Reference No. 83130 55124
PDM–Version C

CVOR 431

Conventional VHF Omnidirectional Radio Range

Technical Manual

Part 2

Operation and Maintenance

As for details, the electrical and mechanical information given in the documentation supplied with each equipment prevails

THALES

CVOR 431

The equipment documentation comprises:

Part	Technical Manuals	Code No.
1	Equipment Description	83130 55123
2	Operation and Maintenance	83130 55124
Volume	**Drawing Set**	**Code No.**
A	Delivery List, Parts List, Schematic diagrams and Layout Drawings	83051 48600
B	Delivery List, Parts List, Schematic diagrams and Layout Drawings	83051 48600
C	Delivery List, Parts List, Schematic diagrams and Layout Drawings	83051 48600

GENERAL

As for details, the electrical and mechanical information given in the documentation supplied with each equipment prevails. Despite of careful editing work technical inaccuracies and printing faults cannot be excluded in this publication. Change of text remains reserved without notification.

Thales reserves the right to make design changes, additions to improvements in its products without obligation to install such in products previously manufactured or installed.

TECHNICAL SUPPORT AND HANDLING REPLACEMENT PARTS

Subassemblies and components which are sent to the manufacturer for repair or returns must be packed in a way that no damage of the parts could arise. It is recommended to use the original packing, e.g. of the spare part, or a comparable packing in corresponding performance to ensure a safe shipping of defective subassemblies or components. For technical support and information on how to order or sent back replacement parts, contact your equipment provider listed below.

Germany:
Thales Air Systems GmbH
Lilienthalstrasse 2
70825 Korntal−Münchingen Germany
Tel: +49 711 86032−151
Fax: +49 711 86032−804

Italy:
Thales Italia SPA
Via E. Mattei, 1
20064 Gorgonzola (MI) Italy
Tel: +39 02 95095−405
Fax: +39 02 95095−331

United States:
Thales ATM Inc.
23501 West 84th Street
Shawnee, Kansas 66227 USA
Tel: +1 913 422−2600
Fax: +1 913 422−2962

LIMITATION OF USE

The use of this manual is limited to the operation and maintenance of the system stated in the title page. It shall not be used for purposes of product manufacture. The installation drawings in the manuals, e.g. foundations and site drawings are for information only. The as−built engineering drawings for the site are the only one to be used. The information in the technical manuals is thought to be used by skilled workers to install the antenna and perform the related electrical and mechanical adjustments. The leader of the installation team should be an engineer, technician or experienced master craftsman. Special training and initiation by Thales are urgently recommended. The fitters should be trained craftsman, for example mechanics, electricians or locksmiths.

SAFETY PRECAUTIONS

The safety regulations laid down by the local authorities (e.g. concerning accident prevention, work safety or operation of electronic equipment and navigation systems) must be observed at all times. The purpose of safety precautions is to protect persons and property, and they must always be heeded. Station shutdown due to repair and maintenance: The responsible authorities must be notified of any work which may require operation of the system to be interrupted, in accordance with national regulations. Further information due to system handling is contained in the correspondent sections.

COPYRIGHT

TRADEMARKS

Microsoft and MS−DOS are registered trademarks, WINDOWS is a trademark of the Microsoft Corporation. IBM is a registered trademark of the International Business Machines Corporation. Pentium® is a registered trademark of the Intel Corporation. All other mentioned product names may be trademarks of the respective manufacturers and must be observed.

PRELIMINARY REMARKS

The equipment manuals for CVOR 431 (50 W and 100 W, single or dual) comprise:

PART	CONTENTS	CODE NO.
1	Equipment Description	83130 55123
2	Operation and Maintenance	83130 55124

This Technical Manual Part 2 includes the Operation and Maintenance with the chapters below:

1 General Information
2 Installation
3 Operation
4 Alignment Procedure
Annex Alignment Procedure 8 Point Ground Check Option
5 Maintenance
6 Fault Location and Repairs
Annex PC User Program (Specific Procedures)

The 50 W and 100 W installations (single or dual) differ only slightly with respect to equipment, functions and operation, separate descriptions are not therefore provided for these two versions, but instead any special features of either are pointed out. The content of part 1 ”Equipment Description” will as well—known presupposed. The 8 point ground check option is integrated in the text where it is useful. For the alignment procedure the individual steps used for 8 PGC are described in an Annex to Chapter 4.

Since it is not possible to include modifications, such as those which may be made to circuitry details or dimensioning in the interests of technical progress, in the Technical Manual, we should point out that questions of detail should always be answered using the technical documentation supplied with the system. It is possible that reference numbers of drawings or subassemblies used in this description are no longer contained in the set of drawings supplied (Volume A to C), but rather than (to conform with the system) they have been replaced by new drawings with another number. Please carry out a once—only check on the basis of delivery list supplied and exchange where appropriate.

Description and use of the ’PC User Program’ will be found for use of **ADRACS** in the Tech. Man., Code No. 83140 55324, the one for use of **MCS** in the Tech. Man., Code No. 83140 55325.

MARK SYMBOLS

To get the best out of the navigation systems Navaids 400 you should study the contents of this manual carefully. In particular you should familiarize yourself with the marks given in this manual which are highlighted for easy recognition:

CAUTION

Cautions call attention to methods and procedures which must be followed to avoid damage to equipment.

WARNING

Warnings call attention to methods, procedures or limits which must be followed precisely to avoid injury to persons.

NOTE or **REMARK :** For more information about operations.

Table of effective pages

Basic edition: 01.04 / Revision: 01.12

Pages	Ed.—No.	Pages	Ed.—No.	Remarks
Title	01.12	6—1	05.06	
Info 1 and 2	09.10	6—2 to 10	01.04	
A	05.06	6—11 to 12	01.12	
B	01.12	6—13 to 15	11.05	
I to XIV	01.12	6—16 to 17	01.12	
AV—1 to 16	08.09	6—18	05.06	
		6—19	01.12	
1—1 to 4	01.04	6—20	05.06	
1—5	05.06	6—21	06.08	
1—6	01.04	6—22 to 44	01.12	
1—7	05.06			
1—8 to 10	01.04	Annex SP	09.09	PC User Program
2—1 to 4	01.04			
2—5	01.12			
2—6 to 11	01.04			
2—12	03.11			
2—13	01.04			
2—14	05.06			
2—15 to 16	01.04			
2—17 to 27	05.06			
2—28 to 29	01.12			
2—30	05.06			
2—31 to 40	01.12			
2—41 to 52	05.06			
3—1	07.09			
3—2	05.06			
3—3	01.12			
3—4	08.10			
3—5 to 8	05.06			
3—9 to 18	07.09			
4—1 to 40	01.12			
A4—1 to 3	09.10			Annex 8 PGC option
A4—4	01.12			
A4—5 to 12	09.10			
5—1 to 18	01.12			

TABLE OF CONTENTS

LIST OF FIGURES

ABKÜRZUNGSVERZEICHNIS
LIST OF ABBREVIATIONS
LISTE D'ABRÉVIATIONS
LISTA DE ABREVIATURAS

A	Antenne Antenna Antena
AC	Alternating Current Courant alternatif Corriente alterna
ACA	Analogical Carrier Amplifier (BITE signal) Amplificateur pour porteurs analogiques (signal BITE) Amplificdor portador analogico (señal BITE)
ACC	Alternating Current Converter
ADC	Analog—Digital Converter Convertisseur analogique/numérique Convertidor analógico/digital
ADCS	Analog—to—digital Converter Subsystem Sous—système convertisseur analogique/numérique Subsistema convertidor analógico/digital
ADR	Analog Display Routine Routine affichage analogique Rutina de indicator analógico
ADRACS	Automatic Data Recording And Control System
ADSB	Alternating Double Sideband Bande latérale double alternante Banda lateral doble alternante
ADU	Antenna Distribution Unit Antennen—Verteileinheit Ensemble de distribution d'antenne Unidad de distribución de antena
AF	Audio Frequency Basse fréquence Audiofrequencia
AFC	Automatic Frequency Control Commande automatique par fréquence Control automático de frecuencia
AGC	Automatic Gain Control Commande automatique de gain Control automático de ganancia
AM	Amplitude Modulation Modulation d'amplitude Modulación de amplitud

AMP	AMPlifier Amplificateur Amplificador
ANSI	American National Standards Institute
ASB	Alternating SideBand Bandes latérales alternantes Banda lateral alternante
ASC	Antenna Switch Control Commutateur d'antennes de commande Control de conmutador de antena
ASCII	American Standard Code for Information Interchange Code standard américain pour l'échange d'informations Código stándard americano para el intercambio de informaciones
ASM	Antenna Switch Module Module de commutateur d'antennes Módulo de conmutador de antena
ASU	Antenna Switching Unit Ensemble de commutation d'antennes Unidad de conmutación de antena
ATC	Air Traffic Control Contrôle du trafic aérien Control del tráfico aéreo
ATIS	Air Traffic Information System Système d'informations du trafic aérien Sistema de informaciones del tráfico aéreo
ATM	Air Traffic Management
AWD	Automatische Wähleinrichtung für Datenverbindungen Automatic dialling equipment for data connections Dispositif automatique de sélection pour liaisons d'acheminement de données Dispositivo automático de selección para comunicaciones de datos
BAZ	Back−Azimuth
BCD	Binär Codiert Dezimal Binary Coded decimal
BCPS	Battery Charging Power Supply Chargeur de batterie et bloc d'alimentation Chargador de bateria y equipo de alimentación
BD	Baud Baud Baudio
BF	Basse Fréquency Audio Frequency Baja frecuencia (audiofrecuencia)
BIT(E)	Built−in Test (Equipment) Dispositif de test intégré Dispositivo de test integrado

BKZ	BefehlsKennZahl Command code number Numéro indicatif de commande Número indicador de orden
BNC	Bayonet Navy Connector Koaxialverbinder mit Bayonetkupplung
BP	Backplane Rückwandverdrahtung
bro.	broches polig pin
BSE	Betriebs– und Schutzerde System and protective ground Prise de terre de système et terre de protection Puesta a tierra del sistema y de protección
BSG–D	Blending Signal Generator Générateur de signaux de transition Generador de señal de transición
BST	Baustahl Structure steel Acier de construction Acero de construcción
BUSGNT	Bus Grant Autorisation de bus Autorización de bus
BUSRQ	Bus Request Demande de bus Solicitud de bus
CA	Carrier Amplifier
CAB	Cabinet Armoire Armario
CAT	Category Kategorie Category Categoría
CCA	Circuit Card Assembly Baugruppe Assemblage de la carte de circuit
CCITT	Commitée Consultatif International Téléphonique et Télégraphique International Telegraph and Telephone Consultative Committee
CCP	Control Coupler Coupleur de commande Acoplador de control

