. **ID Keydown Period**	[30,45]s	40
Configuration > Installation > RXU Controls. **Dead Time Timer**	[0.00,350.00] us	60
Configuration > Installation > RXU Controls. **SDES**	Enabled/Disabled	Disabled
Configuration > Installation > RXU Controls. **LDES**	Enabled/Disabled	Disabled
Configuration > Installation > RXU Controls. **Minimum LDES Level**	[-100,-30] dBm	-100

Configuration > Installation > RXU Controls. **LDES MTL Offset**	[0.0, 100.0] dBm	0.3
Configuration > Installation > RXU Controls. **LDES Timer**	[0, 350] us	150
Configuration > Installation > TXU Controls. **Low Power Pulse Width Adjustment**	[-40,40]%	0
Configuration > Installation > TXU Controls. **High Power Pulse Width Adjustment**	[-42,42]%	0
Configuration > Installation > MTU Controls. **Transmitted Power Offset**	[-2.0, 2.0] dBm	0
Configuration > Installation > MTU Controls. **Radiated Power Offset**	[-2.0, 2.0] dBm	0.2
Configuration > Installation > MTU Controls. **Display Filter**	Enabled/Disabled	Enabled

4.7.8.2 Default Thresholds

In this section, all the DME Alarms Thresholds parameters and its default values are listed.

4.7.8.2.1 MTU General Thresholds

LMT/RMT GUI Path	Options	Default
Thresholds > MTU General > MTU Parameter Limits. **3.3V Secondary High Threshold**	[3.30, 4.00] Volts	3.6
Thresholds > MTU General > MTU Parameter Limits. **24V RF input Secondary High Threshold**	[24.0, 35.0] Volts	30.5
Thresholds > MTU General > MTU Parameter Limits. **24V CTL input Secondary High Threshold**	[24.0, 35.0] Volts	30.5
Thresholds > MTU General > MTU Parameter Limits. **12V Secondary High Threshold**	[12.00, 15.00] Volts	13
Thresholds > MTU General > MTU Parameter Limits. **5V Analog Secondary High Threshold**	[5.00, 6.00] Volts	5.5
Thresholds > MTU General > MTU Parameter Limits. **5V Digital Secondary High Threshold**	[5.00, 6.00] Volts	5.5
Thresholds > MTU General > MTU Parameter Limits. **Analog -5V Secondary High Threshold**	[-6.00, -5.00] Volts	-5.5
Thresholds > MTU General > MTU Parameter Limits. **3.3V Secondary Low Threshold**	[1.80, 3.30] Volts	2.7
Thresholds > MTU General > MTU Parameter Limits. **24V RF input Secondary Low Threshold**	[19.0, 24.0] Volts	21.5
Thresholds > MTU General > MTU Parameter Limits. **24V CTL input Secondary Low Threshold**	[19.0, 24.0] Volts	21.5
Thresholds > MTU General > MTU Parameter Limits. **12V Secondary Low Threshold**	[9.00, 12.00] Volts	11

Thresholds > MTU General > MTU Parameter Limits**. 5V Analog Secondary Low Threshold**	[3.50, 5.00] Volts	4.5
Thresholds > MTU General > MTU Parameter Limits. **5V Digital Secondary Low Threshold**	[3.50, 5.00] Volts	4.5
Thresholds > MTU General > MTU Parameter Limits. **Analog -5V Secondary Low Threshold**	[-5.00, -3.50] Volts	-4.5
Thresholds > MTU General > MTU Parameter Limits. **3.3V Primary High Threshold**	[3.30, 4.00] Volts	3.7
Thresholds > MTU General > MTU Parameter Limits. **24V RF input Primary High Threshold**	[24.0, 35.0] Volts	32
Thresholds > MTU General > MTU Parameter Limits. **24V CTL input Primary High Threshold**	[24.0, 35.0] Volts	32
Thresholds > MTU General > MTU Parameter Limits. **12V Primary High Threshold**	[12.00, 15.00] Volts	13.98
Thresholds > MTU General > MTU Parameter Limits. **5V Analog Primary High Threshold**	[5.00, 6.00] Volts	6
Thresholds > MTU General > MTU Parameter Limits. **5V Digital Primary High Threshold**	[5.00, 6.00] Volts	6
Thresholds > MTU General > MTU Parameter Limits. **Analog -5V Primary High Threshold**	[-6.00, -5.00] Volts	-6
Thresholds > MTU General > MTU Parameter Limits. **3.3V Primary Low Threshold**	[2.80, 3.30] Volts	2.5
Thresholds > MTU General > MTU Parameter Limits. **24V RF input Primary Low Threshold**	[19.0, 24.0] Volts	19
Thresholds > MTU General > MTU Parameter Limits**. 24V CTL input Primary Low Threshold**	[19.0, 24.0] Volts	19
Thresholds > MTU General > MTU Parameter Limits. **12V Primary Low Threshold**	[9.00, 12.00] Volts	9.99
Thresholds > MTU General > MTU Parameter Limits. **5V Digital Primary Low Threshold**	[3.50, 5.00] Volts	4
Thresholds > MTU General > MTU Parameter Limits. **5V Analog Primary Low Threshold**	[3.50, 5.00] Volts	4
Thresholds > MTU General > MTU Parameter Limits. **Analog -5V Primary Low Threshold**	[-5.00, -3.50] Volts	-4

4.7.8.2.2 MTU Executive Thresholds

LMT/RMT GUI Path	Options	Default
Thresholds > MTU Executive > MTU Parameter Limits. **Beacon Delay Primary Alarm Threshold**	[0.00, 1.00] us	0.5
Thresholds > MTU Executive > MTU Parameter Limits. **Beacon Delay Secondary Alarm Threshold**	[0.00, 1.00] us	0.35
Thresholds > MTU Executive > MTU Parameter Limits. **Pulse Spacing Primary Alarm Threshold**	[0.00, 1.00] us	0.7
Thresholds > MTU Executive > MTU Parameter Limits. **Pulse Spacing Secondary Alarm Threshold**	[0.00, 1.00] us	0.5
Thresholds > MTU Executive > MTU Parameter Limits. **Transmitted Power Primary Alarm Threshold**	[25.1, 1500.0]W	50(LP)/500(HP)
Thresholds > MTU Executive > MTU Parameter Limits. **Transmitted Power Secondary Alarm Threshold**	[25.1, 1500.0] W	80(LP)/800(HP)
Thresholds > MTU Executive > MTU Parameter Limits. **Efficiency Primary Alarm Threshold**	[0, 50] %	50
Thresholds > MTU Executive > MTU Parameter Limits. **Efficiency Secondary Alarm Threshold**	[0, 100] %	60
Thresholds > MTU Executive > MTU Parameter Limits. TX Frequency Deviation Primary Alarm Threshold	[1, 20] ppm	20
Thresholds > MTU Executive > MTU Parameter Limits. TX Frequency Deviation Secondary Alarm Threshold	[1, 20] ppm	10
Thresholds > MTU Executive > MTU Parameter Limits. **Pulse Rise Time Primary Alarm Low Threshold**	[1.00, 3.50] us	1
Thresholds > MTU Executive > MTU Parameter Limits. **Pulse Rise Time Secondary Alarm Low Threshold**	[1.00, 3.50] us	1.5
Thresholds > MTU Executive > MTU Parameter Limits. **Pulse Rise Time Primary Alarm High Threshold**	[1.00, 3.50] us	3
Thresholds > MTU Executive > MTU Parameter Limits. **Pulse Rise Time Secondary Alarm High Threshold**	[1.00, 3.50] us	3.5
Thresholds > MTU Executive > MTU Parameter Limits. **Pulse Fall Time Primary Alarm Low Threshold**	[1.50, 3.50] us	1
Thresholds > MTU Executive > MTU Parameter Limits. **Pulse Fall Time Secondary Alarm Low Threshold**	[1.50, 3.50] us	1.5
Thresholds > MTU Executive > MTU Parameter Limits. **Pulse Fall Time Primary Alarm High Threshold**	[1.00, 3.50] us	3
Thresholds > MTU Executive > MTU Parameter Limits. **Pulse Fall Time Secondary Alarm High Threshold**	[1.50, 3.50] us	3.5

Thresholds > MTU Executive > MTU Parameter Limits. **Pulse Width Primary Alarm Low Threshold**	[2.50, 4.50] us	2.5
Thresholds > MTU Executive > MTU Parameter Limits. **Pulse Width Secondary Alarm Low Threshold**	[2.50, 4.50] us	3
Thresholds > MTU Executive > MTU Parameter Limits. **Pulse Width Secondary Alarm High Threshold**	[2.50, 4.50] us	4
Thresholds > MTU Executive > MTU Parameter Limits. **Pulse Width Primary Alarm High Threshold**	[2.50, 4.50] us	4.5
Thresholds > MTU Executive > MTU Parameter Limits. **Pulse Power Variation Primary Alarm Threshold**	[0.50, 2.00] dB	1
Thresholds > MTU Executive > MTU Parameter Limits. **Pulse Power Variation Secondary Alarm Threshold**	[0.50, 2.00] dB	0.52
Thresholds > MTU Executive > MTU Parameter Limits. **Radiated Power Primary Alarm Threshold**	[25.1, 1500.0] W	25(LP)/250(HP)
Thresholds > MTU Executive > MTU Parameter Limits. **Radiated Power Secondary Alarm Threshold**	[25.1, 1500.0] W	35(LP)/350(HP)
Thresholds > MTU Executive > MTU Parameter Limits. **Transmission Rate Primary Alarm Low Threshold**	[400, 1000] ppps	400
Thresholds > MTU Executive > MTU Parameter Limits. **Transmission Rate Secondary Alarm Low Threshold**	[400, 1000] ppps	650
Thresholds > MTU Executive > MTU Parameter Limits. **Transmission Rate Secondary Alarm High Threshold**	[2000, 5000] ppps	4500
Thresholds > MTU Executive > MTU Parameter Limits. **Transmission Rate Primary Alarm High Threshold**	[2000, 5000] ppps	5000
Thresholds > MTU Executive > MTU Parameter Limits. **Ident Period Primary Alarm Upper Threshold**	[5, 80] s	80
Thresholds > MTU Executive > MTU Parameter Limits. **Ident Period Secondary Alarm Upper Threshold**	[5, 80] s	70
Thresholds > MTU Executive > MTU Parameter Limits. **1350 Hz ID Tone Period [741 us] Primary Alarm Low Threshold**	[500, 740] us	714
Thresholds > MTU Executive > MTU Parameter Limits. **1350 Hz ID Tone Period [741 us] Secondary Alarm Low Threshold**	[500, 740] us	725
Thresholds > MTU Executive > MTU Parameter Limits. **1350 Hz ID Tone Period [741 us] Secondary Alarm High Threshold**	[745, 800] us	758
Thresholds > MTU Executive > MTU Parameter Limits. **1350 Hz ID Tone Period [741 us] Primary Alarm High Threshold**	[745, 800] us	769
Thresholds > MTU Executive > MTU Parameter Limits. **Ident Length Primary Alarm Threshold**	[0.00, 10.00] s	10

Thresholds > MTU Executive > MTU Parameter Limits. **Ident Length Secondary Alarm Threshold**	[0.00, 10.00] s	10
Thresholds > MTU Executive > MTU Parameter Limits. **ID Keydown Length Secondary Alarm High Threshold**	[0.00, 5.00] s	5
Thresholds > MTU Executive > MTU Parameter Limits. **ID Keydown Length Primary Alarm High Threshold**	[0.00, 5.00] s	5

4.7.8.2.3 MTU Autodiagnosis Thresholds

LMT/RMT GUI Path	Options	Default
Thresholds > MTU Autodiagnosis > MTU Parameter Limits**. Beacon Delay Auto. Primary Alarm Threshold**	[0.00, 1.00] us	1
Thresholds > MTU Autodiagnosis > MTU Parameter Limits. **Pulse Spacing Auto. Primary Alarm Threshold**	[0.00, 1.00] us	1
Thresholds > MTU Autodiagnosis > MTU Parameter Limits. **Beacon Delay Auto. Secondary Alarm Threshold**	[0.00, 1.00] us	0.7
Thresholds > MTU Autodiagnosis > MTU Parameter Limits. **Pulse Spacing Auto. Secondary Alarm Threshold**	[0.00, 1.00] us	0.7

4.7.8.2.4 Alarms Enable Thresholds

LMT/RMT GUI Path	Options	Default
Thresholds > Alarm Enable > MTU Parameter Limits. **Transmitted Power Primary Alarm Enable**	Enabled/Disabled	Disabled
Thresholds > Alarm Enable > MTU Parameter Limits. **Efficiency Primary Alarm Enable**	Enabled/Disabled	Disabled
Thresholds > Alarm Enable > MTU Parameter Limits. **Frequency Primary Alarm Enable**	Enabled/Disabled	Disabled
Thresholds > Alarm Enable > MTU Parameter Limits. **Pulse Rise Time Primary High Alarm Enable**	Enabled/Disabled	Disabled
Thresholds > Alarm Enable > MTU Parameter Limits. **Pulse Rise Time Primary Low Alarm Enable**	Enabled/Disabled	Disabled
Thresholds > Alarm Enable > MTU Parameter Limits. **Pulse Fall Time Primary High Alarm Enable**	Enabled/Disabled	Disabled
Thresholds > Alarm Enable > MTU Parameter Limits. **Pulse Fall Time Primary Low Alarm Enable**	Enabled/Disabled	Disabled
Thresholds > Alarm Enable > MTU Parameter Limits. **Pulse Width Time Primary High Alarm Enable**	Enabled/Disabled	Disabled
Thresholds > Alarm Enable > MTU Parameter Limits. **Pulse Width Time Primary Low Alarm Enable**	Enabled/Disabled	Disabled
Thresholds > Alarm Enable > MTU Parameter Limits. **Pulse Power Variation Primary Alarm Enable**	Enabled/Disabled	Disabled

Thresholds > Alarm Enable > MTU Parameter Limits. **Transmission Rate Primary High Alarm Enable**	Enabled/Disabled	Disabled
Thresholds > Alarm Enable > MTU Parameter Limits. **Transmission Rate Primary Low Alarm Enable**	Enabled/Disabled	Disabled
Thresholds > Alarm Enable > MTU Parameter Limits. **Radiated Power Primary Alarm Enable**	Enabled/Disabled	Disabled
Thresholds > Alarm Enable > MTU Parameter Limits. **Ident Absence Primary Alarm Enable**	Enabled/Disabled	Disabled
Thresholds > Alarm Enable > MTU Parameter Limits. **Ident Length Primary Alarm Enable**	Enabled/Disabled	Disabled
Thresholds > Alarm Enable > MTU Parameter Limits. **1350 Hz ID Tone Period (741 us) Primary High Alarm Enable**	Enabled/Disabled	Disabled
Thresholds > Alarm Enable > MTU Parameter Limits. **1350 Hz ID Tone Period (741 us) Primary Low Alarm Enable**	Enabled/Disabled	Disabled
Thresholds > Alarm Enable > MTU Parameter Limits. **Beacon Ident Keydown Primary High Alarm Enable**	Enabled/Disabled	Disabled
Thresholds > Alarm Enable > MTU Parameter Limits. **Beacon Ident Keydown Primary Low Alarm Enable**	Enabled/Disabled	Disabled

4.7.8.2.5 HPA Thresholds

LMT/RMT GUI Path	Options	Default
Thresholds > HPA > HPA Parameter Limits. **24V CTL input Primary Low Threshold**	[19.0, 24.0] Volts	19
Thresholds > HPA > HPA Parameter Limits. 2**4V CTL input Secondary Low Threshold**	[19.0, 24.0] Volts	21.5
Thresholds > HPA > HPA Parameter Limits. **24V CTL input Secondary High Threshold**	[24.0, 35.0] Volts	30.5
Thresholds > HPA > HPA Parameter Limits. **24V CTL input Primary High Threshold**	[24.0, 35.0] Volts	32
Thresholds > HPA > HPA Parameter Limits. **24V RF input Primary Low Threshold**	[19.0, 24.0] Volts	19
Thresholds > HPA > HPA Parameter Limits. **24V RF input Secondary Low Threshold**	[19.0, 24.0] Volts	21.5
Thresholds > HPA > HPA Parameter Limits. **24V RF input Secondary High Threshold**	[24.0, 35.0] Volts	30.5
Thresholds > HPA > HPA Parameter Limits. **24V RF input Primary High Threshold**	[24.0, 35.0] Volts	32
Thresholds > HPA > HPA Parameter Limits. **48V Primary High Threshold**	[48.0, 65.0] Volts	56.9

Thresholds > HPA > HPA Parameter Limits. **48V Secondary Low Threshold**	[38.0, 48.0] Volts	50
Thresholds > HPA > HPA Parameter Limits. **48V Primary Low Threshold**	[38.0, 48.0] Volts	41.9
Thresholds > HPA > HPA Parameter Limits. **48V Primary High Threshold**	[48.0, 65.0] Volts	63
Thresholds > HPA > HPA Parameter Limits. **3.3V Primary Low Threshold**	[2.50, 3.30] Volts	2.6
Thresholds > HPA > HPA Parameter Limits. **3.3V Secondary Low Threshold**	[2.50, 3.30] Volts	2.69
Thresholds > HPA > HPA Parameter Limits. **3.3V Secondary High Threshold**	[3.30, 4.00] Volts	3.6
Thresholds > HPA > HPA Parameter Limits. **3.3V Primary High Threshold**	[3.30, 4.00] Volts	3.75
Thresholds > HPA > HPA Parameter Limits. **5V Primary Low Threshold**	[3.50, 5.00] Volts	4
Thresholds > HPA > HPA Parameter Limits. 5**V Secondary Low Threshold**	[3.50, 5.00] Volts	4.5
Thresholds > HPA > HPA Parameter Limits. **5V Secondary High Threshold**	[5.00, 6.00] Volts	5.5
Thresholds > HPA > HPA Parameter Limits. **5V Primary High Threshold**	[5.00, 6.00] Volts	6
Thresholds > HPA > HPA Parameter Limits. **Forward Power Secondary Threshold**	[0.0, 61.0] dBm	47
Thresholds > HPA > HPA Parameter Limits. **Forward Power Primary Threshold**	[0.0, 61.0] dBm	50
Thresholds > HPA > HPA Parameter Limits. **Temperature Secondary High Threshold**	[0, 200] degrees C	75
Thresholds > HPA > HPA Parameter Limits. **Temperature Primary High Threshold**	[0, 200] degrees C	80

4.7.8.2.6 TXU Thresholds

LMT/RMT GUI Path	Options	Default
Thersholds > TXU > TXU Parameter Limits. **12V Primary Low Threshold**	[9.00, 12.00] Volts	9.99
Thersholds > TXU > TXU Parameter Limits. **12V Secondary Low Threshold**	[9.00, 12.00] Volts	11
Thersholds > TXU > TXU Parameter Limits. **12V Secondary High Threshold**	[12.00, 15.00] Volts	13
Thersholds > TXU > TXU Parameter Limits. **12V Primary High Threshold**	[12.00, 15.00] Volts	13.99
Thersholds > TXU > TXU Parameter Limits. **24V CTL input Primary Low Threshold**	[19.0, 24.0] Volts	19
Thersholds > TXU > TXU Parameter Limits. **24V CTL input Secondary Low Threshold**	[19.0, 24.0] Volts	21.5
Thersholds > TXU > TXU Parameter Limits. **24V CTL input Secondary High Threshold**	[24.0, 35.0] Volts	30.5
Thersholds > TXU > TXU Parameter Limits. **24V CTL input Primary High Threshold**	[24.0, 35.0] Volts	32
Thersholds > TXU > TXU Parameter Limits. **24V RF input Primary Low Threshold**	[19.0, 24.0] Volts	19
Thersholds > TXU > TXU Parameter Limits. **24V RF input Secondary Low Threshold**	[19.0, 24.0] Volts	21.5
Thersholds > TXU > TXU Parameter Limits. **24V RF input Secondary High Threshold**	[24.0, 35.0] Volts	30.5
Thersholds > TXU > TXU Parameter Limits. **24V RF input Primary High Threshold**	[24.0, 35.0] Volts	32
Thersholds > TXU > TXU Parameter Limits. **48V Primary Low Threshold**	[38.0, 48.0] Volts	41.9
Thersholds > TXU > TXU Parameter Limits. **48V Secondary Low Threshold**	[38.0, 48.0] Volts	42.9
Thersholds > TXU > TXU Parameter Limits. **48V Secondary High Threshold**	[48.0, 65.0] Volts	57
Thersholds > TXU > TXU Parameter Limits. **48V Primary High Threshold**	[48.0, 65.0] Volts	63
Thersholds > TXU > TXU Parameter Limits. **5V Analog Primary Low Threshold**	[3.50, 5.00] Volts	4
Thersholds > TXU > TXU Parameter Limits. **5V Analog Secondary Low Threshold**	[3.50, 5.00] Volts	4.5
Thersholds > TXU > TXU Parameter Limits. **5V Analog Secondary High Threshold**	[5.00, 6.00] Volts	5.5

Thersholds > TXU > TXU Parameter Limits. **5V Analog Primary High Threshold**	[5.00, 6.00] Volts	6
Thersholds > TXU > TXU Parameter Limits. **5V Digital Primary Low Threshold**	[3.50, 5.00] Volts	4
Thersholds > TXU > TXU Parameter Limits. **5V Digital Secondary Low Threshold**	[3.50, 5.00] Volts	4.5
Thersholds > TXU > TXU Parameter Limits. **5V Digital Secondary High Threshold**	[5.00, 6.00] Volts	5.5
Thersholds > TXU > TXU Parameter Limits. **5V Digital Primary High Threshold**	[5.00, 6.00] Volts	6
Thersholds > TXU > TXU Parameter Limits. **Analog -5V Primary Low Threshold**	[-5.00, -3.50] Volts	-4
Thersholds > TXU > TXU Parameter Limits. **Analog -5V Secondary Low Threshold**	[-5.00, -3.50] Volts	-4.5
Thersholds > TXU > TXU Parameter Limits. **Analog -5V Secondary High Threshold**	[-6.00, -5.00] Volts	-5.5
Thersholds > TXU > TXU Parameter Limits. **Analog -5V Primary High Threshold**	[-6.00, -5.00] Volts	-6
Thersholds > TXU > TXU Parameter Limits. **Forward Power With HPA Secondary Threshold**	[0, 50.0] dBm	37
Thersholds > TXU > TXU Parameter Limits. **Forward Power With HPA Primary Threshold**	[0, 50.0] dBm	40
Thersholds > TXU > TXU Parameter Limits. **Forward Power Without HPA Primary Threshold**	[0, 50.0] dBm	37
Thersholds > TXU > TXU Parameter Limits. **Forward Power Without HPA Secondary Threshold**	[0, 50.0] dBm	40
Thersholds > TXU > TXU Parameter Limits. **Temperature Secondary High Threshold**	[40, 150] degrees C	75
Thersholds > TXU > TXU Parameter Limits. **Temperature Primary High Threshold**	[40, 150] degrees C	80

4.7.8.2.7 RXU Thresholds

LMT/RMT GUI Path	Options	Default
Thresholds > RXU > RXU Parameter Limits. **12V Primary Low Threshold**	[9.00, 12.00] Volts	9.99
Thresholds > RXU > RXU Parameter Limits. **12V Secondary Low Threshold**	[9.00, 12.00] Volts	11
Thresholds > RXU > RXU Parameter Limits. **12V Secondary High Threshold**	[12.00, 15.00] Volts	13
Thresholds > RXU > RXU Parameter Limits. **12V Primary High Threshold**	[12.00, 15.00] Volts	13.99

Thresholds > RXU > RXU Parameter Limits. **24V CTL input Primary Low Threshold**	[19.0, 24.0] Volts	19
Thresholds > RXU > RXU Parameter Limits. **24V CTL input Secondary Low Threshold**	[19.0, 24.0] Volts	21.5
Thresholds > RXU > RXU Parameter Limits. **24V CTL input Secondary High Threshold**	[24.0, 35.0] Volts	30.5
Thresholds > RXU > RXU Parameter Limits. **24V CTL input Primary High Threshold**	[24.0, 35.0] Volts	32
Thresholds > RXU > RXU Parameter Limits. **24V RF input Primary Low Threshold**	[19.0, 24.0] Volts	19
Thresholds > RXU > RXU Parameter Limits. **24V RF input Secondary Low Threshold**	[19.0, 24.0] Volts	21.5
Thresholds > RXU > RXU Parameter Limits. **24V RF input Secondary High Threshold**	[24.0, 35.0] Volts	30.5
Thresholds > RXU > RXU Parameter Limits. **24V RF input Primary High Threshold**	[24.0, 35.0] Volts	32
Thresholds > RXU > RXU Parameter Limits. **3.3V Primary Low Threshold**	[2.50, 3.30] Volts	2.6
Thresholds > RXU > RXU Parameter Limits. **3.3V Secondary Low Threshold**	[2.50, 3.30] Volts	2.7
Thresholds > RXU > RXU Parameter Limits. **3.3V Secondary High Threshold**	[3.30, 4.00] Volts	3.6
Thresholds > RXU > RXU Parameter Limits. **3.3V Primary High Threshold**	[3.30, 4.00] Volts	3.75
Thresholds > RXU > RXU Parameter Limits. **30V Primary Low Threshold**	[22.0, 30.0] Volts	27
Thresholds > RXU > RXU Parameter Limits. **30V Secondary Low Threshold**	[22.0, 30.0] Volts	27.5
Thresholds > RXU > RXU Parameter Limits. **30V Secondary High Threshold**	[28.0, 33.0] Volts	31
Thresholds > RXU > RXU Parameter Limits. **30V Primary High Threshold**	[28.0, 33.0] Volts	32
Thresholds > RXU > RXU Parameter Limits. **5V Analog Primary Low Threshold**	[3.50, 5.00] Volts	4
Thresholds > RXU > RXU Parameter Limits. **5V Analog Secondary Low Threshold**	[3.50, 5.00] Volts	4.5
Thresholds > RXU > RXU Parameter Limits. **5V Analog Secondary High Threshold**	[5.00, 6.00] Volts	5.5
Thresholds > RXU > RXU Parameter Limits. **5V Analog Primary High Threshold**	[5.00, 6.00] Volts	6

Thresholds > RXU > RXU Parameter Limits. **5V Digital Primary Low Threshold**	[3.50, 5.00] Volts	4
Thresholds > RXU > RXU Parameter Limits. **5V Digital Secondary Low Threshold**	[3.50, 5.00] Volts	4.5
Thresholds > RXU > RXU Parameter Limits. **5V Digital Secondary High Threshold**	[5.00, 6.00] Volts	5.5
Thresholds > RXU > RXU Parameter Limits. **5V Digital Primary High Threshold**	[5.00, 6.00] Volts	6
Thresholds > RXU > RXU Parameter Limits. **Analog -5V Primary Low Threshold**	[-5.00, -3.50] Volts	-4
Thresholds > RXU > RXU Parameter Limits. **Analog -5V Secondary Low Threshold**	[-5.00, -3.50] Volts	-4.5
Thresholds > RXU > RXU Parameter Limits. **Analog -5V Secondary High Threshold**	[-6.00, -5.00] Volts	-5.5
Thresholds > RXU > RXU Parameter Limits. **Analog -5V Primary High Threshold**	[-6.00, -5.00] Volts	-6

4.7.8.2.8 RCU Thresholds

LMT/RMT GUI Path	Options	Default
Thresholds > RCU > RCU Parameter Limits. **1.2 V Primary Low**	[0.80,1.20] Volts	1
Thresholds > RCU > RCU Parameter Limits. **1.2 V Secondary Low**	[0.80,1.20] Volts	1.08
Thresholds > RCU > RCU Parameter Limits. **1.2 V Secondary High**	[1.20,1.60] Volts	1.32
Thresholds > RCU > RCU Parameter Limits. **1.2 V Primary High**	[1.20,1.60] Volts	1.4
Thresholds > RCU > RCU Parameter Limits. **24 V Common Primary Low**	[19.0, 24.0] Volts	19
Thresholds > RCU > RCU Parameter Limits. **24 V Common Secondary Low**	[19.0, 24.0] Volts	21.5
Thresholds > RCU > RCU Parameter Limits. **24 V Common Secondary High**	[24.0, 35.0] Volts	30.5
Thresholds > RCU > RCU Parameter Limits. **24 V Common Primary High**	[24.0, 35.0] Volts	32
Thresholds > RCU > RCU Parameter Limits. **24 V Sys A Primary Low**	[19.0, 24.0] Volts	19
Thresholds > RCU > RCU Parameter Limits. **24 V Sys A Secondary Low**	[19.0, 24.0] Volts	21.5
Thresholds > RCU > RCU Parameter Limits. **24 V Sys A Secondary High**	[24.0, 35.0] Volts	30.5

Thresholds > RCU > RCU Parameter Limits. **24 V Sys A Primary High**	[24.0, 35.0] Volts	32
Thresholds > RCU > RCU Parameter Limits. **24 V Sys B Primary Low**	[19.0, 24.0] Volts	19
Thresholds > RCU > RCU Parameter Limits. **24 V Sys B Secondary Low**	[19.0, 24.0] Volts	21.5
Thresholds > RCU > RCU Parameter Limits. **24 V Sys B Secondary High**	[24.0, 35.0] Volts	30.5
Thresholds > RCU > RCU Parameter Limits. **24 V Sys B Primary High**	[24.0, 35.0] Volts	32
Thresholds > RCU > RCU Parameter Limits. **2.5 V Primary Low**	[2.00, 2.50] Volts	2.08
Thresholds > RCU > RCU Parameter Limits. **2.5 V Secondary Low**	[2.00, 2.50] Volts	2.25
Thresholds > RCU > RCU Parameter Limits. **2.5 V Secondary High**	[2.50, 3.00] Volts	2.75
Thresholds > RCU > RCU Parameter Limits. **2.5 V Primary High**	[2.50, 3.00] Volts	2.92
Thresholds > RCU > RCU Parameter Limits. **3.3 V Primary Low**	[2.50, 3.30] Volts	2.6
Thresholds > RCU > RCU Parameter Limits. **3.3 V Secondary Low**	[2.50, 3.30] Volts	2.7
Thresholds > RCU > RCU Parameter Limits. **3.3 V Secondary High**	[3.30, 4.00] Volts	3.6
Thresholds > RCU > RCU Parameter Limits. **3.3 V Primary High**	[3.30, 4.00] Volts	3.75
Thresholds > RCU > RCU Parameter Limits. **5 V Primary Low**	[3.50, 5.00] Volts	3.99
Thresholds > RCU > RCU Parameter Limits. **5 V Secondary Low**	[3.50, 5.00] Volts	4.31
Thresholds > RCU > RCU Parameter Limits. **5 V Secondary High**	[5.00, 5.45] Volts	5.27
Thresholds > RCU > RCU Parameter Limits. **5 V Primary High**	[5.00, 5.45] Volts	5.45
Thresholds > RCU > RCU Parameter Limits. **Relay Voltage Primary Low**	[9.60, 12.00] Volts	9.99
Thresholds > RCU > RCU Parameter Limits. **Relay Voltage Secondary Low**	[9.60, 12.00] Volts	10.69
Thresholds > RCU > RCU Parameter Limits. **Relay Voltage Secondary High**	[12.00, 14.40] Volts	13.07
Thresholds > RCU > RCU Parameter Limits. **Relay Voltage Primary High**	[12.00, 14.40] Volts	13.86

4.7.8.3 Configuration Report

NORMARC LDB-103 DME allows saving its current configuration to a file. Configuration parameters, thresholds values and policies can be exported to a csv file.

LMT/RMT GUI Path	Options	Default
Configuration/System> **Current Configuration and Status Report**	Create Report	-
Configuration/System> **SYS Policies Current Configuration Report**	Report SYS	-
Configuration/MTU> **MTU Current Configuration Report**	Report MTU1/MTU4	-
Configuration/HPA> **HPA Current Configuration Report**	Report HPAA/HPAB	-
Configuration/TXU> **TXU Current Configuration Report**	Report TXUA/TXUB	-
Configuration/RXU> **RXU Current Configuration Report**	Report RXUA/RXUB	-
Configuration/RCU> **RCU Current Configuration Report**	Report RCU	-

4.7.9 Backup

This capacity allows to backup and restorebackup and restoring the DME configuration.
It's possible to export the configuration of each module to a file. System policies can be saved too.

LMT/RMT GUI Path	Options	Default
Administration > Backup > **SYS Policies Save Current Configuration To File**	Save SYS	-
Administration > Backup > **RCU Save Current Configuration To File**	Save RCU	-
Administration > Backup > **MTU Save Current Configuration To File**	Save MTU1/MTU4	-
Administration > Backup > **RXU Save Current Configuration To File**	Save RXUA/RXUB	-
Administration > Backup > **TXU Save Current Configuration To File**	Save TXUA/TXUB	-
Administration > Backup > **HPA Save Current Configuration To File**	Save HPAA/HPAB	-

To restore the configuration, just select the correspond file and click 'apply'. Note a user only will be able to upload the configuration in a module if he has write permission to this module.

LMT/RMT GUI Path	Options	Default
Administration > Backup > **SYS Policies Upload Configuration File**	Select File	-
Administration > Backup > **RCU Upload Configuration File**	Select File	-
Administration > Backup > **MTU Upload Configuration File**	Select File	-
Administration > Backup > **RXU Upload Configuration File**	Select File	-
Administration > Backup > **TXU Upload Configuration File**	Select File	-
Administration > Backup > **HPA Upload Configuration File**	Select File	-

Remember to ***'Write To Flash'*** if you want to enter the new configuration values into persistent memory (*Save Current Configuration To Flash* for the SYS policies file).

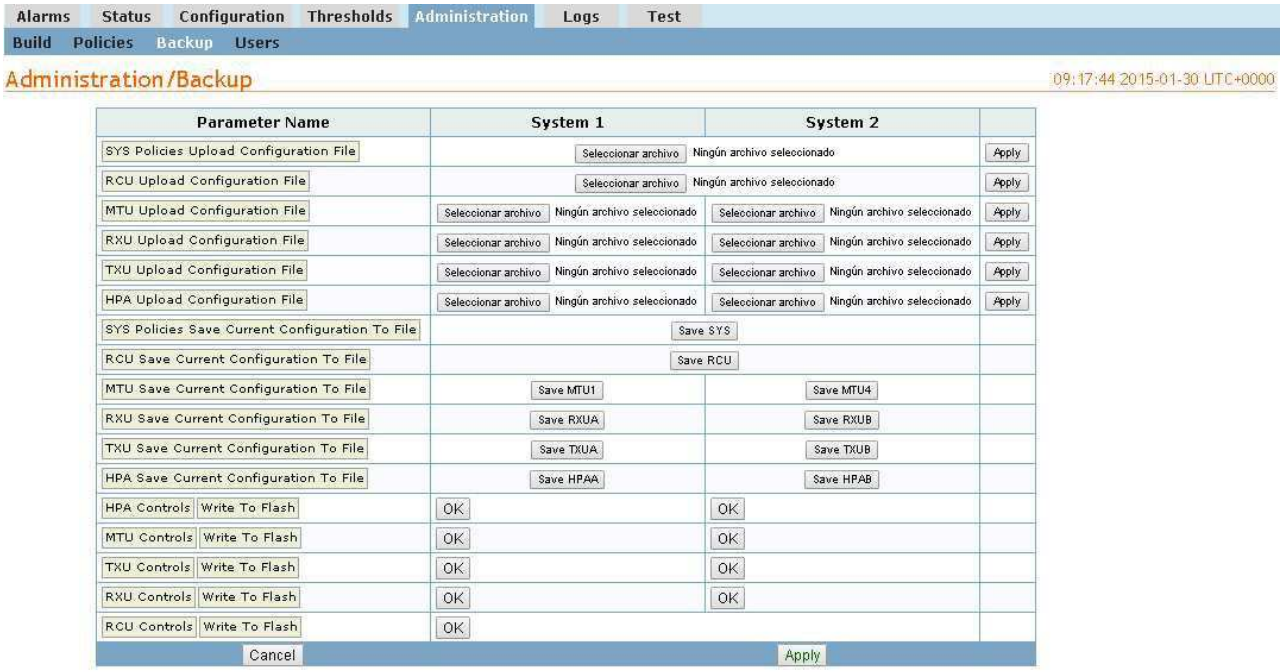


Figure 4.7-17: BACKUP MENU

4.7.10 Performance Test

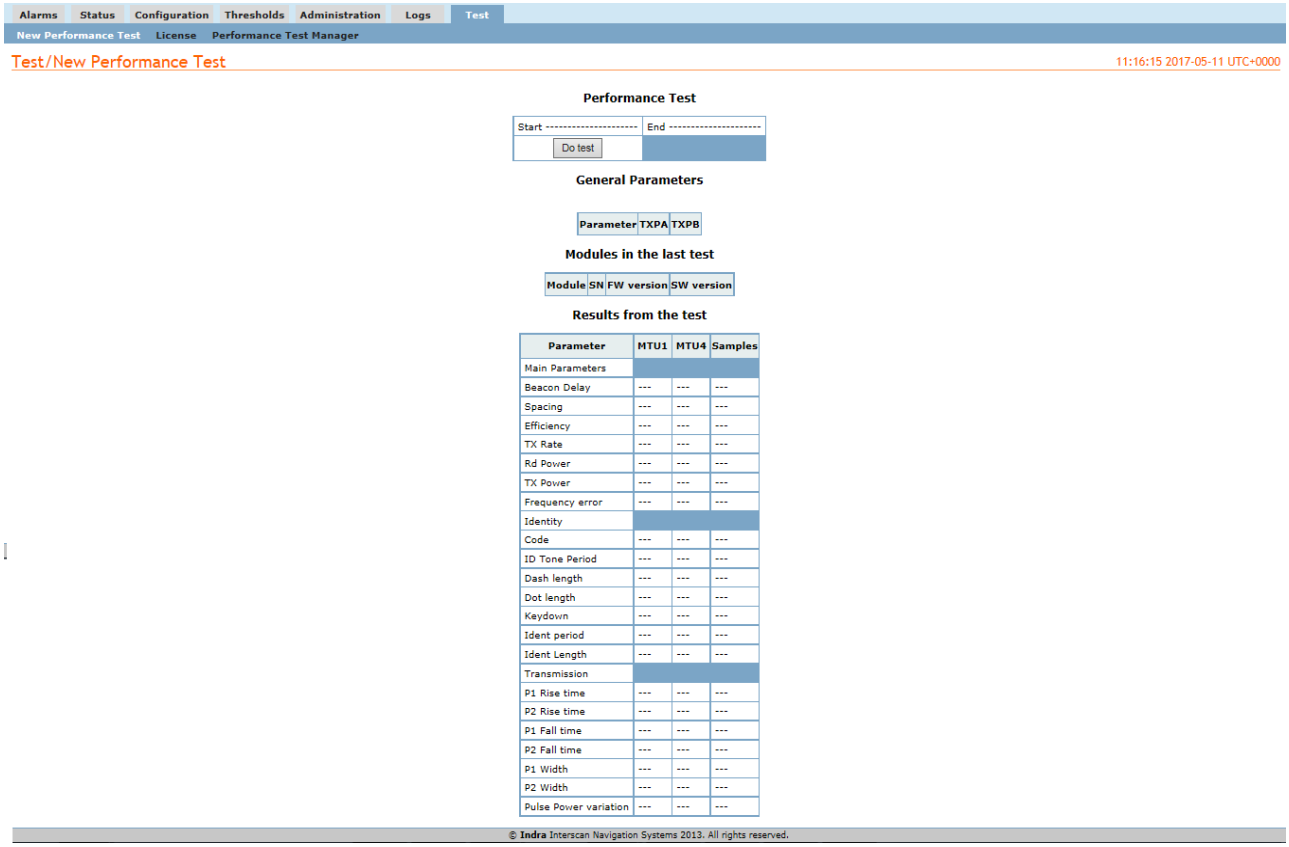
Performance Test is an optional facility, which will be only enabled under customer request.

It is considered as a diagnostic tool, which checks operation of the transponder and helps to identify a possible faulty module with the highest possible level of confidence.

The performance test runs on operator's demand. It will perform quantitative measurements on the relevant parameters but these measurements do not affect or delay the normal monitoring and do not alter the beacon's performance, so the DME can remain in service.

New Performance Test provides access to the current Performance Test.

Performance Test Manager allows obtaining previous results and exporting them in .pdf format as well as clearing the stored data.



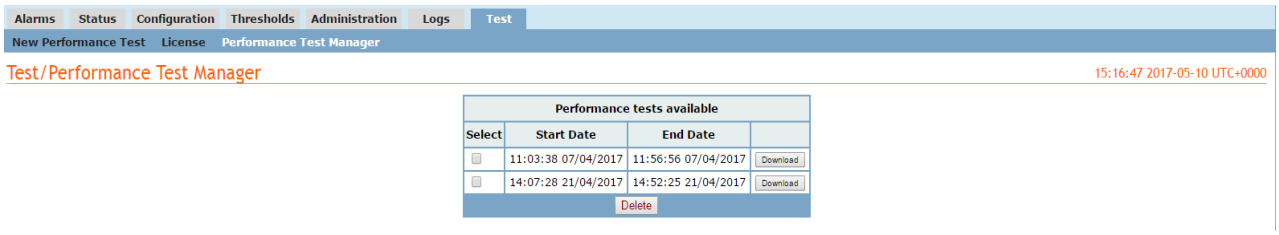


Figure 4.7-18: PERFORMANCE TEST FACILTY

When test finishes, the results will be showed in the LMT screen and they could be exported to a report (pdf file).