CDI	Course Deviation Indicator Indicateur de déviation (cap) Indicador de desviaciòn de rumbo
CD−ROM	Compact Disc − Read Only Memory Disque compact −Mémoire à lecture Disco compacto − Memoria permanente
CE	Conformité Européen oder/or/ou Communautés Européennes
CEE	International Commmision on Rules for the Approval of Electrical Equipment
CLR; CL	Clearance signal Signal de Clearance Señal de Clearance
CMOS	Complementary Metaloxide Semiconductor Semi−conducteur oxyde métallique complémentaire Semiconductor complementario de óxido metálico
CONC	Phone Concentrator Telefon−Umschalteinrichtung Installation de commutation téléphonique Centralilla teléfonica
CPU	Central Processing Unit Zentrale Prozessoreinheit
CR	Carriage Return Retour du chariot Retorno de carro
CRC	Cyclic Redundancy Check
CRT	Cathode Ray Tube Tube cathodique Tubo catódico
CRS; CS	Course signal Kurssignal Signal de directif Señal de rumbo
CSB (1)	Carrier signal with SideBands (HF) Signal de porteuse avec bandes latérales Señal de portadora con bandas laterales
CSB (2)	Control&Status Board (part of the LCSU)
CSL	Control and Selector Logic Logique de commande et de sélection Lógica de control y de selección
CTOL	Conventional Take−off and Landing Décollage et atterrissage classiques Despegue y aterrizaje convencionales
CTS	Clear to Send Prêt à émettre Listo para transmitir

CU	Combining Unit
CW	Continuous Wave Fortlaufende Welle Ondes continues Ondas continuos
DAC	Digital/Analog Converter Convertisseur numérique/analogique Convertidor digital/analógico
DAS	DME−based Azimuth System Système d'azimut basé DME Sistema de acimut basado en DME
DC	Direct Current Courant continu Corriente continua
DCC	DC−Converter Convertisseur de courant continu (Convertisseur CC) Convertidor de corriente continua (convertidor CC)
DCC−MV	DC−Converter Multivolt Convertisseur CC−Multivolt Convertidor CC−Multivolt
DCC−MVD	DC−Converter Multivolt Doppler Convertisseur CC−Multivolt Doppler Convertidor CC−Multivolt Doppler
DDM	Difference in Depth of Modulation Differenz der Modulationsgrade Différence de taux de modulation Diferencia de grados de modulación
DDS	Direct Digital Synthesis
DFS	Deutsche Flugsicherung Administration of air navigation services Bureau de la sécurité aérienne Instituto de protección de vuelo
DFT	Diskrete Fourier Transformation Discrete Fourier Transformation
DIF	Differenzsignal Difference signal Signal différentiel Señal diferencial
DIN	Deutsche Industrie Norm German industrial standard Norme industrielle allemande Norma industrial alemana
DIP	Dual−In−Line Package
DMA	Direct Memory Access

DME	Distance Measuring Equipment Equipement de mesure de la distance Equipo de medición de la distancia
DSB	Double Sideband Bandes latérales doubles Banda lateral doble
DSP	Digital Signal Processing Digitaler Signal Prozessor
DSR	Data Set Ready Enregistrement des données prêt Registro de datos listo
DTR	Data Terminal Ready Terminal de données prêt Terminal de datos listo
DU	Distribution Unit Verteilereinheit Ensemble de distribution Unidad de distribución
DVOR	Doppler Very High Frequency Omnidirectional Radio Range Radiophare omnidirectionnel VHF Doppler Radiofaro omnidireccional VHF Doppler
EC	European Community
ECU	Executive Control Unit Ausführende Steuereinheit Ensemble de contrôl exécutif Unidad de control ejecución
EEPROM	Electrically Erasable Programmable Read Only Memory Mémoire à lecture seule, programmable et erasable électrique Memoria permanente borrable eléctricamente y programada
EMC	Electromagnetic Compatibility Elektromagnetische Verträglichkeit
ENBT	Enable Bus Transfer Validation transfert de bus Conexión transferencia de bus
EPLD	Electrically Programmable Logic Device Elektrisch programmierbare Schaltungseinheit Montage programmable électrique Circuito programado eléctricamente
EPROM	Erasable Programmable Read Only Memory Mémoire à lecture seule, programmable et erasable Memoria permanente borrable y programada
EUROCAE	European Organization for Civil Aviation Electronics Organisation européenne pour l'électronique de l'aviation civile Organización europea para la electrónica de la aviacion civil

FAA	Federal Aviation Administration Administration fédérale de l'aviation Administración federal de aviación
FET	Feldeffekttransistor Field−effect transistor
FFM (FF)	Farfield Monitor Moniteur de champ lointain (zone Fraunhofer) Monitor campo lejano
FIFO	First In/First Out Premier entré/premier sortie Primera entrada/primera salida
FM	Frequency Modulation Modulation de fréquence Modulación de frecuencia
FPE	Functional Protection Earth Betriebsschutzerde
FSK	Frequency−Shift Keying Frequenzumtastverfahren Manipulation par déplacement de fréquence Método de manipulación de frecuencia
GP, GS	Glide Slope, Glide Path Gleitweg Radiophare d'alignement de descente Transmisor de trayectoria de descenso
HF	Hochfrequenz Radio frequency Haute fréquence Alta frecuencia
IC	Integrated Circuit Integrierter Schaltkreis Circuit intégré Circuito integrado
ICAO	International Civil Aviation Organization Organisation de l'aviation civile internationale (OACI) Organización de aviación civil international (OACI)
IF	Intermediate Frequency Zwischenfrequenz (ZF)
ILS	Instrument Landing System Système d'atterrissage aux instruments Sistema de aterrizaje por instrumentos
IM	Inner Marker Radiobalise intérieure Radiobaliza interior
INC	Indication and Control Anzeige und Steuerung

	Indicateur et contrôle Panel de indicaciones y control
INT	Interface Unit Schnittstelleneinheit Unité d'interface Unidad de interfase
INTFC	Interface Board for monitor Schnittstellenkarte für Monitor Platine d'interface du moniteur Placa enchufable de la interfase de monitor
I/O−Port	Input/Output−Port Ein−/Ausgabeport Porte d'entrée/sortie Puerto de entrada/salida
ISO	International Organization for Standardization Internationale Organisation für Normung Organisation Internationale de Normalisation
I/Q	In Phase/Quadraturphase In−phase/Quadratur−phase
KADP	Kabeladapter Cable adapter Adaptateur de cable Adaptador de cable
LCC	Local Communication Control
LCD	Liquid Crystal Display Ecran à cristaux liquides Indicador de cristal liquido
LCI	Local Control Interface Interface de commande locale
LCP	Local Control Panel Panneau de commande locale
LCSU	Local Control and Status Unit
LCU	Local Communication Unit
LED	Light Emitting Diode Diode électroluminiscente Diodo electroluminiscente
LF	Line Feed Avancement de ligne Avance de línea
LG−A	Localizer/Glide Path − Audio Generator LLZ/GP − Générateur Audio
LG−M	Localizer/Glide Path − Monitor Processor LLZ/GP − Processeur du Moniteur
LGM	Modembezeichnung (LOGEM) Modem assignation

LLZ/LOC	Localizer Radiophare d'alignement de piste Localizador
LP	Leiterplatte Printed circuit board Plaquette à circuits imprimé Placa de circuito impreso
LPF	Low Pass Filter Filtre passe−bas Filtro de paso bajo
LRCI	Local/Remote Communication Interface
LRU	Line Replaceable Unit
LSB (1)	Lower Sideband (HF DVOR) Bandes latérales inférieures Banda lateral inferior
LSB (2)	Least Significant Bit (digital)
m	Modulationsgrad Mod−Depth Taux de modulation Profundidad (grado) de modulación
MCS	Monitoring and Control System
MEU	Marker Extension Unit Unité de radiobalise d'extension Fuente de alimentación suplementaria de la radiobaliza
MIA	Monitor Interface Adapter Adapteur d'interface du moniteur Adaptador de la interfase de monitor
MIB	Monitor Interface Board Platine d'interface du moniteur Placa enchufable de la interfase de monitor
MLS	Microwave Landing System Système d'atterrissage aux micro−ondes Sistema de aterrizaje por microondas
MM	Middle Marker Radiobalise médiane Radiobaliza intermedia
MOD	Modulation Modulation Modulación
MODPA	Modulator/Power Amplifier Modulateur/Amplificadeur de puissance Modulador/AmplificadorAlimentación
MOD−SBB	Modulator Sideband Blending (DVOR) Modulateur de transition des bandes latérales Modulador de transición de banda lateral

MON	Monitor Moniteur Monitor
MOS	Metallic Oxide Semiconductor Semi−conducteur métal oxyde Semiconductor de óxido metálico
MPS	Minimum Performance Specification Spécification de rendement minimum Especificación de rendimiento mínimo
MPU	Marker Processing Unit Unité de marqueur de traitement Procesador de radiobaliza
MSB	Most Significant Bit
MSG	Modulation Signal Generator Générateur de signaux de modulation Generador de señal de modulación
MSP	Monitor Signal Processor Processeur de signaux de moniteur Procesador de señal de monitor
MSR	Monitor Service Routine Routine de service de moniteur Rutina de servicio de monitor
MTBF	Meantime between Failures Temps moyen entre défauts Tiempo medio entre fallos
MTTR	Meantime to Repair Temps moyen de réparation Tiempo medio de reparacion
MUX	Multiplexer Multiplexeur Multiplexor
MV	Multivolt
NAV	Navigation Navigation Navigation Navegación
NAVAIDS	Navigational Aids Navigationsanlagen Aide de navigation Radioayudas a la navegación
NC	Normally closed Normalement fermé Normalmente cerrado
NDB	Non−Directional radio Beacon Radiophare omnidirectional Radiofaro omnidireccional

NF	Niederfrequenz Audio frequency Basse fréquence Baja frecuencia
NFK	Niederfrequenzknoten (Sternverteiler) Star distributor (for audio frequency)
NFM	Nearfield Monitor Moniteur de champ proche Monitor campo cercano
NM	Nautical Mile Mile nautique Milla náutica
NO	Normally open Normalement ouvert Normalmente abierto
OAB	Optocoupler Adapter Board Platine d'adaptateur d'optcoupleur Placa enchufable del adaptador optoacoplador
OACI	Organisation de l'aviation civile internationale (= ICAO) International Civil Aviation Organization Organización de aviación civil international
OIO	Opto Coupler Isolated Input/Output
OM	Outer Marker Radiobalise extérieure Radiobaliza exterior
PC	Personal Computer
PCB	Printed Circuit Board Carte à circuit imprimé Tarjeta de circuito impreso
PDME	Precision DME DME de précision DME de precición
PE	Protection Earth
PEP	Peak Envelope Power Spitzenleistung Puissance de pointe Potencia punta
PIR	Portable ILS Receiver
PLL	Phase Locked Loop Boucle à verrouillage de phase Bucle de bloqueo de fase
PM	Phase Modulation Pasenmodulation Modulation de phase Modulación de fase

PMC	Phase Monitor and Control Moniteur de phase et commande Monitor de fase y control
PMM	Power Management Module
POP	Power on Parallel
POSN./Pos.	Position Axe Posición
PROM	Programmable Read Only Memory Mémoire à lecture seule et programmable Memoria permanente programada
PRUM	Protector Unit Marker Radiobalise d'unité de protection Unidad de protección de la radiobaliza
PRUT	Protector Unit Tower Unité de protection Unidad de protección
PS	Power Supply Bloc d'alimentation Equipo de alimentación
PSI	Power Supply Interface Interface du bloc d'alimentation Interfase equipo de alimentación
PSS PSW	Power Supply Switch Interrupteur de puissance Interruptor de alimentación
PSN	Position Position Axe Posición
PSTN	Public Switched Telephone Network
PTT	Post Telephone and Telecommunications (Authority)
PVC	Polyvinylchlorid Polyvinyl chloride Chlorure de polyvinyl (C.P.V.) Chloruro de polivinilo
PWR	Password Routine Routimne de mot de passe Rutina de contrasena
RAM	Random Access Memory Mémoire à accés aléatoire Memoria de acceso aleatorio
RC	Remote Control Télécommande Control remoto

RCMS	Remote Control Monitoring System Système de télécommande et de surveillance Sistema de control y monitoreo remotos
RCSE	Remote Control and Status Equipment
RCSR	Remote Control Service Routine Routine de service de télécommande Rutina de servicio de control remoto
RCSU	Remote Control Status Unit
REU	Remote Electronic Unit
RF	Radio Frequency Haute fréquence (HF) Radiofrecuencia
RIA	Remote Interface Adapter Adaptateur d'interface de télécommande Adaptador de interfase telemando
RIAX	Remote Interface Adapter extended Adaptateur d'interface de télécommande étendé Adaptador suplementario de interfase telemando
RISC	Reduced Instruction Set Computing Rechner mit reduziertem Befehlssatz
RL	Radio link Richtfunkverbindung Liaison hetzienne Radioenlace dirigido
RMMC	Remote Monitoring and Maintenance Configuration
ROM	Read Only Memory Mémoire à lecture seule Memoria permanente
RST	Restart Remettre en marche Nueva puesta en marche
RTC	Real Time Clock Echtzeituhr Rythme en temps réel Reloj en tiempo real
RTCR	Real Time Clock Routine Routine de rythme en temps réel Rutina de reloj en tiempo real
RTS	Request to send Marche l'émetteur Activación del transmisor
RWY	Runway Landebahn Piste d'aviation Pista de aterrizaje

RX	Receiver Récepteur Receptor
RXC	Receiver Clock Rythme du récepteur Reloj de receptor
RXD	Receiver Data Données de récepteur Datos de receptor
RXRDY	Receiver Ready Récepteur prêt Receptor listo
S	Switch Commutateur Conmutador
SB	Sideband Bandes latérales Banda lateral
SB1, SB2	Sideband 1, Sideband 2 Bandes latérales 1, 2 Banda lateral 1, 2
SBA	Sideband A (used in VOR) Bandes latérales A (utilizé en VOR) Banda lateral A (utilizado para VOR)
SBB	Sideband B (used in VOR) Bandes latérales B (utilizé en VOR) Banda lateral B (utilizado para VOR)
SBO	Sideband Only Bandes latérales seulement Banda lateral solamente
SBR	Subrack Sous−bâti Subrack (con junto)
SCC	Serial Communication Controller
SDM	Sum of Depths of Modulation Somme des taux de modulation Suma de grado de modulación
SMA	Subminiature connector type A Miniatur HF−Steckverbinder für Mikrowellenanwendungen
SPDT	Single Pole Double Throw Commutateur unipolaire Conmutador unipolar doble
SP3T	Single Pole 3 Throw Commutateur unipolaire triple Conmutador unipolar triple

SRAM	Static Random Access Memmory
STOL	Short Take—Off and Landing Système de décollage et d'atterissage court Despegue y aterrizaje corto
SUM	Summensignal Summation Signal Signal de la somme Señal de suma
SW	Software
SYN (1)	Synchronisation Synchronisation Sincronización
SYN (2)	Synthesizer
TACAN	Tactical Air Navigation Navigation aérienne tactique Navigación aérea táctica
TCXO	Temperature Compensated Crystal Oscillator Temperatur kompensierter Quarzoszillator Oscillateur à quartz compensé par témperature Oscilador de cuarzo termo compensado
TEG	Test Generator Générateur de test Generador de test
THR	Threshold Schwellwert Valeur de seuil Nivel determinado
TNC	Threaded Navy Connector Koaxialverbinder mit Gewindekupplung
TNV	Telephone Network Voltage
TOR	Time Out Routine Routine de temps de suspension Rutina de tiempo de suspensión
TTL	Transistor—Transistor Logic Logique transistor—transistor Lógica transistor — transistor
TX	Transmitter Emetteur Transmisor
TXC	Transmitter Clock Rythme d'émetteur Reloj de transmisor
TXD	Transmitter Data Données d'émetteur Datos de transmisor

TXRDY	Transmitter Ready Emetteur prêt Transmisor listo
USART	Universal Synchronous/Asynchronous Receiver/Transmitter Récepteur/émetteur universel synchrone/asynchrone Receptor/transmisor universal síncrono/asíncrono
USB	Upper Sideband (HF DVOR) Bandes latérales supérieures Banda lateral superior
UV	Ultraviolet Ultraviolet Ultravioleta
VAM	Voice Amplifier Amplificateur vocal Amplificador vocal
VCO	Voltage Controlled Oscillator
VGA	Video Graphic Adapter
VHF	Very High Frequency Hyperfréquence Hiperfrecuencia
VOR	Very High Frequency Omnidirectional Radio Range Radiophare omnidirectionnel VHF Radiofaro omnidireccional VHF
VSWR	Voltage Standing Wave Ratio Taux d'ondulation Grado de ondulación
VTOL	Vertical Take−off and Landing Décollage et atterrissage verticaux Despegue y aterrizaje vertical
WI	Width signal Breite−Signal Signal faisceau
WT	Wechselstrom−Telegrafie Voice−frequency carrier telegraphy Télégraphie harmonique à ondes porteuses Telegrafía armónica
ZF	Zwischenfrequenz Intermediate Frequency
ZU	Zeichenumsetzer Modem for data transfer Convertisseur de signaux Convertidor de señal

CHAPTER 1
GENERAL INFORMATION

1.1 STORING AND UNPACKING THE EQUIPMENT

1.1.1 General

The equipment should be unpacked as soon as possible in order to check that it is complete and intact. The place of storage used for any intermediate storage period must be dry. The temperature range specified in the technical data in Part 1 must be conformed with. The table below is an example of the type of packing.

Package	Contents	Ref. No.	Dimensions with packaging (mm)	Gross weight (kg)
1	1 Shelter including: cabinet CVOR (equipped): – 50 W dual or single *or* – 100 W dual or single enclosed: 1 Matching Device Documentation CVOR	 83011 40100 / 40150 83011 40200 / 40250 58317 24013	3000 x 2440 x 2440	1,900
2	1 CVOR antenna	83131 72401	3500 x 1100 x 1300	500
				2,400

Fig. 1–1 CVOR in 10 ft container shelter for all types of transport

Package	Contents	Ref. No.	Dimensions with packaging (mm)	Gross weight (kg)
1	1 Cabinet CVOR (equipped) – 50 W dual or single *or* – 100 W dual or single	 83011 40100 / 40150 83011 40200 / 40250	1940 x 830 x 880* 1980 x 880 x 890**	approx. 279 approx. 323
2	Documentation CVOR			
3	1 CVOR antenna	83131 72401	3500 x 1100 x 1300	approx. 500

* Corrugated paper container ** wooden crate

Fig. 1–2 CVOR with packing for rail or road transport

1.1.2 Unpacking

The equipment and components are also packed in wooden crates for transport by sea. These wooden crates should always be deposited with the side marked ”Oben” (Top) facing upwards.

– Open the lid of these crates using a hammer and nail puller. Remove the filler. Remove the equipment in the plastic sheeting horizontally, and lay it down so that the side marked ”Oben” faces upwards. Cut open the plastic sheet and remove the equipment.

CAUTION

The packaging with the transmitter cabinet (Fig. 1–3) should always be laid down so that the pallet (Fig. 1–3/4) is at the bottom. In addition arrows and inscriptions painted on the crate indicate the side which must face upwards.

– Cut through the three plastic ribbons (Fig. 1–3/2) with scissors and remove. Lift off the telescope box (Fig. 1–3/1), 2 people required. Remove the foam panel (Fig. 1–3/8). Carefully lift the transmitter cabinet (Fig. 1–3/6), 2 people required, and install in a vertical position.

WARNING

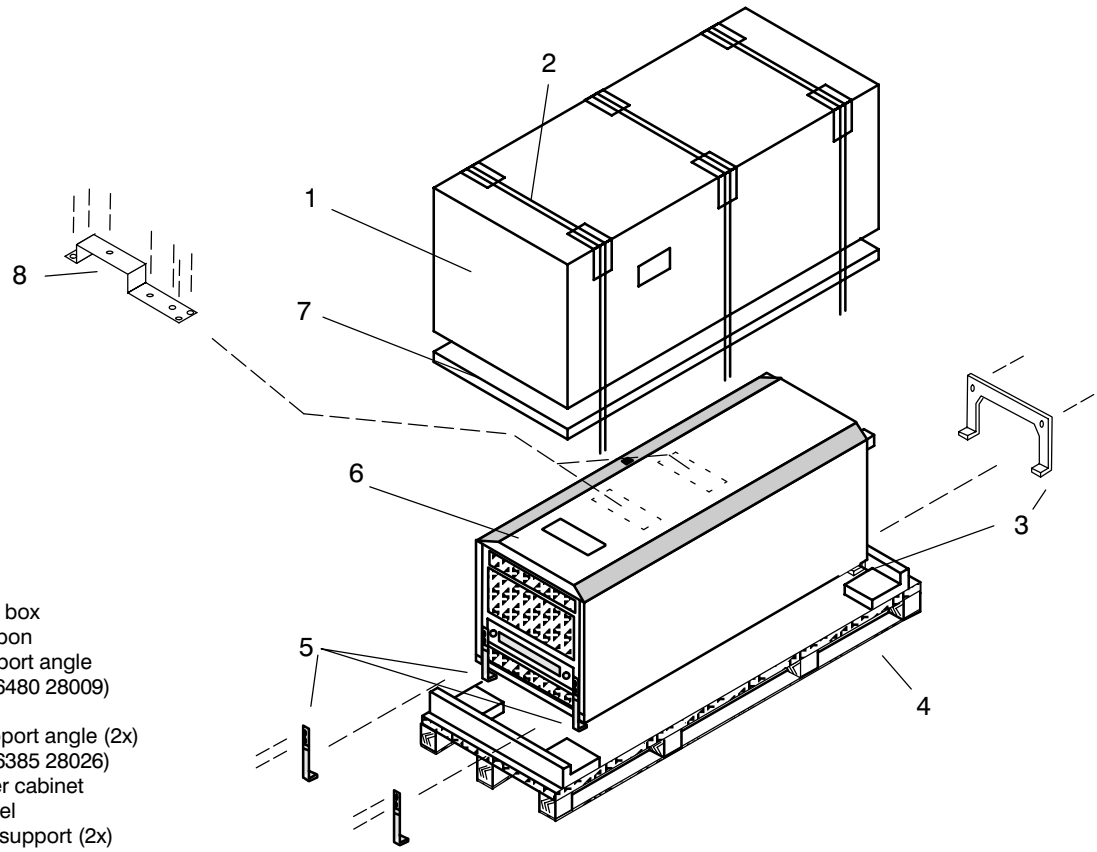
Hold the transmitter cabinet firmly in position until the support angles (Fig. 1–3/3 and 5) have been dismantled. Pay special attention when removing the lower support angle.