The test checks the following parameters:

- **Main Parameters:** Beacon delay, Pulse pair spacing, Efficiency, Transmission rate, Transmitted power and Radiated power.
- **Identity Code:** Code transmitted, Continuous keying, Dash/dot/space length, Identity code length, Time between identification periods.
- **Transmitted pulses characteristics:** P1 Rise time (10% to 90%), P2 Rise time, P1 Fall time (90% to 10%), P2 Fall time, P1 Pulse width (50%), P2 Pulse Width and Pulse Power variation (constituent pulses).
- **Reply efficiency** at interrogation levels of -20dBm; -40dBm; -60dBm; and +11, +6, +4, +2 and +0 dB in relation to the nominal sensitivity.
- **Reply Delay** at interrogation levels of -20dBm; -40dBm; -60dBm; and +11, +6, +4, +2 and +0 dB in relation to the nominal sensitivity.
- **Receiver bandwidth:** Reply efficiency at 3 dB over the sensitivity threshold with a variation in frequency of ±100kHz and ±200 kHz.
- **Rejection of the adjacent channel:** Reply efficiency at an interrogation level of -10 dBm and with a variation in frequency of ±900 kHz.
- **Decoder operation:** Reply efficiency at an interrogation level of 3 dB above the sensitivity threshold and with a variation in spacing between the interrogating pulses of ±1 µs; then reply efficiency at an interrogation level of -10 dBm and variations in the spacing between the interrogating pulses of ±2 µs
- **Rejection of the single pulse:** Reply efficiency at -10 dBm and with single pulse interrogations.
- **Dead time:** Reply efficiency to interrogations which occur within the dead time of a previous interrogation and immediately afterwards.
- **LDES (Long Echo suppression)** for the equipment configuration.

4.8 CONTROL & MONITORING UNIT (CMU) SOFTWARE UPGRADE

During the SW upgrading process, system policies information and the log register could be erased. Therefore, before starting the upgrading process it is recommended to make a system policies backup and to download the logs to a file, if the user does not want to lose this information.
Moreover, the data disks should be formatted in order to avoid problems with the new SW version. Finally, the system policies information shall be restored to the DME once the SW upgrading has been successfully accomplished.

It is important to do the whole process in the right order.

1. Make a System Policies Backup and save the *SYS_config.bin* file generated with this information.
2. Download the logs to a file.
3. Prepare the data disks and SW disks.
4. Make the SW upgrade itself.
5. Restore system policies information to the equipment to get back its configuration.

These steps are described in more detail in the following sections.

> **Note**: DME configured users will be lost in this process. Only factory default users will remain after upgrading process if data disks are changed.

4.8.1 Installation Preparation: Access to the DME

Connect a 100/10 Base-T Cat 5 network cable from the laptop computer to the connector on the front of the NMP. The network configuration of the laptop computer may require modification to execute in DHCP mode (automatic mode). To do so:

- Open Control Panel.
- Open Network and Sharing Centre.
- On the left part of the window click on Change Adapter Settings.
- Right Click on the Local Area Connection icon and click on Properties.
- Highlight Internet Protocol Version 4 (TCP/IPv4) and click on Properties.
- Select: Obtain an IP address automatically and click Ok.
- Close all the windows.

When configured correctly in this mode, the NMP will be able to successfully provide the laptop computer with a suitable TCP/IP address to enable a network connection. You may wish to issue the ipconfig command from a *cmd* window to verify the allocated TCP/IP address is in the range 10.6.0.XX, where XX will typically be a number greater or equal to 80. If the IP shown is not within the network 10.6.0.XX try typing:

```
ipconfig /release
```

```
ipconfig /renew
```

Use a web browser to log into the CMU master as an administrator. The local LAN address of the master CMU is http://10.6.0.132 and the default installer is "*administrator*" with a password of *"nav"*. If the browser does not prompt for a login, it is likely that the network configuration is not correct. Refer to the Windows documentation for help on how to setup a DHCP client.

4.8.2 System Policies Backup

A System Policies Backup must be done before upgrading process if the user does not want to lose the system policies information.

Go to *Administration* > *Backup* > *SYS Policies Save Current Configuration To File,* press the *Save SYS* button and save the *SYS_config.bin* file in a secure site.

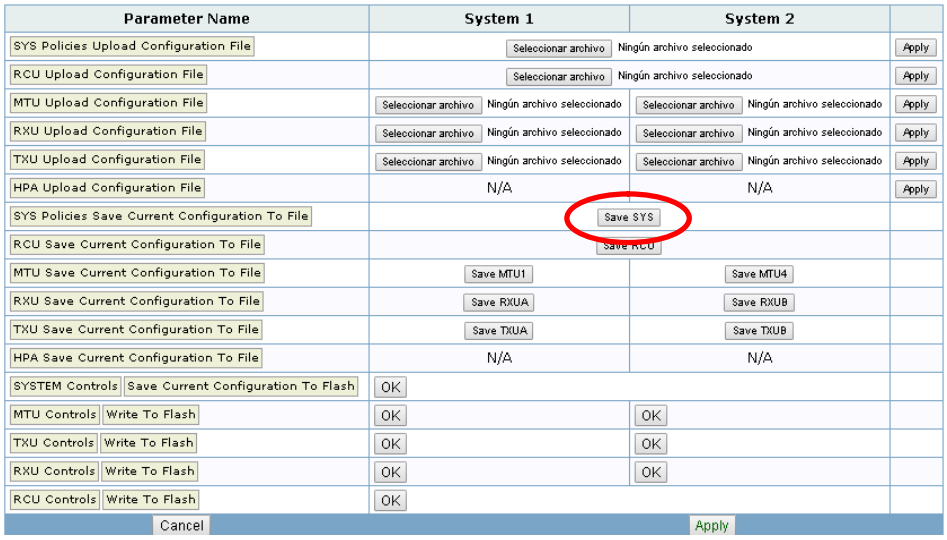


Figure 4.8-1: SYSTEM POLICIES BACKUP

Note: Remember that an administrator user must do the system policies backup.

4.8.3 Logs Copy

After SW upgrading the equipment log register could have been deleted, so it is recommended to download the logs to a file and store it in a secure site. In this way all the logs will be stored and they could be consulted if is needed.

To make a logs copy, go to *Logs* > *Combined* and press the *Download Logs* button.

4.8.4 Software Updating and Verification

Note: Secondary alarms will be generated during this procedure. However, the DME NORMARC LDB-103 will continue to function as normal. In addition, if the DME is driving Remote Status Panels (RSP's) then these may shortly report the incorrect status.

There are two possible methods to realize the SW upgrade:

4.8.4.1 Pre-programmed Compact Flash Disks

Upgrading the software requires replacement or reprogramming of the CMU compact flash media. The compact flash program disk is located within the second slot from the front of the CMU module. This slot is marked with the component reference number (P101). This disk must be replaced on both CMU's with the ones that contains the new software as supplied by Indra.

To replace the disks, follow the procedure below. This will verify correct operation on both upgraded CMU's.

- Determine which CMU is the master. The master CMU will have a green polling LED. The slave CMU will have a yellow polling LED.
- Physically remove the slave CMU from the beacon first and then remove the master CMU. Note it is not possible to upgrade the software on one CMU while the other CMU is in the rack running with a different software version.
- On the CMU master, replace the compact flash media disk in the second slot from the front (labelled P101) with the new disk marked with ultimate software version. Remove the data disk in the front slot before re-inserting the CMU.
- Re-insert the CMU module in its original location (System 1 or 2) and wait until the CMU has booted up and is running.
- Then remove the CMU module again and re-insert the data disk in the first slot.
- Re-insert the CMU module in its original location and wait until the CMU has booted up and is running again.
- Log into the newly inserted CMU module, which will take on the role as master, using http://10.6.0.132. Navigate to the "Administration/Build" web page and confirm the CMU Accounting Software Revision.
- On the second CMU module replace the compact flash disk in the second slot from the front with the new disk, and temporarily remove the data disk in the front slot.
- Then re-insert the second updated CMU module in the rack and wait until the second updated CMU module has booted up and is running.
- Remove the second updated CMU module from the rack, re-insert the data disk in the first slot and then plug the CMU module back into the rack and wait until the software is up and running again.
- Navigate to the "Administration/Build" web page and confirm the CMU Accounting Software Revision is the last one upgraded on both, System 1 and System 2.

If all the above steps completed successfully, then the software has been verified and the installation is now complete.

Note that any spare CMU modules must have the new compact flash disks installed as well. It is recommended that testing the software installation for these spare CMU modules should be carried out in conjunction with the live CMU modules as described above.

> **Note:** Depending on the previous SW version, some errors could appear during the SW updating process. In this case, please, remove the data disk (first slot) and format them. Before, remember to go to 'Logs menu', download the logs to a file and save it.

4.8.4.2 ISO Image File

If you do not have pre-programmed compact flash disks with the ultimate software version, follow the method described in the document, "*INDRA DME SW LOADER USER GUIDE–CMU SW UPDATE*" (0063400000100IF17) [RD.4] *to upgrade at* last version released.

4.8.5 Restore System Policies

Once the SW has been updated, it is recommended restoring the system policies to get back the equipment with its original configuration.

You can restore its original configuration using the system policies backup file. Please, follow the next instructions:

- Log as Administrator.
- Go to *Administration* > *Backup* > *SYS Policies Upload Configuration File*, and select the corresponding backup file.
- Press *Apply* button to upload the configuration.

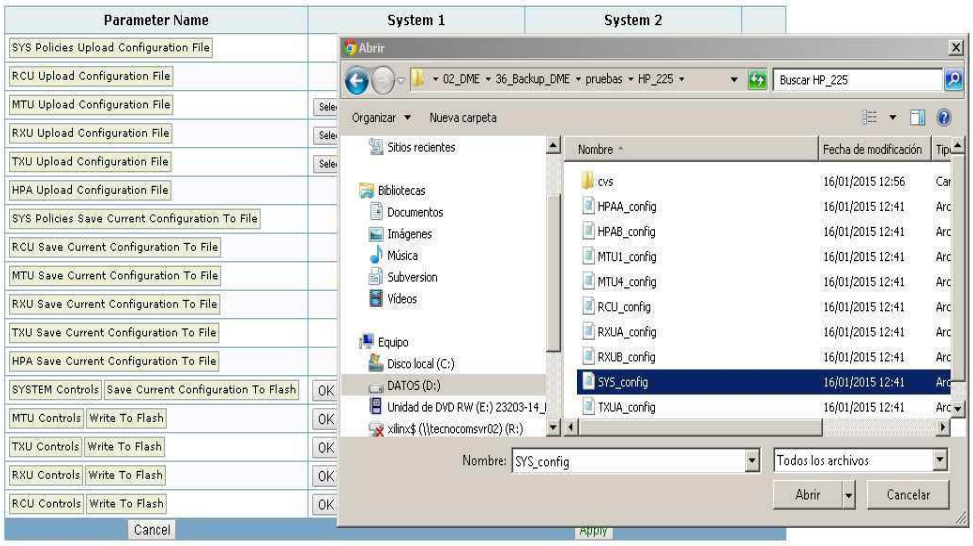


Figure 4.8-2: RESTORE SYSTEM POLICIES – UPLOAD FILE

- Finally, write to flash to enter the new configuration values into persistent memory: *Administration* > *Backup* > *SYSTEM Controls* > *Save Current Configuration To Flash.*

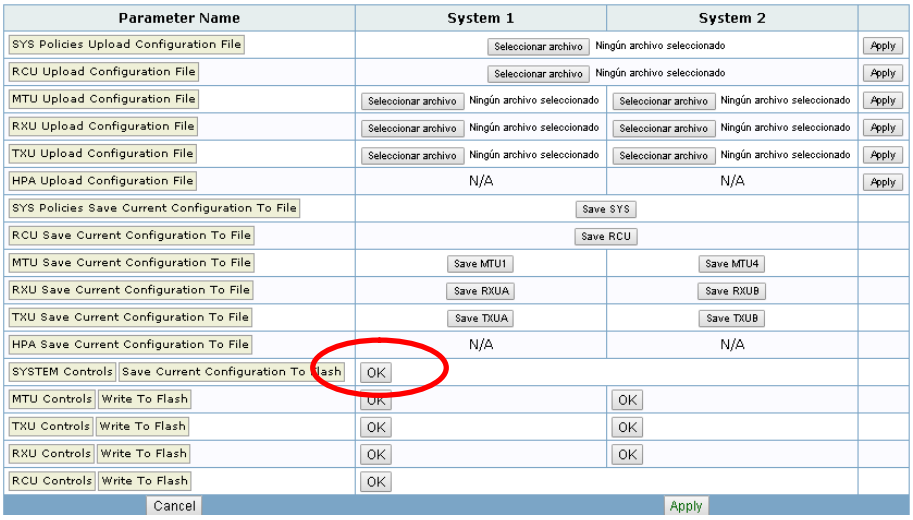


Figure 4.8-3: RESTORE SYSTEM POLICIES – SAVE CONFIGURATION

Note: Remember that the system policies restore, must be done by an administrator user.

4.9 PSU OPERATING INSTRUCTIONS

Many parameters in the Power Supply Unit (PSU) are configurable. A quick exploration of its web pages reveals all of these. Most of the parameters are the same for this DME application at all sites. The PSU are therefore supplied and pre-configured with known site-specific variations programmed in. The areas that may be site-specific include the Rectifiers, Batteries and Alarms.

This section provides general setup and management instructions for the mains power supplies.

4.9.1 Power Supply Setup

The PSU can be accessed as follows for setup, administration and monitoring:

- Using a local PC, connected via a crossover LAN cable.
- Using a networked PC, connected with the WAN.

If you plan to use either the methods that are based on a PC, you must set its IP address. This is because the power supply is set in the factory to respond only to a PC with the appropriate IP address.

A PSU may have one of the two following IP addresses: “10.6.0.139” or “10.6.0.147”. The first address (10.6.0.107) is that of a PSU that is to be fitted into the equipment at the upper location in the rack. The second address (10.6.0.115) is that of a PSU that is to be fitted into the equipment at the lower location in the rack.

In the following, section 4.9.1.1 describes steps to connect a computer to the PSU to access the PSU web page. Section 4.9.1.2 to 4.9.1.21.5 elaborate the menu through which monitored status and control of various parameters can be viewed and/or changed.

The controller is designed to interface with the DC power supply system having many configurations, the parameter list is therefore exhaustive but only a sub-set of these parameters is applicable to a particular configuration. For the NORMARC LDB-103 DME, controlled parameters are in general factory set. Site-specific parameters include normally those associated with power back-up system. Normally only inventory data need update from time to time. Many of the parameters in the menu need not to be altered and are listed for completeness.

4.9.1.1 Add power supply to your LAN

CAUTION: This procedure gives access to parameters than can damage the batteries if not set properly.

Use this procedure if you want to have access to all of the power supply parameters that can be configured. The more common parameters are already available through the CMU interface and most users will not need any other parameters.

A dedicated IP address needs to be assigned to each power supply by your facilities manager or IT support department. You need to know those IP addresses before beginning this procedure.

If your power supply and the PC are not on the same side of the firewall or network switch, you will also need to obtain a value for default gateway.

Note: Windows Vista is required for these procedures.

Step 1: Open network settings (Windows Vista)

1. Click the Windows orb and select **Control Panel.**
2. Double-click Network and Sharing Center.
3. Select **Manage Network** Connection from the list of options on the left.
4. Double-click Local Area Connection.

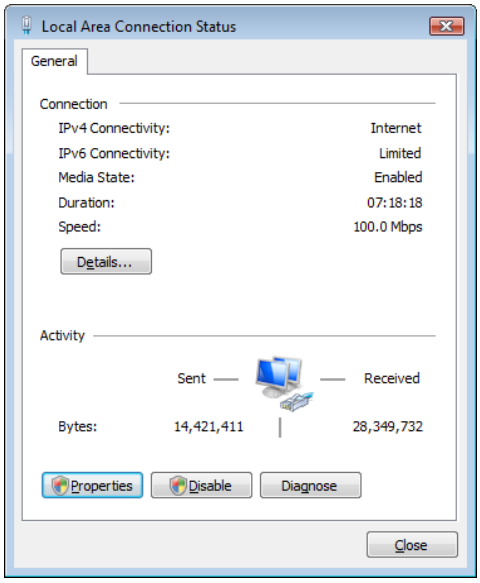


Figure 4.9-1: POWER SUPPLY SETUP - LOCAL AREA CONNECTION STATUS

5. Click Properties.

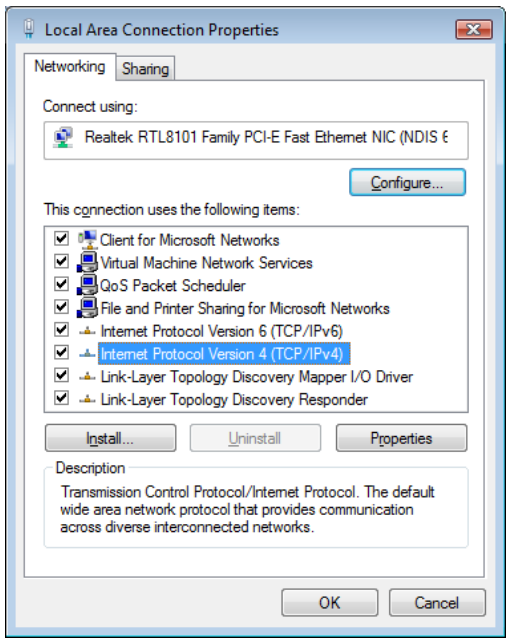


Figure 4.9-2: POWER SUPPLY SETUP - LOCAL AREA CONNECTION PROPERTIES

6. Select Internet *Protocol Version 4 (TCP/IPv4)* and click **Properties.**

Step 2: Set IP address

1. Select the option for *Use the following IP address,* if it is not already selected.
2. Enter the following settings

   IP address: 10.6.0.90

   Subnet mask: 255.255.255.0
3. Optional: set the default gateway if necessary. This is the IP address of your firewall or network switch.

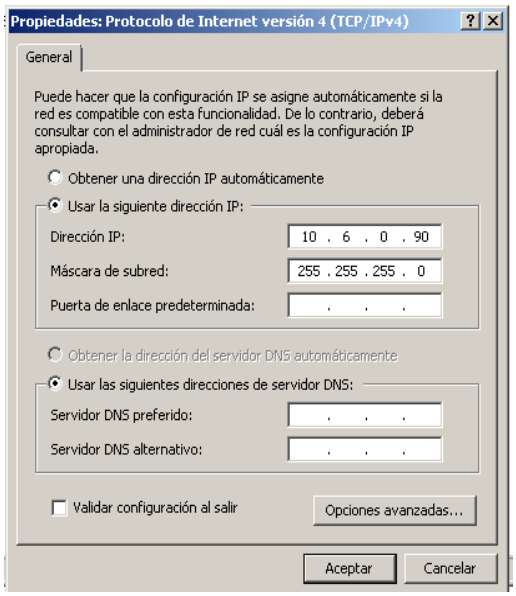


Figure 4.9-3: POWER SUPPLY SETUP – DEFAULT GATEWAY

4. Click **OK.**

Step 3: Log on to the power supply

1. Connect your PC to the power supply using a crossover LAN cable.
2. Open Windows Internet Explorer and enter the following address:

   http:// 10.6.0.139

   You are prompted to log in.
3. Enter the your normal network user ID and the following password: 1234

   Note: this is a user password. You will also be given an administrator password as part of the sign-off documentation.
4. Click **OK.**

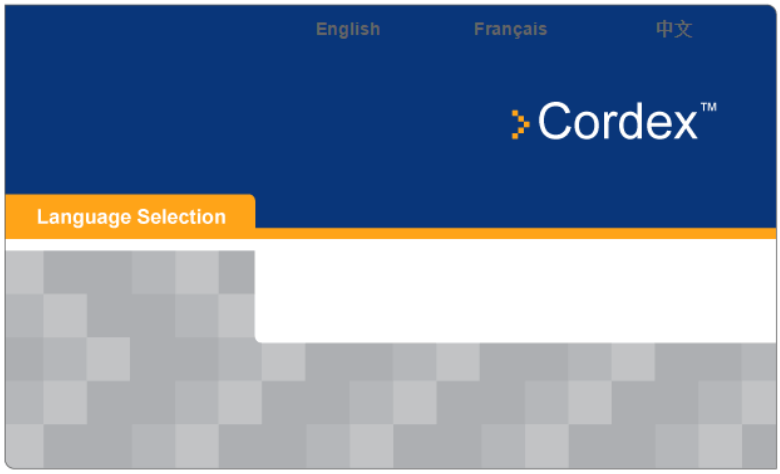


Figure 4.9-4: POWER SUPPLY SETUP – MAIN SCREEN

5. Click **English**, or one of the other language buttons.

   The main status page is displayed.

4.9.1.2 Set date and time

The first time the PSU is powered up, the date and time need to be set. This is used in all event records and logs. The date and time also need to be set again if power is lost for more than a few seconds.

Select **Controller - Date & Time:**

1. Either:

   Enter the date and time manually, or

   Enable Select Enable SNTP and enter the IP address of the timeserver, then click **Get Time Now.**

2. Click **Submit Changes.**
3. Click **Accept.**

4.9.1.3 Set battery parameters

Note: these settings are based on the recommended Exide Marathon M12V105FT and may not be suitable for other batteries. Refer to manufacturer's specification.

Rectifiers

Select **Rectifiers - Configure Rectifiers.**

1. Set *Float Voltage* to 27.2 V.
2. Set *BT Voltage* to 22.0 V.

   A battery capacity terminates at this voltage. Although the battery could discharge further, the system can calculate the battery's capacity from a partial discharge.

3. Set Safe Voltage to 26.0 V.

This is the default voltage of the rectifier if it loses communication with the controller.

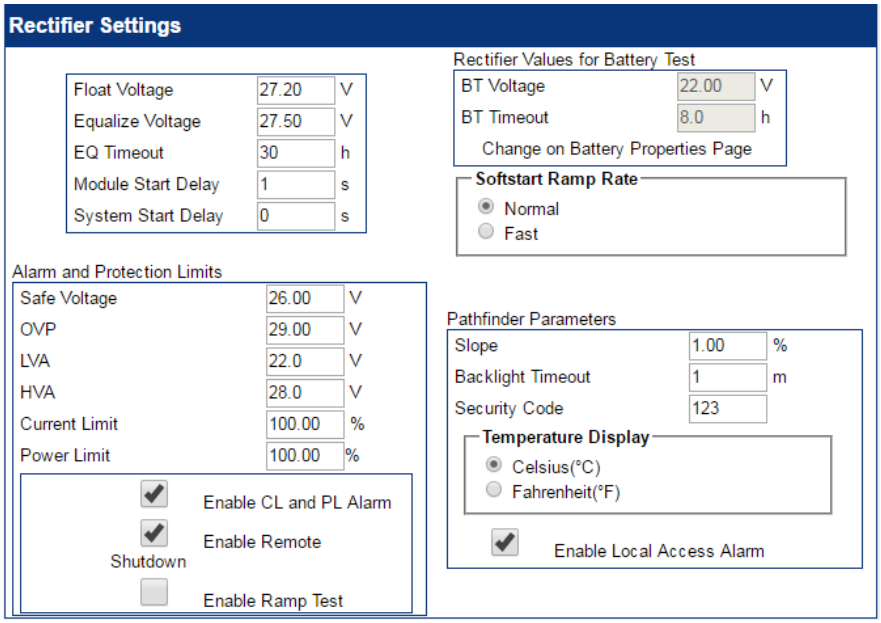


Figure 4.9-5: POWER SUPPLY SETUP – RECTIFIER SETTINGS

4. Click **Submit Changes.**
5. Click **Accept.**

Select **Batteries - Configure Batteries**.

1. Set charge rate to 10A.

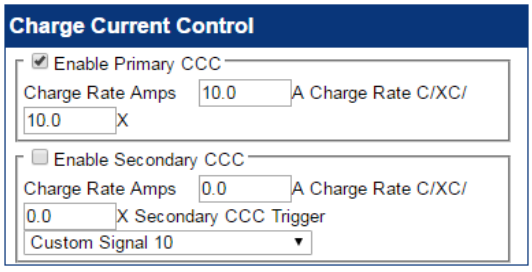


Figure 4.9-6: POWER SUPPLY SETUP – CHARGE CURRENT CONTROL

2. Set *Temp Comp Slope* to 5.5 mV/°C/Cell.

3. Set Upper Breakpoint to 26.52 and Lower Breakpoint to 27.90.

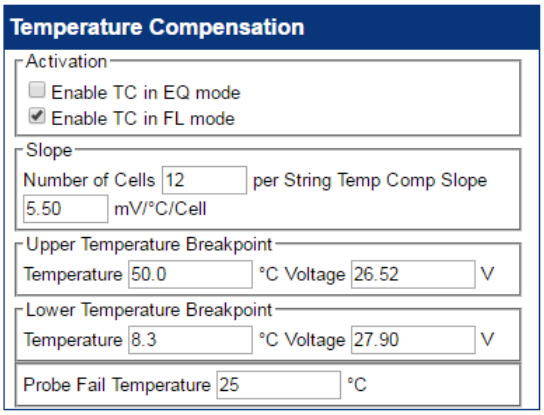


Figure 4.9-7: POWER SUPPLY SETUP – TEMPERATURE COMPENSATION

4. Click **Submit Changes.**
5. Click **Accept.**

4.9.1.4 Replacing a battery

Over the life of a battery, the system automatically reduces its capacity reading as a result of periodic battery tests. When replacing a battery, you need to reset the value to 100%.

Select **Batteries - Configure Batteries.**

1. Set Capacity Calibration to 100%.

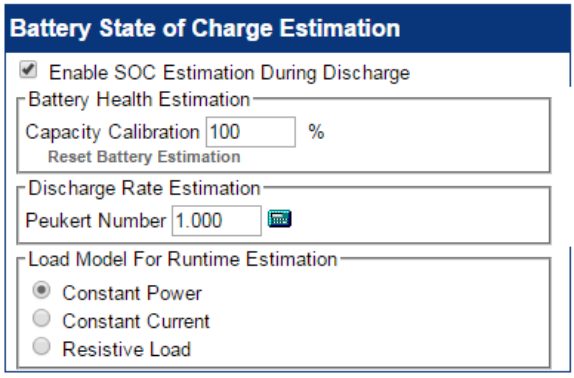


Figure 4.9-8: POWER SUPPLY SETUP – CAPACITY CALIBRATION

2. Click **Submit Changes**.
3. Click **Accept**.

4.9.1.5 Enable battery logging

This optional setting causes battery monitor data to be recorded in a log file. Some manufactures require evidence of environmental conditions and a maintenance log to validate warranty claims.

Select **Batteries - Configure Batteries.**

1. Select Enable SOC Estimation During Discharge.
2. Click **Submit Changes.**
3. Click **Accept.**

4.9.1.6 Enable system logging

This optional setting causes various system parameters to be saved in a log file that you specify. You also specify which parameters are saved.

Select **Signals - Configure Data Logging.**

1. Select one of the logging files, e.g. DATALOG_1.
2. Select a Start Trigger (usually Manual Start).
3. Click **Submit Changes**.
4. Click **Accept**.

You can also create a custom log file that is triggered by values above or below limits that you set.

4.9.1.7 Alarm Display and Handling

Alarm signals generated by the PSU cause a generic alarm display on the EIU, and also, on the CMU when fitted. Specific details of each alarm are recorded in the CMU log.

4.9.1.8 System information

4.9.1.8.1 System voltage mode

Select **System** – **Select Voltage Mode**.

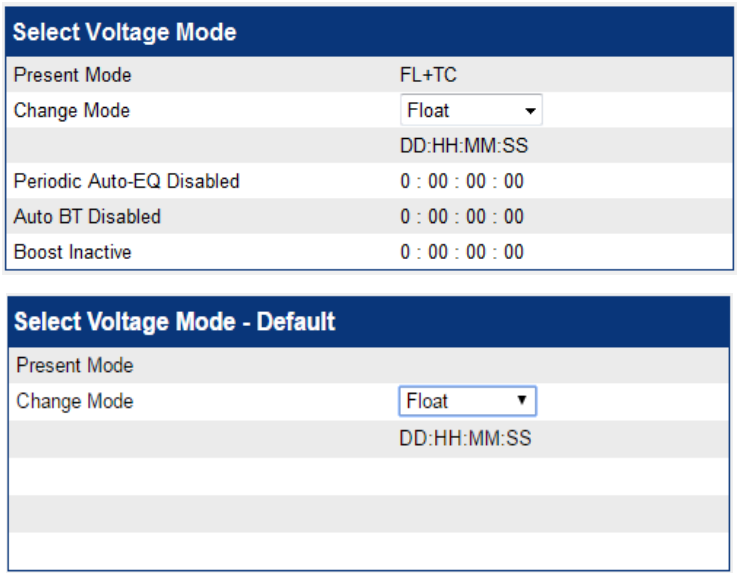


Figure 4.9-9: POWER SUPPLY SETUP – VOLTAGE MODE

4.9.1.8.2 Upgrade firmware

It is possible that PSU firmware needs upgrading for any reason. When this is the case, this firmware will be supplied by INDRA to be installed into the PSU. Procedure for installing is given below.

Select **System** – **Upgrade Firmware**.

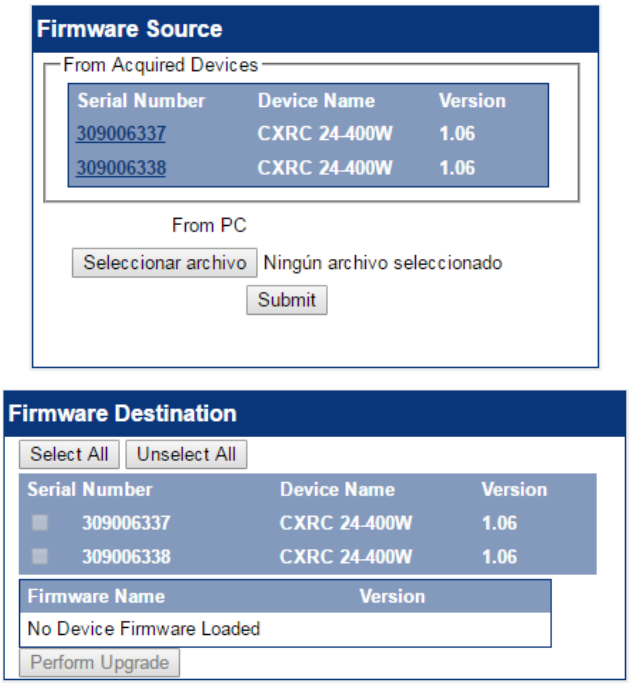


Figure 4.9-10: POWER SUPPLY SETUP - FIRMWARE

4.9.1.8.3 Set ADIO Module Number

In complex systems, parallel interface mapping can be done with the so-called ADIO (Abstract Device Interface for I/O) numbers. Assignment for ADIO number may be effected following this steps.

Select **System** – **Set ADIO Module Number**.

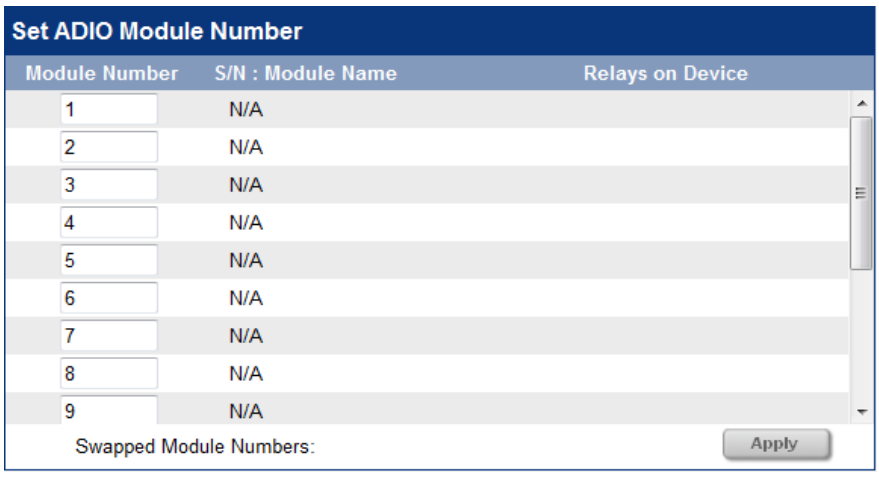


Figure 4.9-11: POWER SUPPLY SETUP – ADIO MODULE NUMBER

4.9.1.8.4 Set user inventory

For book-keeping purposes, inventory list may be created. Steps for doing so are given below.

Select **System** – **User inventory**.

User Inventory

#	Serial Number	Name	Description	Date Installed	Comments
1					
2					
3					
4					
5					
6					
7					
8					
9					

Figure 4.9-12: POWER SUPPLY SETUP – USER INVENTORY

4.9.1.8.5 View system inventory

This is a read-only list of system devices, batteries and user inventory items.

Select **System** – **System inventory**.

Acquired CAN Devices

Device Name	Serial Number	Version
CXRC 24-400W	309006337	1.06
CXRC 24-400W	309006338	1.06
No Acquired Converters		
No Acquired LPS		
No Acquired ADIO Devices		

Figure 4.9-13: POWER SUPPLY SETUP – SYSTEM INVENTORY

4.9.1.9 Controller Settings

4.9.1.9.1 View factory information

Factory Information		
Unit Serial #	153370500698772	
Ethernet/Mac Address	0090EAA2C244	
Motherboard Revision	4	
Factory Notes		
Controller Information		
Application Software Version	2.21	
Bootloader Software Version	1.02	
Model	CXCI+/CXCM1+	
Motherboard ID	6	
IO Type ID	15	Integrated IO
IO List Option ID	6	List 0 (V1 V2 I1 I2 T1 T2)
Number of Digital Inputs	6	
Number of Relays	7	

Figure 4.9-14: POWER SUPPLY SETUP – FACTORY INFORMATION

4.9.1.9.2 Set date and time

Select **Controller** – **Date & Time**.

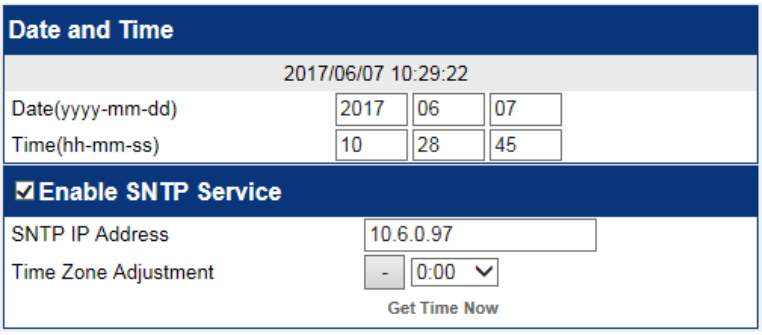


Figure 4.9-15: POWER SUPPLY SETUP – DATE AND TIME

4.9.1.9.3 Set temperature unit

This enables you to set either Celsius or Fahrenheit as the units of temperature measurement.

Select **Controller** – **Temperature Units**.



Figure 4.9-16: POWER SUPPLY SETUP – TEMPERATURE UNITS

4.9.1.9.4 Upgrade software

It is possible that PSU software needs upgrading for any reason. When this is the case, this software will be supplied by INDRA to be installed into the PSU.

Select **Controller** – **Upgrade Software**.

And follow the menu therein.

4.9.1.9.5 Upgrade bootloader

It is possible that PSU bootloader needs upgrading for any reason. When this is the case, the new bootloader will be supplied by INDRA to be installed into the PSU.

Select **Controller** – **Upgrade Bootloader**.

And follow the menu therein.

4.9.1.9.6 Reset Controller

This resets every parameter in the controller, including IP address and passwords.

Select **Controller** – **Reset**.

Warning: Unplanned use of Reset could adversely affect operation of the DME system.

4.9.1.10 Converters

There are no active converters provided in the NORMARC LDB-103 DME configuration. Do not change any default settings related to converters.

4.9.1.11 Rectifiers

4.9.1.11.1 Configuration

Select **Rectifiers – Configure Rectifiers**.

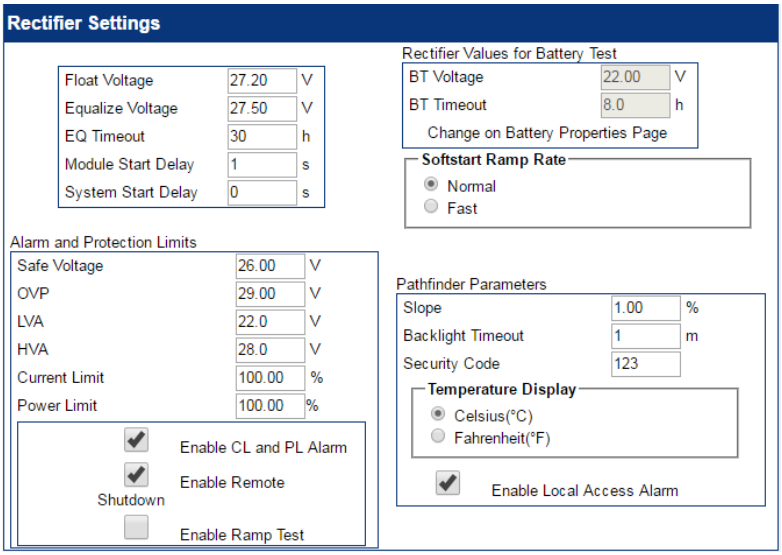


Figure 4.9-17: RECTIFIERS – CONFIGURATION

4.9.1.11.2 Power Save

Select **Rectifiers – Power Save**.

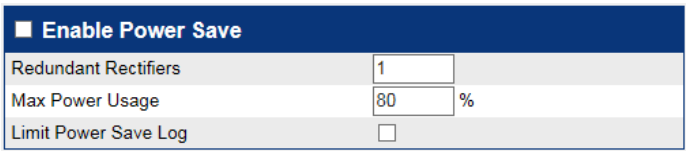


Figure 4.9-18: RECTIFIERS – POWER SAVE

4.9.1.11.3 Rectifier phase mapping

Select **Rectifiers – Phase Mapping**.

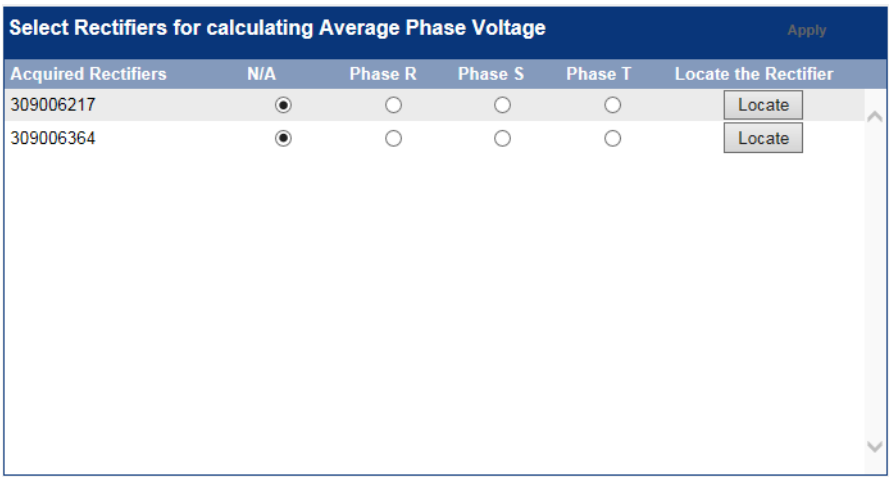


Figure 4.9-19: RECTIFIERS – PHASE MAPPING

4.9.1.12 Batteries

4.9.1.12.1 Enter Battery Information

Use this procedure to enter reference information for each battery in your system, such as serial number and installation date.

Select **Batteries – Battery Information**.

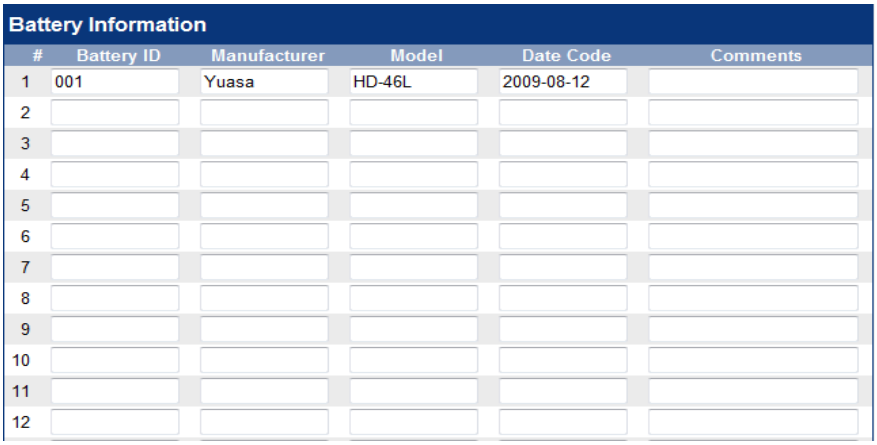


Figure 4.9-20: BATTERIES – BATTERY INFORMATION

1. Enter details for each battery in your system.
2. Click **Submit Changes**.
3. Click **Accept** when prompted to accept the changes.