– Undo the two screws (M10) left and right on the upper support angles (Fig. 1–3/5). Remove the screws and washers and the upper support angles left and right. Tilt the transmitter cabinet (Fig. 1–3/6) forward slightly, hold it and dismantle the lower support angle (Fig. 1–3/3). Then carry the transmitter cabinet to its point of installation and screw to the floor.

– Open the front door and remove the foam panel behind it. Unscrew and remove both retaining supports (Fig. 1–3/8) which fix the subassemblies of the trandmitter subracks for transport.

– Close the front door.

Store away all despatch packaging (Fig. 1–3), so that it can be used again for transport purposes if required. Use the original packaging components to repack. Repack the equipment and subassemblies as described above, but in reverse sequence.



1 Telescope box
2 Plastic ribbon
3 lower support angle (ref. no. 36480 28009)
4 Pallet
5 upper support angle (2x) (ref. no. 36385 28026)
6 Transmitter cabinet
7 Foam panel
8 Retaining support (2x)

Fig. 1–3 Packaging for rail and road transport

1.2 STORING AND UNPACKING THE CVOR ANTENNA

The CVOR antenna is supplied in a crate with dimensions approx. 3500 x 1300 x 1100 [mm].

CAUTION

This crate is not suitable for stacking, and should not be subjected to any load. The crane driver must be instructed that it is essential to pull the lifting cable under the pallet. The crate may be transported using the fork lift truck, because the pallet has been designed accordingly.

If intermediate storage is necessary, the crate or the unpacked antenna should be stored in a dry room. It is advisable to check the intactness of the antenna immediately after it is received. An unpacked antenna should always be stored on the pallet.

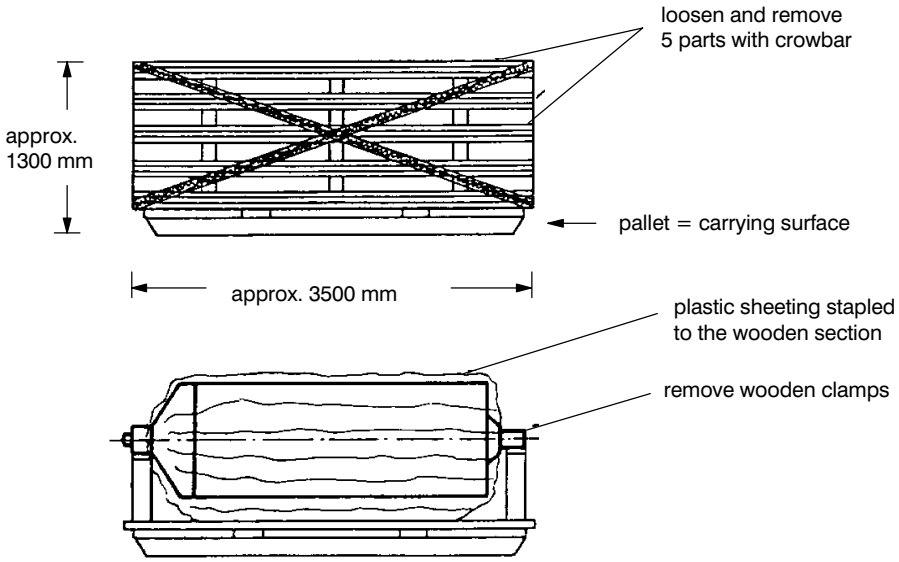


Fig. 1–4 Packaging for CVOR antenna

The antenna should be unpacked with care. On no account should the crate be forced open with a hammer. A crowbar (nail puller) should be used to remove the nails and loosen the side sections. The pallet, the lid and the side panels should be preserved for transport at a later date. After removing the crate sections remove the plastic sheeting 3 m x 5 m. This too should be stored for use at a later date. The ends of the antenna are secured with two wooden clamps for protection during transport. Remove these wooden clamps.

CAUTION

The antenna may only be lifted at the ends. Four persons should carry it. Weight of antenna: With crate 495 kg, without crate 115 kg.

If no fork lift truck is available, the antenna should be unloaded on delivery such that the distance over which the unpacked antenna is transported is as short as possible.

1.3 GENERAL INSTALLATION INFORMATION

1.3.1 Safety Precautions

It is the task of the site supervisor or construction manager to make available the materials supplied by Thales, independently procured special materials and tools. For every site strict attention should be paid to safety regulations issued by the local authorities.

1.3.1.1 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 influence of alcohol will not be tolerated on the installation site.
- Protective goggles and safety gloves are to 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 are to be worn. Safety belts with rescue line and carbine swivel have to be used working on the counterpoise platform.
- 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.
- 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.
- Jewelry 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:
  - 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.

1.3.1.2 Precautionary Measures against Damage caused by Animals

Damage caused by animals is highly improbable. The door should be locked in the absence of the personnel. During installation and maintenance period it is absolutely essential that the radome remains closed overnight as well as during work breaks in the daytime. Otherwise it is likely that birds will build their nests inside the radome.

1.3.1.3 Equipment Safety Notes

Subassemblies should not be removed whilst under voltage. The consequence of this type of action is the likelihood of permanent damage and the transmitter cabinet can not be set in operation correctly.

Never energize the installation with a non−grounded rack. The first electrical connection to be made should be the rack ground. If there is no ground, the equipment central processing unit may develop a fault or become blocked.

1.3.2 Personnel Requirement

At least 4 persons are required to install the shelter. In addition to the crane driver, at least two further persons are required to install the antenna on the counterpoise. It is however advisable to keep four persons ready for all installation work, so that a standby is available in case of unforeseen events. If the antenna is lifted onto the shelter roof using improvised means and without a crane truck, then four persons are absolutely essential, and a fifth person would simplify operations.

1.3.3 Tools and Special Materials

The delivery list provided by Thales should be checked at as early a date as possible in order to identify materials not included in the Thales scope of delivery which may be essential for the infrastructure of the overall installation. For example, materials for grounding the CVOR installation must be provided. Suggestions and instructions on correct grounding are contained in Chapter 2. The following tools and equipment are the minimum required to unpack and assemble the equipment and the antenna system (not including the DME or the TACAN):

1 crane truck, lifting capacity $\geq$ 500 kg, min. jib reach 3 m, lifting height approx. 7 m; alternatively a 10 to 12 m long guyed auxiliary mast with block and tackle can be used (see also installation of CVOR antenna)
1 crowbar
1 hammer 1000 g
2 ratchets with sets of sockets
1 three−square scraper
1 inch ruler
1 spirit level
1 impact drill, min. power 600 W
1 set screwdrivers, blade width 3.5 mm to 8 mm

various flat and round files
various carbide drills
various twist drills for metal

2 Protective goggles
1 Safety belt with rescue line and carbine swivel
1 First Aid box
4 (5) Safety helmets, safety gloves

The list does not include standard tools, such as cable stripping knives, various pliers, side cutting pliers, metal cutters, chisels, center punches, or electrical instruments, such as continuity testers, voltage testers or a digital multimeter.

1.4 LIST OF RECOMMENDED INSTRUMENTS AND ACCESSORIES

The following list contains recommendations for instruments, cables, attenuators, adapters and other accessories, which may be used for installation, maintenance and trouble shooting of navigation equipment, or at least will make the work easier. This equipment (or that with comparable characteristics) is normally present within large workshops or central repair facility. If not, it can be supplied optionally by Thales. A selection of necessary equipment and accessories to be provided can be defined in consultation with Thales.

However, the minimum test equipment and accessories actually required for installation and commissioning is listed in the Alignment Section. This equipment is typically recommended to be always available at or near equipment to support troubleshooting and repairs. For the appropriate works the necessary equipment is mentioned in the chapters concerned.

			ILS		CVOR		DVOR		Marker	
Designation	**Code No .**	**Remarks/Type**								
Digital Voltmeter	97991 28217		x		x		x			
Dual trace oscilloscope	97991 28454	TDS 360	x		x		x		x	
Thruline Wattmeter	97991 28040	0.45...2300 MHz	x		x		x		x	
Monitor dipole, mobile	58317 24019				x					
Dipole 60 cm	38826 28006				x					
Mon. dipole add. parts mobile	83131 72409				x					
Tripod	19614 72801	G5K, No. 1151			x					
VOR—Monitor signal simulator	83134 31600				x					
ILS/VOR signal analyzer	97991 28447	7010 portable	x		x					
Attenuator 100 W/30 dB	49901 28051	50 Ohm / RBU100.8654.37			x					
Probe	19983 15001						x			
Measuring element 50 W	97991 28043	50 C, Bird, 100...250 MHz	x		x		x			
Measuring element 25 W	97991 28111	25 D, Bird, 200...500 MHz	x							
Measuring element 10 W	97980 28193	10 C, Bird, 100...250 MHz	x		x					
Measuring element 5 W	97991 28112	5 D, Bird, 200...500 MHz	x							
Measuring element 1 W	97991 28192	095—1, Bird, 275...450 MHz	x							
Measuring element 1 W	97991 28193	275—1, Bird, 100...250 MHz	x		x		x			
Measuring element 5 W	97991 28041	5 C, Bird, 100...250 MHz			x		x			
Measuring element 100 W	97991 28182	100 C, Bird, 100...250 MHz			x		x			
Directional coupler	97991 28273	HP 778 D	x		x		x			
Terminating resistor	97991 28274	HP 8491 A, 30 dB, opt. 30	x		x		x			
Attenuator 100 W/30 dB	97499 28007	50 Ohm, BN 745395	x		x		x			
3—dB—coupler	49901 23002	CH—132, M.SMA	x		x		x			
VHF—dummy load 1 W	24338 20401	50 Ohm, BN753790			x					
Attenuator 20 dB/3,5 W	49901 20402	50 Ohm, BN654104	x		x		x			
Attenuator 10 dB/1 W	49901 20405	50 Ohm, R414510 TNC	x		x		x			
Attenuator 6 dB/2.5 W	49901 20403	50 Ohm, R414506 TNC	x		x		x			
Attenuator 20 dB/1 W	49901 20406	50 Ohm, R414520 TNC	x		x		x			
Attenuator 10 dB/10 W	49901 28044	50 Ohm, BN745383			x		—			
Adapter	24334 20323	TNC male/fem. BN150419	x		x		x			
Adapter	24334 20342	TNC male/male BN746700	x		x		x			
Adapter	24334 20403	TNC fem./fem. BN746600	x		x		x			
Adapter	24334 20404	BNC male/banana SHU06996	x		x		x			
Adapter	24334 20408	BNC male/TNC fem. BN712100	x		x		x			
Adapter	24334 20409	TNC male/N fem. BN725900	x		x		x			

x = available (optional)