4.9.1.12.2 Configure Batteries

Use this procedure to enter charging and load parameters for each battery in your system.

Select **Batteries – Configure Batteries**.

Battery Properties

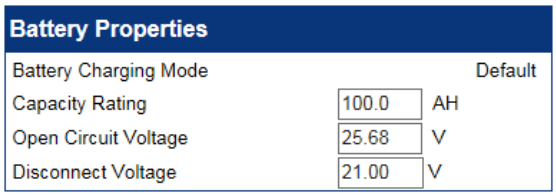


Figure 4.9-21: BATTERIES – PROPERTIES

Battery Charging Summary

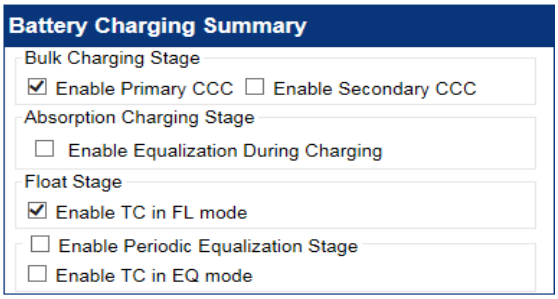


Figure 4.9-22: BATTERIES – CHARGING SUMMARY

Battery State of Charge Estimation

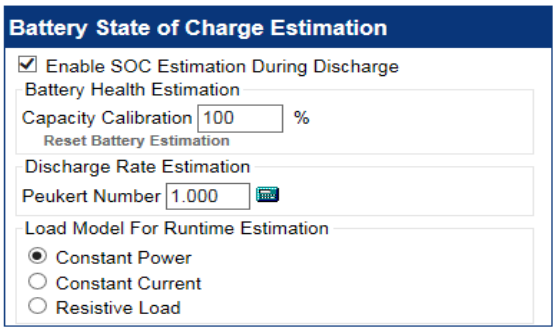


Figure 4.9-23: BATTERIES – STATE OF CHARGE ESTIMATION

Battery Test

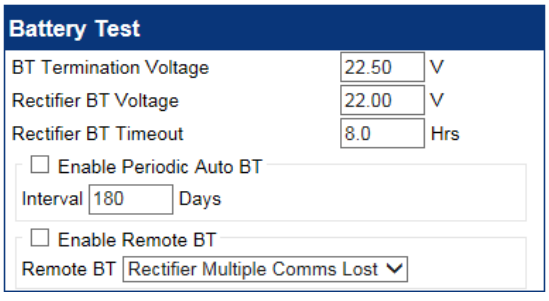


Figure 4.9-24: BATTERIES – TEST

Equalization

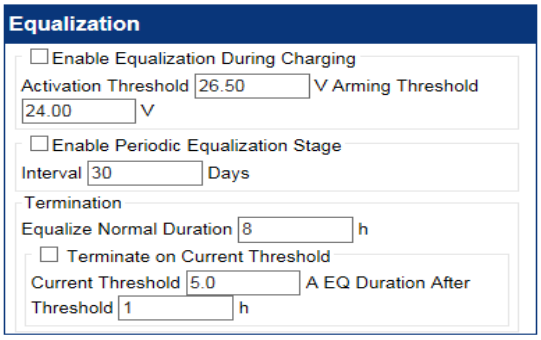


Figure 4.9-25: BATTERIES – EQUALIZATION

Temperature Compensation

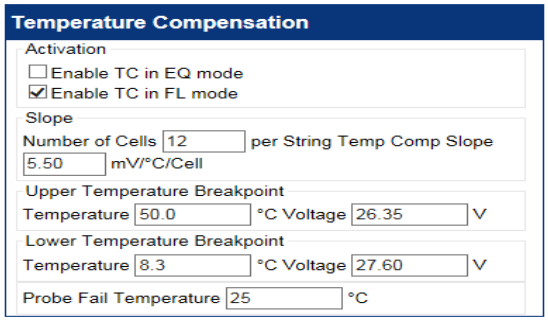


Figure 4.9-26: BATTERIES – TEMPERATURE COMPENSATION

Charge Current Control

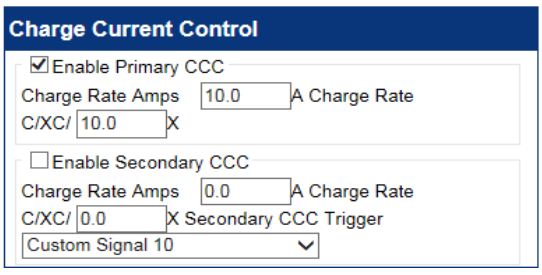


Figure 4.9-27: BATTERIES – CHARGE CURRENT CONTROL

Boost mode

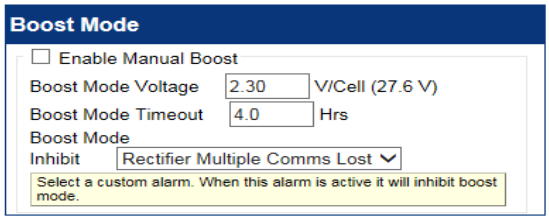


Figure 4.9-28: BATTERIES – BOOST MODE

4.9.1.13 Alarms

4.9.1.13.1 Configure alarms

Select **Alarms – Configure Alarms**.

Alarm Configuration Voltage Alarms

Alarm Name	Activation Value		Enable	Priority	Relay Mapping	Alarm Cut Off	Email	SNMP	Severity
AC Mains High	270.0	V	☐	Minor	N/A	☑	☑	☑	0
AC Mains Low	180.0	V	☐	Minor	N/A	☑	☑	☑	0
High Voltage 1	28.00	V	☑	Minor	N/A	☑	☑	☑	0
High Voltage 2	29.00	V	☑	Major	N/A	☑	☑	☑	0
Low Voltage 1	24.00	V	☑	Minor	N/A	☑	☑	☑	0
Low Voltage 2	22.50	V	☑	Major	N/A	☑	☑	☑	0
Midpoint Monitor 1	0.50	±V	☐	Minor	N/A	☑	☑	☑	0
Midpoint Monitor 2	0.50	±V	☐	Minor	N/A	☑	☑	☑	0
Midpoint Monitor 3	0.50	±V	☐	Minor	N/A	☑	☑	☑	0
Midpoint Monitor 4	0.50	±V	☐	Minor	N/A	☑	☑	☑	0
Midpoint Monitor 5	0.50	±V	☐	Minor	N/A	☑	☑	☑	0

Figure 4.9-29: ALARMS – CONFIGURATION

Click one of the Midpoint Monitor links.

Mid-point monitor

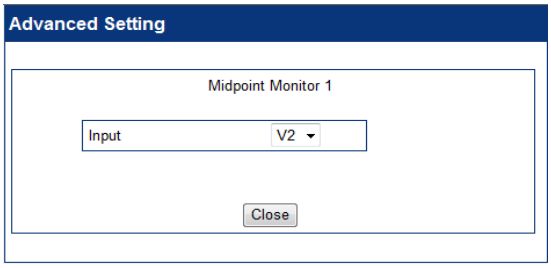


Figure 4.9-30: ALARMS – MID-POINT MONITOR

4.9.1.13.2 Global alarm configuration

Select **Alarms – Global Alarm Configuration**.

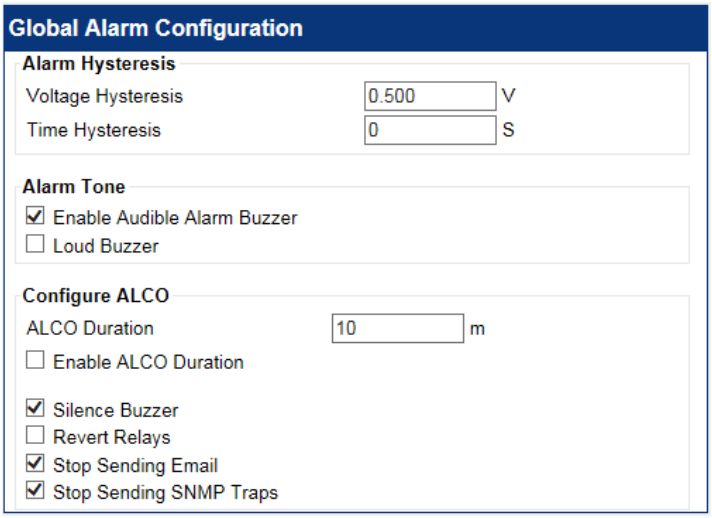


Figure 4.9-31: ALARMS – GLOBAL ALARM CONFIGURATION

4.9.1.14 Signals

4.9.1.14.1 Configure signals

Select **Signals – Configure Signals**.

This facility is one of the more frequently accessed. To provide readings of acceptable accuracy, type in the actual value to calibrate identity being monitored by the controller so that the controller will subsequently show the correct value.

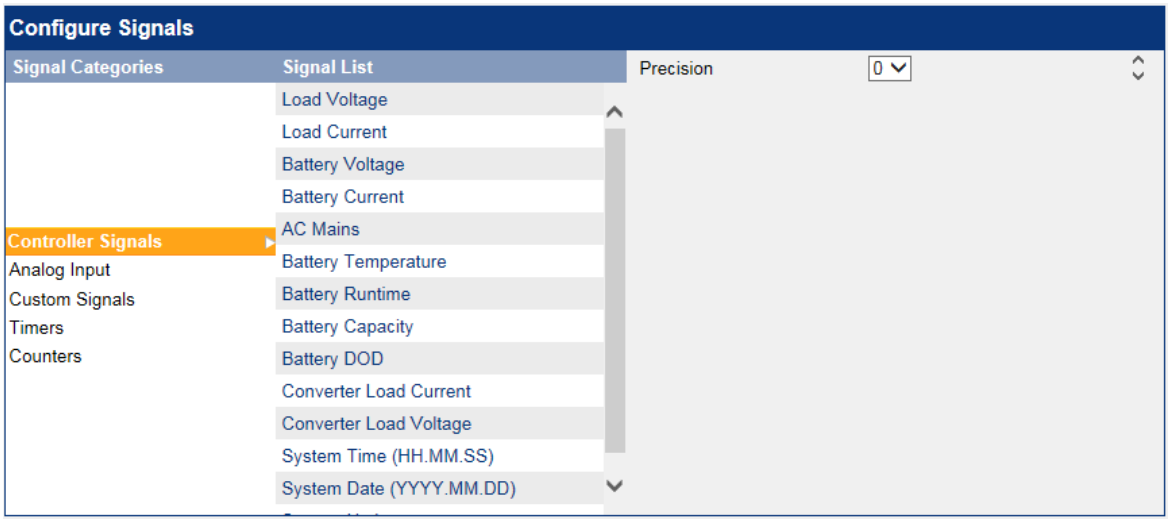


Figure 4.9-32: SIGNALS – CONFIGURATION

4.9.1.15 Data logging

Select **Signals – Configure Data Logging**.

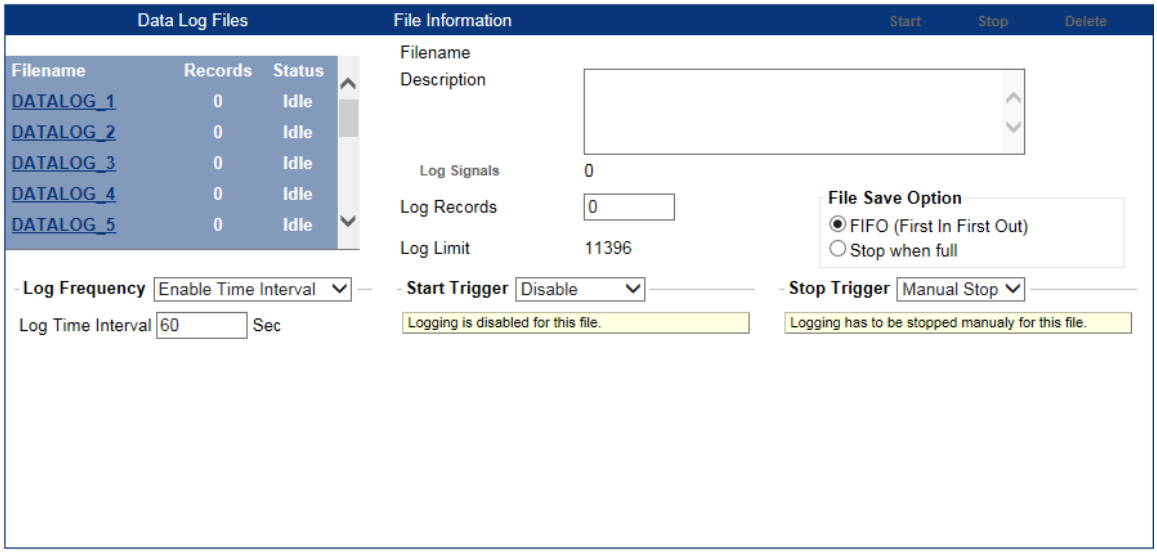


Figure 4.9-33: SIGNALS – DATA LOGGIN

4.9.1.16 Controls

Select **Controls – Configure Controls**.

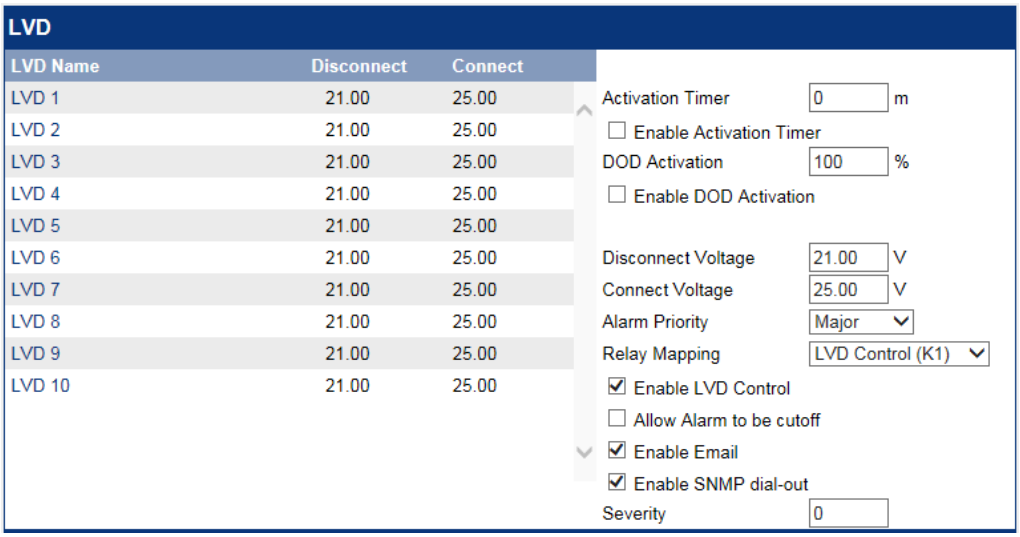


Figure 4.9-34: SIGNALS – CONTROLS LVD

4.9.1.17 Communications

4.9.1.17.1 Event notification destination

Select **Communications – Configure Communication**.

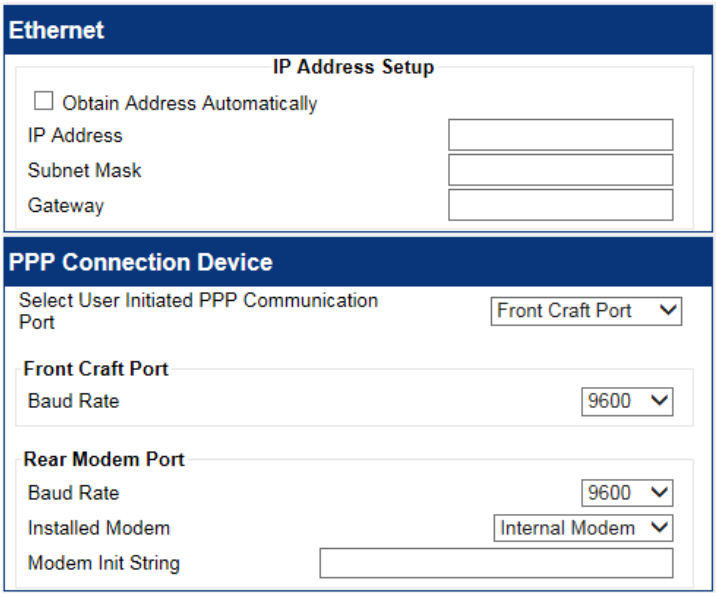


Figure 4.9-35: COMMUNICATIONS – CONFIGURATION

4.9.1.18 Event notification setup

Select **Communications – Event Notification Destination**.

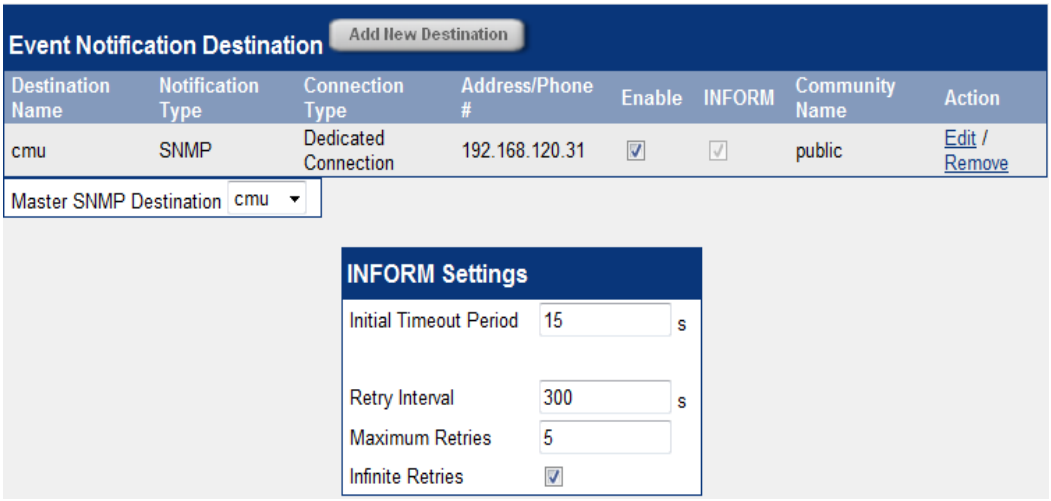


Figure 4.9-36: EVENT NOTIFICATION

4.9.1.19 SNMP Configuration

Select **Communications – SNMP Configuration**.

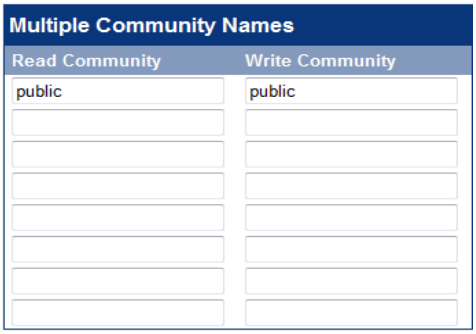


Figure 4.9-37: SNMP CONFIGURATION

4.9.1.20 Hardware

4.9.1.20.1 Configure relays

Select **Hardware – Configure Relays**.

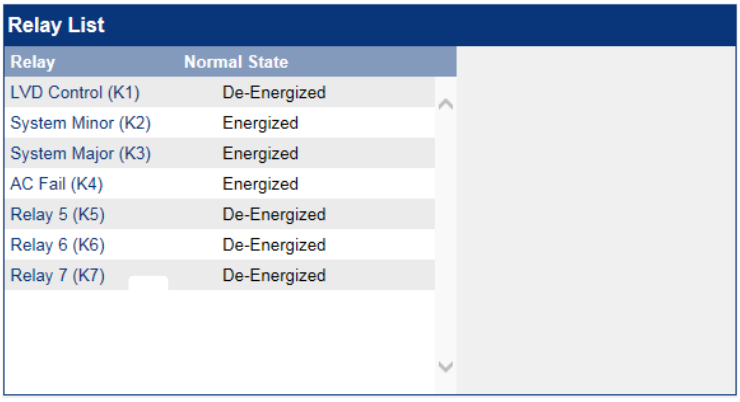


Figure 4.9-38: HARDWARE – RELAYS CONFIGURATION

4.9.1.20.2 Test Relay

Select **Hardware – Test Relays**.

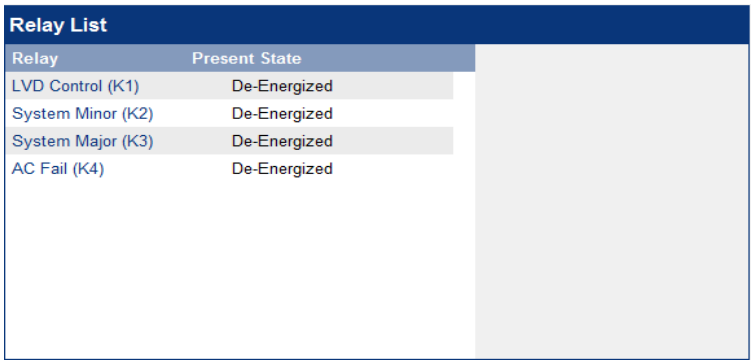


Figure 4.9-39: HARDWARE – TEST RELAYS

4.9.1.20.3 Test Modem

Select **Hardware – Test Modem**.

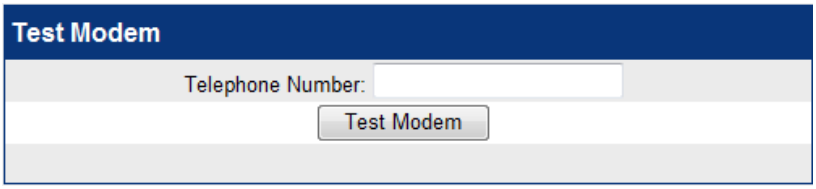


Figure 4.9-40: HARDWARE – TEST MODEM

4.9.1.21 Logs and Files

4.9.1.21.1 Retrieve logs

Select **Logs and Files– Retrieve Logs**.

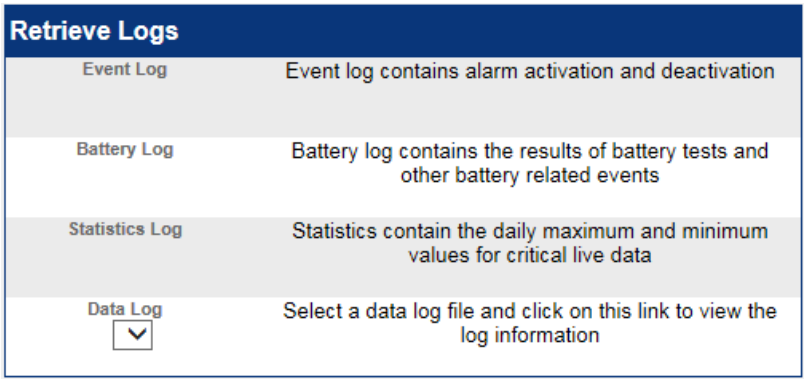
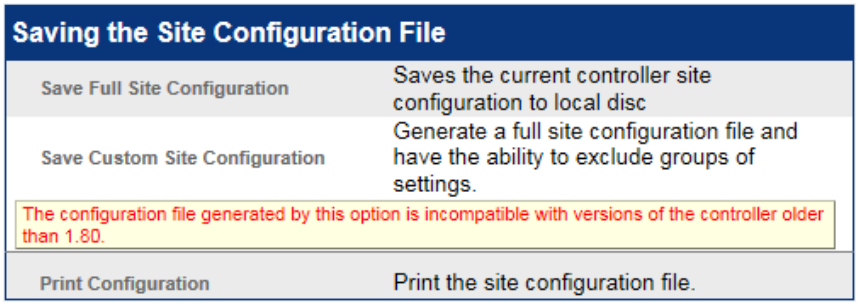


Figure 4.9-41: LOGS AND FILES – RETRIEVE LOGS

4.9.1.21.2 Manage Configuration File

Select **Logs and Files – Manage Configuration File**.



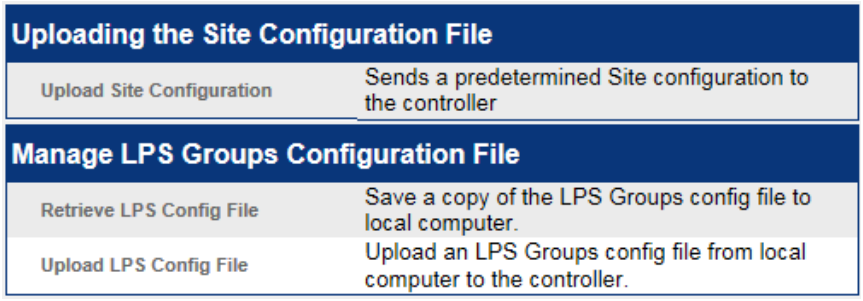


Figure 4.9-42: LOGS AND FILES – MANAGE CONFIGURATION FILE

4.9.1.21.3 Manage Editable Text Files

This procedure enables you to write your own labels for message text, for example to replace *Rectifier Fail* with *Rectifier Fault*, or to write messages in another language.

Select **Logs and Files – Manage Editable Text Files**.

1. Alarm Labels
2. Signal Labels
3. Relay Labels

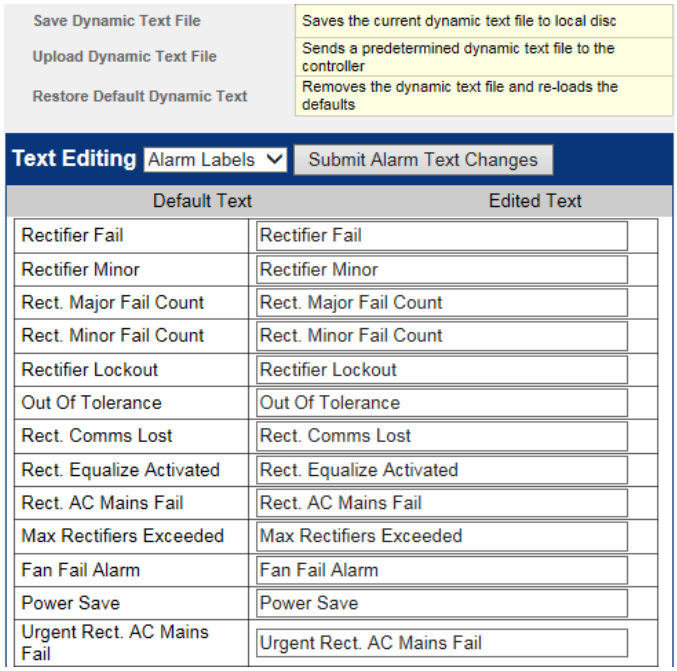


Figure 4.9-43: LOGS AND FILES – EDITABLE TEST FILES

4.9.1.21.4 Manage language files

Select **Logs and Files – Manage Language Files**.

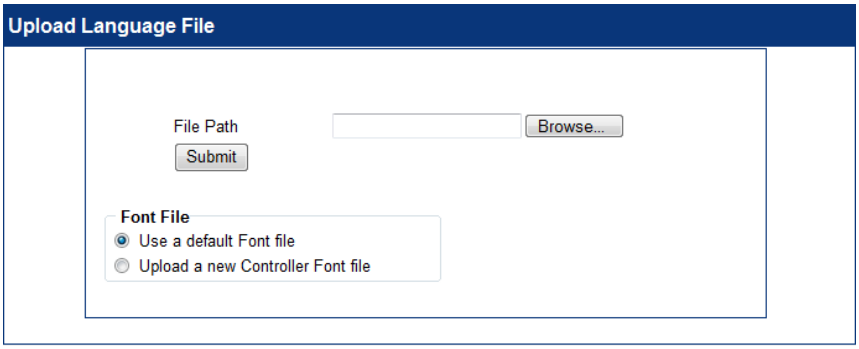


Figure 4.9-44: LOGS AND FILES – LANGUAGE FILES

4.9.1.21.5 Retrieve Diagnostic File

Select **Logs and Files – Retrieve Diagnostic File**.

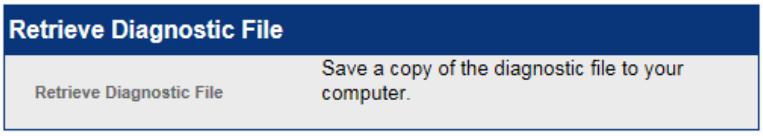


Figure 4.9-45: LOGS AND FILES – RETRIEVE DIAGNOSTIC FILE

4.9.1.22 Supervisor

4.9.1.22.1 Change password

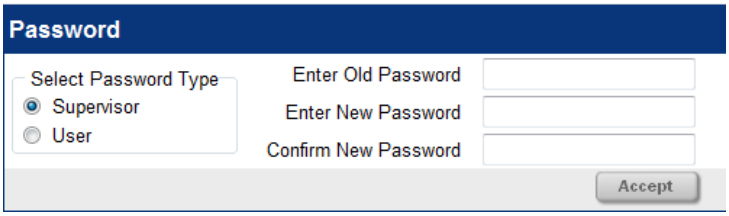


Figure 4.9-46: SUPERVISOR - CHANGE PASSWORD

4.10 OPERATING NOTES

The following notes are given to assist the operator when an abnormal indication occurs:

- Upon switching on, it is often advisable to next make connection to the battery by turning on the lowest toggle at the PSU circuit breaker panel. This ensures that battery charging if needed is catered for. Observe the current reading at the PSU to ascertain if this is the case.
- If any *Alarm/ System* indicators remain on following switch-on, then one of the equipment set's operating parameters are out of tolerance, and the equipment performs the transfer - shut down sequence after the delay period. The indications in the *Alarm/ System* can be used as a guide to proceed to module level toward the cause of the fault condition.
- If the Green LEDs on the PSUs are not on after the PSU has been powered on for 15 seconds and their circuit breakers are closed, then the operation of the AC Power Supply should be checked for presence of AC mains and correct DC output voltage.
- If the Green LEDs on the PSUs are not on and steady after the PSU has been powered on for 15 seconds and their circuit breakers are closed and the relays do not remain closed, then the rack DC supply voltage is too low or the surge currents are too high for proper operation and the rack will not switch on. In the short term, ensure back-up batteries are properly connected to act as damper for current surge. The DC output from the AC Power Supply and the battery voltage should be eventually checked.
- The *Alarm Inhibit* facility may then be activated (in web page Config/ RCU), if desired, to provide time for trouble shooting without the active status of the equipment being automatically transferred to the standby set.
- In web page Administration/Policy, '*Single Controller'* OFF means everyone can have control of the equipment. When '*Single Control'* button (second line in top panel of any web page) is pressed, the display changes to '*Release Control*'. And, only the person pressing the button has control of the equipment. If there is no activity for a preset minutes (Controller Inactivity TimeOut), the control is automatically released.

4.11 MAINTENANCE MODE

The *Maintenance Mode* soft button makes the applicable system ready for maintenance by disabling the SNMP trap notifications and providing the Maintenance indication through the output relays.

In a DME, *Maintenance Mode* operation is the same as normal operation, except that RMM messages are inhibited and 'Maintenance' is signaled to the RMM System.

4.12 NETWORK CONSIDERATIONS FOR CO-EXISTENCE OF NORMARC LDB-103 AND VRB-53D

Where both a DVOR VRB-53D and NORMARC LDB-103 DME are located in the same physical shelter, some further network configuration is required.

The typical functionality of the NMP for both the DVOR and DME is to provide a simple LAN that can be accessed through an external WAN TCP/IP address and port number combination. By default, the NMP has a fixed LAN IP address of 10.6.0.97 and it allocates LAN IP addresses on demand for connected equipment using DHCP within the 10.6.0 subnet.

Where both a DME and a DVOR are to be used together, only one of the NMPs must be responsible for DHCP IP address allocation and the two NMP's IP address should not be identical. However, all the connected Navaid equipment must still belong to the same local LAN regardless of which NMP

each Navaid is connected to. To achieve this, the NMP in the DME must be assigned a different IP address to avoid LAN address conflicts and must also not be a DHCP server. Use the IP address of 10.6.0.98 for the DME NMP but only if there is to be co-existence of the DME and DVOR in the same physical shelter.

Changing the LAN IP address of the NMP is best performed from the front LAN ETH connector on the NMP using a laptop which has DHCP enabled. Firstly create a network connection between the laptop and NMP by joining with a CAT 5 cable and wait for the NMP to allocate an IP address for the laptop. Once allocated, use the laptop to log into the NMP using an up to date web browser like Firefox and type in the URL http://10.6.0.97. Log in with a user/password combination of ‘admin’/’admin’. Navigate to Local/Network menu and change the ‘LAN Interface IP Address’ to 10.6.0.98. Disable the DHCP checkbox under the DHCP Server Configuration heading, uncheck the DHCP checkbox and apply the changes. Note then check that both 10.6.0.97 and 10.6.0.98 are accessible. WAN connections should be made to the 10.6.0.97 NMP installed in the DVOR.

The internal LANs of the DVOR and DME must then be joined together using a CAT 5 cable through the local LAN ETH connections of each NMP. (Use one of the empty connectors on each NMP marked LAN ETH1~3). The joining of the networks can also be done via each network switch if this is a preferred solution.

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5. SECTION 5 – MAINTENANCE

5.1 MAINTENANCE PROGRAM

This program recommends nominal schedule and procedure for inspection and test of the NORMARC LDB-103 DME to ascertain the operability of the navaid equipment.

The actual activities and their frequency are dependent on the site authority; bearing in mind the recommendations prescribed by ICAO 8071 Vol.1 [AD.2] and the level of confidence in the site operation as well as the environmental conditions for the actual site.

These checks are for maintenance purposes, limits of measured values may deviate from ICAO Annex 10 [AD.1] due to proximity of monitor or limitation of test equipment at site. Changes in the measured values may often be more relevant to the indication of changes in the site performance relative to that at the time of the site commissioning or at the time of the last calibration flight.

QUARTERLY:

Activity:

1. Log in the equipment.
2. Inspect for absence of 'Fault' in the status summary (top horizontal panel).

Note if the operating system of the previous inspection remain the operating system.

3. Navigate to 'Status'. Check for absence of anomalous parameters. Record power outputs.
4. Navigate to 'Status/MTU Executive'. Check for absence of anomalous parameters.
5. Navigate to 'Status/RCU'. Inspect for the number of recycles. Reset to standard setup: Main, Standby, Zero cycle count as required.
6. Navigate to 'Logs' and display logs for the wanted time duration. Check for absence of anomalous messages.

Document: Task list, check sheet and record inspection activity to be generated by site authority as required. Assessment for any remedial activities to be listed.

ANNUALLY:

Activity: Visit the site. For each equipment:

1. Perform all six tasks for monthly check as above.
2. Check the pulse spacing.
3. Verification of the monitoring serviceability as prescribed in this document.
4. Exercise Change-Over action.
5. Check output power and pulse characteristics.
6. Check the reply delay and verify that the system meets the requirements.
   - Reply delay$_{X\ mode}$: 50 +/- 0.25 us.
   - Reply delay$_{Y\ mode}$: 56 +/- 0.25us.

Depends on the site authority the reply delay can be checked as follow:

a) Read the MTUs values.

b) Follow the procedure described in section 5.1.1.

7. MTU Frequency Calibration. Follow the procedure described in section 5.1.2.
8. Verify the batteries.
9. Inspect cleanliness, neatness and fitting of equipment and facility (lighting, air conditioning etc) within the equipment area and within the shelter.

Document: Task list and check sheet and record of visit to be generated by site authority as required. Assessment for any remedial activities to be listed. These are to be archived.

DAILY or WEEKLY DATA COLLECTION (OPTIONAL):

Daily or weekly tasks are presented in case the local authority requires high frequency data collection, not being necessary for the maintenance of the beacon. All the described tasks are not intrusive, so they can be done without interfering the normal behavior of the equipment.

These tasks can be avoid, being covered with the quarterly inspections.

Activity:

1. Log in the equipment.
2. Inspect for absence of “Fault” in the status summary (top horizontal panel).

Note if the operating system of the previous inspection remain the operating system. Note the recycling number.

3. Navigate to “Logs” and display logs for the wanted time duration. Check for absence of anomalous messages.

Document: Task list, check sheet and record inspection activity to be generated by site authority as required. Assessment for any remedial activities to be listed.

Note that non-zero recycle number may simply relate to incidental occurrences (weather, power surges etc) and may not be material to the operation quality of the Navaid. Judicious assessment is required. Site visit is optional to check for intrusion of insect etc.

5.1.1 Reply Delay Measurement

1. Power on the equipment. The DME system is in normal mode operating at squitter rate.
2. Ensure the TXP to be measured is enabled and transmitting on antenna.
3. Perform the measurement in the operative channel.
4. Connect the Oscilloscope to MTU Test connectors: 15 pin and 17 pin. Use the accessory Test Board.
5. Configure the oscilloscope as follows:
   - Channel1: 15 pin.
   - Channel2: 17 pin.
   - Use the Channel1 as trigger.

6. Adjust the oscilloscope setting to visualize both signals and use zoom option if needed. The signal in channel1 (yellow signal) is the Interrogation Window and the signal visualized in channel2 (green) is the Answer Detection Pulse.



Figure 5.1-1: REPLAY DELAY MEASUREMENT 1

7. Measure the time difference between the rising edge of Interrogation Window and the rising edge of the first Answer Detection Pulse ($Value_{MEASURE}$). This value is the *Reply Delay + 20 us* (8 from the latency of the process plus 12 us from the distance between answer pulses).



Figure 5.1-2: REPLAY DELAY MEASUREMENT 2

8. Register the *Reply Delay* Value ($Value_{MEASURE}$ – 20 us) and note that this value should be invariable. In this example the *Reply Delay*$_{CHANNEL_X}$ is 50us.

The previous explained process is for a channel type X. If the operative channel is a channel type Y the process is the same, but now the distance between answer pulses is 30 us, so:

$$\left.\begin{array}{l} Delay_{CHANNEL_Y} = Value_{MEASEURE} - 8us - 30us; \\ Value_{MEASEURE} = 94\ us; \\ Delay_{CHANNEL_Y} = 94\ us - 8\ us - 30\ us; \end{array}\right\} Delay_{CHANNEL_Y} = 56\ us$$

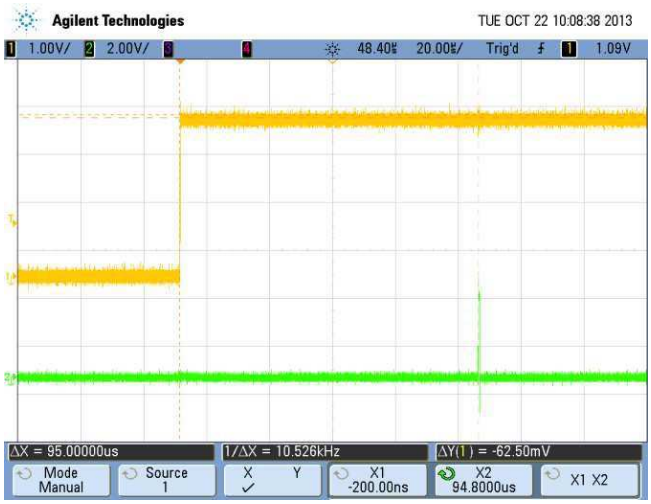


Figure 5.1-3: REPLAY DELAY MEASUREMENT 3



Figure 5.1-4: REPLAY DELAY MEASUREMENT 4

Note: To calculate the reply delay value, it is important to know that latency is 8us only for those equipments whose MTU firmware version is 1.13 or later. For previous versions, the considered latency should be 9 us.

5.1.2 MTU Frequency Calibration

1. Install "*Indra DME MTU CALIBRATION-Setup-1.1.exe*". Make a note of the folder path where the program is being installed.
2. Connect to the DME with Putty.

Before using the MTU Calibration tool for the first time, it is necessary to connect to the Master CMU with PuTTY. PuTTY is included in the files, which are installed by the MTU Calibration SW installer. Follow the below steps to log in with Putty.

a) Connect the computer to the local Ethernet port on the DME. (The computer must have an IP address in the 10.6.0 subnet).
b) Locate *PuTTY.exe* in the folder where the Indra DME MTU Calibration SW was installed. Double click the file to start PuTTY.
c) Select "*Connection type*": SSH, and enter the IP address for the Master CMU (10.6.0.132) in the "*Host Name (or IP address)*" address field. Then press "*Open*".

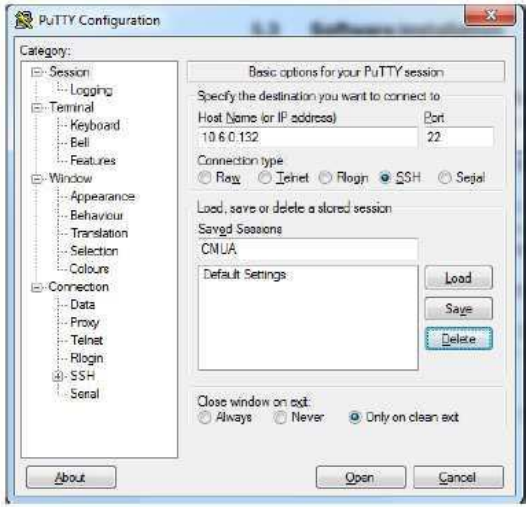


Figure 5.1-5: PUTTY - CONFIGURATION

d) A dialog box with a "*Putty Security Alert*" should appear. Press "*Yes*" to add the key to PuTTY's cache.

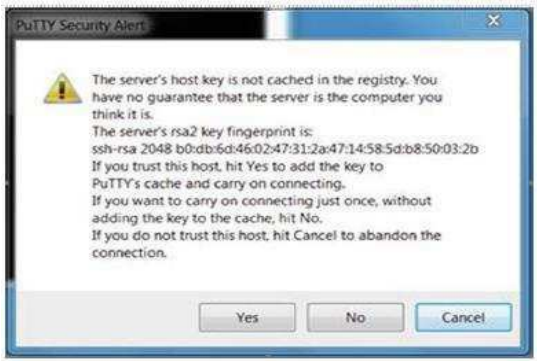


Figure 5.1-6: PUTTY SECURITY ALERT

e) PuTTY can now be closed.

3. Transmitter Frequency Check

The oscillator for the transmitter is located in the Receiver Unit (RXU). The frequency can be checked by connecting a frequency counter to pin-1 of the test connector located at the front of the RXU. The signal on pin-1 is a sample of the oscillator frequency divided by 5000.

E.g. for a DME with channel 23 X (reply fq. 984MHz), the measured frequency should be:

984MHz/5000=196.8kHz

Follow this procedure to check the frequency:

a) Insert the DME Test Board in the test connector at the front of the RXU on the transponder which is on-air.
b) Connect a frequency counter to pin-1 on the test board.
c) Multiply the measured frequency with 5000. The result should match the channel reply frequency of the DME.

Carry out a changeover and repeat the above steps for the other transponder.

If the frequency is correct within a tolerance of ±2ppm, then carry out the MTU calibration procedure in step below.

4. MTU Frequency Measurement Calibration

a) Connect the computer to the local Ethernet port at the front of the DME.
b) The computer must have an IP address in the 10.6.0 subnet.
c) Start the MTU Calibration SW.
d) Select the MTU which shall be calibrated, and the TXP which is on-air.
e) Press "*Calibrate*".



Figure 5.1-7: MTU FREQUENCY MEASUREMENT CALIBRATION

5.2 CORRECTIVE MAINTENANCE

5.2.1 Maintenance Procedures

This section covers those topics related to the maintenance of a DME beacon. It includes routine and special maintenance instructions as follow:

- Routine Maintenance.
- Section 5.2.2 contains fault location flow.
- Section 5.2.3 contains instructions relating to the replacement of line replaceable units (LRUs). This includes a list of recommended LRUs, removal instructions, and tests required following LRU replacement.

5.2.2 Fault Location & Troubleshooting

According to the alarms double classification as Executive / BITE and Primary / Secondary, the User can locate an alarm in three ways:

- Front Panel.
- LCU.
- LMT/RMT.

5.2.2.1 Front Panel Fault Location

The user can located by means of the green/yellow/red leds on the modules front panels.

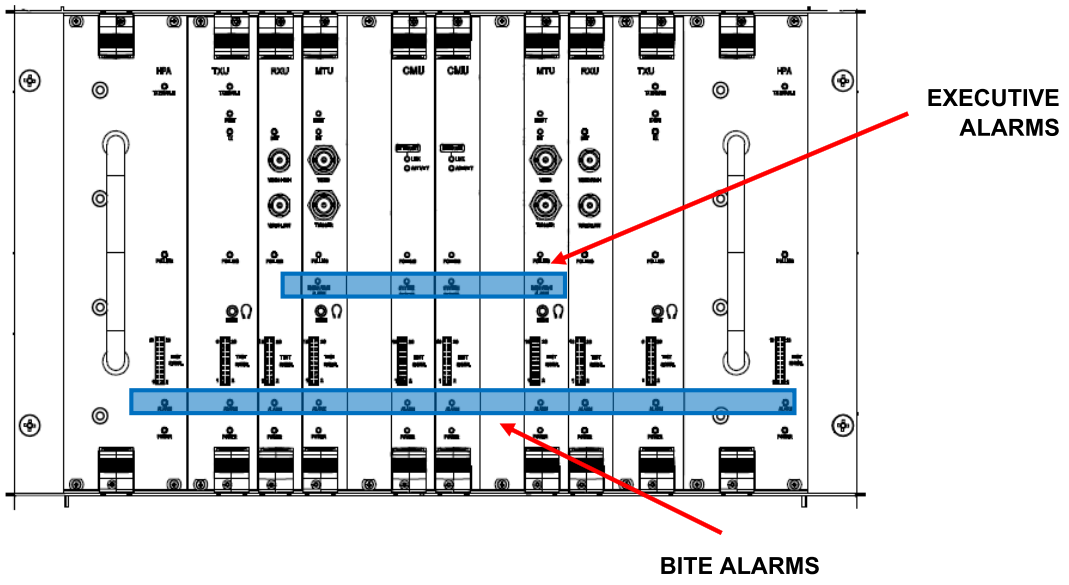


Figure 5.2-1: FRONT PANEL ALARM LED INDICATIONS

5.2.2.2 LCU Fault Location

Using the LCU module the fault location flow is as follows:

- Step 1: ALARMS tab indication.
- Step 2: SELECT SYSTEM button (if required).
- Step 3: Module selection and final fault location.

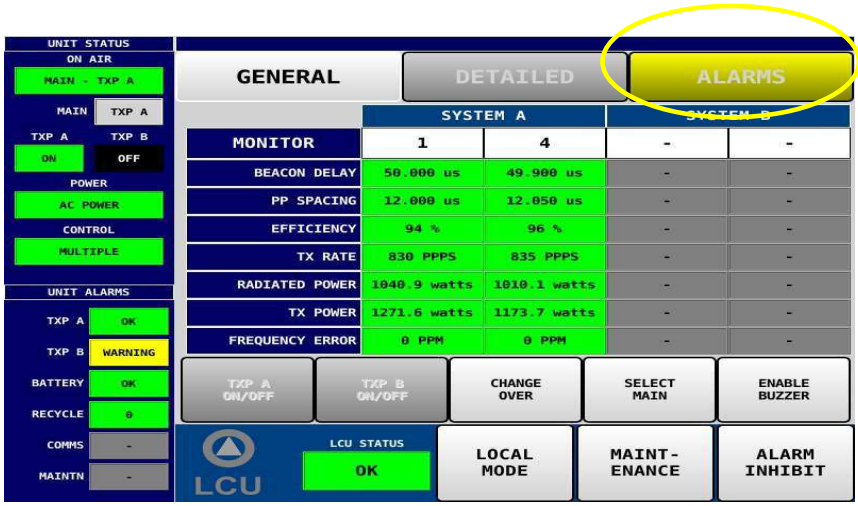


Figure 5.2-2: LCU FAULT LOCATION - STEP 1

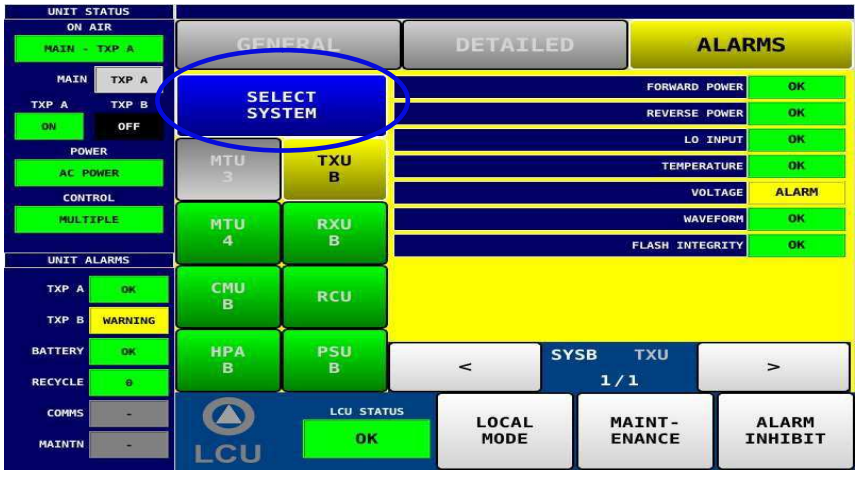


Figure 5.2-3: LCU FAULT LOCATION - STEP 2

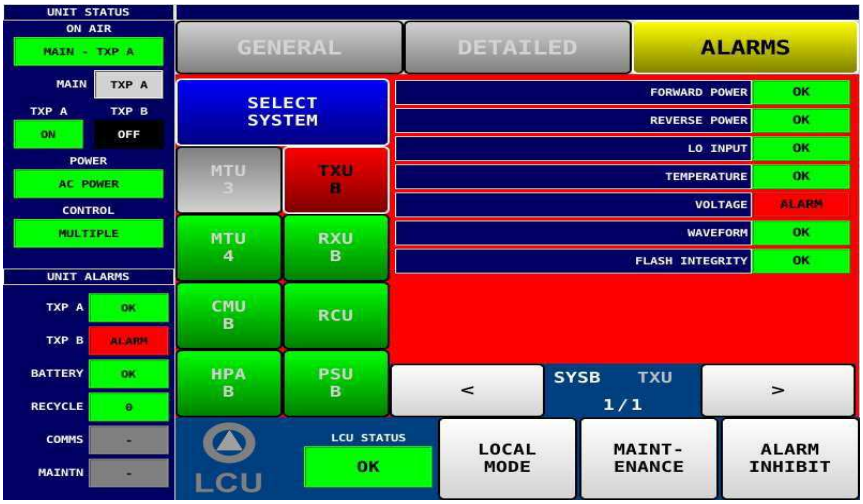


Figure 5.2-4: LCU FAULT LOCATION - STEP 3

In addition, the executive alarms are also checked in LCU general tab.

The alarm detection flow for the executive signals is:

- Step 1: MTUs detect the Alarm condition.
- Step 2: Alarm source could also be followed in ALARMS tab.
- Step 3: On the one hand, if there is a primary alarm the equipment changeover to Standby TXP automatically. In this case the alarm is shown only for 3 second, so it is necessary to check the logs to know which has been the error. On the other hand, when a secondary alarm happens, it could be detected because the parameter is shown is yellow color.

5.2.2.3 LMT/RMT Fault Location

Using the LMT/RMT interface, the fault location flow is as follows:

- Step 1: DME GUI STATUS BAR shows if an alarms happens and the type of alarms:
  - The BITE alarms: are shown in the first row DME GUI STATUS BAR. They are the result of a BITE and indicate than a module has an error.
  - The EXECUTIVE alarms: are shown in the second row. They indicate that the signal is not fulfill the specifications outlined in the ICAO.

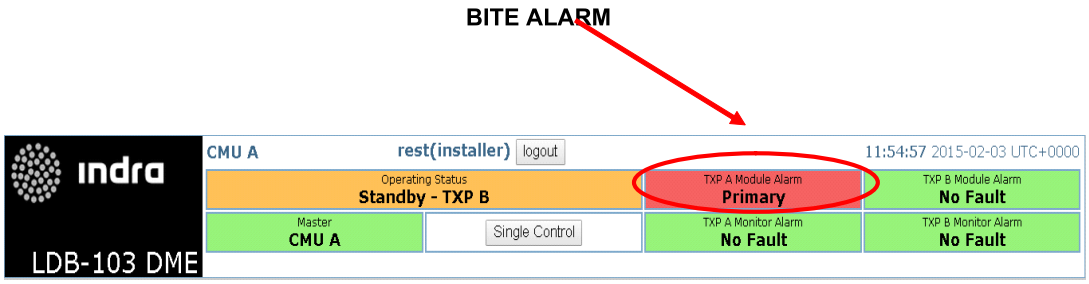




Figure 5.2-5: LMT\RMT GENERAL STATUS HEADER - STEP 1

- Step 2: Go to the Parameter Table and select ALARM. Select SYSTEM and observe the table. Here there are both types of alarms: BITE and EXECUTIVE alarms. For example the System *Alarms/TXP A BITE* is the aggregation of all BITES *and System Alarms/TXP A Integrity* is the executive alarms of the monitor.
- Step 3: In order to know the value of the different parameters, go to Parameter Table and select STATUS.
- Step 4: Other option to localize a fault is to observe the logs. Go to Parameter Table and select LOG

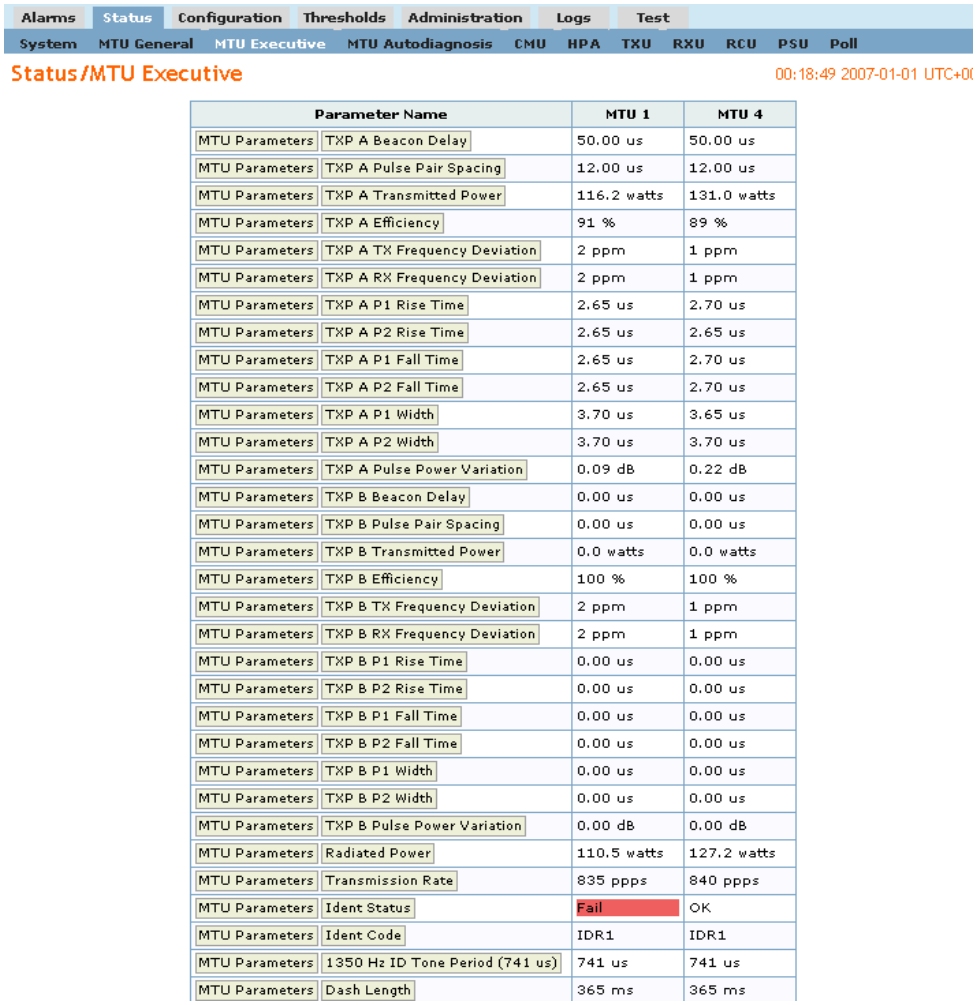
Alarms | Status | Configuration | Thresholds | Administration | Logs | Test

System | MTU Local | MTU Executive | MTU Autodiagnosis | CMU | HPA | TXU | RXU | RCU | PSU

Alarms/System 00:33:30 2007-01-01 UTC+0000

Parameter Name		System 1	System 2	
System Alarms	DME System	Primary		
System Alarms	TXP Sub-System	Secondary		
System Alarms	Monitor Sub-System	Primary		
System Alarms	Management & Control Sub-System	Primary		
System Alarms	Relay Control Sub-System	No Fault		
System Alarms	PSU Sub-System	Primary		
System Alarms	TXP A Overall	Secondary		
System Alarms	TXP B Overall	No Fault		
System Alarms	TXP A BITE	No Fault		
System Alarms	TXP B BITE	No Fault		
System Alarms	TXP A Integrity	Secondary		EXECUTIVE ALARMS
System Alarms	TXP B Integrity	No Fault		
MTU AlarmsStatus	Basic BITE Primary Alarm	Primary	No Fault	BITE ALARMS
MTU AlarmsStatus	Basic BITE Secondary Alarm	No Fault	No Fault	
MTU AlarmsStatus	Autodiagnosis BITE Primary Alarm	No Fault	No Fault	
MTU AlarmsStatus	Autodiagnosis BITE Secondary Alarm	No Fault	No Fault	
CMU AlarmsStatus	BITE Primary Alarm	No Fault	N/A	
CMU AlarmsStatus	BITE Secondary Alarm	No Fault	N/A	
RXU AlarmsStatus	Primary Alarm	No Fault	No Fault	
RXU AlarmsStatus	Secondary Alarm	No Fault	No Fault	
TXU AlarmsStatus	Primary Alarm	No Fault	No Fault	
TXU AlarmsStatus	Secondary Alarm	No Fault	No Fault	
RCUlarms	Primary Alarm	No Fault		
RCUlarms	Secondary Alarm	No Fault		

Figure 5.2-6: LMT\RMT ALARM TABLE - STEP 2



Alarms | Status | Configuration | Thresholds | Administration | Logs | Test

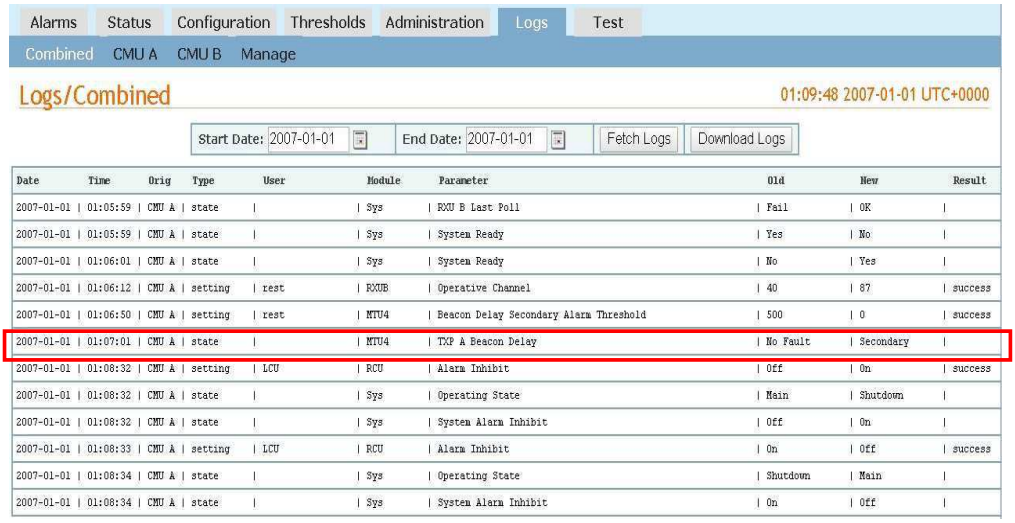
System | MTU General | MTU Executive | MTU Autodiagnosis | CMU | HPA | TXU | RXU | RCU | PSU | Poll

Status/MTU Executive

00:18:49 2007-01-01 UTC+0(

Parameter Name		MTU 1	MTU 4
MTU Parameters	TXP A Beacon Delay	50.00 us	50.00 us
MTU Parameters	TXP A Pulse Pair Spacing	12.00 us	12.00 us
MTU Parameters	TXP A Transmitted Power	116.2 watts	131.0 watts
MTU Parameters	TXP A Efficiency	91 %	89 %
MTU Parameters	TXP A TX Frequency Deviation	2 ppm	1 ppm
MTU Parameters	TXP A RX Frequency Deviation	2 ppm	1 ppm
MTU Parameters	TXP A P1 Rise Time	2.65 us	2.70 us
MTU Parameters	TXP A P2 Rise Time	2.65 us	2.65 us
MTU Parameters	TXP A P1 Fall Time	2.65 us	2.70 us
MTU Parameters	TXP A P2 Fall Time	2.65 us	2.70 us
MTU Parameters	TXP A P1 Width	3.70 us	3.65 us
MTU Parameters	TXP A P2 Width	3.70 us	3.70 us
MTU Parameters	TXP A Pulse Power Variation	0.09 dB	0.22 dB
MTU Parameters	TXP B Beacon Delay	0.00 us	0.00 us
MTU Parameters	TXP B Pulse Pair Spacing	0.00 us	0.00 us
MTU Parameters	TXP B Transmitted Power	0.0 watts	0.0 watts
MTU Parameters	TXP B Efficiency	100 %	100 %
MTU Parameters	TXP B TX Frequency Deviation	2 ppm	1 ppm
MTU Parameters	TXP B RX Frequency Deviation	2 ppm	1 ppm
MTU Parameters	TXP B P1 Rise Time	0.00 us	0.00 us
MTU Parameters	TXP B P2 Rise Time	0.00 us	0.00 us
MTU Parameters	TXP B P1 Fall Time	0.00 us	0.00 us
MTU Parameters	TXP B P2 Fall Time	0.00 us	0.00 us
MTU Parameters	TXP B P1 Width	0.00 us	0.00 us
MTU Parameters	TXP B P2 Width	0.00 us	0.00 us
MTU Parameters	TXP B Pulse Power Variation	0.00 dB	0.00 dB
MTU Parameters	Radiated Power	110.5 watts	127.2 watts
MTU Parameters	Transmission Rate	835 ppps	840 ppps
MTU Parameters	Ident Status	Fail	OK
MTU Parameters	Ident Code	IDR1	IDR1
MTU Parameters	1350 Hz ID Tone Period (741 us)	741 us	741 us
MTU Parameters	Dash Length	365 ms	365 ms

Figure 5.2-7: LMT\RMT STATUS TABLE - STEP 3



Alarms | Status | Configuration | Thresholds | Administration | Logs | Test

Combined | CMU A | CMU B | Manage

Logs/Combined

01:09:48 2007-01-01 UTC+0000

Start Date: 2007-01-01 End Date: 2007-01-01 Fetch Logs Download Logs

Date	Time	Orig	Type	User	Module	Parameter	Old	New	Result
2007-01-01	01:05:59	CMU A	state		Sys	RXU B Last Poll	Fail	OK	
2007-01-01	01:05:59	CMU A	state		Sys	System Ready	Yes	No	
2007-01-01	01:06:01	CMU A	state		Sys	System Ready	No	Yes	
2007-01-01	01:06:12	CMU A	setting	rest	RXUB	Operative Channel	40	87	success
2007-01-01	01:06:50	CMU A	setting	rest	MTU4	Beacon Delay Secondary Alarm Threshold	500	0	success
2007-01-01	01:07:01	CMU A	state		MTU4	TXP A Beacon Delay	No Fault	Secondary	
2007-01-01	01:08:32	CMU A	setting	LCU	RCU	Alarm Inhibit	Off	On	success
2007-01-01	01:08:32	CMU A	state		Sys	Operating State	Main	Shutdown	
2007-01-01	01:08:32	CMU A	state		Sys	System Alarm Inhibit	Off	On	
2007-01-01	01:08:33	CMU A	setting	LCU	RCU	Alarm Inhibit	On	Off	success
2007-01-01	01:08:34	CMU A	state		Sys	Operating State	Shutdown	Main	
2007-01-01	01:08:34	CMU A	state		Sys	System Alarm Inhibit	On	Off	

Figure 5.2-8: LMT\RMT LOG TABLE - STEP 4

5.2.2.4 Troubleshooting

Troubleshooting is made easier thanks to the alarms information available in the NORMARC LDB-103 DME.

By looking at the failure messages displayed in the LCU (see 5.2.2.2) or LMT/RM (see 5.2.2.3), the operator may easily detect any beacon malfunction; these messages make it possible to detect the malfunctioning module, if any, and to take the necessary organization and urgency measures (primary or secondary alarm) so as to repair the module.

Table 5.2-1 helps the operator to make the diagnosis.

Table 5.2-1: TROUBLESHOOTING TABLE

ALARM		POSSIBLE FAILTY MODULE	
GROUP	**PARAMETERS**	**1º**	**2º**
MTU	Internal Voltage	MTU	
	LO Power	MTU	
	LO Not Locked	MTU	
	Flash Integrity	MTU	
	Polling	MTU	
	Beacon Delay	TXU	RXU
	Pulse Pair Spacing	TXU	
	Efficiency	RXU	HPA (HP Equipment)
			TXU (LP Equipment)
	Frequency Difference	RXU	
	Pulse Shape	TXU	
	Radiofrequency Power	HPA (HP Equipment)	TXU (HP Equipment)
		TXU (LP Equipment)	RXU (LP Equipment)
	TXP A P1 Rise Time	HPA (HP Equipment)	TXU (HP Equipment)
		TXU (LP Equipment)	
	TXP A P2 Rise Time	HPA (HP Equipment)	TXU (HP Equipment)
		TXU (LP Equipment)	
	TXP A P1 Fall Time	HPA (HP Equipment)	TXU (HP Equipment)
		TXU (LP Equipment)	

Table 5.2-1: TROUBLESHOOTING TABLE

ALARM		POSSIBLE FAILTY MODULE	
GROUP	**PARAMETERS**	**1º**	**2º**
	TXP A P2 Fall Time	HPA (HP Equipment)	TXU (HP Equipment)
		TXU (LP Equipment)	
	TXP A P1 Width	HPA (HP Equipment)	TXU (HP Equipment)
		TXU (LP Equipment)	
	TXP A P2 Width	HPA (HP Equipment)	TXU (HP Equipment)
		TXU (LP Equipment)	
	TXP A Pulse Power Variation	HPA (HP Equipment)	TXU (HP Equipment)
		TXU (LP Equipment)	
	Transmission Rate	TXU	RXU
	ident Status	TXU	
	Ident Code	TXU	
	1350 Hz ID Tone Period (741 us)	TXU	
	Dash Length	TXU	
	Dot Length	TXU	
	ID Keydown Length	TXU	
	Ident Period	TXU	
	Ident Length	TXU	
	Beacon Delay (Autodiagnosis)	MTU	
	Pulse Pair Spacing (Autodiagnosis)	MTU	
CMU	BITE 24 V	CMU	
	BITE 5 V	CMU	
	BITE 3.3 V	CMU	

Table 5.2-1: TROUBLESHOOTING TABLE

ALARM		POSSIBLE FAILTY MODULE	
GROUP	**PARAMETERS**	**1º**	**2º**
	BITE 2.5 V	CMU	
	BITE 1.2 V	CMU	
	BITE Power Good	CMU	
	BITE LO Not Locked	CMU	
	BITE Watchdog Timeout	CMU	
HPA	Internal Voltage	HPA	
	Input Power	HPA	TXU
	Forward Power	HPA	TXU
	Reverse Power	HPA	
	Temperature	HPA	
	Flash Integrity	HPA	
	Polling	HPA	CMU
TXU	Internal Voltage	TXU	
	LO Input Power	TXU	
	Forward Power	TXU	
	Reverse Power	TXU	HPA(HP Equipment)
	Temperature	TXU	
	Flash Integrity	TXU	
	Polling	TXU	CMU
RXU	Internal Voltage	RXU	
	LO Power	RXU	
	LO Not Locked	RXU	
	Flash Integrity	RXU	RCU
	AC Fail	PSU	
	AC I/P Level	PSU	
	DC O/P Level	PSU	
PSU	Rectifier Fail	PSU	
	PSU Alarm Status	PSU	

5.2.3 Replacement procedure for Line Replaceable Units

5.2.3.1 Introduction

This section contains information relating to the replacement of line replaceable units (LRUs) during field servicing. These LRUs are the modules or subassemblies that may be changed when faults occur in an operational beacon. Faulty units would normally be returned to a maintenance depot for repair. This section includes the following details:

- Section 5.2.3.2 contains a list of the recommended LRUs.
- Section 5.2.3.3 contains removal/replacement instructions for LRUs.
- Section 5.2.3.5 contains a list of the tests that are required following replacement of any LRU, and identifies the section of the handbooks in which each required test procedure is detailed.
- Section 5.3 contains guidance material to assist in the location of faulty units.

5.2.3.2 Recommended Line Replaceable Units

This section lists the recommended line replaceable units required for the field servicing of a DME type LDB-103. Table 5.2-2 lists the LRUs for an equipment.

In the table, the following apply:

- The three-letter unit identifiers are shown thus - MTU.
- Subassemblies contained within a main unit have the parent unit identifier shown in brackets, thus - [MTU].

Table 5.2-2: RECOMMENDED LRU SPARES FOR A DME

ASSEMBLY / SUBASSEMBLY		
IDENTIFIER	**NAME**	**TYPE No.**
LCU	Local Control Unit	0063420003100
RCU	Relay Change-Over Unit	0063420003200
CMU	Control and Monitoring Unit	0063420004100
MTU	Monitor Transponder Unit	0063420004200
RXU	Receiver Unit	0063420004300
TXU	Transmitter Unit	0063420004400
HPA	High Power Amplifier	0063420004500
NMP/EIU	Network Management Processor/External Interface Unit	0063420007000
	Rectifier Module	0063420005500

5.2.3.3 Removal/Replacement Instructions for LRUs

5.2.3.3.1 Introduction

The NORMARC LDB-103 then contains a number of line replaceable units (LRUs) which can be replaced during field servicing. Most of the units may be removed by using the procedures detailed in the section 5.2.3.3.2 below.

5.2.3.3.2 General Instructions

NOTE: These general instructions apply to all units for which special instructions are not specified. Units may be reassembled by reversing the order of actions used for their removal.

Please, always use a properly fitted and grounded wrist strap connected to the bonding point to the equipment when handling the NORMARC LDB-103 DME.

Separation of Modules from 3U or 6U Sub-Racks.

1. Loosen the captive retaining M2.5 screws. The HPA, TXU, LCU and RCU have four retaining screws; all other modules have two each.
2. Disengage the module from the back plane by pressing the two levers outward: the top one upward and the bottom one downward.
3. Prepare to support the unit once it is out clear of the supporting subrack. Pull the unit out of the sub-rack, sliding on its guiding rails.
4. When refitting, be aware of the re-engagement of the multipin connectors at the back of the module to their counterparts in the back plane. Be sure to obtain a positive, firm plugging action.

WARNING: the HPA module weights about 5 kgs, and may be quite warm, prepare to support the unit when it is clear of the supporting subrack.

Separation of Module from Power Supply Unit.

The PSU has two LRUs: the Rectifier and the Circuit Breaker. For field serving purposes, the Controller is integrated to the PSU chassis.

1. Loosen the captive retaining M4 screw. The Circuit Breaker has two retaining screws.
2. Prepare to support the unit once it is out clear of the supporting subrack. Pull the unit out of the sub-rack, sliding on its guiding rails.

WARNING: the rectifier modules weigh about 4 Kgs each, prepare to support the unit when it is clear of the supporting chassis.

Separation of PSU chassis

1. Unplug the cables from the Access Panel Distribution.
2. Loosen the captive retaining M4 screws. The chassis has four retaining screws.

Separation of NMP

1. Unplug the power cable.
2. Unplug the networking cables.
3. Unplug the plane cables.
4. Loosen the captive retaining M2.5 screw. The NMP has two retaining screws

For more details about NMP connections, see the Interconnection Diagram Document (0063410000100DI00) [RD.5].

5.2.3.4 Fault Location

A faulty DME beacon is serviced by replacing defective modules or subassemblies with corresponding operational spare units.

The following guidance information is given to assist technical personnel to locate a faulty module or subassembly after a beacon has shut down due to a failure.

- Alarms.

  The LCU panel and the GUI includes a group of indicators via its web page to show which alarms are active or were present when a beacon was switched off. When technical personnel visits a beacon shut down due to a fault, the alarm register and sit logs should be examined before switching the beacon on again. The alarm indicated shows which parameters were out of tolerance, and this often suggests which subsystem is at fault.

  If there is an executive alarms, the technical personnel should think about the signal flow and the diagram of responsibilities to know which module or subassembly has faulty.

- Adjustment

  There is no hardware adjustment in the NORMARC LDB-103 DME that is recommended to be done in the field during maintenance visits.

5.2.3.5 LRU Replacement Tests

This section details the tests and/or adjustments required to be made to an operational beacon following the replacement of any module or subassembly. The information is presented in tabular form, as follows:

- Column 1 lists the module or subassembly.
- Column 2 contains a brief statement of the parameter or performance function required to be checked, or adjustments required to be made, as applicable.
- Column 3 refers to the relevant section of this handbook where the detailed procedure for the required check, measurement, or adjustment may be found.

If any module or subassembly is replaced during servicing, then the procedures listed for that unit MUST be performed to restore the beacon to operational status. All other units in the beacon must be in normal working order.

Table 5.2-3: LRU REPLACEMENT TESTS

MODULE or SUBASSEMBLY	PARAMETER TO BE CHECKED or ADJUSTMENT TO BE MADE		REFER TO SECTION
0063420003100 **Local Control Unit** LCU	1	DC voltage rails at POWER LED– FRONT PANEL	3.4
	2	Tab navigation (touch screen functionality) - LCU	3.4
	3	Control and data accuracy display - (connectivity) - LCU	3.4
	4	LCU Layout View - LMT	4.7.5.13
0063420003200 **Relay Control Unit** RCU	1	DC voltage rails at POWER LED– FRONT PANEL	3.5
	2	Connectivity Web Browser - LCU/LMT	4.7.2
	3	MTU Assignment Policy - LMT	4.7.5.9
	4	Switch Over activity - LCU/LMT	4.7.5.9
	5	Alarm inhibit operation - LCU/LMT	4.7.5.9
	6	Recycle Configuration - LMT	4.7.5.9
0063420004100 **Control & Monitor Unit** CMU	1	DC voltage rails at POWER LED– FRONT PANEL	3.6
	2	Connectivity Web Browser - LCU/LMT	4.7.2
	3	Verify the RU fitted - LMT	4.7.5.2
0063420004200 **Monitor Transponder Unit** MTU	1	DC voltage rails at POWER LED – FRONT PANEL	3.7
	2	Connectivity Web Browser - LCU/LMT	4.7.2
	3	Change Mode - LMT	4.7.4.11
	4	Change frequency - LMT	4.7.5.4
	5	Radiated Power Offset - LMT	4.7.5.6
	6	Transmitted/Radiated Power measurement Offset - LMT	4.7.5.6
	7	Monitor Ident Detection – LMT	4.7.5.3
	8	Configure the transmitted and received power thresholds - LMT	4.7.5.8
0063420004300 **Receiver Unit** RXU	1	DC voltage rails at POWER LED – FRONT PANEL	3.8
	2	Connectivitiy Web Browser - LCU/ LMT	4.7.2
	3	Change frequency -LMT	4.7.5.4
	4	Transmitted/Radiated Power measurement Offset - LMT	4.7.5.6
0063420004400 **Transmitter Unit** TXU	1	DC voltage rails at POWER LED – FRONT PANEL	3.9
	2	Connectivity Web Browser - LCU/LMT	4.7.2

Table 5.2-3: LRU REPLACEMENT TESTS

MODULE or SUBASSEMBLY	PARAMETER TO BE CHECKED or ADJUSTMENT TO BE MADE		REFER TO SECTION
	3	Change Mode - LMT	4.7.4.11
	4	Check power and pulse characteristics - LMT	4.7.5.7
	5	Transmitted Power Offset - LMT	4.7.5.5
	6	Transmitted/Radiated Power measurement Offset - LMT	4.7.5.6
	7	Monitor Ident Detection -LMT	4.7.5.3
	8	Verify the Interlock - LMT	4.7.5.10.8
0063420004500 **High Power Amplifier** HPA Module	1	DC voltage rails at POWER LED - FRONT PANEL	3.10
	2	Connectivity Web Browser - LCU/LMT	4.7.2
	3	Change frequency - LMT	4.7.5.4
	4	Verify the RU fitted - LMT	4.7.5.2
	5	Check power and pulse characteristics - LCU/ LMT	4.7.5.7
0063420004400 **Power Supply Unit** PSU	1	PSU connectivity - PSU or LMT	3.11
	2	PSU configuration - LMT	4.7.8.3

5.3 ACCESORIES AND TEST EQUIPMET

No special accessories and test equipment are required to perform the preventive and corrective maintenance.

5.4 ADDITIONAL MAINTENANCE CAPABILITIES

5.4.1 Introduction

Although the procedures described in this section are not required for a normal maintenance of the equipment, they provide additional information about its status.

In this section it is explained how to access to the most interesting signal of the signal flow. They are divided in two groups: firstly, the signals obtained though the test connector of each module and secondly the signal obtained though the Output Samples Front Panel[11].

[11] Only for NORMARC LDB-103 DME Model .31 and Model .41

5.4.2 Test Points

Test points are provided at the test port, a 20-way connector located at the front of each DME module.

As all waveforms are digitally synthesized they are accessible only at I/O ports of some amplifiers and analog filters. As a result, test parameters available at test port for most modules are principally values of voltage rails and digital status of functional identities such as PLL locks etc.

Relevant waveforms whose appearances in shapes and magnitudes should ensure proper operational status for the beacon, are listed below. The actual waveforms that are displayed include the following:

- MTU TRIGGER and VIDEO signal.
- MTU local oscillator DIVIDED_FREQ.
- MTU INT FRAME TRIGGERS, PULSE DETECTION and REPLY DETECTION.
- RXU VIDEO.
- OL_SAMPLE.
- RXU INT DETECTION and PULSE DETECTION.
- SQUITTER REPLIES pulses.
- ALL REPLIES pulses.
- IDENT envelope.

An extender card can be used for facilitating access to individual pin of the 20-way test connector located in the front panel of the equipment modules. It is plugged into the 20-way socket and its pinning is defined by the module definition for its own 20-way connector pinning.

5.4.2.1 LCU Test Connector

N/A

5.4.2.2 RCU Test Connector

Table below lists RCU test connector pin allocation.

Table 5.4-1: RCU TEST CONNECTOR ALLOCATION

PIN NUMBER	SIGNAL NAME	PIN NUMBER	SIGNAL NAME
1	N/U	11	+5V
2	GND	12	+3.3V
3	N/U	13	+24B_CTRL
4	+2.5V	14	+24A_CTRL
5	TP2	15	+4.1V
6	+2.5V	16	N/U
7	+1.2V	17	N/U
8	VRLY (12V)	18	N/U

Table 5.4-1: RCU TEST CONNECTOR ALLOCATION

PIN NUMBER	SIGNAL NAME	PIN NUMBER	SIGNAL NAME
9	N/U	19	N/U
10	+24V_COMMON	20	GND

5.4.2.3 CMU Test Connector

Table below lists CMU test connector pin allocation.

Table 5.4-2: CMU TEST CONNECTOR ALLOCATION

PIN NUMBER	SIGNAL NAME	PIN NUMBER	SIGNAL NAME
1	AGND	11	+24V
2	N/U	12	+5V
3	N/U	13	+3.3V
4	N/U	14	SPARE
5	N/U	15	+4.1V
6	AGND	16	N/U
7	PGOOD	17	N/U
8	+1.2V	18	N/U
9	+2.5V	19	N/U
10	+24V_RAW	20	AGND

5.4.2.4 MTU Test Connector

Table below lists MTU test connector pin allocation.

Table 5.4-3: MTU TEST CONNECTOR ALLOCATION

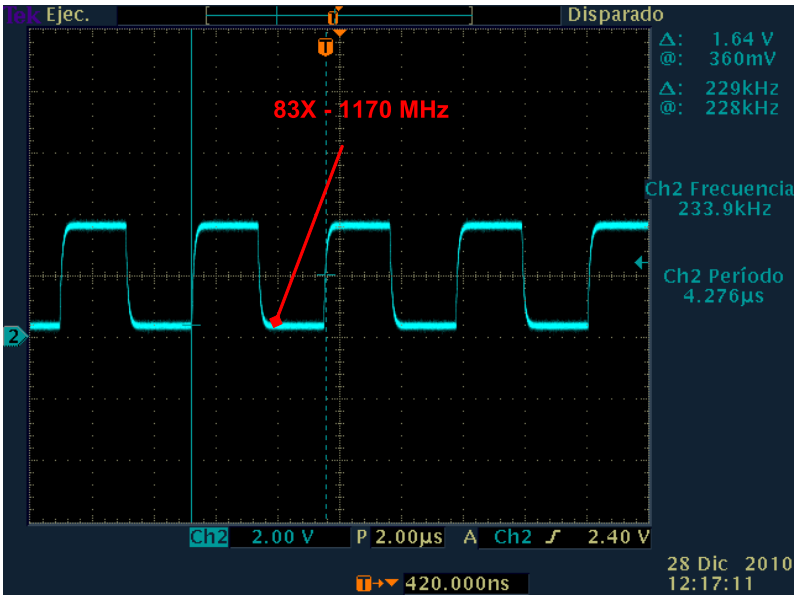
PIN NUMBER	SIGNAL NAME	PIN NUMBER	SIGNAL NAME
1	+24V_CTL	11	AGND
2	+24V_RF	12	VIDEO_ANTENNA_PROBE_TEST
3	AGC_CTRL_TEST	13	DIVIDED_FREQ
4	+5V_ANALOG	14	MOD_CTRL_TEST
5	+12V	15	INT FRAME TRIGGERS
6	-5V	16	PULSE DETECTION
7	+5V_DIG	17	REPLY DETECTION
8	+3.3V_DIG	18	REPLY GATE
9	+2.5V_DIG	19	PRIMARY TEST ENABLE
10	+1.2V_DIG	20	DGND

5.4.2.5 RXU Test Connector

Table below lists RXU test connector pin allocation.