			ILS		CVOR		DVOR		Marker	
Designation	**Code No**	**Remarks/Type**								
Adapter	24334 20412	TNC fem./N male BN 725800	x		x		x			
Adapter	24334 28017	SMA male/TNC fem. BN150907	x		x		x			
Adapter	24334 28018	SMA fem./TNC male BN150908	x		x		x			
RF−cable, 0,5 m	24029 28051	TNC male/male	x		x		x			
RF−cable, 2 m	24029 28052	TNC male/male	x		x		x			
RF−cable, 2 m	24029 28207	BNC male/male	x		x		x			
RF−cable, 55°/113MHz	27288 03859	TNC male/fem.			x					
RF−cable, 30 m	24029 28062	TNC male/male BN201961			x		x			
RF−cable, 0,08 m	24029 28185	TNC male/fem., 50 Ohm	x		x					
RF−cable, 0,60 m	24029 28187	TNC male/fem., 50 Ohm	x		x		x			
RF−cable, 0,40 m	24029 28373	N male/TNC male, 50 Ohm	x		x		x			
RF−cable	27288 03856	SMA/TNC			x					
RF−cable	27288 03886	SMA−N RG400			x					
AF−cable, 3 m	24029 28218	Banana pin/banana pin, shielded	x		x		x			
AF−cable	24039 28136	∅ 2.5^2 , 300 mm yellow/green			x					
AF−cable	24039 28137	∅ 2.5^2 , 520 mm yellow/green			x					
AF−cable	24039 28138	∅ 2.5^2 , 520 mm blue			x					
AF−cable	24039 28139	∅ 2.5^2 , 520 mm brown			x					
Coaxial adapter	97243 21318	BNC fem./TNC fem. BN712300	x		x		x			
Coaxial adapter	97243 21319	BNC fem./TNC male BN712000	x		x		x			
Coaxial adapter	97243 21320	BNC male/BNC male BN591700	x		x		x			
Coaxial adapter	97243 21321	BNC fem./N male BN999400	x		x		x			
Coaxial adapter	97243 21322	TNC fem./N fem. BN726000	x		x		x			
Coaxial adapter	97243 21323	SMA fem./TNC fem. BN150906	x		x		x			
Coaxial adapter	97243 21324	SMA fem./BNC fem. BN640802	x		x		x			
Coaxial adapter	97243 21325	SMA male/BNC fem. BN640800	x		x		x			

Others (Used for battery charging/maintenance):

Acid syringe with areometer
Acid jug
Funnel
Container (non−metallic) with distilled water
Cleaning agent (vaseline, soda, waste wool)

x = available (optional)

CHAPTER 2
INSTALLATION

2.1 SELECTING THE INSTALLATION SITE

The area in which a CVOR is to be installed is determined by the responsible Civil Aviation Authority according to the international air traffic regulations. This area is generally sufficiently large to allow a point with the optimum topography and thus the optimum propagation conditions to be choosen. This point is determined by means of a site survey at which a surveyor must always be present. Thales can provide an engineering consultant on site for this survey. When the installation site has been determined precise bearings must be taken, either with reference to trigonometrical points or – if a satellite receiver is available – via satellite radio for increased precision.

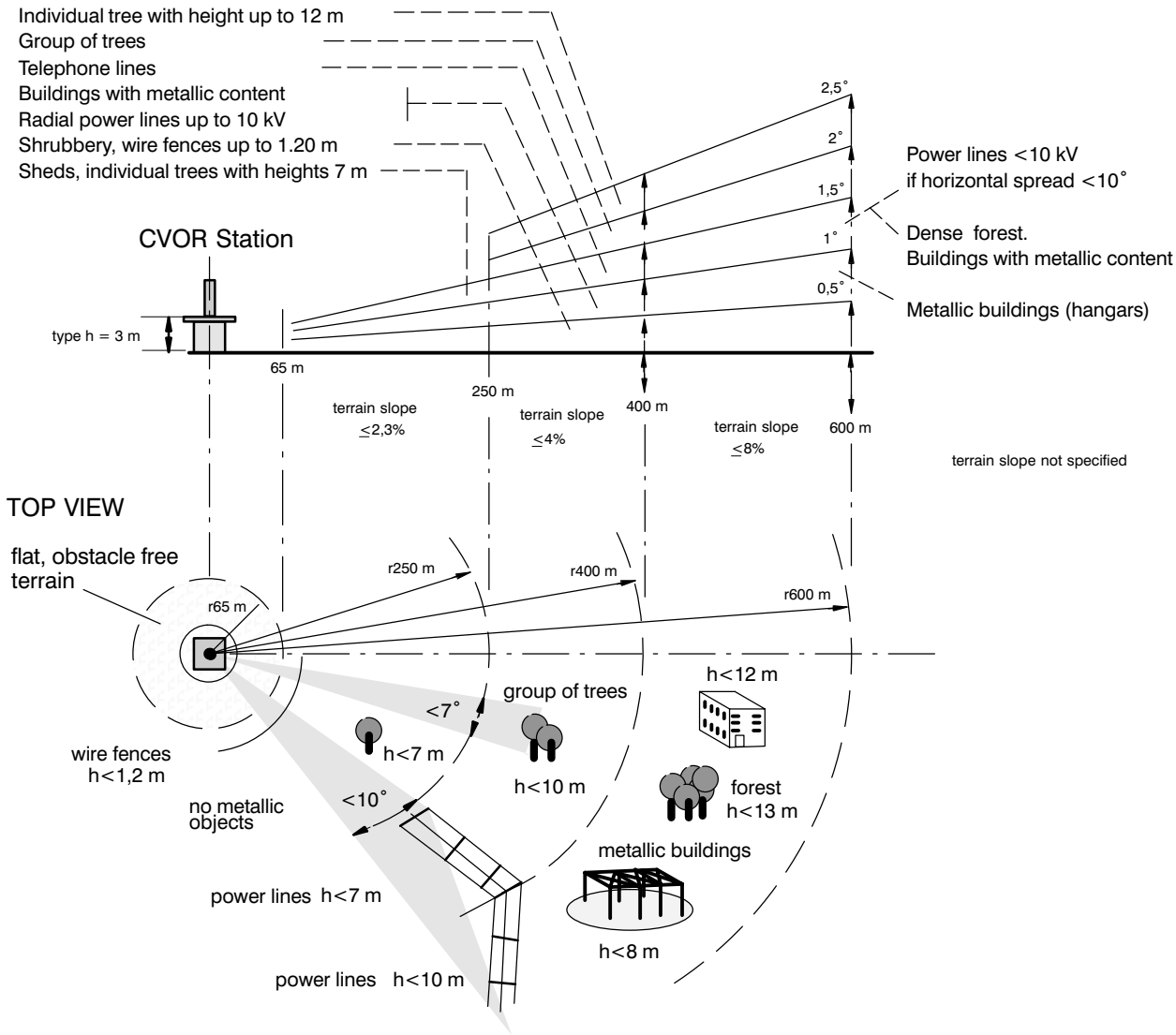


Fig. 2–1 CVOR siting criteria (general data)

2.2 VOR SHELTER

2.2.1 General

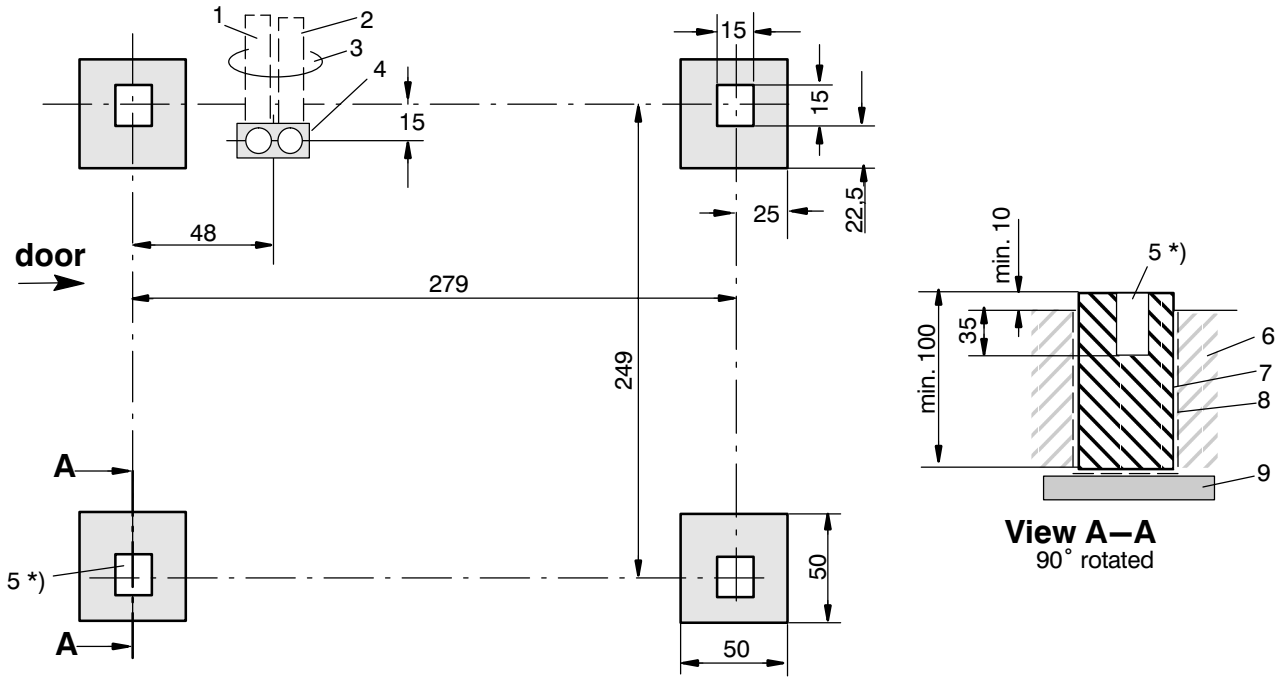
The following type of shelter is available to build up an CVOR installation:

– 10 ft CVOR container shelter Ref. No. 83134 60010

An adaptation plate ref. no. 35980 28001 is available for adaptation to existing shelter/buildings.

2.2.2 Shelter Foundation

The following drawing shows the foundations for the standard 10 ft shelter which is used in a modified version for a CVOR Installation. The drawings are for information only.



NOTE:
– Dimensions in cm
– Concrete quality B25

1 Tube for data, signal and monitor cable
2 Tube for mains voltage supply cable
3 Tubes diameter 100 mm ∅ each
4 Arrangement for cable entry through the shelter floor
5 Recess (4x) only for use of rag bolts
*) ommitted for shelter fixing with anchor rods
6 selected filling, 100 % compressed

Optional
7 Bitumen coating (Nitroprime–10)
8 Damp proof course (min. 150 µm)
9 Stone bedding (Layer height approx. 150 mm)

Fig. 2–2 CVOR 10 ft shelter, foundations (informative view)

2.2.3 CVOR Container Shelter

See Figs. 2−3 to 2−6.