Table 5.4-4: RXU TEST CONNECTOR ALLOCATION

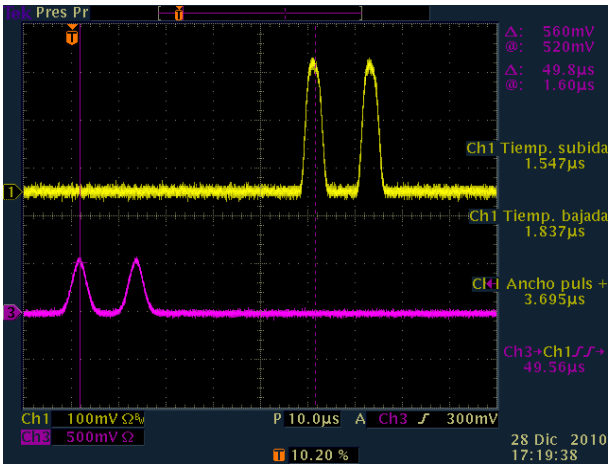
PIN NUMBER	SIGNAL NAME	PIN NUMBER	SIGNAL NAME
1	OL_SAMPLE	11	AGND
2	PGOOD	12	+3.3V_DIG
3	VIDEO_CH1	13	+3.3V_A
4	SPARE_1	14	+5V_DIG
5	INT DETECTION	15	+5V_A
6	PULSE DETECTION	16	+12V
7	SPARE_OUT3	17	+24V_CTL
8	+2.5V_TEST	18	+24V_RF
9	+1.2V_TEST	19	+28V
10	+3.3V_TEST	20	DGND



233,99962 kHz

PIN 1 - RXU TEST CONNECTOR [OL divided by 5000] **FREQ. COUNTER**

Figure 5.4-1: PIN 1- RXU TEST CONNECTOR



PIN 5 - RXU TEST CONNECTOR[INTERROGATION DETECTION (purple signal)
(Yellow signal is the reply detected by the MTU)

Figure 5.4-2: PIN 5- RXU TEST CONNECTOR

NOTE: It is an un-calibrated output.

5.4.2.6 TXU Test Connector

Table below lists TXU test connector pin allocation.

Table 5.4-5: TXU TEST CONNECTOR ALLOCATION

PIN NUMBER	SIGNAL NAME	PIN NUMBER	SIGNAL NAME
1	+24V_CTL	11	AGND
2	+24V_RF	12	VDETECT_RF_FWD
3	+48V	13	PULSE_GATE
4	+5VA	14	DETECT_IN
5	+12VA	15	TX_GATE
6	-5VA	16	SQUITTER REPLIES
7	+5V_DIG	17	IDENT ENVELOPE
8	+3.3V_DIG	18	ALL REPLIES
9	+2.5V_DIG	19	FPGA_TEST_4
10	+1.2V_DIG	20	FPGA_TEST_5

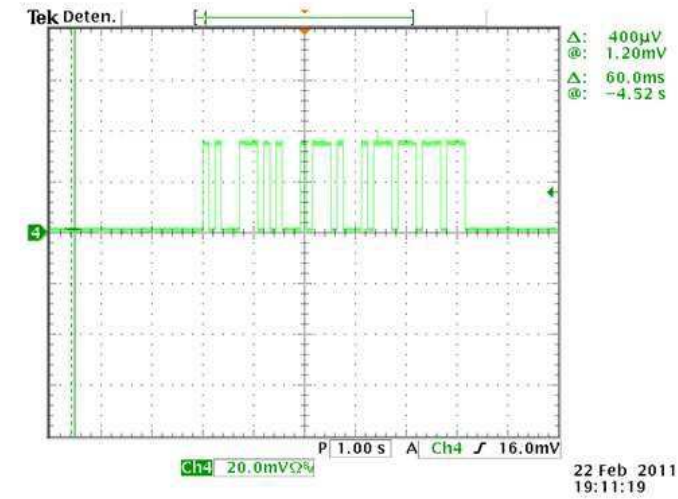
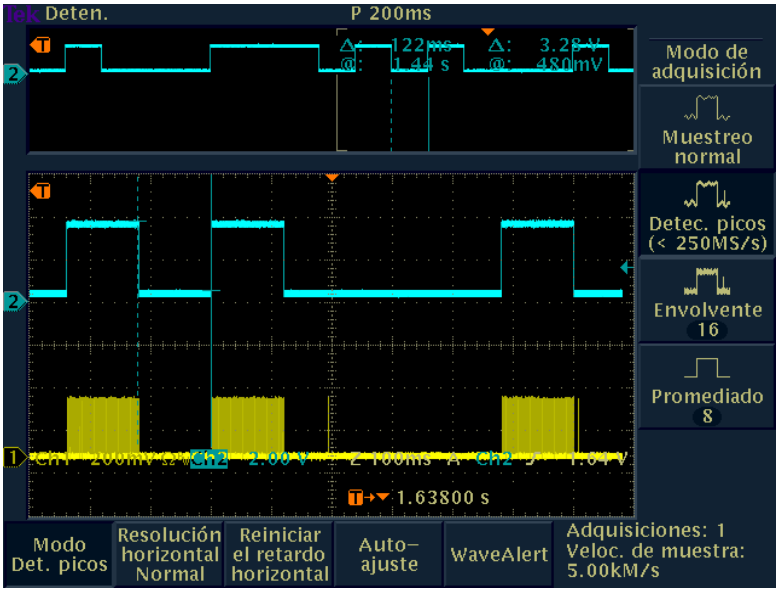


Figure 5.4-3: PIN 17- TXU TEST CONNECTOR



200 ms/div
snapshot

Figure 5.4-4: PIN 17- TXU TEST CONNECTOR

5.4.2.7 HPA Test Connector

Table below lists HPA test connector pin allocation.

Table 5.4-6: HPA TEST CONNECTOR ALLOCATION

PIN NUMBER	SIGNAL NAME	PIN NUMBER	SIGNAL NAME
1	+24V_CTRL	11	GND
2	+24V_RF	12	VDETECT_RF_IN_TEST
3	+48V	13	VDETECT_RF_FWD_TEST
4	+5V	14	VDETECT_RF_REV_TEST
5	-5VA	15	CTRL_GATE_TEST
6	NO CONNECT	16	TX_GATE_TEST
7	+3.3V	17	NO CONNECT
8	+3.3V_DIG	18	NO CONNECT
9	+2.5V_DIG	19	NO CONNECT
10	+1.2V_DIG	20	GND

5.4.3 Measurements

The measurements contained in this section are only available for NORMARC LDB-103 DME Model .31 and Model .41. These signals are available through de Output Samples Front Panel module.

5.4.3.1 Low Power DME Pulse Characteristics

Figure 5.4-5 and Figure 5.4-6 show typical reply pulses response for a low power LDB-103.

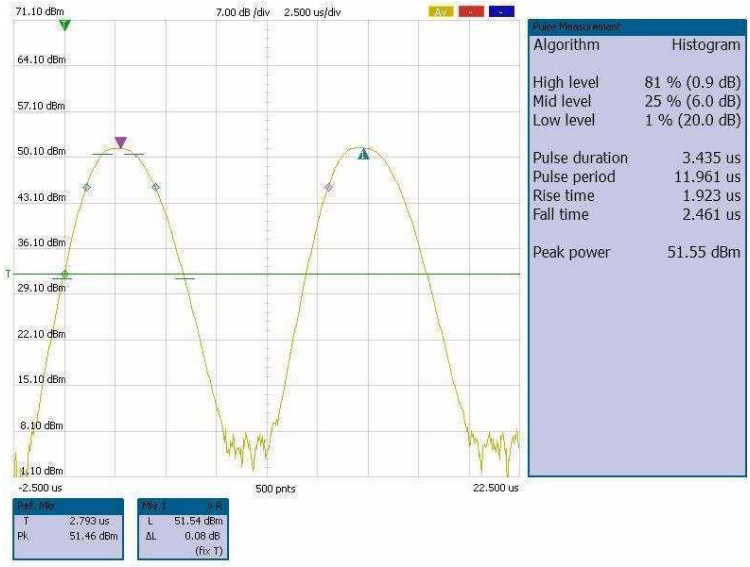


Figure 5.4-5: LOW POWER PULSES CHANNEL 1X - 962 MHz



Figure 5.4-6: LOW POWER PULSES CHANNEL 126X - 1213 MHz

5.4.3.2 High Power DME Pulse Characteristics

Figure 5.4-7 and Figure 5.4-8 show typical reply pulses response for a high power LDB-103.

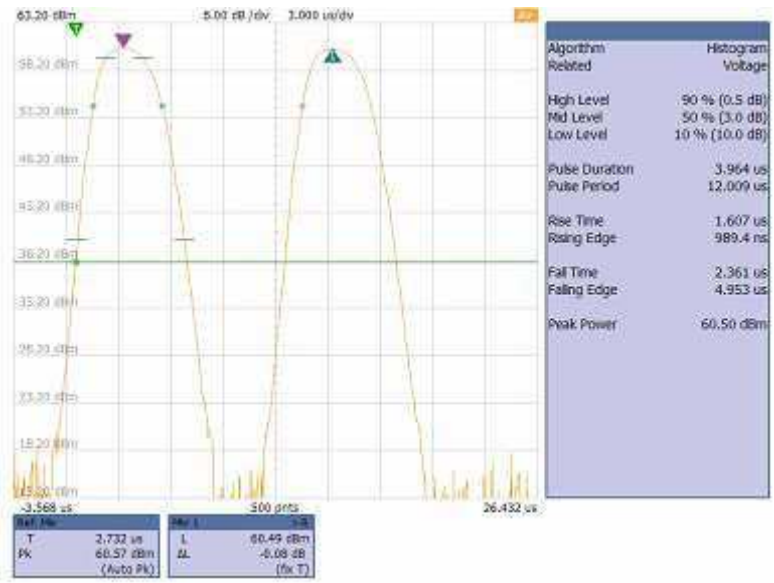


Figure 5.4-7: HIGH POWER PULSES CHANNEL 1X - 962 MHZ

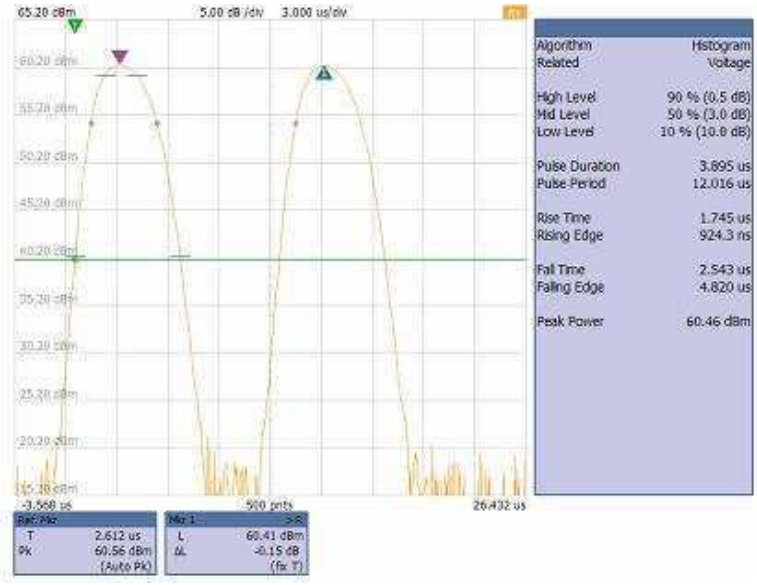


Figure 5.4-8: HIGH POWER PULSES CHANNEL 126X - 1213 MHZ

5.4.3.3 Transmitted Spectrum - High Power DME

Figure 5.4-9 and Figure 5.4-10 show typical transmitted spectrums for a high power LDB-103.

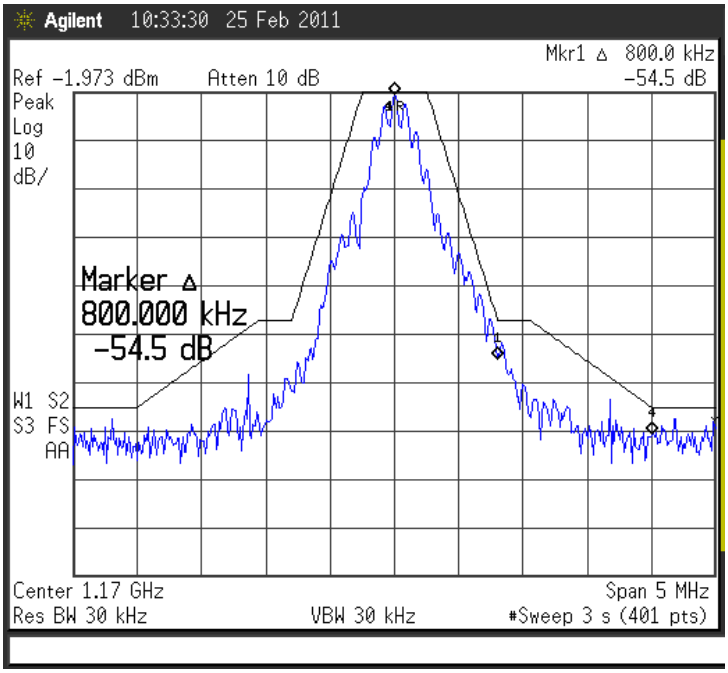


Figure 5.4-9: TRANSMITTED SPECTRUM - HIGH POWER LDB-103

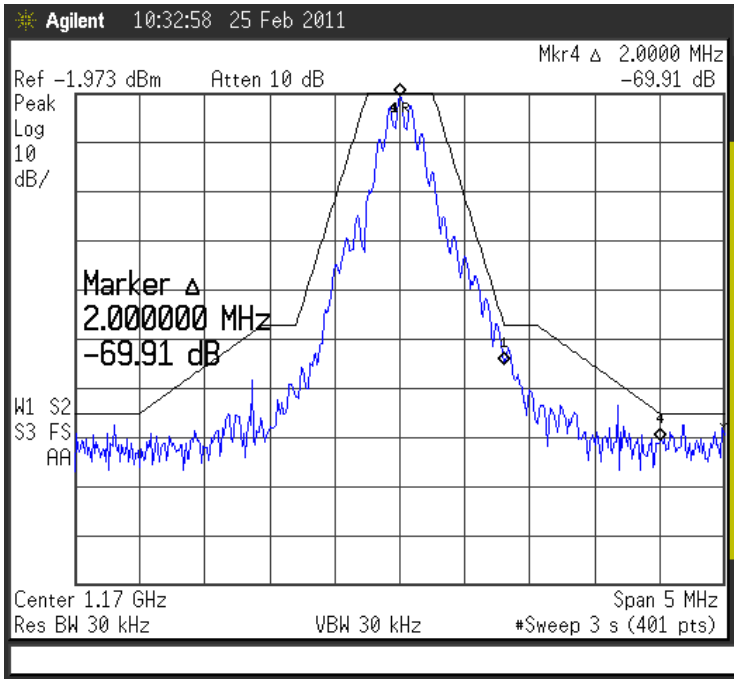


Figure 5.4-10: TRANSMITTED SPECTRUM - HIGH POWER LDB-103

5.4.3.4 Transmitted Spectrum - Low Power DME

Figure 5.4-11 and

Figure 5.4-12 show typical transmitted spectrums for a low power LDB-103.

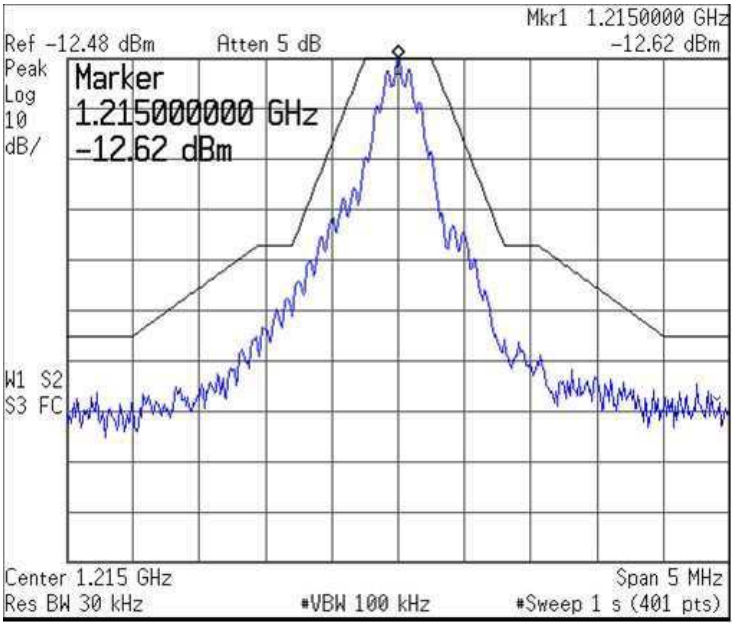


Figure 5.4-11: TRANSMITTED SPECTRUM - LOW POWER LDB-103

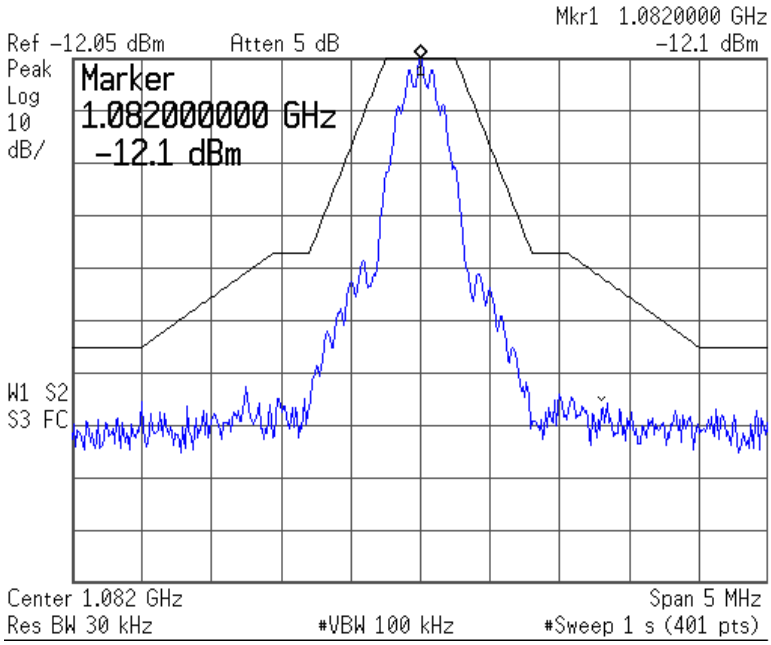


Figure 5.4-12: TRANSMITTED SPECTRUM - LOW POWER LDB-103

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6. SYSTEM INSTALLATION

6.1 INTRODUCTION

This section describes the recommended procedures for installing a DME beacon type LDB-103. The procedure is compiled in a sequence which provides the simplest installation plan. Some details are determined by particular site characteristics and can only be decided locally; these items, listed below, are not covered in this document.

Details not covered are:

1. Site preparation.
2. Assembly of antenna mast.
3. Assembly of equipment shelter.
4. Laying of power cables and control and monitoring cables.
5. Assembly and wiring of workbench, lights and power outlets in the equipment shelter.
6. Mounting and connections to the remote control facility.

Note: If wet cell batteries are used, the design of the equipment shelter should not overlook the necessity to locate the batteries in a room separated from the main equipment. The battery room must have adequate ventilation to prevent accumulation of fumes. An alternative arrangement is to house the batteries in a suitable box outside the main shelter, again with adequate ventilation.

A typical equipment shelter layout is shown in Figure 6.4-8.

If sealed gel type batteries are used, then the batteries may be placed in the same room as the equipment. In fact, compartment within the equipment cabinet is reserved for the inclusion of batteries for up 28 hours (100 W model) or 11.5 hours (1 kW model) of operation (27000 pps) in the case of AC power failure.

This section is written in a sequence, which provides the simplest installation plan.

This manual does not give installation details of the optional Remote Maintenance Monitoring (RMM) system. If an RMM system is to be used with the DME, then refer to installation instructions in the separate RCSUs system handbooks (0066910000100MA04 [RD.6] and 0066910000600MA00 [RD.7]).

6.2 SAFETY PRECAUTIONS

It is the task of the Site Supervisor or Construction Manager to make available the materials supplied by Indra, independently procured special materials and tools. For every site, strict attention should be paid to safety regulations issued by the local authorities. For details, please read the **WARNING** and **CAUTION** instructions in the preliminary pages of this manual.

6.2.1 General Rules

The following rules should be observed for prevention of accidents:

- Consumption of alcohol in any form is forbidden on the installation site.
- Drunken persons or those under the influence of alcohol will not be tolerated on the installation site.
- Protective goggles and safety gloves should be worn when work is being carried out on batteries. Rinsing water, soda and several cleaning cloths should be available.
- Sturdy shoes, safety gloves and safety helmets should be worn.
- Protruding nails, strips etc. must be removed immediately. Ladders and planks must always be carefully checked before use.
- Do not tread on protruding plank sections.
- Never leave objects on scaffolding or ladders.
- Scaffolding or frames are to be erected sturdily and must always be tested before use.
- Test electrical devices and extension cables for accident safety.
- Remove fuses before carrying out work on mains power supplies.
- If it is necessary to work within live equipment, ensure that adequate precautions are taken to protect the safety of personnel. See WARNING in preliminary pages of this manual.
- Wear protective goggles when carrying out sanding or drilling operations.
- Sand off burr from chisels and punches in good time.
- Test striking tools for tightness of fit.
- Do not put pointed or sharp objects into working-clothing pockets.
- Jewellery such as chains and rings should be removed when working on building sites - especially when working with electrical devices.
- Always keep escape routes clear.
- Every employee on an installation site should know the following:
  - Where the First-Aid box is kept
  - The telephone number of the nearest casualty doctor and eye specialist
  - Where the fire extinguisher is kept
  - The location of hazardous areas on the way to the work place, or at the work place itself.
- The door of the shelter or equipment room should be locked when personnel are absent.

6.3 SITE REQUIREMENTS

The responsible Civil Aviation Authority, according to the international air traffic regulations, determines the area in which a DME beacon is to be installed. The area is dependent on the type of obstacle involved and also clearance and runway configuration (e.g. overrun, clearway, stopway) in case the equipment is to be located in the terminal area. The following site selection guidelines are general recommendation and only guiding environmental conditions for information.

The exact environmental conditions are locally dependent decisions, which are made during installation. They are computed with formulas, which take into account the terrain and other obstacles. The installation is determined by means of a site survey at which a Surveyor must always be present. Indra can provide an Engineering Consultant on site for this survey if required.

DME installation area selection depends on the following conditions:

1. Terminal Area beacon.
    a. DME (substituting or integrating MARKER functions) placed with ILS equipment. In this case, the DME antenna, usually a directional antenna, is mounted on the Glide Slope antenna mast and the DME equipment is installed inside the Glide Slope shelter.
    b. Stand-alone. The DME with omnidirectional antenna is mounted on its own mast and the equipment is installed into a suitable shelter. The area is dependent on clearance and runway configuration.
2. En-route Beacon. External zone site and normally far away from the terminal area, with or without associated VOR equipment.

The ground DME beacon may be installed in a control room or inside a shelter, which complies with the environmental temperature, humidity and pressure values listed in the detailed technical specification for the appropriate CAD Series DME being installed.

6.4 DME RACK INSTALLATION

The technician must perform the following operations when installing the DME rack:

- Select and prepare the site.
- Unpack and check the equipment.
- For a typical installation:
    - Ground the equipment.
    - Connect the power supplies.
    - Connect the antenna.
    - Connect DME external interfaces and Remote Monitoring System.
- It may be necessary to make the following connections, depending on the DME configuration selected and the options used:
    - Connection with associated VHF navaid equipment.
    - Connection to GPS Antenna.

6.4.1 Installation Items required

This section lists all the major ancillary items needed for the installation of a NORMARC LDB-103 DME station, which are NOT supplied by the manufacturer, and references them to the sections in which they are specified.

6.4.1.1 Hardware

1. Power cable for mains supply connection, rated for 240 volts, 8 amperes minimum. Conventional flexible 3-core 1.5 mm^2 mains cable is sufficient. (Qty 2 required for a DME): see Section 6.4.6.1.

   It is strongly recommended to install between the site main AC supply and the equipment AC input, one 16 Amperes Thermal Magnetic Circuit Breaker as protection circuit against short-circuit currents and against overload currents. In the same way, a 16A/30mA in-line power breaker is strongly recommended as a protection against live and neutral earth faults.
2. Power cable for connection to batteries. Recommended type is 25mm^2 stranded flexible and PVC insulated cable.
3. Battery terminal lugs to suit batteries used: see Section 6.4.6.2.
4. Battery supply fuse (if required); if used, it is to be slow blow (delay) type, 32 amperes rating, HRC type or equivalent: see Section see Section 6.4.6.2.
5. Antenna mounting pipe, diameter to suit antenna used: see Section 6.5.
6. Antenna obstruction lights (if to be fitted): see Section 6.5.
7. Mains power cable for connection to antenna obstruction lights (if fitted): see Section 6.5.
8. Cable strain bracket (if required): see Section 6.5.
9. Cable(s) for earthing rack to earth bus (not less than 20 square mm area of copper total) and lugs as necessary: see Section 6.4.5
10. Wooden plinth for mounting rack: see Section 6.4.4.
11. Masonry anchors for securing plinth: see Section 6.4.4.
12. Coach screws 120 mm long by 10 mm diameter, for securing rack to wooden plinth; Qty 4 per rack: see Section 6.4.4.

The following are required only if the unit is NOT collocated with other equipment requiring extensive grounding; otherwise, use a common earth bus for all equipments (see Section 6.4.5).

1. Grounding stakes, 2 metres long minimum; Qty 2 minimum.
2. Earth bus, copper bar 25 mm by 3 mm; lengths as necessary for the installation.
3. Mechanical and electrical fittings for earth bus (screws, lugs, cable).

6.4.1.2 Tools

As well as normal hand tools appropriate to the installation of an electronic system such as the LDB 103 DME, the following special items are required:

1. Two wrenches, 13/16 inch capacity (for termination of antenna feeder (1/2") and monitor (1/4") outdoor cables).
2. Crimp tool for fixing type N connectors on type RG-213 coaxial cable (for termination of the indoor RF cables).

6.4.1.3 Test Equipment

Test equipment required is specified in Section 6.7.

6.4.2 Unpacking and Rack inspection

REFER Section 3 for major item dimensions and weights.

The equipment should be unpacked as soon as possible in order to check that it is complete and intact. The wired DME rack is packed in a large wooden crate with most plug-in modules in place. Heavier modules like power supply rectifiers are packed separately in their own boxes and must be re-assembled on site.

This wooden crate is shipped horizontal with the opening lid facing up.

To open the crate:

1. Partially unfasten the lid, leaving the last two opposite fasteners in place.
2. In a clear area, turn the crate to stand it upright.
3. Open the lid and carefully slide out the partly populated cabinet.

Ensure that the partly populated cabinet is protected from impacts.

Carefully unpack the rack, modules, cables and put packing material to storage for possible re-use. Check for any damage that may have occurred during transit, particularly to the connectors at the rear.

Check that all items of equipment are present. Refer to Section 3 for a list of the major items.

Any place of storage used for any intermediate storage period must be dry and the temperature range specified in the detailed technical specification must be conformed to.

6.4.3 Module Assembly

REFER Section 3 for drawings of DME rack assembly and its front view for location of modules.

After unpacking:

1. Replace any screws or fasteners that are found lying loose inside the rack as a result of vibration in transit.
2. Check that no module guide rails have come loose during transit.
3. Fit into the rack, all remaining modules.
4. Check that the following electronic sub-units are properly mounted in the cabinet. The module name is also printed above the connector on the subrack motherboards. This is visible from the front of the rack when the modules are removed.

   Record the serial numbers of the installed modules, and ensure they are the ones listed on the packing list and the Factory Test Report, which accompanies the equipment.

A common rack configuration is provided below.

For the 3U DME subrack 1:

- Local Control Unit [LCU], P/N: 006342 00031 00.
- Relay Change-Over Unit [RCU], P/N: 006342 00032 00.

For the 6U DME subrack2, from Left to Right:

- High Power Amplifier 1 [HPA] [12], P/N: 006342 00045 00.
- Transmitter Unit 1 [TXU], P/N: 006342 00044 00.
- Receiver Unit 1 [RXU], P/N: 006342 00043 00.
- Monitor Transponder Unit 1 [MTU], P/N: 006342 00042 00.
- Control and Monitor Unit 1 [CMU], P/N: 006342 00041 00.
- Control and Monitor Unit 2 [CMU], P/N: 006342 00041 00.
- Monitor Transponder Unit 4 [MTU], P/N: 006342 00042 00.
- Receiver Unit 2 [RXU], P/N: 006342 00043 00.
- Transmitter Unit 2 [TXU], P/N: 006342 00044 00.
- High Power Amplifier 1 [HPA] [13], P/N: 006342 00045 00.

For external connections:

- Network Management Processor/External Interface Unit, P/N: 006342 00061 00.

5. Secure the front panel module locking screws.
6. The cabinet is next moved to its final position. It should now be secured to the floor before further assembly.

6.4.4 Placement of DME Rack

The equipment room/shelter should be provided with in-floor ducts for the earth bus, DC input power cables from the battery room and AC mains power cables. If required, remote control cables can also be ducted; recommended duct size is 150 mm by 100 mm.

The rack should be mounted on its four footing brackets bolted into the floor to enable about 60 mm floor clearance; leave at least 800 mm clearance from the wall behind the rack for access. The mounting centres and general details can be seen in Figure 6.4-1.

[12] Only for HPA model.

[13] Only for HPA model.

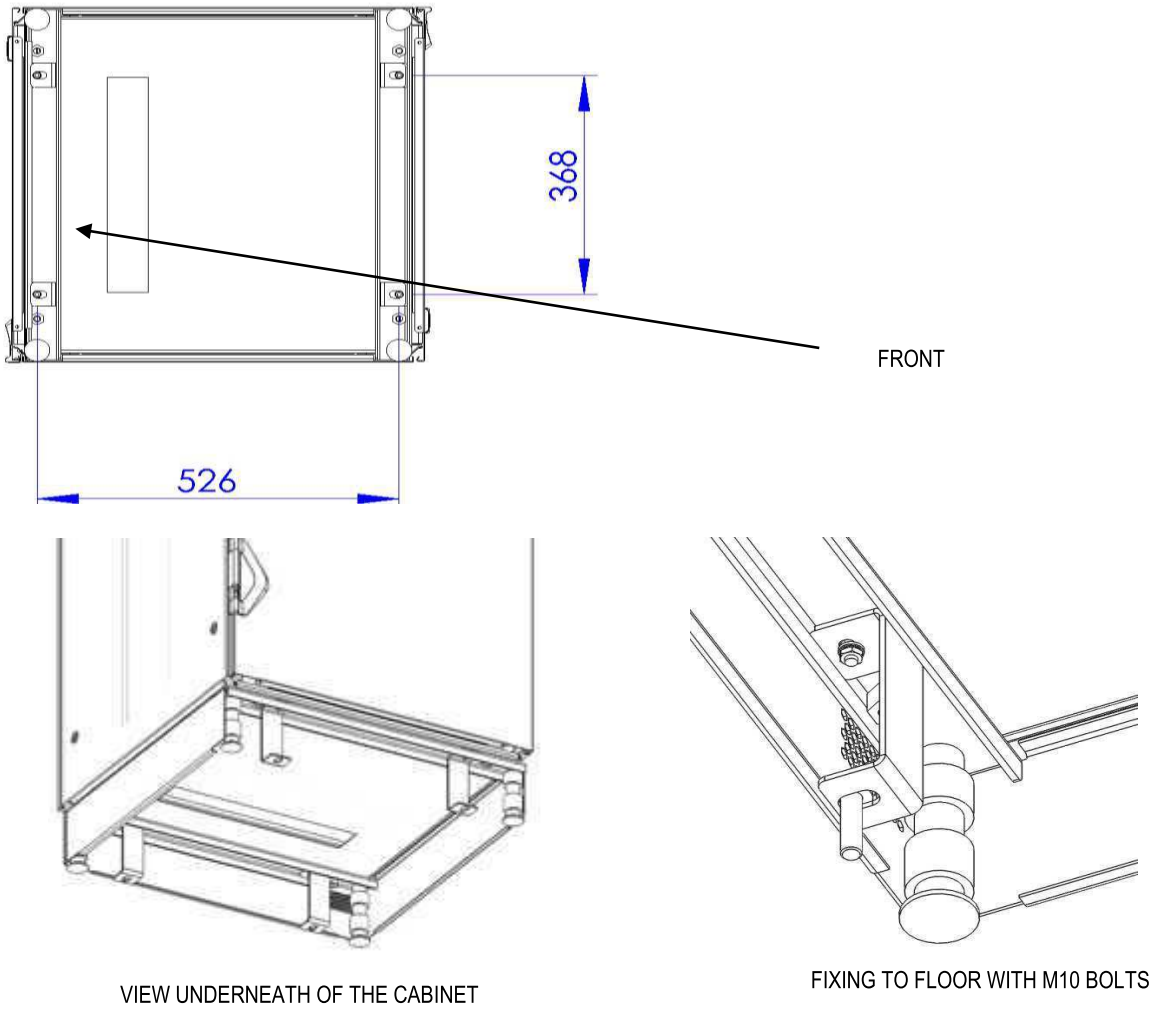


Figure 6.4-1: RACK PLACEMENT

6.4.5 Equipment Earthing

Very good ground connections between the rack and the installation ground are essential.

It is recommended that 2-metre long copper stakes be used, with a minimum of two stakes spaced about 1750 mm apart and connected together at their tops with 25 mm by 3 mm copper bar, or very heavy PVC-covered cable. Copper braid must not be used. If the ground contains a high percentage of non-conductive elements such as silica or calcium, longer stakes should be used.

A copper earthing bar at least 25 mm by 3 mm should be fitted inside the shelter. The copper bar should pass through the wall of the shelter and be bolted securely to the copper bar or cable joining the ground stakes.

The site earth system, available at the copper bar, is now to be connected to the equipment at the cabinet earth anchor bolt using heavy duty multi-strand earthing cable fitted with lugs at each end. This anchor bolt is located at the bottom RHS looking from the back of the cabinet, behind the AC INPUT BOX.

Note that within the cabinet, the anchor bolt joins with the equipment earth system via the central copper bar that runs vertically along the RHS of the cabinet. The cable used to join the equipment earth to the site earth system should have a cross-sectional area of at least 25 square mm.

Three lightning arrestors are provided with the DME Installation Kit. These three arrestors are to be installed on the RF Cable Entry Panel, to protect the DME rack connection to the antenna against lightning discharges. The lightning arrestors must be properly grounded. For this purpose, a lighting arrestor grounding kit is provided within the DME Installation Kit.

In the following figure, recommended grounding of lightning arrestors is provided.

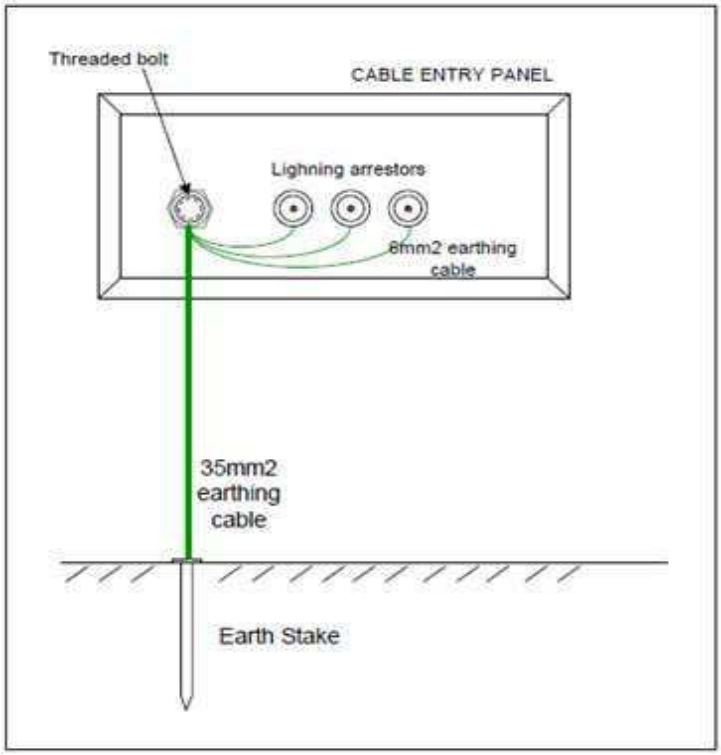


Figure 6.4-2: RECOMMENDED GROUNDING OF LIGHTNING ARRESTORS

An M10 threaded bolt (supplied with the Installation Kit) should be installed on the RF Cable Entry Panel to the shelter. This bolt should be electrically connected to the 3 lightning arrestors through the 6mm2 earthing cable and the lugs supplied (M10 at the threaded bolt and 3xM16 at the lightning arrestors). The threaded bolt should then be electrically connected to the closest earthing stake by means of the 35mm2 earthing cable and M10 lug supplied. Earthing cable must be run through the outside wall of the shelter.

6.4.6 Power Connections

6.4.6.1 AC connections

For a DME beacon installations, the AC mains supply cables are fed into the main rack through an elongated slot, in the base or the top of the rack, depending on the site requirements, and plugs into its switched socket designated as MAINS 1 and MAINS 2 on the AC INPUT BOX [006342 00013 HH]. In a system installation, two separate mains cables are required, one for each Power Supply Unit (PSU).

The AC INPUT BOX module provides independently main control and/or emergency stop switches for both mains supply lines. Three general purpose AC outlets are also available in EU, USA and AUS versions at the frontal panel of the AC INPUT BOX and fed by an independent mains line.

The mains terminal block cable colors are:

ACTIVE: BROWN;

NEUTRAL: BLUE;

EARTH: GREEN/YELLOW.

An additional power inlet is provided at the AC Input Box. This outlet is meant to be used to connect auxiliary or test equipment when required. It is recommended to connect this power outlet on the shelter Power Distribution Panel to a circuit breaker different from the one used to protect the DME rack.

No power should be connected to the rack until after installation is complete and beacon is ready for testing.

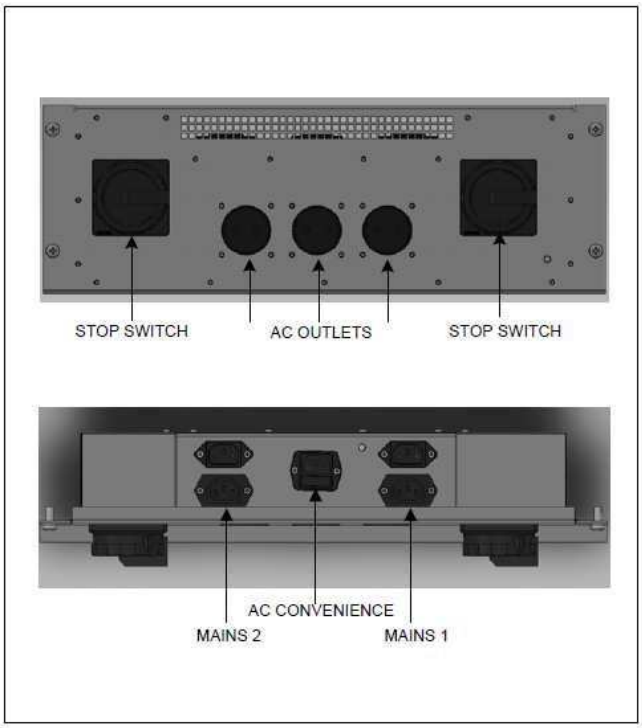


Figure 6.4-3: AC INPUT BOX [006342 00013 HH].

6.4.6.2 DC connections

The DC battery connection cable must be chosen to give a total voltage drop of less than 0.25 volts from the battery to the rack and rated to handle a maximum current of 12 amperes. This applies over the cable length in the particular installation at a normal load current for each set of equipment Main and Standby, about 12 amperes for a 1 kW beacon. Total cable loop resistance for the above currents is about 0.03 and 0.02 ohms respectively.

When the batteries are housed outside the rack, the cable from the battery bank is fed through a slot in the base or the top of the rack. It is connected to a pair of heavy duty terminals, marked BATTERY at the distribution panel at the rear side. It is recommended that the installation includes a delay fuse (32 amperes HRC, for example) in series with the batteries to prevent catastrophic short circuit conditions in the event of wiring damage; the DME equipment itself is protected by surge-proof circuit breakers.

Cables should be secured to convenient points within the rack, using cable ties. No power should be connected to the rack until after installation is complete and beacon is ready for testing.

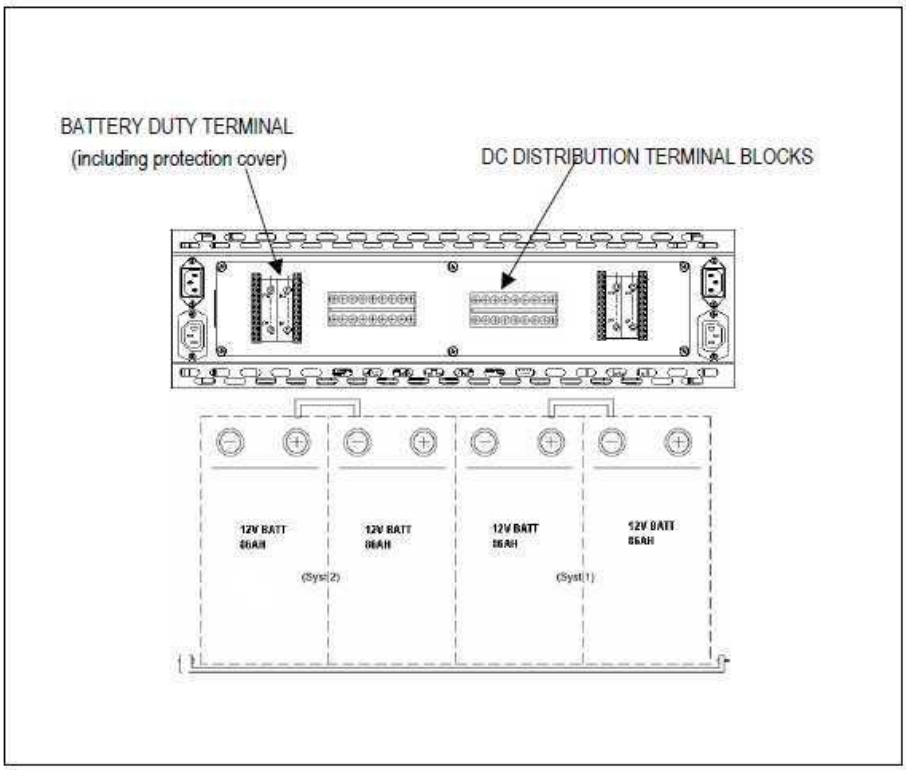


Figure 6.4-4: LAYOUT OF DC POWER DISTRIBUTION

6.4.7 External Wiring

All external signal connections to the DME rack are made to the NMP/EIU Assembly, which is mounted on the first third of the bottom part of the rack. The NMP/EIU is pre-wired to the different NORMARC LDB-103 modules.

The Figure 6.4-5 shows the front panel of the NMP/EIU assembly [006342 00061 00] in its fully equipped versions.

All NMP/EIU connectors, DB or RJ45, are accessible at its front panel. These connections include IDENT/ILS interfaces, auxiliary site status alarms, LAN and WAN ports for remote communications as well as hardwired status and remote signals upon customer request.

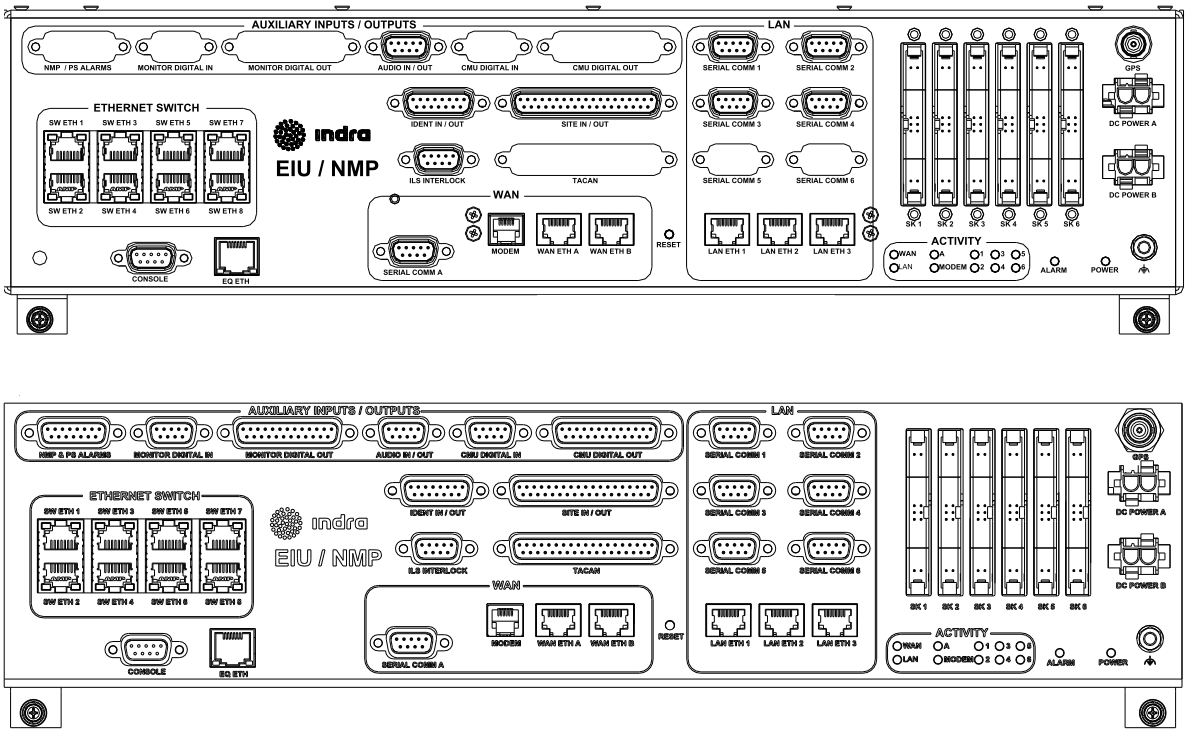


Figure 6.4-5: NMP/EIU MODULE VERSIONS

6.4.7.1 Network Interfaces

Network Management Processor/External Interface Unit (NMP/EIU) provides the gateway between the navaid equipment and the remote control and monitoring centres as well as protocol support for legacy navaids.

The following connections will be made to the NMP/EIU network interface during NORMARC LDB-103 installation:

1. LAN Network: All equipment to be connected to the NORMARC LDB-103 Local Area Network will be connected to the NMP/EIU LAN ETH connectors through UTP CAT 5 cable (or better). Cable termination on NMP/EIU will be RJ45.

NORMARC LDB-103 Ethernet modules (CMU's and PSU's) are already pre-wired to the NMP/EIU, so only external Ethernet devices need to be connected at this point. This includes:

- Collocated IP managed navaids equipment (i.e. DVOR VRB-53D).
- Site PC to be used as Local Management Terminal (LMT).
- Other IP devices that need to be connected to the DME Local Area Network.

2. WAN Network: NORMARC LDB-103 will be connected to the customer IP Network through one of the WAN ETH ports on the NMP/EIU. The connection will be done using a CAT5 (or better) cable terminated on a RJ45 connector on the NMP/EIU side.

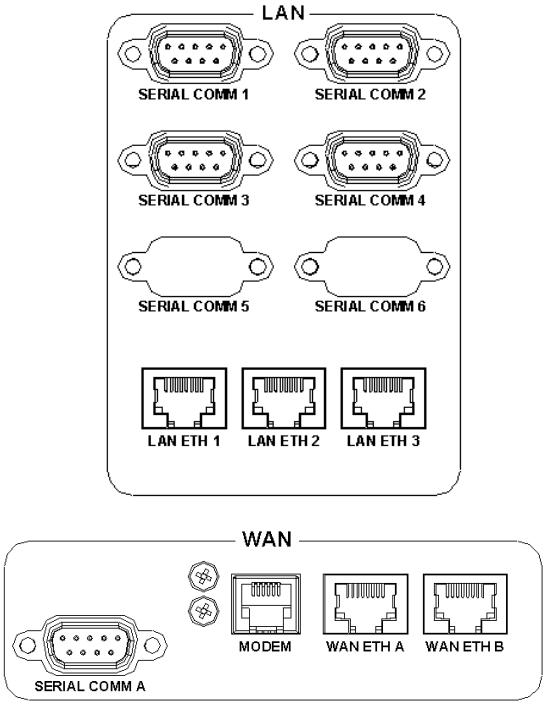
   The following equipment will be connected to the WAN ETH ports:

   - An Ethernet based radio link to be used to connect the NORMARC LDB-103 to a remote site for maintenance.
   - A Modem used for connection to a remote site.
   - A switch or router belonging to the customer IP Network.

WARNING: Depending on the network environment complexity, it will be necessary to set a static route to direct the network traffic between subnets.

3. Sub-D interfaces are also available at the NMP/EIU to allow Indra legacy equipment to be integrated with NORMARC LDB-103.

The Figure 6.5-4 details the LAN and WAN areas of the NMP/EIU front panel.



- 3 RJ45 for LAN network connections
- Up to 6 D-sub for RS232/RS485 interfaces

- 1 RJ11 for leased line or dial up modem
- 1 D-sub for serial RS232/RS485 interfaces
- 1 RJ45 for WAN Network connection

Figure 6.4-6: NMP/EIU LAN-WAN FRONT PANEL DETAIL

6.4.7.2 Hardwired Remote Control and Status signaling

REFER Annex A.

Network Management Processor/External Interface Unit (NMP/EIU) provides hardwired remote control and status monitoring of the DME. Hardwired connections are made to the Auxiliary Inputs/Outputs area on the frontal panel of the NMP/EIU assembly.

The following remote control inputs are available:

- OFF/RESET
- AUTO ON
- DME Nº. 1 ON
- DME Nº. 2 ON

The following remote status indications are also available:

- [NORMAL;TRANSFER;SHUTDOWN]
- AUTO ON
- Nº. 1 ON
- Nº. 2 ON (Dual only)
- PRIMARY FAULT
- SECONDATY FAULT
- MONITOR FAULT
- LOCAL CONTROL
- ALARM INHIBIT
- MAINTENANCE
- MAINS 1 OK
- LOAD VOLTAGE 1 OK
- MAINS 2 OK
- LOAD VOLTAGE 2 OK

The recovered keyed Ident tone from the DME monitor is available for external. Connections for this are available at the MONITOR DIGITAL OUT connector on the front panel of the NMP/EIU module:

MON. DIGITAL OUT:02 → Key Out+
MON. DIGITAL OUT:15 → Key Out -

To connect the remote control and status signal cable proceed as follows:

1. Check the cable(s) pin-out observing the polarity indications. Note that all interface connectors are D-sub female type.
2. Feed the interconnecting cable(s) through the elongated slot in the base or the top of the rack, depending of the site requirements.
3. Run the cable(s) up the frontal panel of the NMP/EIU assembly, fastening the cables to the rack frame using cable ties.

4. Connect the cable(s) to the relevant connectors.
5. The remote control inputs require a switched positive voltage of at least +12 volts to activate the function. If this voltage is not available from the external signalling system, +24 volts DC may be obtained from CMU DIGITAL IN, CMU DIGITAL OUT and MONITOR DIGITAL OUT DB connectors.
6. If the external remote signaling system requires either a switched positive voltage or a closure to ground to assert a signal, these may be obtained from the available D-sub connectors. If either of these is required, make a “daisy chain” connection to the common contact of each status signaling function.

Note: The remote control inputs, and the remote signalling outputs, are not protected beyond the 100 V AC isolation specified in Annex A. If these terminals are connected directly to external lines where there is a possibility of lightning induced surges, then external surge protection must be provided in order to protect the DME.

Refer to Annex A for hardwire remote control and status indication pinouts on the NMP/EIU.

6.4.7.3 Wiring to Associated VHF navaid

If the DME is collocated with an associated VHF navaid, such as a Doppler VOR or ILS, connections must be made between the two navaids to ensure synchronized Ident generation (as specified in the ICAO requirements).

As an associated beacon, the NORMARC LDB-103 can be configured as master, driving the associated VHF equipment with a synchronization pulse indicating the moment of identity transmission (trigger) or directly sending the keying signal (MORSE code); or as a slave of a VHF equipment, managing an input signal indicating the identity code transmission trigger or an input signal acting as a keyer.

The electrical requirements of the Ident interface are specified in Annex A, but it should be noted that:

1. The Associated IDENT IN n requires a closure to ground to signal an Ident “mark” (dot or dash).
2. The Associated IDENT OUT n provides a floating closure for an Ident “mark” which is polarity sensitive.

To connect the wiring for the associated VHF navaid, proceed as follows:

1. Check the cable pin-out observing the polarity indications. Note that all interface connectors are DB female type.
2. Feed the interconnecting cable through the elongated slot in the base or the top of the rack, depending of the site requirements.
3. Run the cable up the frontal panel of the NMP/EIU assembly, fastening the cables to the rack frame using cable ties.
4. Connect the cable(s) to the IDENT IN/OUT connector.

6.4.8 Typical Installation diagrams

Following figures show useful diagrams and drawings for a typical DME installation.

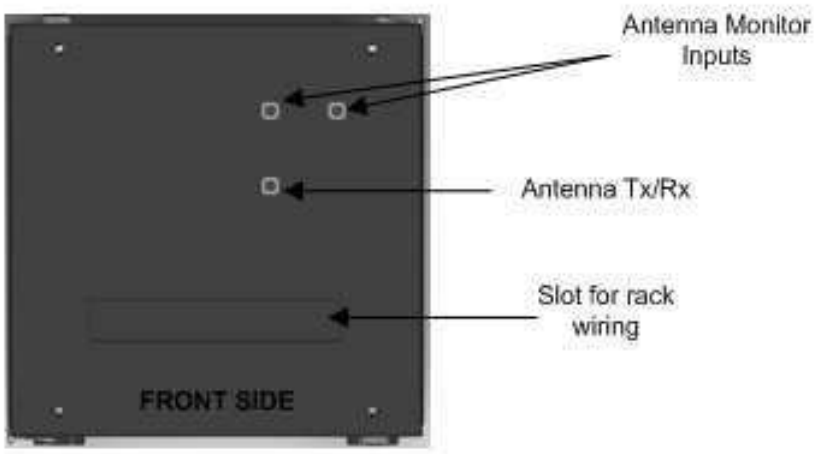


Figure 6.4-7: DME RACK - BOTTOM VIEW

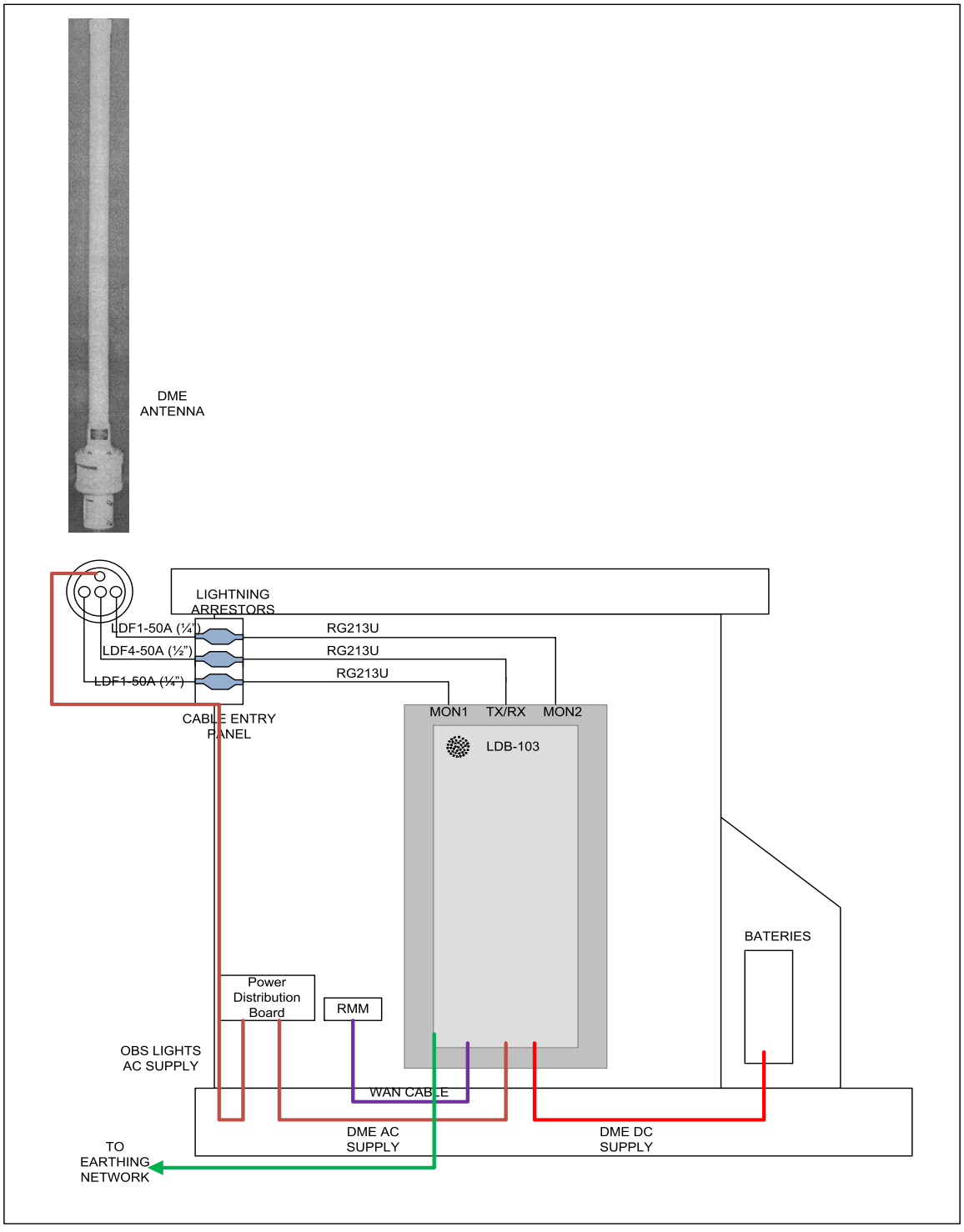


Figure 6.4-8: TYPICAL INSTALLATION CONNECTIONS

WARNING: Be careful when connecting the power antenna probes to Monitor Transponder Unit (MTU). That could cause severe damages on MTU.

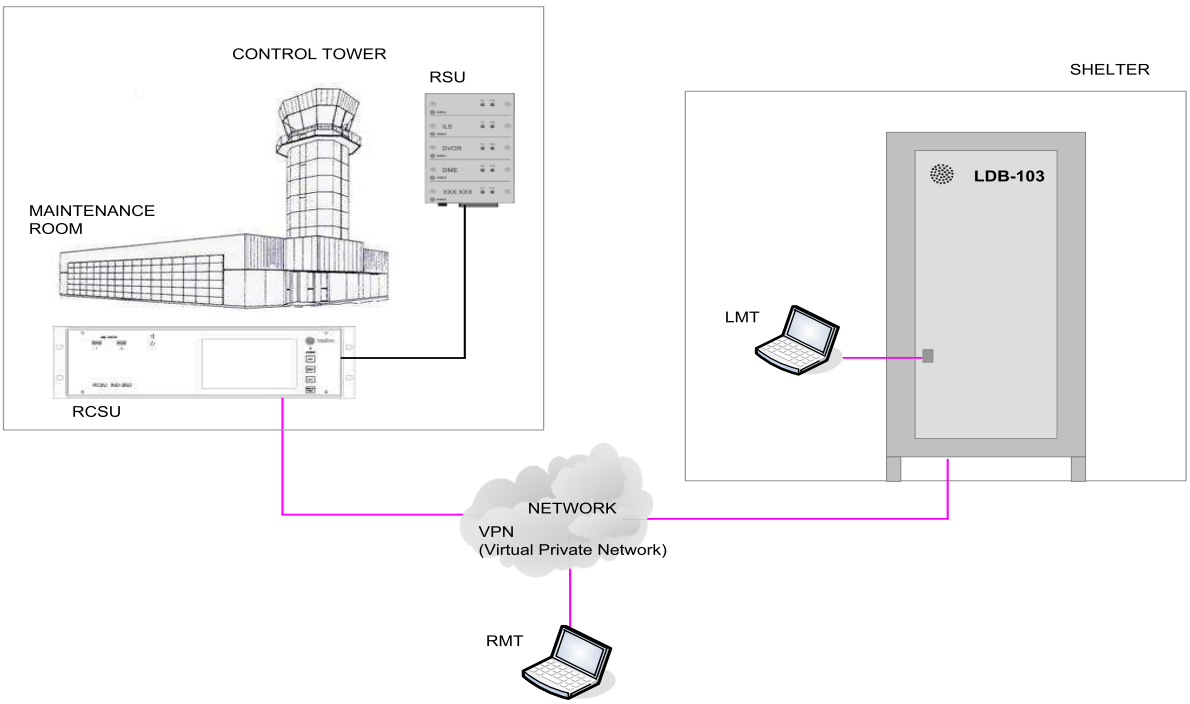


Figure 6.4-9: RMM TYPICAL DIAGRAM

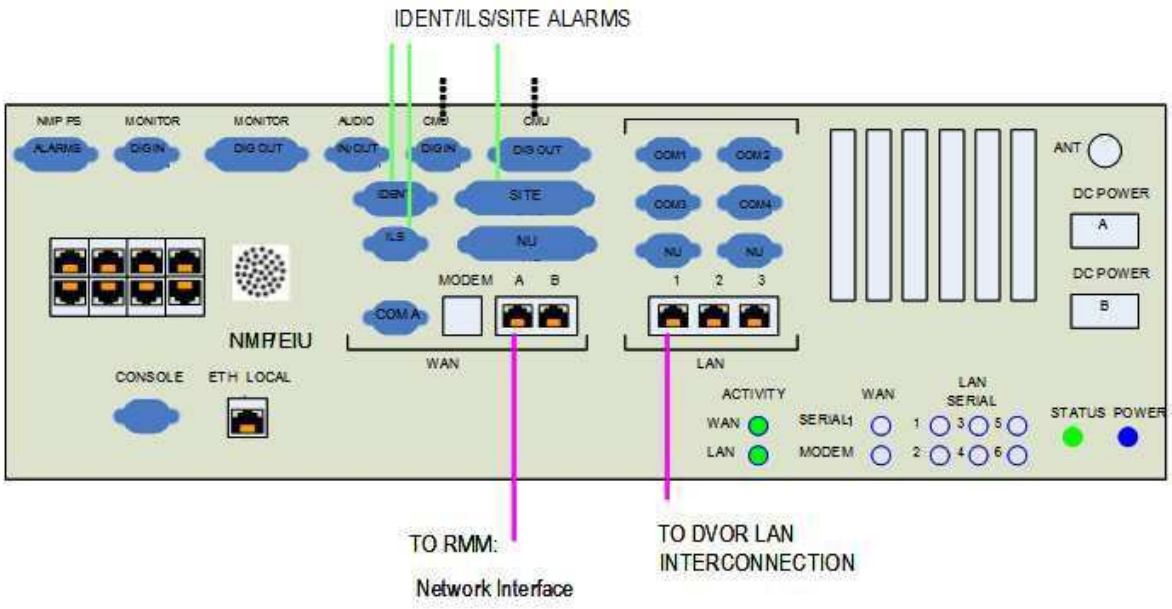


Figure 6.4-10: EXTERNAL WIRING DIAGRAM

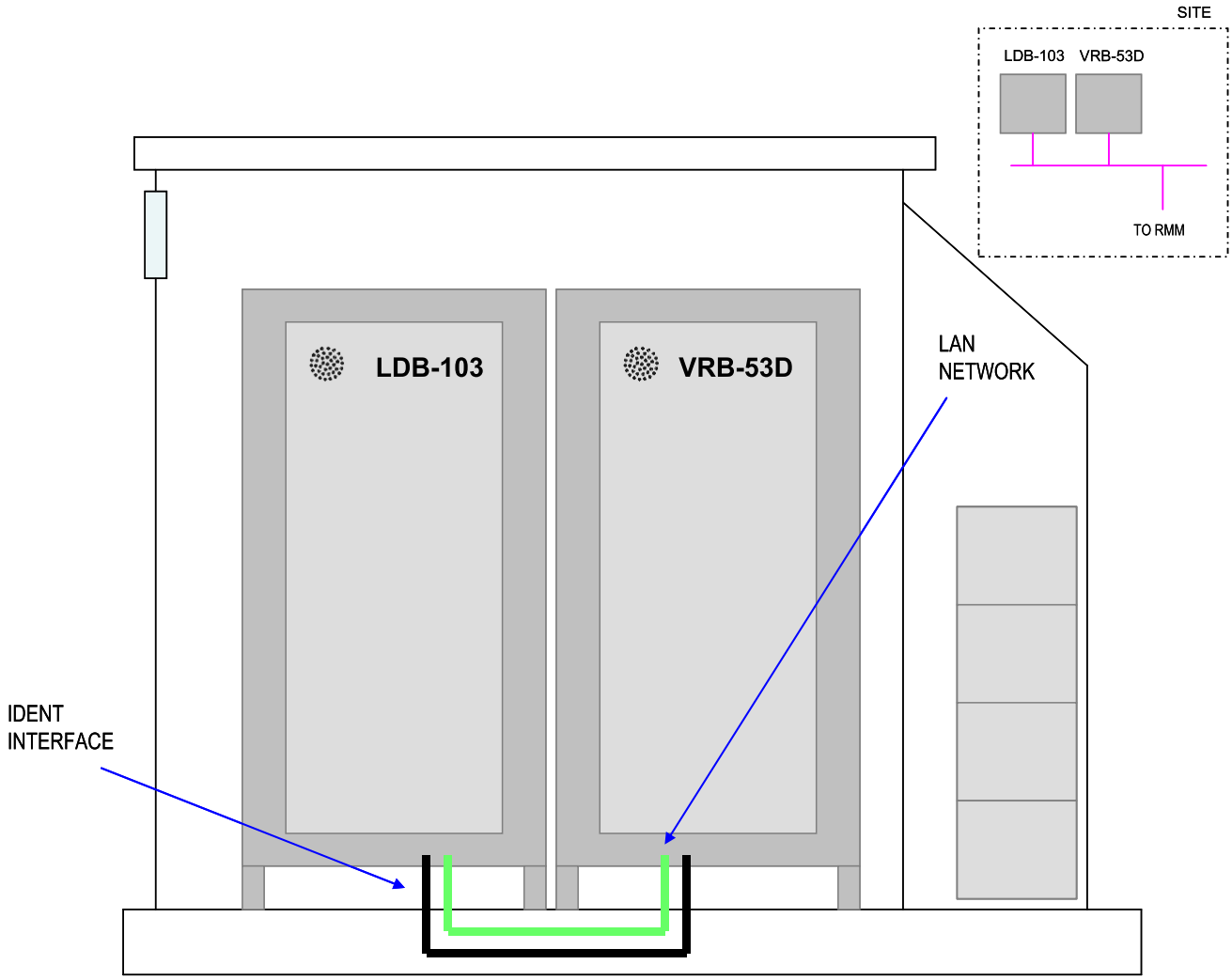


Figure 6.4-11: DME/DVOR EQUIPMENT ASSOCIATED EXAMPLE

6.5 ANTENNA INSTALLATION

6.5.1 General

This section contains information and diagrams to help the installer quickly select the height of the aerial mast best suited for a particular site configuration. Some specifications for building up the aerial mast are also given.

6.5.2 Antenna Sitting criteria

6.5.2.1 Optimum Antenna Installation

Reflecting objects present in the area around the aerial may reduce the signal amplitude. As a result of the antenna's inherent characteristics, the vertical radiation pattern has an up tilt of the main lobe, which rises 3° to 5° above the horizon. This up tilt reduces the amplitude of the radiated signal in the areas in which reflecting objects may be located.

The vertical width of the main antenna lobe is usually approximately 8°, with amplitude at the horizon 2 to 3 decibels less than the maximum at 3° to 5° above the horizon. The antenna system is consequently less subject to Site errors.

Wherever possible, the ground beacon antenna should be mounted on a mast 10 m, or more, high. This height complies with the requirements of maximum range with minimum loss of the radiated signal, which may be caused by nulls in the vertical radiation pattern.

When the distance between the base of the antenna and the ground is less than 10 m, nulls in the vertical radiation pattern may cause loss of ground beacon information for variable periods dependent upon the speed and the altitude of the aircraft and the height of the ground beacon antenna.

The DME antennas are designed to obtain the best horizon gain and diagram slope around the horizon as far as the vertical opening considered is concerned, to reduce the coverage loss caused by the first null.

To reduce deterioration in range, which is caused by reduced antenna height due to local reflecting objects, the following specifications have been given.

6.5.2.1.1 Basic Criteria

All the objects in the proximity of the antenna should be under the surface of rotation ABC illustrated in Figure 6.5-1. This surface may be obtained by means of two cones: a truncated cone, which consists of the base structure of the antenna, the upper portion of which should slope downward from the antenna base at an angle 35° below the horizon, and an inverted cone, the apex of which lies 3.5 m directly below the antenna base, the sides of which slope up at an angle of 3° above the horizontal. These two cones intersect each other and the surfaces, which are not common to both cones, limit the area in which the antenna should be cleared of objects.

The reflecting objects that are below this area do not affect the accuracy of the information transmitted by the beacon, while for any objects rising above this surface, the following exceptions are allowed changeover.

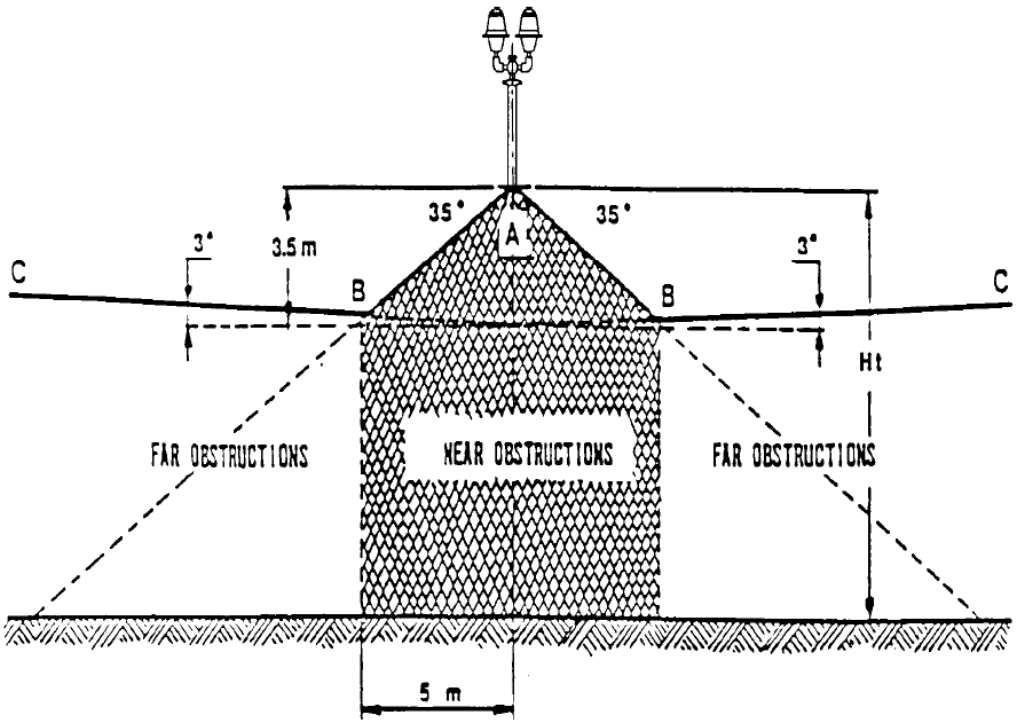


Figure 6.5-1: OBSTRUCTION HEIGHT LIMITS

6.5.2.1.2 Exception A

No more than two obstructions between 100 feet (33 m) and 1000 feet (330 m) from the antenna, protruding up to a maximum of 2° above the specified 3° of the inverted cone are permissible, if each one subtends less than 10° or more in azimuth.

6.5.2.1.3 Exception B

Alternatively, no more than five obstructions between 100 feet (33 m) and 1000 feet (330 m) from the antenna, protruding up to a maximum of 5° above the specified 3° of the inverted cone are permissible, if each one subtends less than 3° in azimuth and any two obstructions are separated by 10° or more in azimuth.

6.5.2.1.4 Exception C

If the protruding obstructions permitted by Exceptions A or B above consist of natural vegetation such as trees or bushes, they may protrude up to twice the above specified amounts and may subtend three times the above specified angles in azimuth.

6.5.2.2 Other Exceptions

Other admitted exceptions are listed in the following table where the maximum elevation angle is measured from a point located 3.5 m under the antenna.

Class 2 exceptions may produce shadowing in the sector behind the obstructions. The number of exceptions should not exceed five from class 1, or two from class 2 or two from class 1 plus one from class 2.

CLASS OF EXCEPTION	TYPE OF OBSTRUCTIONS	MAX. ANGLE SUBTENDED IN AZIMUTH	MAX. ALEVATION ANGLE
1	Vegetation-Narrow	9º	13º
1	Solid-Narrow	3º	8º
2	Vegetation-Wide	30º	7º
2	Solid-Wide	10º	5º

Diagrams have been included in following sections to help the installer to resolve the following problems:

- Given the obstruction dimensions and distances from the antenna mast, determine the minimum height of the antenna mast suitable for correct DME system operation.
- Given the height of the antenna mast, determine or check whether the reflecting objects in the Site can be permitted (inverse of the former).

6.5.2.3 Close and Distant obstructions

Figure 6.5-2 shows that for each antenna mast height Ht it is possible to draw a broken line such as that shown in the figure.

In order to comply with the relevant specifications, the height of each obstruction, Do meters from the antenna, must not exceed the maximum value Ho given by the formula:

$Ho = Ht - (Do/1.428)$ for $Do \leq 5$ m

$Ho = Ht - 3.5 + 0.052 \cdot Do$ for $Do \geq 5$ m

In the figure, the variable Ho is plotted against the distance Do for each figure Ht, thus an aggregate of broken lines are obtained, which constitutes the locus of close and distant obstructions. In accordance with the specifications, however, the height of the antenna mast may in no case be less than 20 feet (6.7 m) or more than 60 feet (20 m).

To solve the first problem of Figure 6.5-3 it is sufficient to plot the heights of obstructions against their distances from the antenna in the logs of Figure 6.5-3: the broken line passing through the maximum height of the obstructions gives the values of the desired antenna height. Inversely, if every ordinate of the obstructions lies under the broken line relative to given Ht of the mast, this means that the specifications of have been followed.

6.5.2.3.1 Exceptions

Similarly, it is possible to plot the diagrams relative to the exceptions of Figure 6.5-3. The formulas, with values expressed in meters, are as follows:

- Class A obstructions (solid wide: 5° elevation, 10° azimuth):

$$Ho = Ht - 0.5 + 0.087 \cdot Do$$

- Class B obstructions (solid-narrow: 8° elevation, 3° azimuth):

$$Ho = Ht - 3.5 + 0.14 \cdot Do$$

- Class C obstructions (vegetation-wide: 7° elevation, 30° azimuth):

  $$Ho = Ht - 3.5 + 0.123 \cdot Do$$

- Class D obstructions (vegetation narrow: 13° elevation, 9° azimuth):

  $$Ho = Ht - 3.5 + 0.23 \cdot Do$$

Figure 6.5-3 to Figure 6.5-6 show the diagram relative to these exceptions.

If there are more than one obstruction, it must be remembered that the following maximum number of obstructions can be tolerated:

- Class (B+D): no more than 5, provided that any 2 are separated by 10° minimum in azimuth.
- Class (A+B): no more than 2, provided that any 2 are separated by 10° minimum in azimuth.
- Two of class (B+D) plus one of (C+A).