The Navaids equipment can be supplied already installed in a 10 ft Standard Shelter (type 1D) which is offered by Thales. To cover the requirements the shelter is based on the definition on transport containers ISO/DIN standards. The shelter consists of a self−supporting, distortion resistant steel frame construction with eight ISO corners and walls made of sandwich panels in standardized container dimensions.

WARNING

Sturdy shoes, safety gloves and safety helmets are to be worn during installation. Safety belts with rescue line and carbine swivel have to be used working on the counterpoise platform. Avoid walking on the counterpoise outer parts during antenna installation.

During installation, the shelter should be placed on the foundations such that the door is oriented according to the site survey and project drawings. The shelter is anchored to the four foundation blocks using the ISO corners and twist locks. The power supply (mains) and signal (RC, field monitor) feeder cables enter from below through openings in the shelter floor.

NOTE: When installing the antenna it should be remembered that the roof of the shelter may be mounted by two persons max., though the lateral counterpoise sections should not be used as a working surface.

No risk is involved if these sections are mounted briefly occasionally, providing all supports are fitted correctly.

A completely flat, electrically homogeneous counterpoise surface, which remains stable in windy conditions, is essential for the quality of the radiated signal. A check should be performed following installation to ensure that the surface of the counterpoise has no uneven points higher than 5 mm or cracks longer than 50 mm.

When transporting the shelter by crane or helicopter, care should be taken to ensure that the angle between the lifting harness and the crate is at least 60° (see Fig. 2−3).

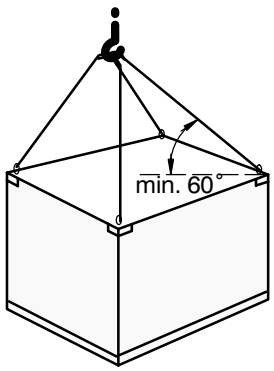
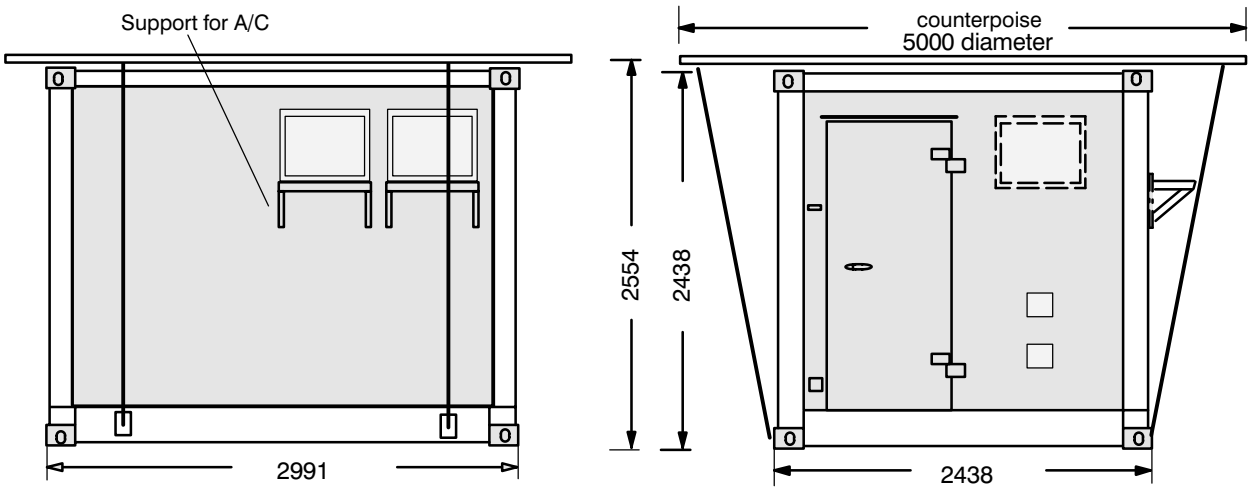


Fig. 2−3 Correct lifting with a lifting harness



(Dimensions in mm; Tare weight approx. 900 kg, without counterpoise)