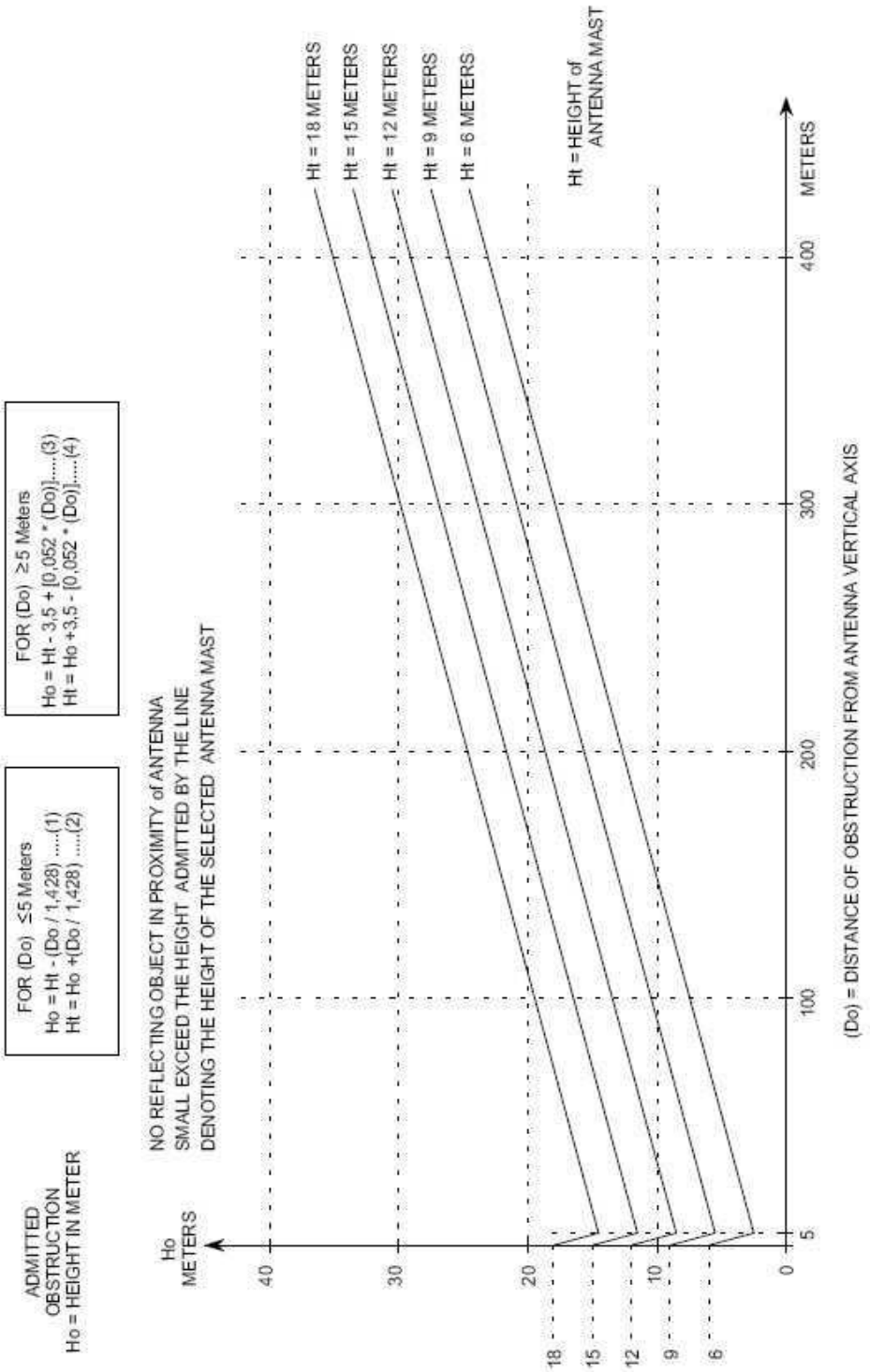


Figure 6.5-2: BASIC CRITERIA - NEAR AND FAR OBSTRUCTIONS

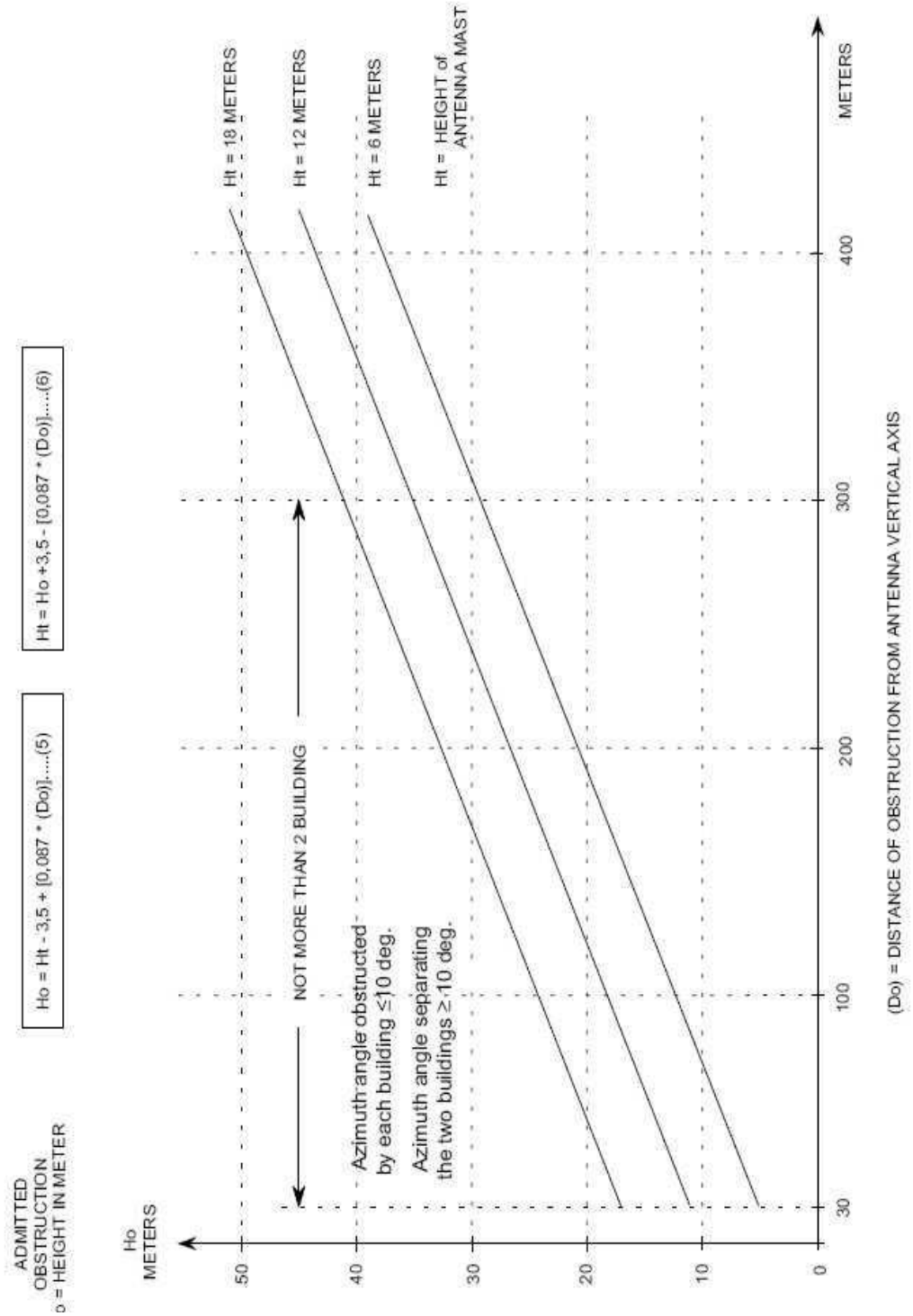


Figure 6.5-3: CLASS A OBSTRUCTIONS: WIDE BUILDINGS

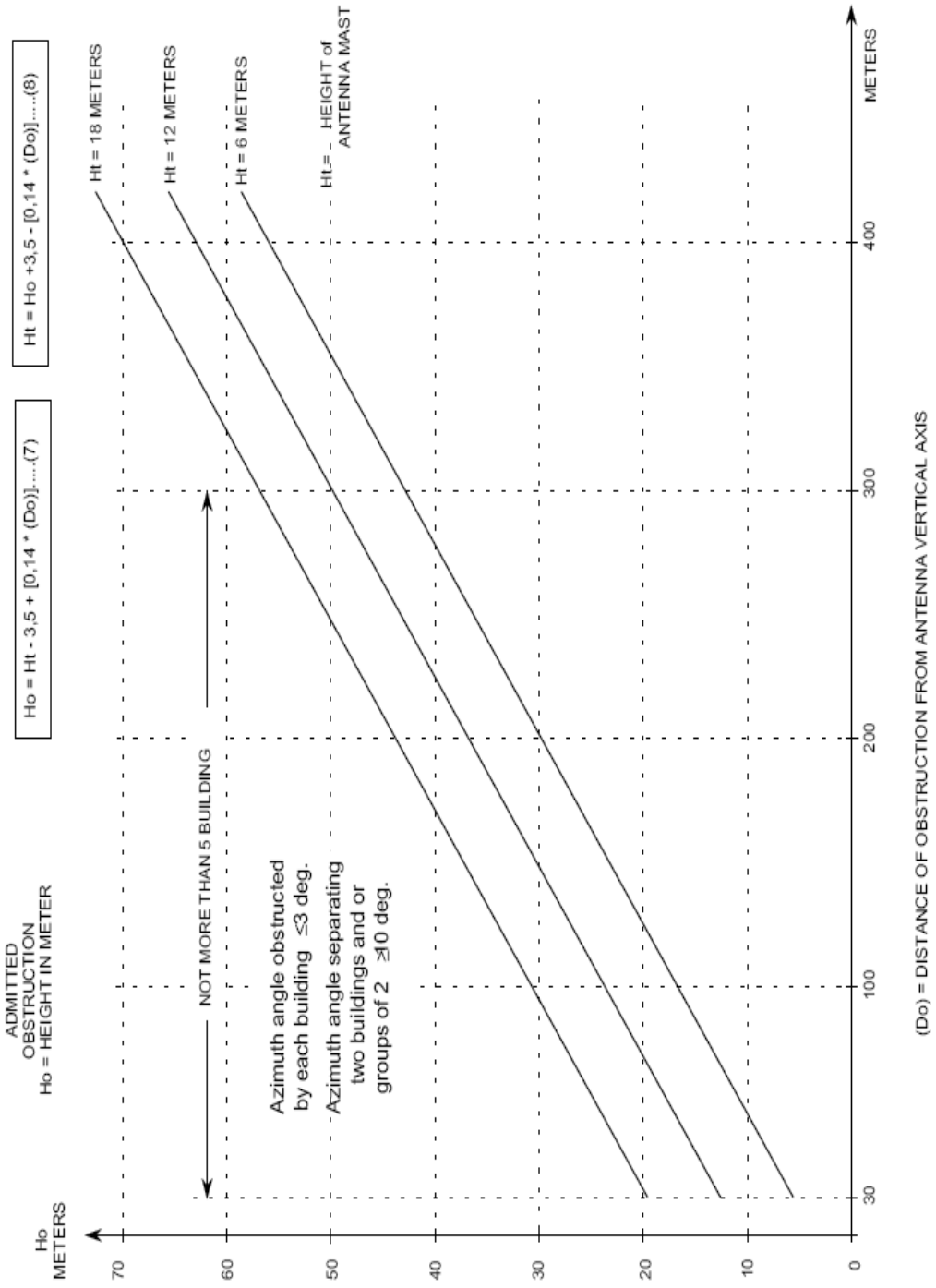


Figure 6.5-4: CLASS B OBSTRUCTIONS: NARROW BUILDINGS

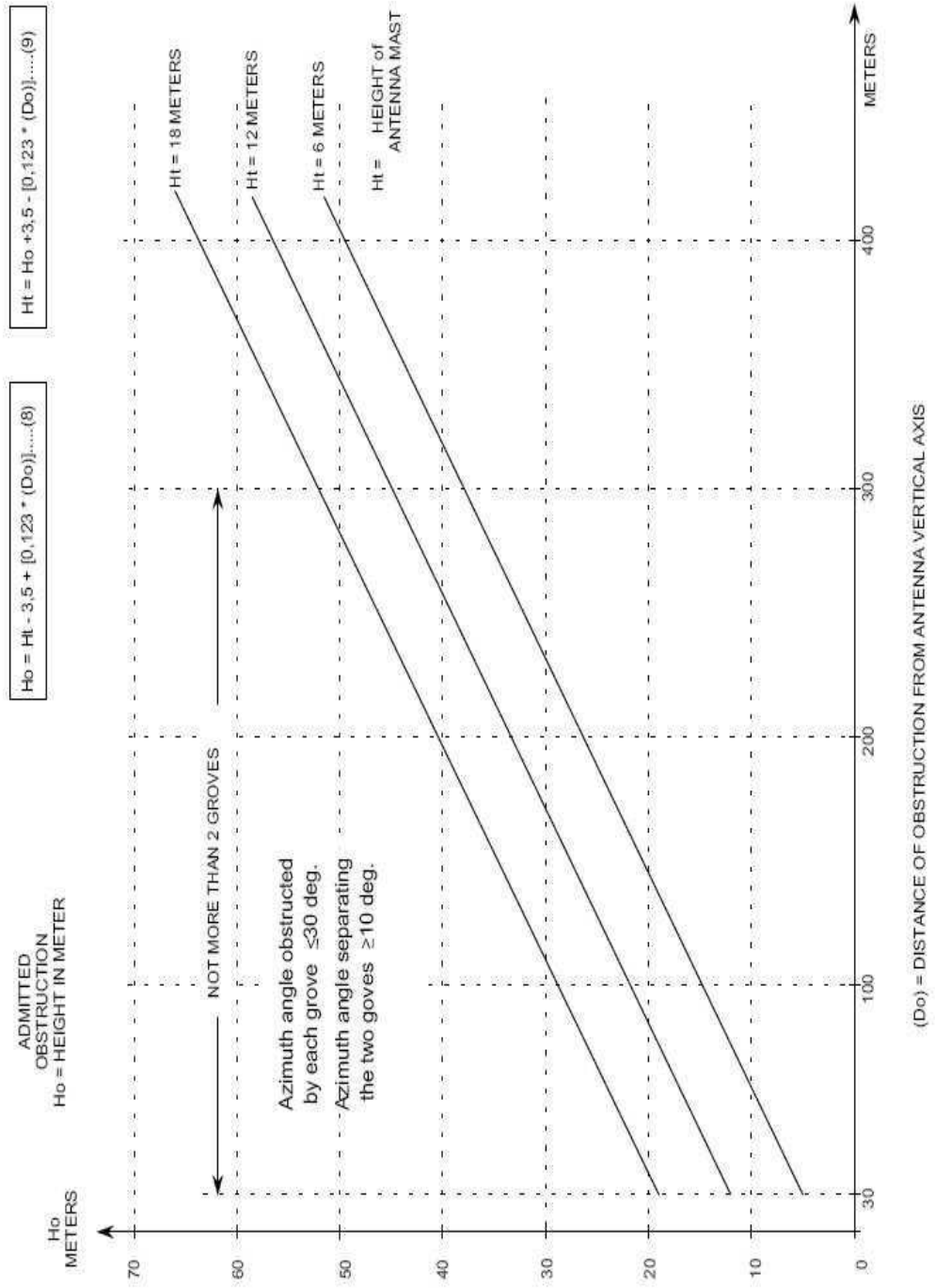


Figure 6.5-5: CLASS C OBSTRUCTIONS: WIDE VEGETATION

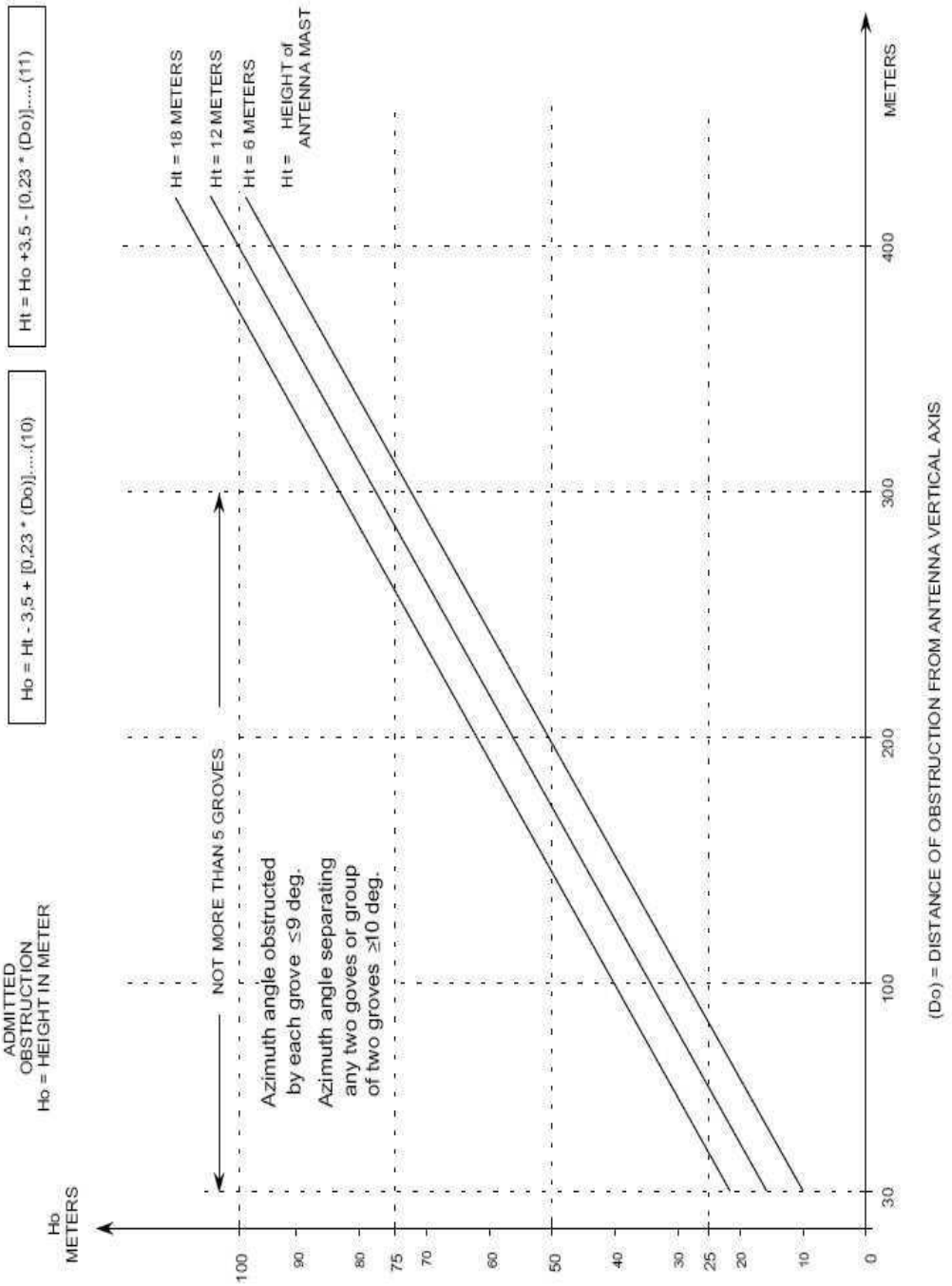


Figure 6.5-6: CLASS D OBSTRUCTIONS: NARROW VEGETATION

6.5.3 Pipe Mounting Installation

The height of the antenna installation must be such that it is above any local obstruction (such as DVOR antennas, if collocated) or equipment buildings. Choose an appropriate pipe length, to give adequate antenna height, and ensure rigid mounting of the pipe base.

An entry hole for the antenna cables is recommended. This hole should allow the entrance of the 4 cables to be connected to the DME Antenna:

- One ½" Heliax cable used for DME Tx/Rx Signal
- Two ¼" Heliax cables used for antenna monitor outputs
- One AC Power cable used for Obstruction lighting AC power (if required)

If the pipe is fastened to the side of a building and projects more than 1m above the point of fixing, then guying or strutting must be provided to prevent wind gust resonance.

If a free-standing mast is to be used, ensure it is sufficiently rigid to prevent deflection or vibration of the antenna under the maximum wind speeds expected at the site.

The pipe mount for the antenna should be pre-assembled on to the pipe (as applicable, depending on the type supplied) before the pipe is erected, and the antenna mounted onto the pipe after erection; if this cannot be done then, the antenna could be fitted to the mast before erection and carefully lifted with the mast. The installation procedure adopted will depend on individual site limitations.

The recommended routing of the antenna cables is to support them overhead between the mast and the shelter roof overhang. This method is preferable when low-loss 'Heliax' type cable is used, to reduce length and to minimise cable handling and bending.

It is also recommended that the antenna cables be routed inside the antenna pipe to the antenna connectors. This gives the cables protection from the weather. If this cannot be done, then the cables may be routed on the outside of the pipe or mast, provided they are securely fastened at regular intervals.

6.5.4 Antenna Cables

NORMARC LDB-103 Installation Kit provides all necessary cables for a common DME installation.

The following materials are provided as part of the installation kit for antenna – DME interconnection:

- (1 set) 25 metres of Heliax LDF4-50A (1/2") coaxial cable + 2 N-type male connectors to fit LDF4-50A, to be used for DME Tx/Rx signal cable outdoors run out.
- (2 sets) 25 metres of Heliax LDF1-50A (1/4") coaxial cable + 2 N-type male connectors to fit LDF1-50A, to be used for DME antenna monitor signal cable outdoors run out.
- (1 set) 25 metres of 3x1,5mm2 power cable + 1 MS3116E8-3S connector. This cable and connector are provided for obstruction light connection when DB Systems 5100A antenna is supplied.
- 6 metres of RG214U coaxial cable + 6 N-type male connectors to fit RG214U, to be used for DME Signal and monitor signal cable indoor run out.

6.5.4.1 Antenna Feeded cables

The low-loss antenna feed cable (supplied) should be cut to the minimum practicable length for the installation, to allow maximum radiated power.

The cable and connectors supplied for this purpose are:

- (1 set) 25 metres of Heliax LDF4-50A (1/2") coaxial cable
- 2 N-type male connectors to fit LDF4-50A, to be used for DME Tx/Rx signal cable outdoors run out.

LDF4-50A cable should be run from shelter cable entry panel up to DME antenna port. Once the cable is run, it should be terminated at both ends with proper N-type connectors (also supplied), T following EXACTLY the instructions given in the datasheet that comes with the connector.

6.5.4.2 Monitor cables

The antenna includes provision for sampling the effective radiated power (ERP) of the transmitter signal. In a DME, two ERP monitors are used.

For this purpose, the following cables and connectors are supplied with the DME Installation Kit:

- (2 sets) 25 metres of Heliax LDF1-50A (1/4") coaxial cable.
- (2 sets) 2 N-type male connectors to fit LDF1-50A, to be used for DME antenna monitor signal cable outdoors run out.

LDF1-50A cables should be run from shelter cable entry panel up to DME antenna monitor ports. Once the cables are run, they should be terminated at both ends with proper N-type connectors (also supplied), following EXACTLY the instructions given in the datasheet that comes with the connector.

6.5.4.3 Monitor cables

Indoors Coaxial Cable for Indoors coax cable runs, the following cables and connectors are supplied with the DME Installation Kit:

- 15 metres of RG213U coaxial cable.
- 6 N-type male connectors to fit RG214U, to be used for DME Signal and monitor signal cable indoor run out.

These cables are supplied to ease indoors cable run out, as they are more flexible that outdoors cables supplied, but thay should only be used in short run outs, as their attenuation is also much higher.

6.6 COMPLETION

When all the work in the preceding sections has been completed, check the following items before proceeding with the beacon alignment:

1. Placement of cabinet and all external wiring, including power and earthing.
2. All modules correctly inserted in rack.
3. DC power wiring and batteries correctly connected.
4. VHF navaid Ident interface connected (if used).
5. Antenna feed cable and adaptor connected and connectors tightened.
6. Antenna ERP monitor cables connected and connectors tightened.

The Beacon is now ready for testing and alignment. The procedures for this are described in Section 4.7.4 System Configuration .

6.7 TEST EQUIPMET

The DME will be sent to site only when its whole performance has been fully tested at the factory or at a customer testing facility.

When the DME is on site, its operation can be fully tested using the Local Management Terminal (LMT). All DME performance parameters are tested within the equipment and registered on the CMU web server based facility, and can be accessed by the installer or operator through the LMT.

So, for On Site Testing, only equipment to cover the following tasks will be needed:

- General Site Installation Testing
- DME Operation Testing
- Beacon Alignment

Table below lists the recommended equipments for this purpose:

Table 6.7-1: HPA TEST CONNECTOR ALLOCATION

ITEM	QTY	CHARACTERISTICS	SUITABLE TYPE/MODEL	
Laptop	1	Speed ~ 2GHz, Memory ~ 2G, OS: Windows XP or later	Screen ~14", HD ~ 100G Resident: Office, Internet Explorer, Mozilla Firefox	-
DME Test Board	1	DME Test Board	This module consists on a 20 pin board that can be used to access the test signals on the 20 pin connector on the front panel of each module. One test board is supplied as part of the installation materials of the DME.	Indra 0063430005800
Digital multimeter	1	Voltage range: Accuracy:	2 to 50 volts full scale 0.5%	Fluke 8010A
Field Peak power meter	1	Frequency range: Input power: Input impedance:	950 to 1260 MHz 1kW 50 ohms, VSWR <1.2	Bird 4391A Wattmeter with 1000J and 100J elements.
	-	A most powerful peak power meter like the one described on Chapter E1 can also be used if available.		
Network Analyzer	1	Frequency Range: Dynamic Range: Measurements:	0 – 2GHz 90dB S11, S12, S21, S22	Agilent N9912A
Additional cabling and accessories	1	Additional accessories to interconnect test equipment to DUT:	- 50 Ohm Coaxial cables terminated N-type male connector - Set of transitions: N-type, BNC - Attenuators	As required

A. ANNEX A – REMOTE CONTROL AND MONITORING FACILITIES

A.1 INTRODUCTION

This annex gives details of the control inputs and status outputs for use by a Remote Management and Monitoring System (RMMS).

A.2 NMP/EIU Facilities

A.2.1 Remote Control Inputs

The four remote control functions shown in Table A-1 are available on the NMP/EIU front panel connectors upon customer request. These control signals are each activated by contact closure or grounding the electrical path between relevant control inputs on the NMP/EIU interface module. Although these inputs are protected against reverse polarity, the correct polarity must be used to activate the input.

Table A - 1: NMP/EIU CONTROL INPUTS

	EXTERNAL NMP/EIU MODULE CONTACTS	
SIGNAL NAME	**Negative Input (-) [low]**	**Positive Input (+) [high]**
SYSTEM OFF	MON. DIGITAL IN:04	MON. DIGITAL IN:09
SELECT MAIN	MON. DIGITAL IN:02	MON. DIGITAL IN:06
RELAY SEMANTICS	CMU DIGITAL IN:02	CMU DIGITAL IN:06
CHANGEOVER	CMU DIGITAL IN:09	CMU DIGITAL IN:04

Table A-2 lists the polarity definition of the remote control signals when input terminals are opened, closed or grounded. Refer to Figure A 3 for pin out types. The loop resistance of the external circuit must not exceed 1200 ohms. The changeover control responds to either impulse (0.2 to 2 seconds impulse duration) and the others to continuous activation. These inputs are optically isolated to 1500 V_{RMS}.

Table A - 2: NMP/EIU CONTROL INPUTS FUNCTIONS

SIGNAL NAME	OPENED	CLOSED / GND
SELECT MAIN	TXP B	TXP A
SYSTEM OFF	DME ON	DME OFF
RELAY SEMANTICS	MODE AND ALARM	TXP INFO
CHANGEOVER	**Note 1**	**Note 1**

Note 1:

In order to perform a changeover, the input level should be changed. Any change from OPENED to CLOSED or from CLOSED to OPENED performs a changeover. The signal has to remain in the new assigned level a minimum period of time of 2 seconds. Otherwise, the behavior of the equipment is not assured.

A.2.2 Remote Status Outputs

For each remote status indication, upon customer request, the NMP/EIU front panel interface provides voltage-free (dry) changeover relay contacts capable of switching +50 VDC at 200 mA and +24 VDC at 500 mA, surge protected and isolated to 1500 V_{RMS}. They are listed in Table A - 3.

+24 VDC Protected and Earth are also available on the NMP/EIU front panel connectors at the following terminals:

+24 VDC Protected: [CMU DIGITAL IN:8] / [CMU DIGITAL OUT:6/ 7/ 18/ 19]
[MONITOR DIGITAL OUT:6/ 7/ 18/ 19]

Ground: [CMU DIGITAL IN:3/ 7] / [CMU DIGITAL OUT:3/ 5/ 9/ 11]
[MONITOR DIGITAL OUT: 3/ 5/ 9/ 11]

Table A - 3: NMP/EIU CONTROL OUTPUTS

	EXTERNAL NMP/EIU MODULE CONTACTS		
SIGNAL NAME	**COMMON**	**NORMALLY CLOSED**	**NORMALLY OPEN**
MAIN	CMU DIGITAL OUT:02	CMU DIGITAL OUT:14	CMU DIGITAL OUT:15
STANDBY	CMU DIGITAL OUT:04	CMU DIGITAL OUT:16	CMU DIGITAL OUT:17
SHUTDOWN	CMU DIGITAL OUT:08	CMU DIGITAL OUT:20	CMU DIGITAL OUT:21
SECONDARY ALARM	CMU DIGITAL OUT:10	CMU DIGITAL OUT:22	CMU DIGITAL OUT:23
PRIMARY ALARM	CMU DIGITAL OUT:12	CMU DIGITAL OUT:24	CMU DIGITAL OUT:25
MAINS 1 ALARM	NMP&PS ALARMS:03	NMP&PS ALARMS:04	NMP&PS ALARMS:02
LOAD VOLTAGE 1 ALARM	NMP&PS ALARMS:05	NMP&PS ALARMS:12	NMP&PS ALARMS:11
MAINS 2 ALARM	NMP&PS ALARMS:09	NMP&PS ALARMS:10	NMP&PS ALARMS:08
LOAD VOLTAGE 2 ALARM	NMP&PS ALARMS:06	NMP&PS ALARMS:13	NMP&PS ALARMS:14
LOCAL MODE	MON. DIGITAL OUT:17	MON. DIGITAL OUT:16	MON. DIGITAL OUT:04
ALARM INHIBIT	MON. DIGITAL OUT:08	MON. DIGITAL OUT:20	MON. DIGITAL OUT:21
MAINTENANCE MODE	MON. DIGITAL OUT:10	MON. DIGITAL OUT:22	MON. DIGITAL OUT:23
TXP A ON AIR (configurable)			
MONITOR ALARM	MON. DIGITAL OUT:12	MON. DIGITAL OUT:24	MON. DIGITAL OUT:25
TXP B ON AIR (configurable)			

Table A - 4: REMOTE IDENTIFICATION FUNCTIONS

SIGNAL NAME	DESCRIPTION / FUNCTIONALITY	(N.C) ACTIVE STATE	(N. O) ACTIVE STATE
MAIN	Indicates that the selected Main transponder is on and operating into the antenna system. Will not be active if the monitor alarms are inhibited.	Low Z	High Z
STANDBY	Indicates that the Standby transponder is on and operating into the antenna system (dual system only).	Low Z	High Z
SHUTDOWN	Indicates that the rack(s) have been turned off by the monitor subsystem (due to a fault condition) or the Alarm Inhibit has been activated.	Low Z	High Z
SECONDARY ALARM	Indicates that the DME has a secondary fault or alarm. Includes either a Module BIT alarm or Monitor Executive alarm.	Low Z	High Z
PRIMARY ALARM	Indicates that the DME has a primary fault or alarm. Includes either a Module BIT alarm or Monitor Executive alarm.	Low Z	High Z
MAINS 1 ALARM	Indicates that the input AC power for PSU1 is not available.	Low Z	High Z
LOAD VOLTAGE1 ALARM	Indicates a faulty DC Supply 1 or Battery Charger.	Low Z	High Z
MAINS 2 ALARM	Indicates that the input AC power for PSU2 is not available.	Low Z	High Z
LOAD VOLTAGE 2 ALARM	Indicates a faulty DC Supply 2 or Battery Charger.	Low Z	High Z
LOCAL MODE	Indicates that the DME has been put into Local control mode, rejecting any remote control attempts.	Low Z	High Z
ALARM INHIBIT	Indicates that the DME is set to ignore the fault signals from the monitor(s).	Low Z	High Z
MAINTENANCE MODE (Op1)	Indicates that the DME is in 'maintenance' mode.	Low Z	High Z
TXP A ON AIR (Op 2)	Indicates that TXP A is connected to the antenna. **(Note 2)**	Low Z	High Z
MONITOR ALARM (Op 1)	Indicates there is Primary Monitor Executive Alarm present. Does not indicate the presence of a Secondary Monitor Executive Alarm nor any (primary and secondary) Module BIT alarms. **(Note 3)**	Low Z	High Z
TXP B ON AIR (Op 2)	Indicates that TXP B is connected to the antenna. **(Note 2)**	Low Z	High Z

Note 1: Low Z = Low Impedance / High Z = High Impedance

Note 2: Administration → Policies → Relay Semantics to configure Op1/Op2.

Note 3: An executive alarm is shown as soon as detected and during the configurable time before executing the action. Once the system turns off the faulty TXP, the signal cannot be monitored anymore and the indication is cleared.

A.2.3 Associated VHF navaids

The facilities to support connection to different VHF facilities list in Table A – 5.

Table A - 5: NMP/EIU ASSOCIATED VHF NAVAID INTERFACE

	EXTERNAL NMP/EIU MODULE CONTACTS	
SIGNAL NAME	**Negative Input (-)**	**Positive Input (+)**
ASSOCIATED IDENT IN 1 [from the VHF Navaid]	IDENT IN/OUT:10	IDENT IN/OUT:02
ASSOCIATED IDENT IN 2 [from the VHF Navaid]	IDENT IN/OUT:11	IDENT IN/OUT:04
ASSOCIATED IDENT OUT 1 [to the VHF Navaid]	IDENT IN/OUT:07	IDENT IN/OUT:14
ASSOCIATED IDENT OUT 2 [to the VHF Navaid]	IDENT IN/OUT:13	IDENT IN/OUT:05
INTERLOCK_ILS 1	ILS INTERLOCK:09	ILS INTERLOCK:07
INTERLOCK_ILS 2	ILS INTERLOCK:05	ILS INTERLOCK:03

Note: Interlock is active when input terminal contact is opened.

A.2.4 Electrical Interface

The figure below shows the auxiliary connectors located on the front panel of the NMP/EIU assembly. The signal assignment is listed in the following tables.

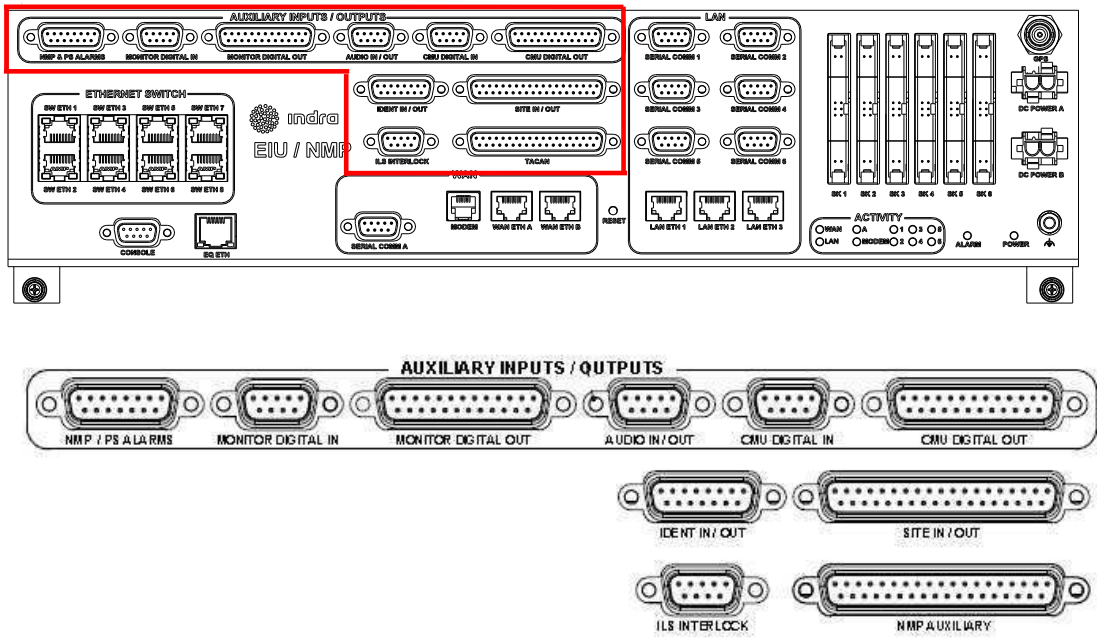


Figure A 1: NMP/EIU MODULE (FULL VERSION) - ELECTRICAL INTERFACES

Table A - 6: NMP/PS ALARMS CONNECTOR ASSIGNMENT

NAME: NMP/PS ALARMS		TYPE: subD 15pin Female	
SIGNAL	**PIN**	**TYPE**	**IN / OUT**
CHASSIS	1	COMMON	-
MAINS1_ALARM_NO	2	RELAY CONTACT	OUTPUT
MAINS1_ALARM_C	3	COMMON	-
MAINS1_ALARM_NC	4	RELAY CONTACT	OUTPUT
LOAD VOLTAGE1_ALARM_C	5	COMMON	-
LOAD VOLTAGE2_ALARM_C	6	COMMON	-
GND	7	GND	-
MAINS2_ALARM_NO	8	RELAY CONTACT	OUTPUT
MAINS2_ALARM_C	9	COMMON	-
MAINS2_ALARM_NOC	10	RELAY CONTACT	OUTPUT
LOAD VOLTAGE1_ALARM_NO	11	RELAY CONTACT	OUTPUT
LOAD VOLTAGE1_ALARM_NC	12	RELAY CONTACT	OUTPUT
LOAD VOLTAGE2_ALARM_NC	13	RELAY CONTACT	OUTPUT
LOAD VOLTAGE2_ALARM_N0	14	RELAY CONTACT	OUTPUT
CHASSIS	15	COMMON	-

Table A - 7: MONITOR DIGITAL INPUTS CONNECTOR ASSIGNMENT

NAME: MONITOR DIGITAL INPUTS		TYPE: subD 9pin Female	
SIGNAL	**PIN**	**TYPE**	**IN / OUT**
CHASSIS	1	COMMON	-
SELECT MAIN - [IP1-]	2	DIGITAL	INPUT
GND	3	GND	-
SYSTEM OFF - [IP0-]	4	DIGITAL	INPUT
CHASSIS	5	COMMON	-
SELECT MAIN + [IP1+]	6	DIGITAL	INPUT
RESET_IN_1	7	DIGITAL	NU
RESET_IN_2	8	DIGITAL	NU
SYSTEM OFF + [IP0+]	9	DIGITAL	INPUT

Table A - 8: MONITOR DIGITAL OUTPUTS CONNECTOR ASSIGNMENT

NAME: MONITOR DIGITAL OUTPUTS		TYPE: TYPE: subD 25pin Female	
SIGNAL	**PIN**	**TYPE**	**IN / OUT**
CHASSIS	1	COMMON	-
MONITOR_Key_Out+	2	RELAY CONTACT	OUTPUT
GND	3	GND	-
MONITOR_Out0_NO	4	RELAY CONTACT	OUTPUT
GND	5	GND	-
Vprot2	6	DC Supply	-
Vprot2	7	DC Supply	-
MONITOR_Out1_C	8	RELAY CONTACT	OUTPUT
GND	9	GND	-

Table A - 8: MONITOR DIGITAL OUTPUTS CONNECTOR ASSIGNMENT

NAME: MONITOR DIGITAL OUTPUTS		TYPE: TYPE: subD 25pin Female	
SIGNAL	**PIN**	**TYPE**	**IN / OUT**
MONITOR_Out2_C	10	RELAY CONTACT	OUTPUT
GND	11	GND	-
MONITOR_Out3_C	12	RELAY CONTACT	OUTPUT
CHASSIS	13	COMMON	-
Vprot2	14	DC Supply	-
MONITOR_Key_Out-	15	RELAY CONTACT	OUTPUT
MONITOR_Out0_NC	16	RELAY CONTACT	OUTPUT
MONITOR_Out0_C	17	RELAY CONTACT	OUTPUT
Vprot2	18	DC Supply	-
Vprot2	19	DC Supply	-
MONITOR_Out1_NC	20	RELAY CONTACT	OUTPUT
MONITOR_Out1_NO	21	RELAY CONTACT	OUTPUT
MONITOR_Out2_NC	22	RELAY CONTACT	OUTPUT
MONITOR_Out2_NO	23	RELAY CONTACT	OUTPUT
MONITOR_Out3_NC	24	RELAY CONTACT	OUTPUT
MONITOR_Out3_NO	25	RELAY CONTACT	OUTPUT

Table A - 9: AUDIO IN/OUT CONNECTOR ASSIGNMENT

NAME: AUDIO IN/OUT		TYPE: subD 9pin Female	
SIGNAL	**PIN**	**TYPE**	**IN / OUT**
CHASSIS	1	COMMON	-
LINE_OUT+ (SGU)	2	AUDIO	OUTPUT
LINE_IN+ (SGU)	3	AUDIO	INPUT
LINE_OUT- (MTU)	4	AUDIO	OUTPUT
CHASSIS	5	COMMON	-
LINE_OUT- (SGU)	6	AUDIO	OUTPUT
LINE_IN- (SGU)	7	AUDIO	INPUT
GND	8	GND	-
LINE_OUT+ (MTU)	9	AUDIO	OUTPUT

Table A - 10: IDENT IN/OUT CONNECTOR ASSIGNMENT

NAME: IDENT IN/OUT		TYPE: subD 15pin Female	
SIGNAL	**PIN**	**TYPE**	**IN / OUT**
CHASSIS	1	COMMON	-
IN1+	2	DIGITAL	INPUT
KEY_BYP-	3	RELAY CONTACT	INPUT
IN2+	4	DIGITAL	INPUT
OUT2+	5	RELAY CONTACT	OUTPUT
NC	6	Not Connected	NC
OUT1-	7	RELAY CONTACT	OUTPUT
CHASSIS	8	COMMON	-

Table A - 10: IDENT IN/OUT CONNECTOR ASSIGNMENT

NAME: IDENT IN/OUT		TYPE: subD 15pin Female	
SIGNAL	**PIN**	**TYPE**	**IN / OUT**
KEY_BYP+	9	RELAY CONTACT	INPUT
IN1-	10	DIGITAL	INPUT
IN2-	11	DIGITAL	INPUT
CHASSIS	12	COMMON	-
OUT2-	13	RELAY CONTACT	OUTPUT
OUT1+	14	RELAY CONTACT	OUTPUT
NC	15	Not Connected	NC

Table A - 11: CMU DIGITAL INPUTS CONNECTOR ASSIGNMENT

NAME: CMU DIGITAL INPUTS		TYPE: subD 9pin Female	
SIGNAL	**PIN**	**TYPE**	**IN / OUT**
CHASSIS	1	COMMON	-
RELAY SEMANTICS- [IP0-]	2	DIGITAL	INPUT
NC	3	Not Connected	NC
CHANGEOVER+ [IP2+]	4	DIGITAL	INPUT
CHASSIS	5	COMMON	-
RELAY SEMANTICS+ [IP0+]	6	DIGITAL	INPUT
GND	7	GND	-
GND	8	GND	-
CHANGEOVER- [IP2-]	9	DIGITAL	INPUT

Table A - 12: CMU DIGITAL OUTPUTS CONNECTOR ASSIGNMENT

NAME: CMU DIGITAL OUTPUTS		TYPE: subD 25pin Female	
SIGNAL	**PIN**	**TYPE**	**IN / OUT**
CHASSIS	1	COMMON	-
CMU_Out0_C	2	RELAY CONTACT	OUTPUT
GND	3	GND	-
CMU_Out1_C	4	RELAY CONTACT	OUTPUT
GND	5	GND	-
Vprot1	6	DC Supply	-
Vprot1	7	DC Supply	-
CMU_Out2_C	8	RELAY CONTACT	OUTPUT
GND	9	GND	-
CMU_Out3_C	10	RELAY CONTACT	OUTPUT
GND	11	GND	-
CMU_Out4_C	12	RELAY CONTACT	OUTPUT
CHASSIS	13	COMMON	-
CMU_Out0_NC	14	RELAY CONTACT	OUTPUT
CMU_Out0_NO	15	RELAY CONTACT	OUTPUT
CMU_Out1_NC	16	RELAY CONTACT	OUTPUT
CMU_Out1_NO	17	RELAY CONTACT	OUTPUT

Table A - 12: CMU DIGITAL OUTPUTS CONNECTOR ASSIGNMENT

NAME: CMU DIGITAL OUTPUTS		TYPE: subD 25pin Female	
SIGNAL	**PIN**	**TYPE**	**IN / OUT**
Vprot1	18	DC Supply	-
Vprot1	19	DC Supply	-
CMU_Out2_NC	20	RELAY CONTACT	OUTPUT
CMU_Out2_NO	21	RELAY CONTACT	OUTPUT
CMU_Out3_NC	22	RELAY CONTACT	OUTPUT
CMU_Out3_NO	23	RELAY CONTACT	OUTPUT
CMU_Out4_NC	24	RELAY CONTACT	OUTPUT
CMU_Out4_NO	25	RELAY CONTACT	OUTPUT

Table A - 13: SITE IN/OUT CONNECTOR ASSIGNMENT

NAME: SITE IN/OUT		TYPE: subD 37pin Female	
SIGNAL	**PIN**	**TYPE**	**IN / OUT**
GND	1	GND	-
NC	2	Not Connected	NC
+12V_AUX	3	DC Supply	-
INEXT7	4	DIGITAL	INPUT
INEXT6	5	DIGITAL	INPUT
INEXT5	6	DIGITAL	INPUT
INEXT4	7	DIGITAL	INPUT
INEXT3	8	DIGITAL	INPUT
INEXT2	9	DIGITAL	INPUT
INEXT1	10	DIGITAL	INPUT
INEXT0	11	DIGITAL	INPUT
NC	12	Not Connected	NC
OUTEXT3_NO	13	RELAY CONTACT	OUTPUT
OUTEXT2_NO	14	RELAY CONTACT	OUTPUT
OUTEXT1_NO	15	RELAY CONTACT	OUTPUT
OUTEXT0_NO	16	RELAY CONTACT	OUTPUT
NC	17	Not Connected	NC
NC	18	Not Connected	NC
GND	19	GND	-
GND	20	GND	-
NC	21	Not Connected	NC
+12_RTN	22	COMMON	-
nINEXT7	23	DIGITAL	INPUT
nINEXT6	24	DIGITAL	INPUT
nINEXT5	25	DIGITAL	INPUT
nINEXT4	26	DIGITAL	INPUT
nINEXT3	27	DIGITAL	INPUT
nINEXT2	28	DIGITAL	INPUT
nINEXT1	29	DIGITAL	INPUT
nINEXT0	30	DIGITAL	INPUT
NC	31	Not Connected	NC

Table A - 13: SITE IN/OUT CONNECTOR ASSIGNMENT

NAME: SITE IN/OUT		TYPE: subD 37pin Female	
SIGNAL	**PIN**	**TYPE**	**IN / OUT**
OUTEXT3_C	32	RELAY CONTACT	OUTPUT
OUTEXT2_C	33	RELAY CONTACT	OUTPUT
OUTEXT1_C	34	RELAY CONTACT	OUTPUT
OUTEXT0_C	35	RELAY CONTACT	OUTPUT
nc	36	Not Connected	NC
GND	37	GND	-

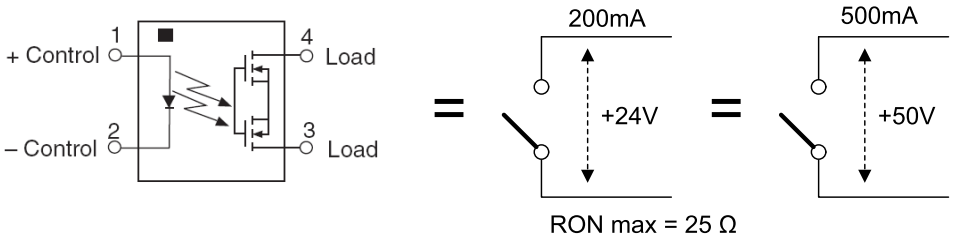
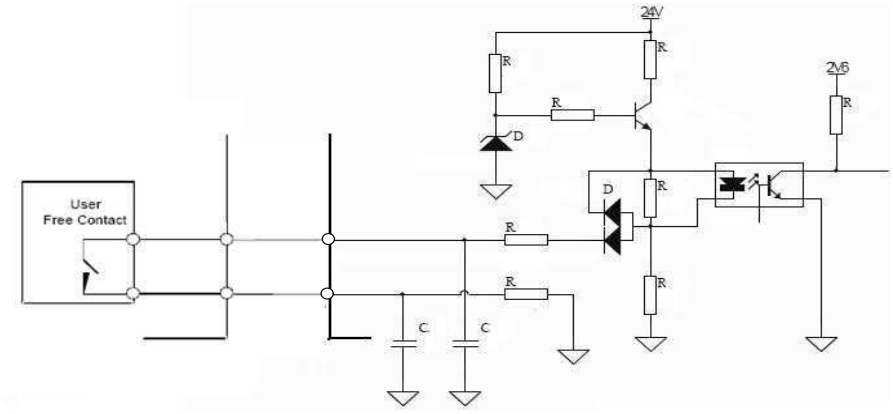


Figure A 2: RELAY OUTPUT CONTACTS EQUIVALENT CIRCUIT

NOTE: +24VDC protected available at the NMP/EIU module.