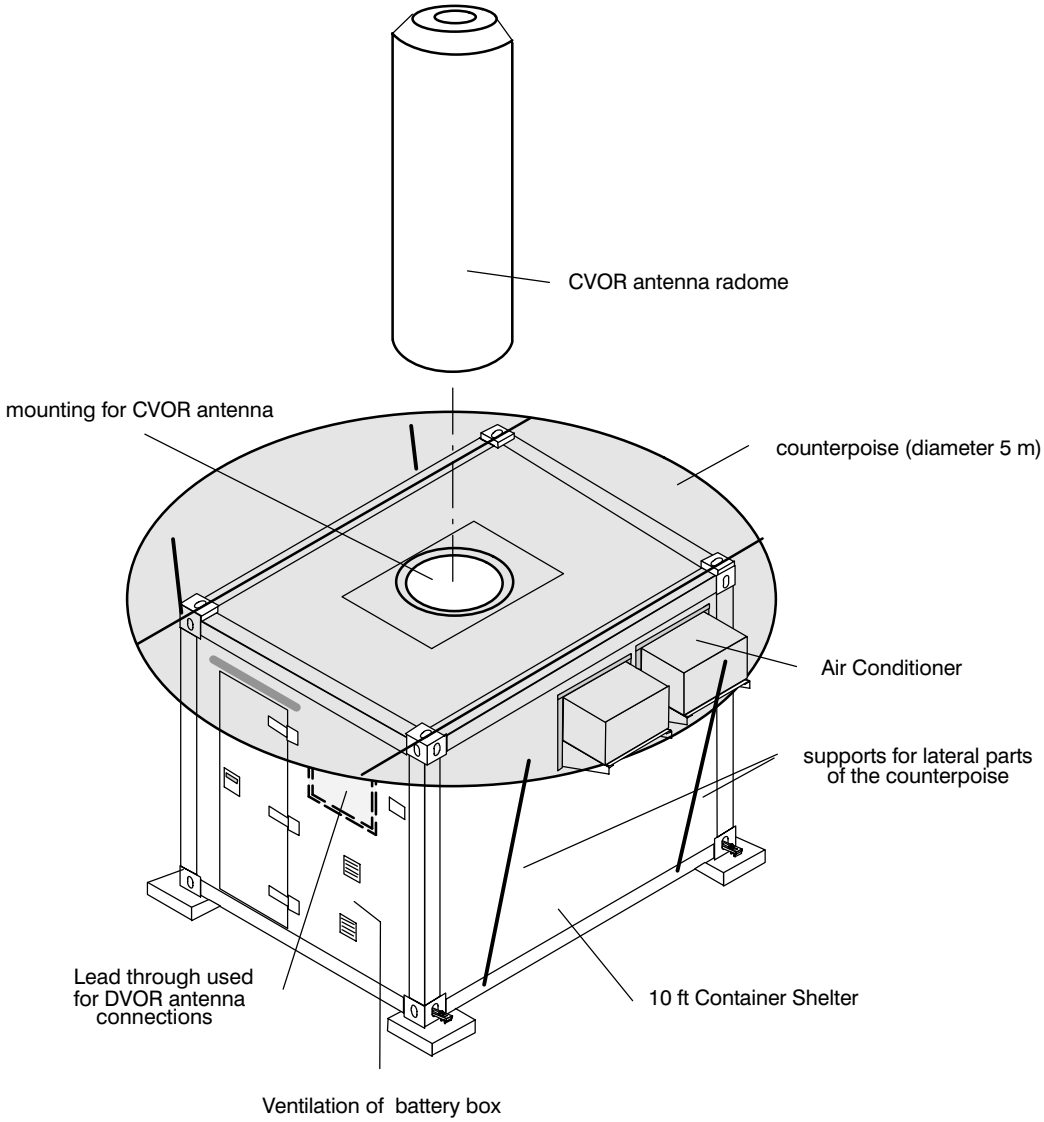


Fig. 2–4 10 ft CVOR container shelter, dimension and general view

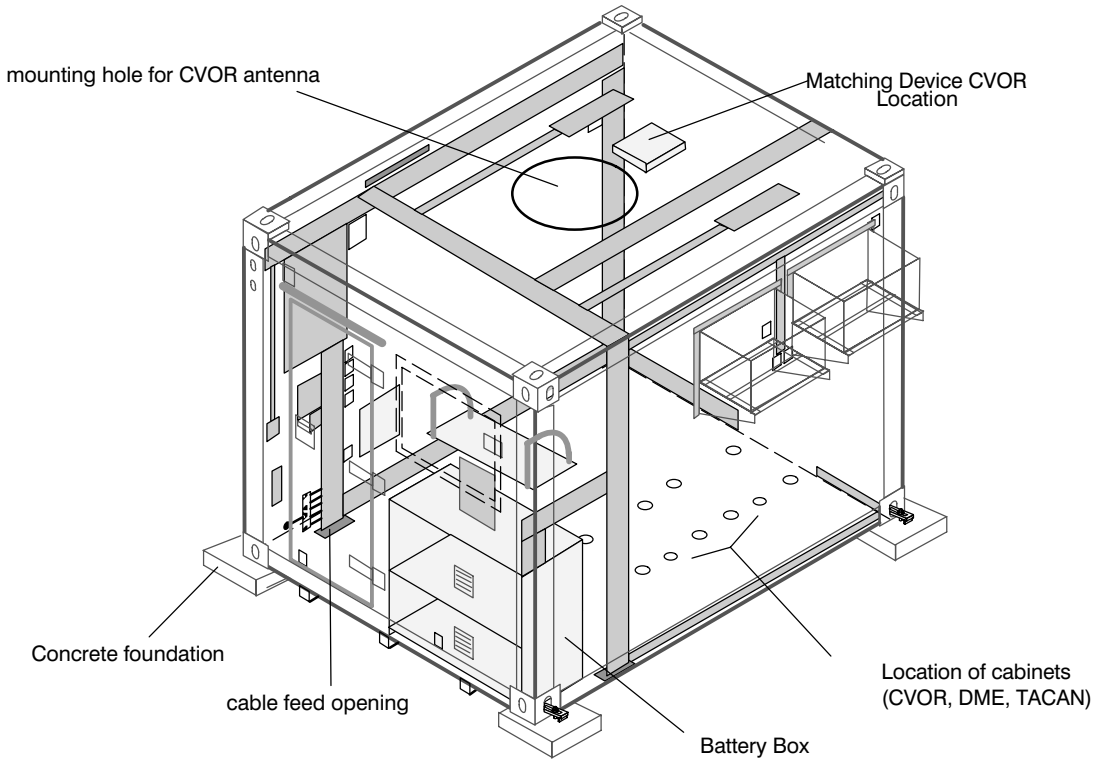


Fig. 2–5 10 ft CVOR container shelter without counterpoise, inner design

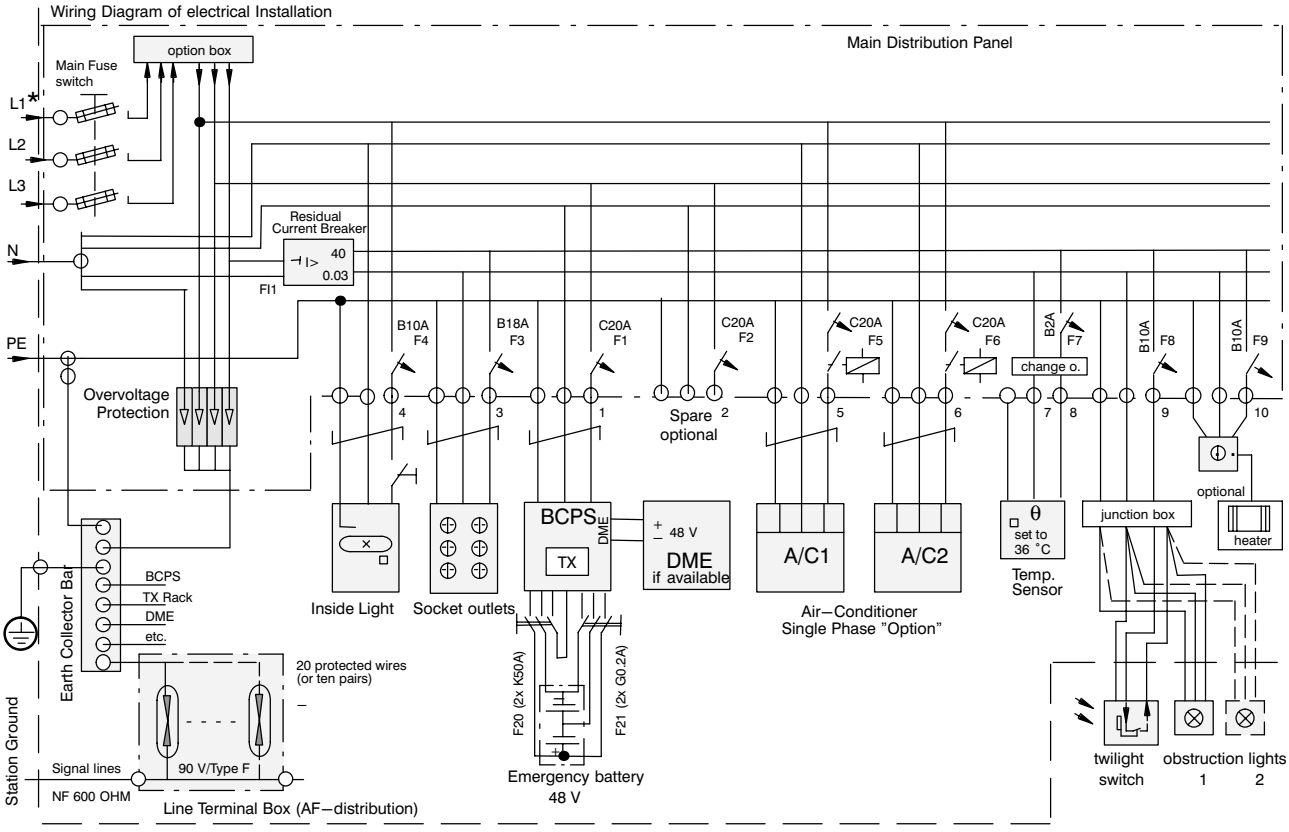
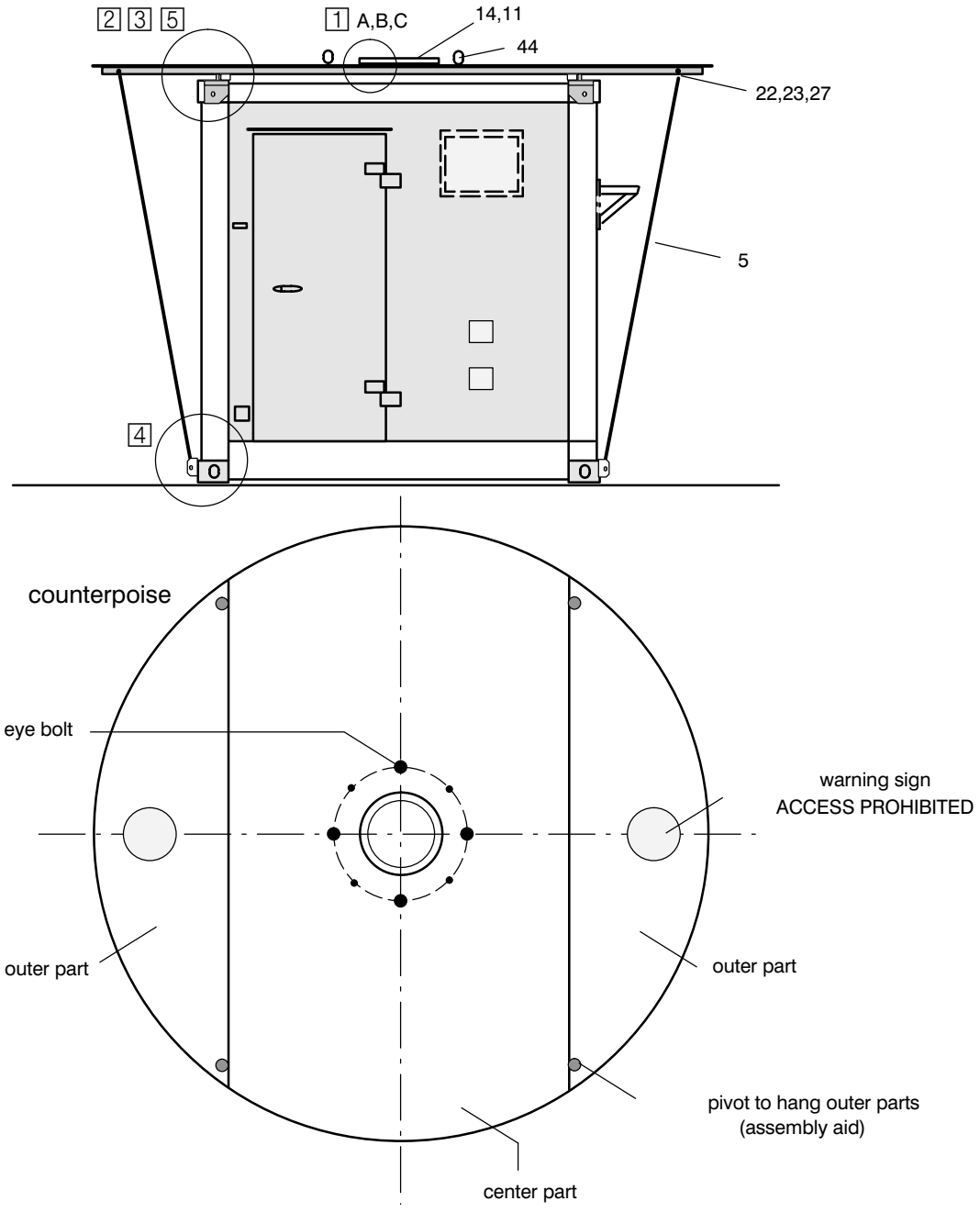


Fig. 2–6 Standard shelter, electrical installation CVOR (example)

2.2.3.1 Mounting the Counterpoise



5	support	22	hex. nut	44	eye bolt
6	angle	23	spring washer		
9	clamp	25	hex. screw		
10	contact plate	26	spring washer		
11	cover	27	hex. screw		
14	L ring	28	spring washer		
15	fittings	29	washer		
16	fittings	38	round seal		
18	sealant pistol	41	hex. screw		
19	sealant	42	hex. nut		
20	plate screw	43	spring washer		

NOTE:
4 means detailed figures

Fig. 2–7 Assembly of counterpoise (∅ 5 m) (1 of 2)

1 Assembly of center part

Unscrew antenna opening cover (11), re−use (33) and (34) to secure (14) (see 1 A).

Mount L ring (14) with (33) and (34), then seal the joint between shelter roof and L−ring completely using the sealant provided (18,19) (see 1 B).

Secure the 4 contact plates (10) to the two longer sides of the center part using plate screws (20). Cut off excess material (see 2).

Secure connection fittings (15) and (16) to upper ISO corners of shelter with (9, 25, 26) (see 3).

Lift center part onto shelter roof (use ring screws (44) as eye bolts) and center.

Screw connection fittings (15) and (16) to center part using (41, 42, 43) and (27, 28, 29) (see 3).

Remove the four ring screws (44).

Insert round seal (38) between L ring of shelter roof and plate ring of center part (access from inside shelter) (see 1 C).

2 Assembly of outer parts

Secure four angle connectors (6) to lower shelter frame using (27, 28) (see 4).

Hang outer part onto pivots of center part, lift supports and screw to outer part using connections (22, 23, 27).

Screw outer parts and center part together using (27, 28; 14 required per side) (see 5).

3 Assembly of the CVOR antenna

After positioning and securing the CVOR antenna with the counterpoise, seal the base ring and the antenna flange completely with sealant (19). Use sealant pistol.

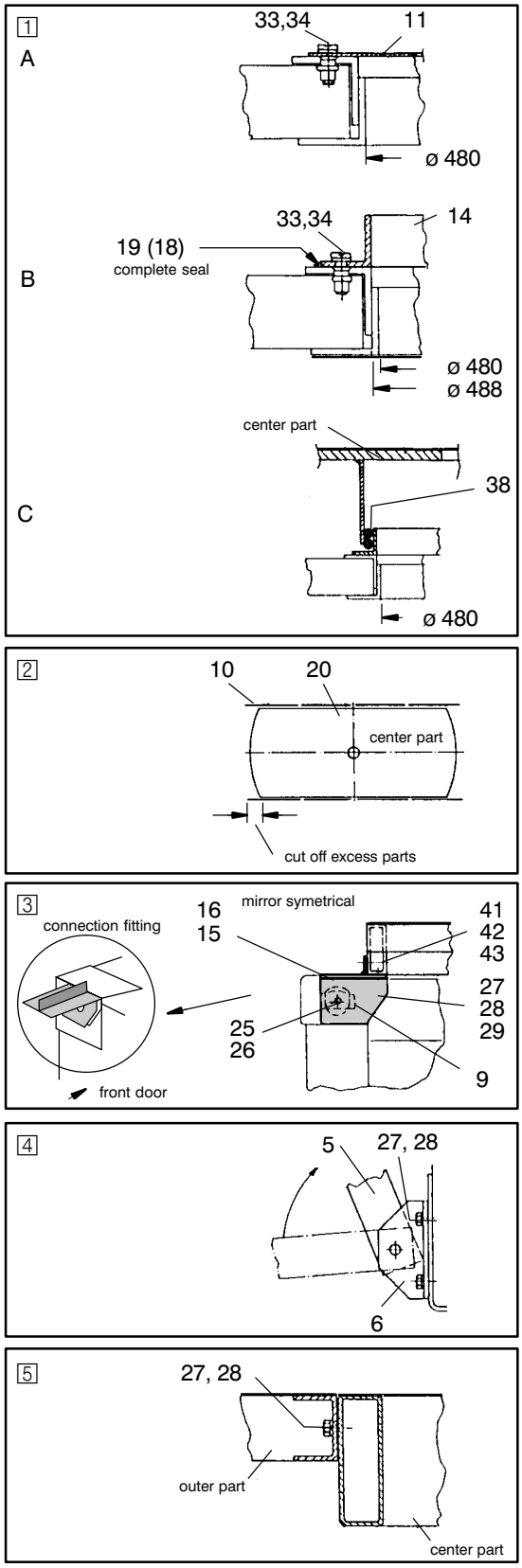


Fig. 2−7 Assembly of counterpoise (∅ 5 m) (2 of 2)

2.2.3.2 Installation of the CVOR Antenna

See Figs. 2−8 to 2−13.