NOTE: INn and IPn input types.

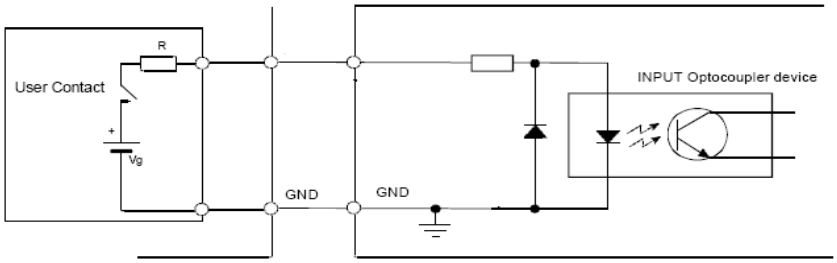


Figure A 3: DIGITAL INPUTS EQUIVALENT CIRCUITS

NOTE: INEXTn and nINEXTn input types.

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B. ANNEX B – RCSU AND RSU OPERATING INSTRUCTIONS

This annex gives instructions to operate to the DME LBD-103 through the two following interfaces: the RCSU (Remote and Control Supervision Unit) and RSU (Remote Supervision Unit).

B.1 RCSU OPERATING INSTRUCTIONS

B.1.1 General

The RCSU is able to command and supervise multiple Navaids (maximum 5). For that purpose, it presents information relative to all Navaids connected in the main screen at any moment.

Following screenshots show the interface presented to operator when system is initiated as well as the three main parts in the RCSU main screen is divided into:

- **Navaid's general information area.**

  This panel shows the general state of the units controlled by the application, up to a maximum of five. It allows an extended format if an access in depth to a specific unit is required, or a minimized format too. This panel is always visible.

- **Navaid's detailed information area.**

  Once selected a Navaid unit from Status Panel, it shows the extended status of unit's alarms and other parameters. Additionally, it allows basic equipment control.

- **RCSU configuration area.**

  By clicking on RCSU icon, a drop-down menu unfolds upwards, hiding the detailed information area. This panel allows access to extended options in configuration and application status of RCSU. By clicking on RCSU icon again, the panel returns to its retracted state.



Figure B 1: RCSU MAIN SCREEN

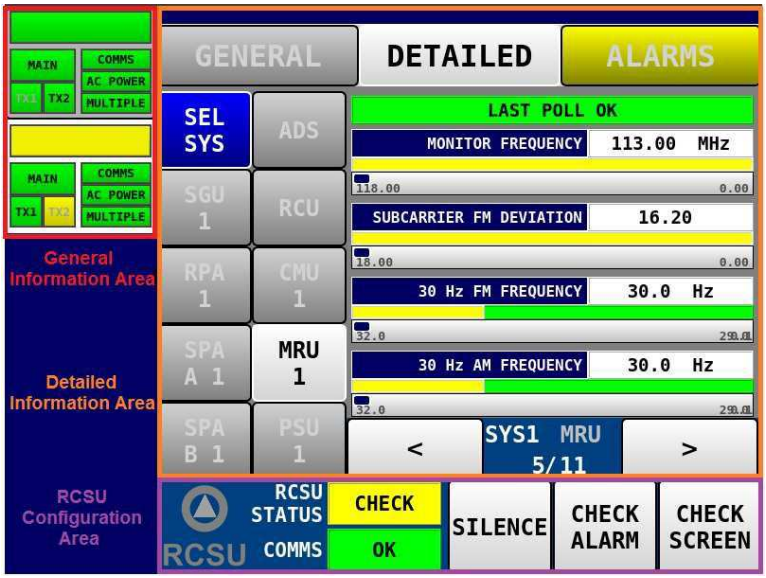


Figure B 2: RCSU MAIN SCREEN AREAS



Figure B 3: RCSU FRONTAL PANEL

B.1.2 Navaid General Information area

The RCSU frontal presents general indications for each Navaid connected. The information presented is at least:

- *Navaid type*
- Id code for the Navaid.
- Operative status [MAIN, STANDBY, SHUTDOWN].
- Transmitter status [ON/OFF, OK/WARNING/ALARM, BYPASS].
- Active transmitter (on air).
- Power status [AC POWER/BATTERY, LOW BATTERY].
- Communications status.
- Navaid control availability.

B.1.3 Navaid Detailed information area

Detailed information area presents to the operator commands and basic indications referring to connected Navaids. This information can change depending on the connected Navaid.

B.1.3.1 General tab

Every time a single Navaid is selected, RCSU screen presents its general information to operator. Using this screen, operator is able to obtain a global vision of the Navaid status. Access to the following parameters is possible:

- Operative status of Navaid transmitters and monitors.
- Transmission frequency/power.
- Antennas status.
- Operation parameters for each Navaid module.
- Alarms for each Navaid module.
- Site alarms.
- Integrity alarms, secondary alarms and maintenance indications.

B.1.3.2 Detailed tab

Once operator has selected a concrete Navaid it is possible to check detailed information relative to the beacon down to LRU level. Information about the system, module configuration, status information or relevant operation parameters could be obtained.

B.1.3.3 Alarms status tab

Once operator has selected a concrete Navaid it is possible to check alarms reported by the Navaid down to LRU level. Site alarms and auxiliary signals are also available.

B.1.4 System Configurations and Control

To configure which Navaid equipment is commanded and supervised by the RCSU, follow the next step.

B.1.4.1 RCSU Interface Configuration

1. Press the arrow button on the main screen of the RCSU to show all the options.
2. Press the “Configure Interfaces” button.
3. Insert password “….” (4 dots).
4. Select “ETHERNET 1” and press OK.
5. Type the network settings and press OK:
   - WAN IP: 192.168.120.5 (Example)
   - Net Mask: 255.255.255.0 (Example)
   - Gateway: 192.168.120.1 (Example)
   - MTU: 1300 (Example)



Figure B 4: RCSU INTERFACE WITHOUT MONITORIZED EQUIPMENTS

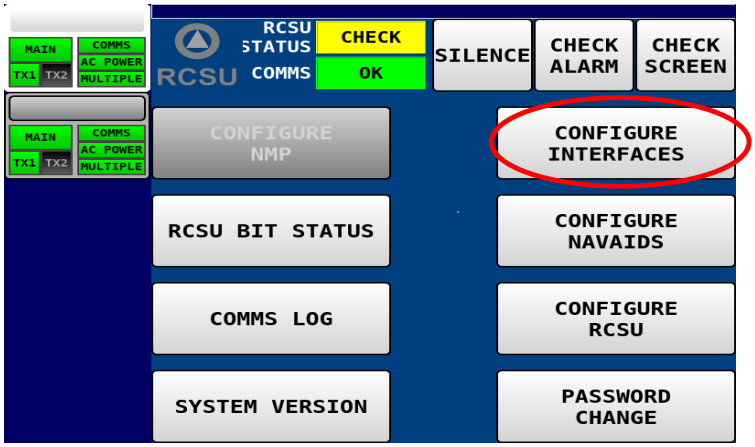
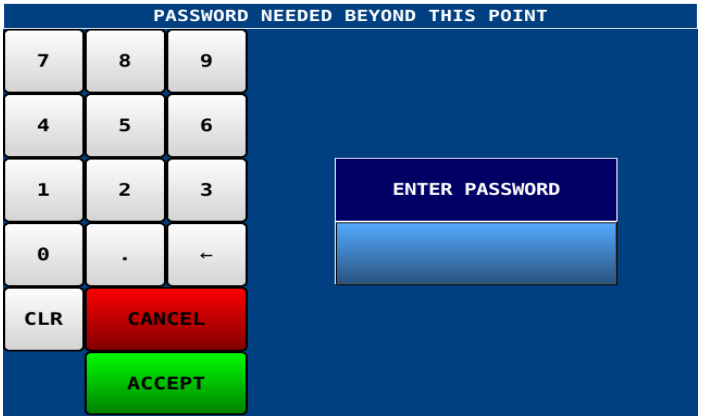


Figure B 5 RCSU INTERFACE WHEN TOUCHING MENU ARROW BUTTON



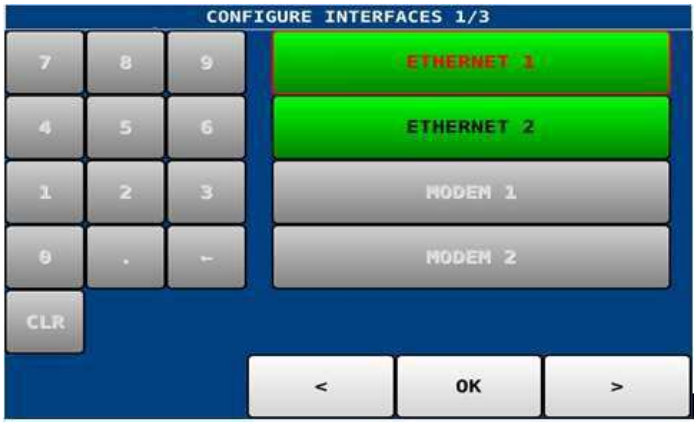


Figure B 6: PASSWORD ENTRY AND INTERFACE LIST WINDOW

Notes:

- Password: " . . . . "
- Interface by default is ETHERNET 1 (Top RJ45 connector).

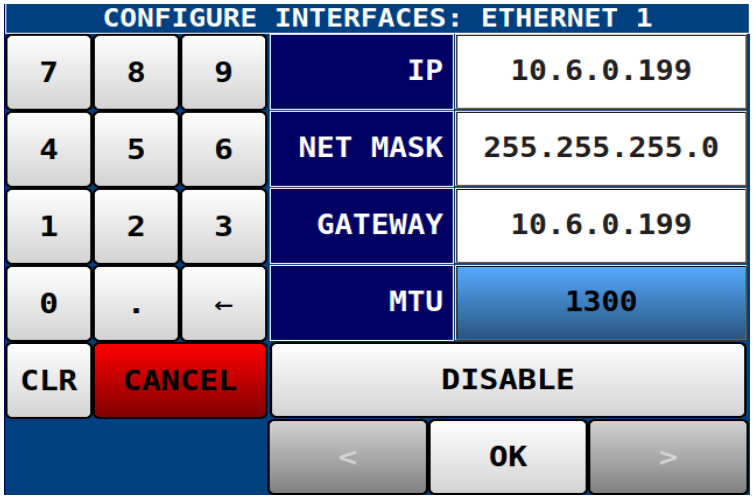


Figure B 7: INTERFACE DATA NETWORK CONFIGURATION WINDOWS

Interface Button View	Status
ETHERNET 2	Interface On and properly configured
ETHERNET 1	Interface On but wrong configured
ETHERNET 2	Interface Off and properly configured

Interface Button View	Status
	Interface Off but wrong configured
	Not installed interface

6. Press the “Configure Navaids” button.
7. Insert password “….”
8. Press “Navaid 1” button.
9. Type the proper configuration:
   - Type: DME/DVOR (as the case may be).
   - WAN IP for NMP module (Gateway).
   - Comms Protocol: SNMP.
   - Write/Read Ports: 26161 for DVOR / 34161 for DME.
10. Press “Ping” and check there is connection between RCSU and Navaid equipment and press OK.

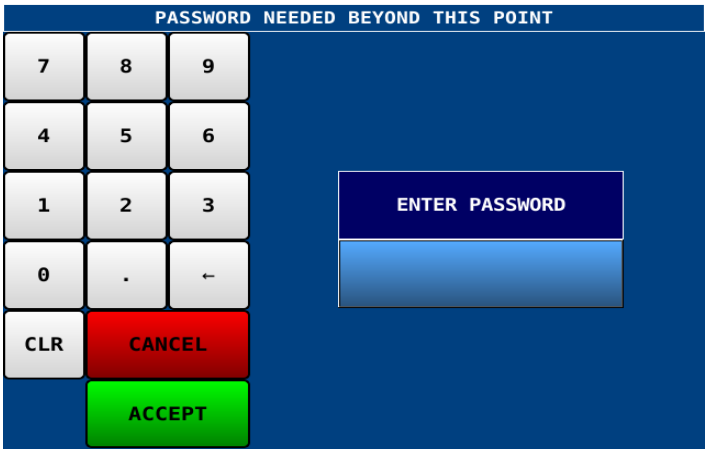
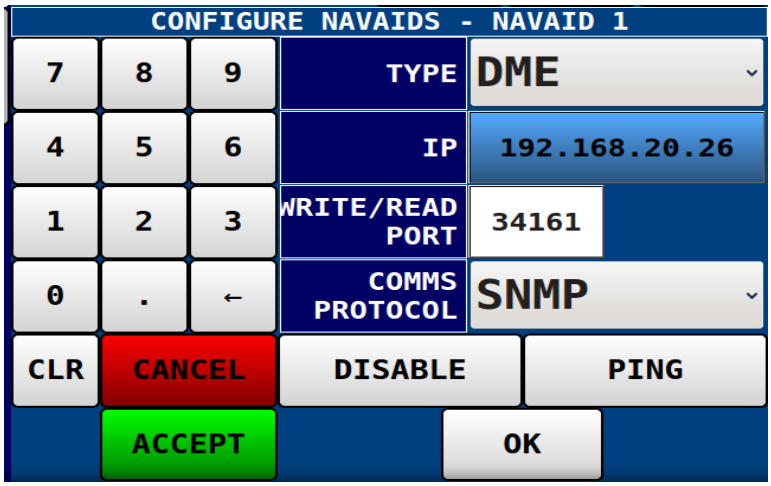




Figure B 8: PASSWORD ENTRY AND NAVAID ENABLED WINDOWS

Interface Button View	Status
NAVAID 1	Enabled Navaid properly configured
NAVAID 2	Enabled Navaid wrong configured
NAVAID 3	Disabled navaid properly configured
NAVAID 4	Disabled navaid wrong configured



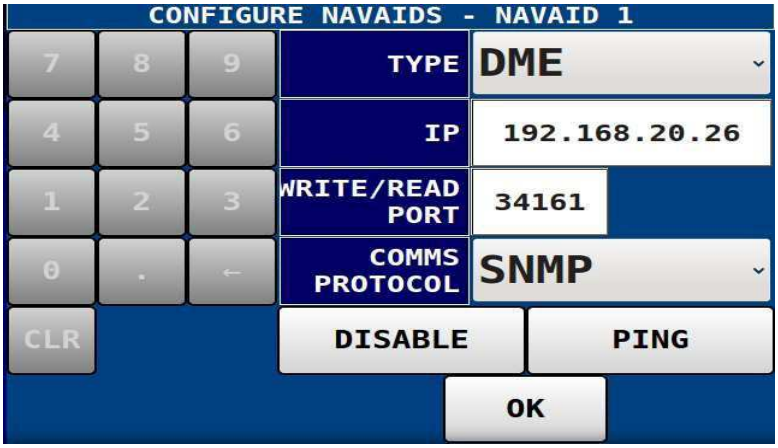


Figure B 9: NAVAID CONFIGURATION WINDOWS

Notes:

- Password: " . . . . "
- Protocol: SNMP - DVOR port: 26161 - DME port: 34161

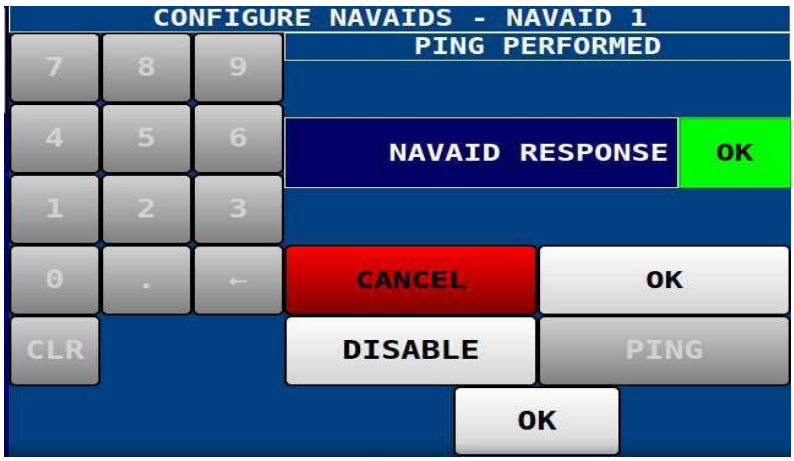


Figure B 10: NAVAID CONFIGURATION WINDOWS - PING

B.1.4.2 RCSU Language Configuration:

1. Press the “RCSU Configure” button in the RCSU arrow menu.
2. Set time and date.
3. Set language as required.
4. Set Connection Timeout (1-10 minutes).
5. Set type of Alarm Policy.

To return to its factory default values, press RESET.

Note: CONNECTION TIMEOUT parameter included in version 1.1.0
TX ALARM POLICY included in version 1.1.4

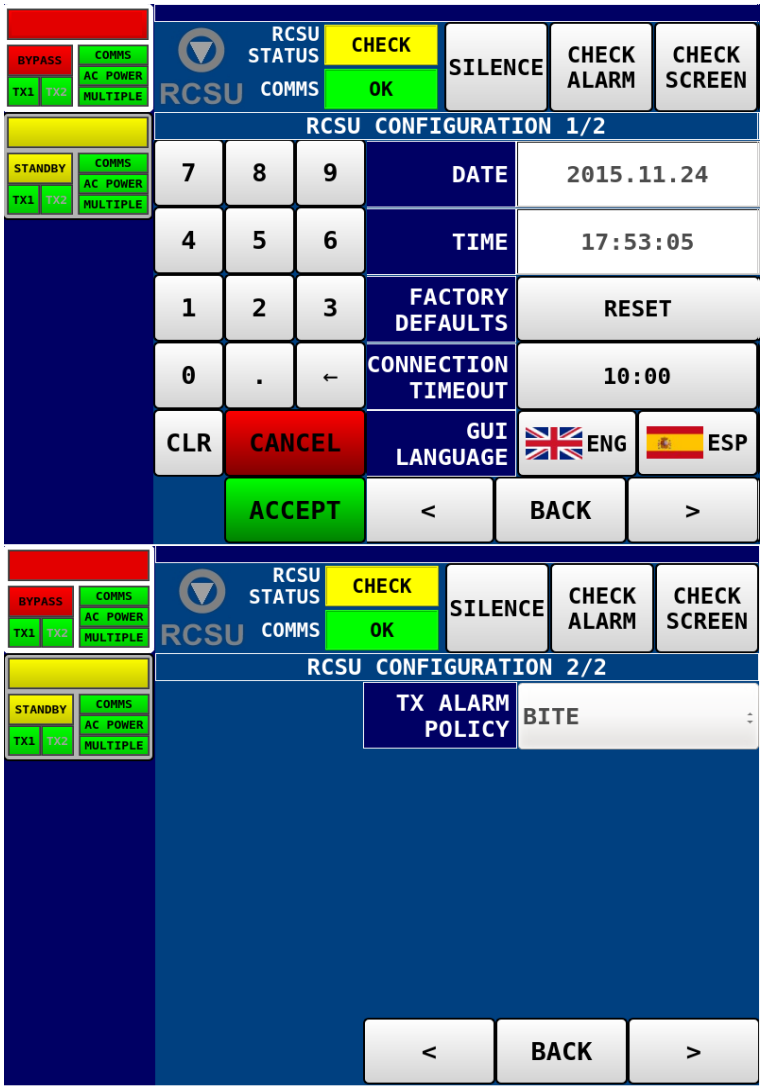


Figure B 11: RCSU CONFIGURATION WINDOW

B.1.4.3 RCSU System Version Checking:

1. Press the “System Version” button in the RCSU arrow menu.
2. Check and record system information.

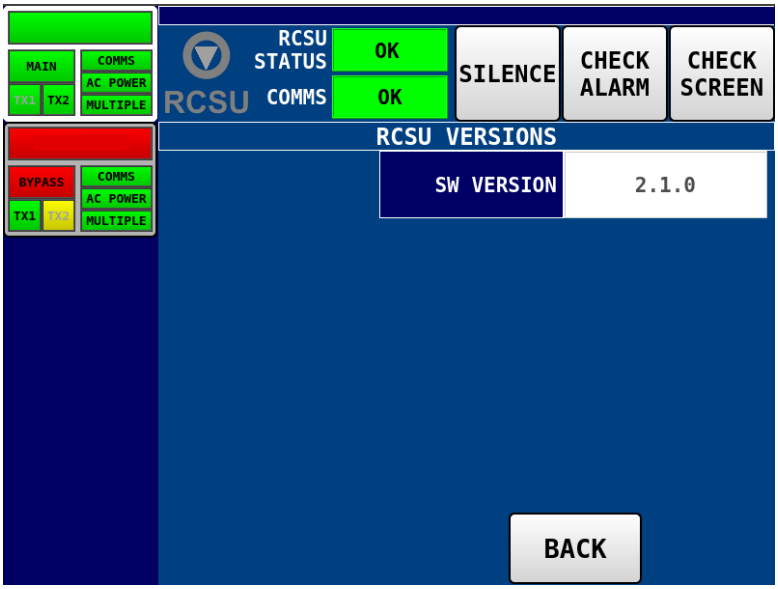


Figure B 12: SYSTEM VERSION WINDOW

B.1.4.4 RCSU Communitcations Log

1. Press the “Comms Log” button in the RCSU arrow menu
2. Check system information.

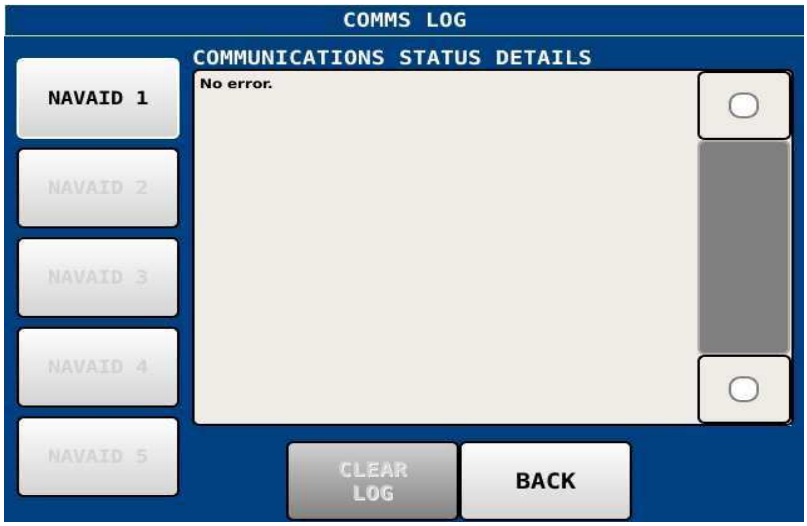


Figure B 13: COMMS LOG WINDOW

B.1.5 Remote Commands

RCSU REQUEST CONTROL allows the following controls on Navaids equipments:

- Selection of main and standby transmitters.
- Activation of transmitter commutation.
- Power ON/OFF of Navaid transmitters.

- Disable the acoustic alarm.
- Restore the service (reset).
- Request equipment remote control.
- Inhibit monitors actions (BYPASS).

B.1.6 Indications

RCSU allows in a fast way to know the status of each sub-system in the installation. For that purpose it uses a color code for the indication through the touch screen.

Frontal panel is equipped with a loudspeaker to provide acoustic information when an alarm occurs. Operator is able to disable acoustic alarms.

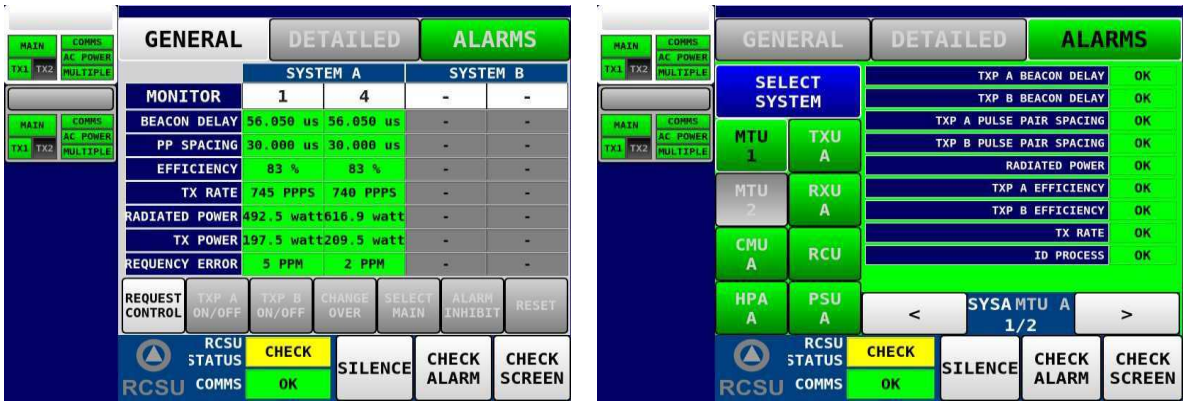


Figure B 14: NORMAL OPERATION (GREEN COLOURED) – WITHOUT ALARMS

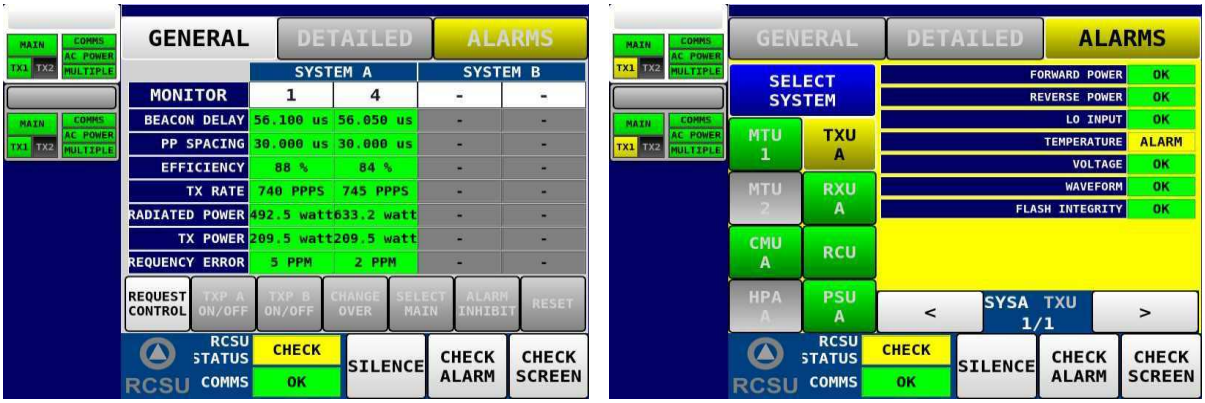


Figure B 15: SECONDARY ALARM INDICATION (YELLOW COLOURED)

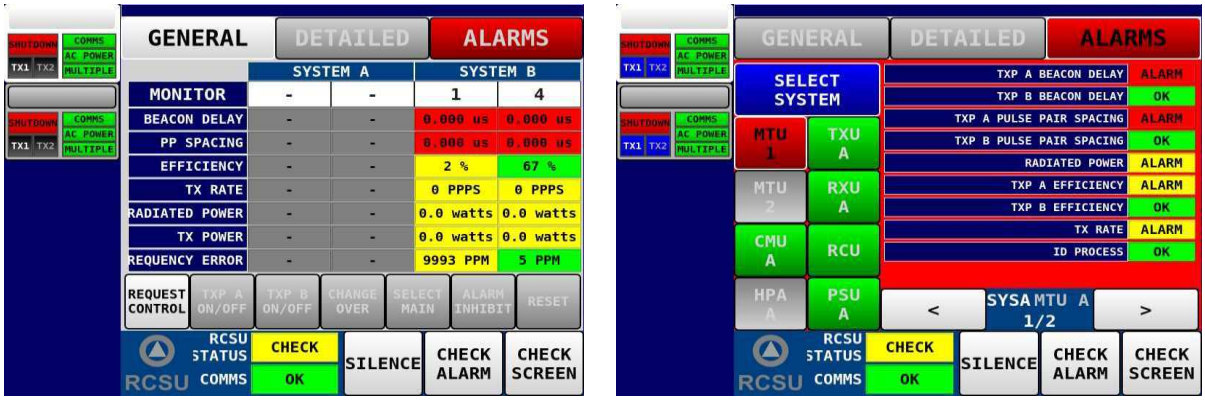


Figure B 16: FAILURE INDICATION (RED COLOURED)

B.2 RSU OPERATING INSTRUCTIONS

B.2.1 General

The Remote Supervision Unit (RSU) can be installed in the air traffic control area, in the control tower or at any point of the Remote Control Center.

Its main function is reporting information about the state and availability of the Navaid systems to the operator. Each RSU has indicators to monitor the basic status (FAIL/OK) of the Navaids supervised by the RCSU (up five).

B.2.2 Navaid Information Area

The RSU frontal presents general indications for each Navaid connected. The information presented is at least:

- LED Panel: simple and compact solution (2 LEDs) for each supervision navaid. The navaid status shown by the RSU just indicates two states :
  - Navaid OK: (green led ON)
  - Navaid NO OK: (red led ON)
  - NO OK status include “out of service” status such as maintenance works with monitors disabled, or ALARM INHIBIT/TX BYPASS status active or SHUTDOWN
- Lamp Test: to verify the right operating of the LED panel.
- Silence Panel: to disable/silence audible alarm after a NO OK status risen and indicate if the silence button has been press (red LED).

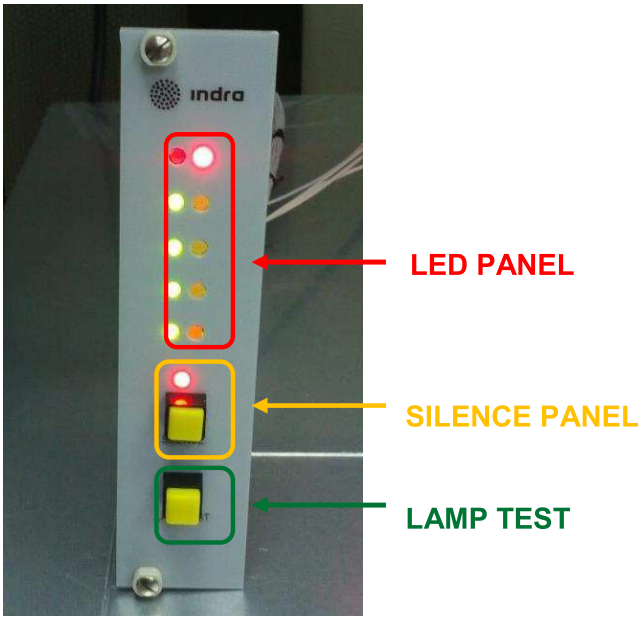


Figure B 17: RSU FRONT PANEL

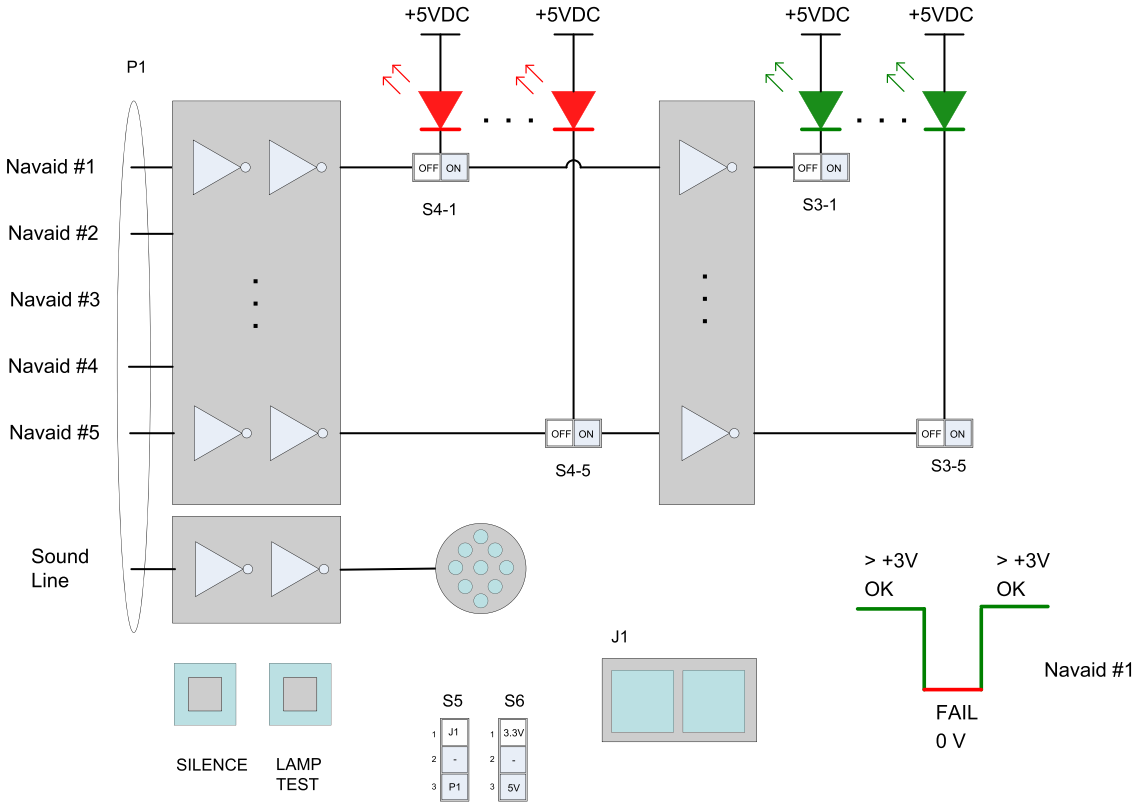


Figure B 18: RSU BLOCK DIAGRAM

Notes:

Navaids OK input voltage: 3.3V to 31V (High Level).

Navaids FAIL input signal: 0 V (Low Level).

S3/S4 Navaids OK/FAIL LEDS enable.

S5/S6 Power supply configuration.

B.2.2.1 RSU Interface Configuration

To RSU is a very simple instrument. To get on running in, only the power connection must be configured.

As it is shown in Figure B 19, there are two possibilities to feed the RSU: trough a D-Sub connector (P1) or through a header (J1). By the Switch A is possible to select which power source is active:

- Up: Header connection.
- Down: D-Sub Connector.

If the Head connection is active, the switch B allows selecting how much is the input power level.

- Up: 3.3 V.
- Down: 5 V.

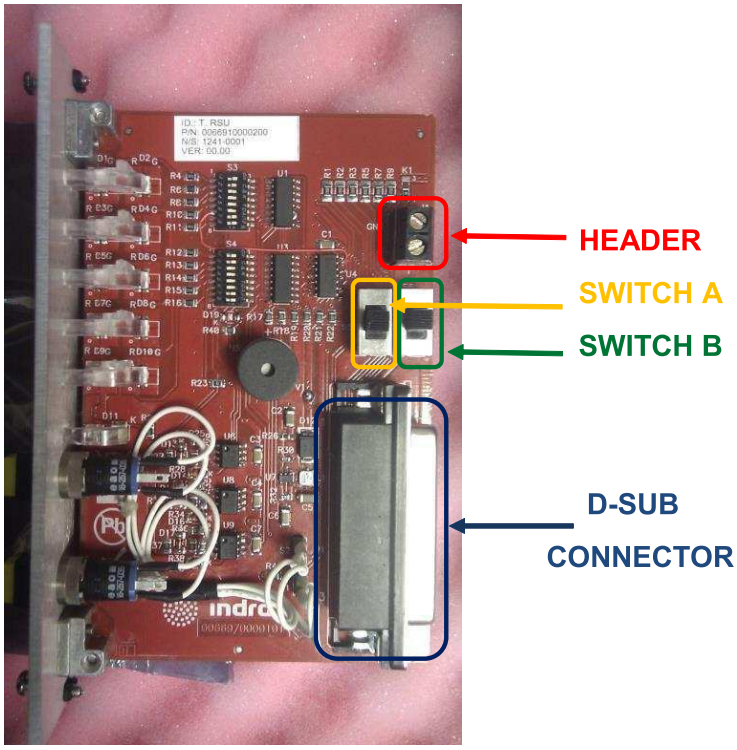


Figure B 19: RSU POWER SELECTION

B.3 RCSU-RSU CABLING PIN-OUT

B.3.1 RCSU - PN 0066910000100 (OBSOLETE)

Standard assembly AWG 22/24 or equivalent.

- RCSU connector: D-SUB 50p female.
- RSU connector: D-SUB 25p female.
- RCSU-RSU cable: D-SUB-D 50p male - D-SUB 25p male.
- RCSU-RSU cable length: As needed.

Table B - 1: RCSU PN 0066910000200 - RSU CABLE PIN OUT (SUBD 50p MALE TO SUBD 25p MALE)

Pin RCSU SUBD 50p	Pin RSU SUBD 25p	Description
1	1	NAVAID 1_Input
2	3	GND_Input
3	2	NAVAID 2_Input
4	3	GND_Input
5	4	NAVAID 3_Input
6	6	GND_Input
7	5	NAVAID 4_Input
8	6	GND_Input
9	7	NAVAID 5_Input
10	9	GND_Input
41	8	SOUND LINE_Input
42	9	GND_Input
11	10	NAVAID 1_Output
12	18	GND_Output
13	11	NAVAID 2_Output
14	18	GND_Output
15	13	NAVAID 3_Output
16	20	GND_Output
17	14	NAVAID 4_Output
18	20	GND_Output
19	16	NAVAID 5_Output
20	22	GND_Output
21	17	SOUND LINE_Output
22	22	GND_Output
45	19	3.3 V
46	21	3.3 V
47	24	GND_Output
48	23	5V
49	25	5V
50	24	GND_Output

B.3.2 RCSU - PN 0066910000600

Standard assembly AWG 22/24 or equivalent.

- RCSU connector: D-SUB 25p female
- RSU connector: D-SUB 25p female
- RCSU-RSU cable: D-SUB-D 25p male - D-SUB 25p male
- RCSU-RSU cable length: As needed

Table B - 2: RCSU PN 0066910000600 - RSU CABLE PIN OUT (SUBD 25p MALE TO SUBD 25p MALE)

Pin RSU SUBD 25p	Pin RCSU SUBD 25p	Description
1	2	NAVAID_1_IN
2	3	NAVAID_2_IN
3	18	AGND
3	19	GND
4	4	NAVAID_3_IN
5	5	NAVAID_4_IN
6	20; 21	AGND
7	6	NAVAID_5_IN
8	7	SOUND_LINE_IN
9	22; 23	AGND
10		NAVAID_1_OUT
11		NAVAID_2_OUT
12		VBB
13		NAVAID_3_OUT
14		NAVAID_4_OUT
15		VBB
16		NAVAID_5_OUT
17		SOUND_LINE_OUT
18		GND_out
19		3,3V
20		GND_out
21		3,3V
22		GND_out
23		5V
24		GND_out
25		5V

Notes:

Input Voltage: 3V to 31V.

Ground isolation: 50 V.

Output lines: Not used

Open collector (Darlington pairs).

Output Voltage: 0-5V, maximum current per output 33 mA.