NOTE: The antenna should not normally be unpacked from its transportation crate until it is in the immediate vicinity of the shelter.

WARNING

When installing the antenna on the shelter roof, observe any relevant safety regulations. (regard also information in section 2.2.3).
At least 3 to 4 people are required for handling the antenna, which weights approximately 115 kg. Handle the antenna carefully during transportation and installation. Take particular care with the antenna connection.

a) Installing the antenna with the aid of a crane:

– If a crane is used to install the antenna, hooks or similar should only be secured to the jack rings on the cover plate (Fig. 2−8/4).

– Unpack the antenna (Fig. 2−8/2) and keep the joint sealing compound (washing bottle) (Fig. 2−8/3) in a safe place.

– Raise the antenna onto the shelter roof with the aid of the crane, and position with the antenna connection in the recess provided in the antenna adapter plate.

b) Installing the antenna without aid of a crane:

– Construct a sloping plane with two sufficiently stable beams and secure to the roof structure.

– Position the beams sufficiently far apart for the ends of the antenna to be laid on them.

– Roll the antenna up the beams, then install and position with the antenna connection in the recess in the antenna adapter plate.

WARNING

Secure the antenna with anchoring wires or supports to prevent it falling over until it has been screwed tight.

c) Further steps

– Mark the position of the two overlapping quarter−shells of the antenna cover (radome) and remove the shells.

CAUTION

There is a risk of damage to the antenna system when the quarter−shells are removed!

– Remove the transportation safeguard (2 angle bars) (Fig. 2−11/3).

– Position the ø 13 mm holes in the antenna base ring (Fig. 2−11/5) so that they are exactly congruent with those in the antenna adapter plate (with the center section of the cover above it).

– Screw the antenna adapter plate (Fig. 2–9/1) to the antenna base ring (Fig. 2–9/3) to standard tightness using 8 hexagonal bolts (Fig. 2–9/2).

– Remove the anchoring wires or supports.

– Screw the lower mount for the quarter–shells (Fig. 2–11/7) to the antenna adapter plate (Fig. 2–11/8) to standard tightness using 8 hexagonal bolts.

– Loosen the 8 hexagonal bolts (Fig. 2–9/5) until the antenna base can be turned on the antenna base ring.

– Insert a metal rod (Fig. 2–10/3) (or a long, sturdy screwdriver) into the two holes at the bottom of the inner tube (Fig. 2–10/2).

– Turn the inner tube (and thus also the antenna system) as shown in Fig. 2–12 until the imaginary line from the monitor mast to the longitudinal axis of the inner tube divides the 90˚ angle between the two dipole halves into two sectors of 45˚.

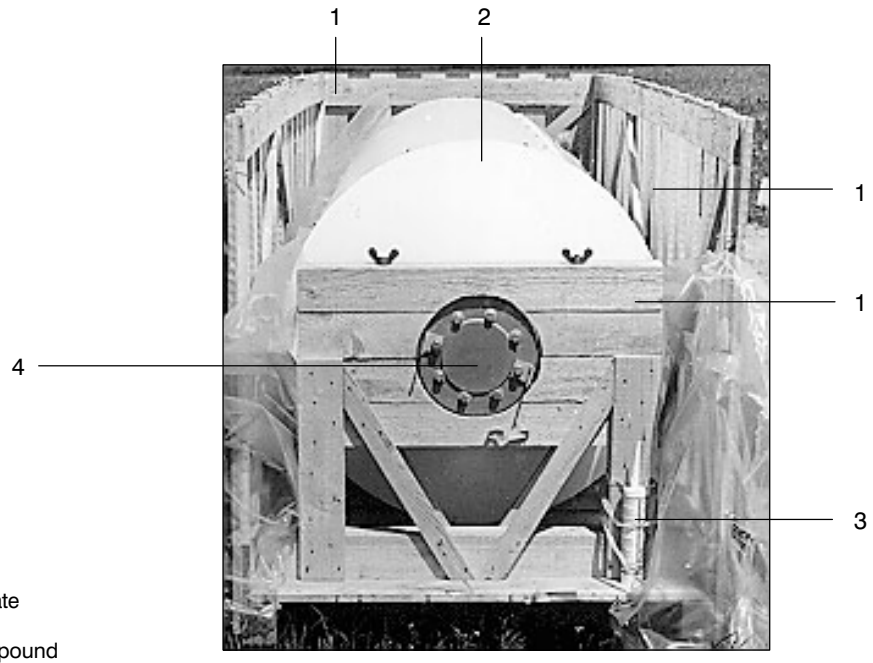
– Tighten the 8 hexagonal nuts (Fig. 2–9/5) to standard tightness.

– Remove the metal rod (or similar).

– Seal the joint (Fig. 2–11/4) with the joint sealing compound (Fig. 2–8/3).

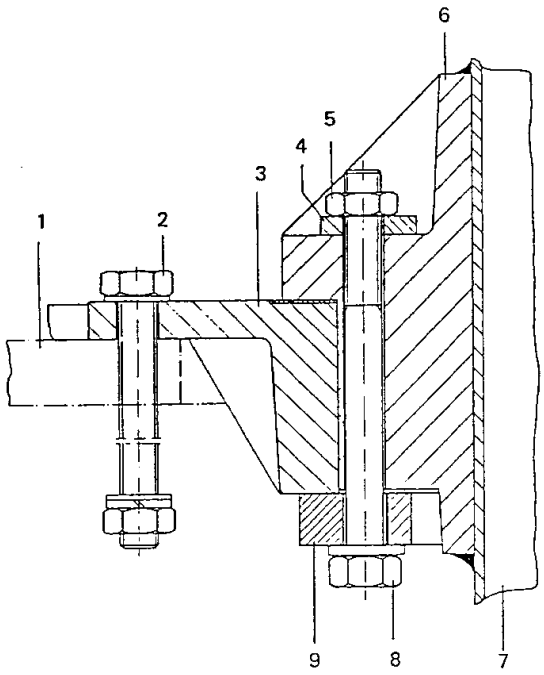
– Secure the matching device subassembly in the immediate vicinity of the opening in the center of the ceiling using self–tapping screws.

– Connect the coaxial cables (see Fig. 2–13).



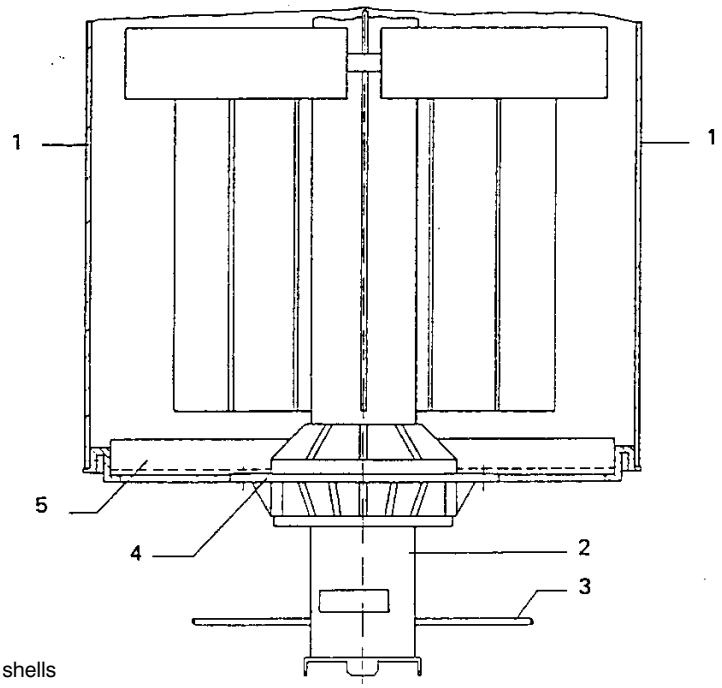
1 Transportation crate
2 CVOR antenna
3 Joint sealing compound
4 Cover plate with 2 jack rings

Fig. 2–8 CVOR antenna in transportation crate



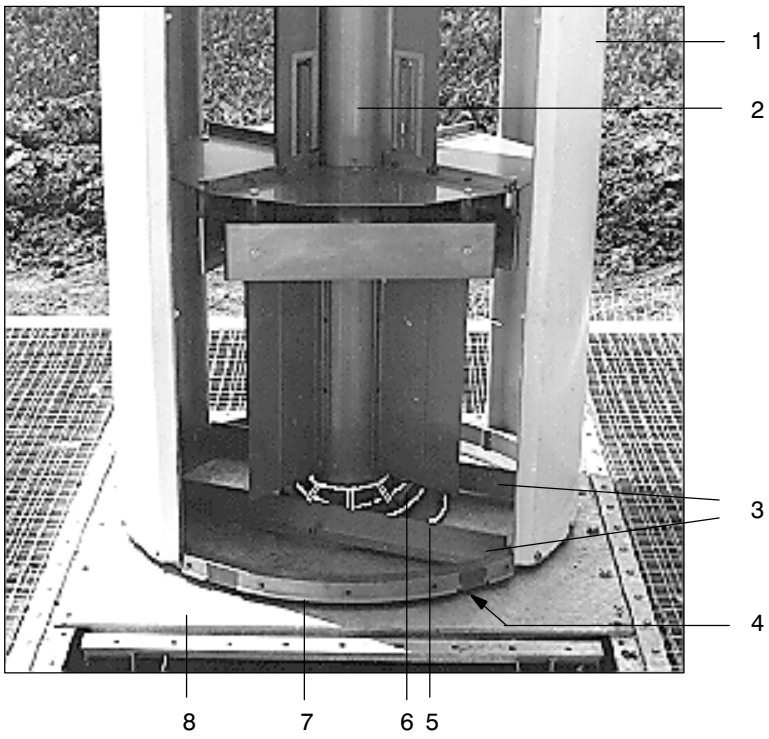
1 Antenna adapter plate
2 Hexagonal bolt
3 Antenna base ring
4 Washer
5 Hexagonal nut
6 Antenna base (welded to inner tube)
7 Inner tube
8 Hexagonal bolt
9 Ring

Fig. 2–9 Locking device at antenna base



1 Radome (quarter shells)
2 Inner tube
3 Metal rod
4 Antenna base
5 Lower mount for quarter shells

Fig. 2–10 Mechanical alignment of antenna



1 Underlapping quarter shells
2 Inner tube
3 Transportation safeguard
4 Joint
5 Antenna base ring
6 Antenna base
7 Lower mount for quarter shells
8 Antenna adapter plate

Fig. 2–11 Securing the CVOR antenna

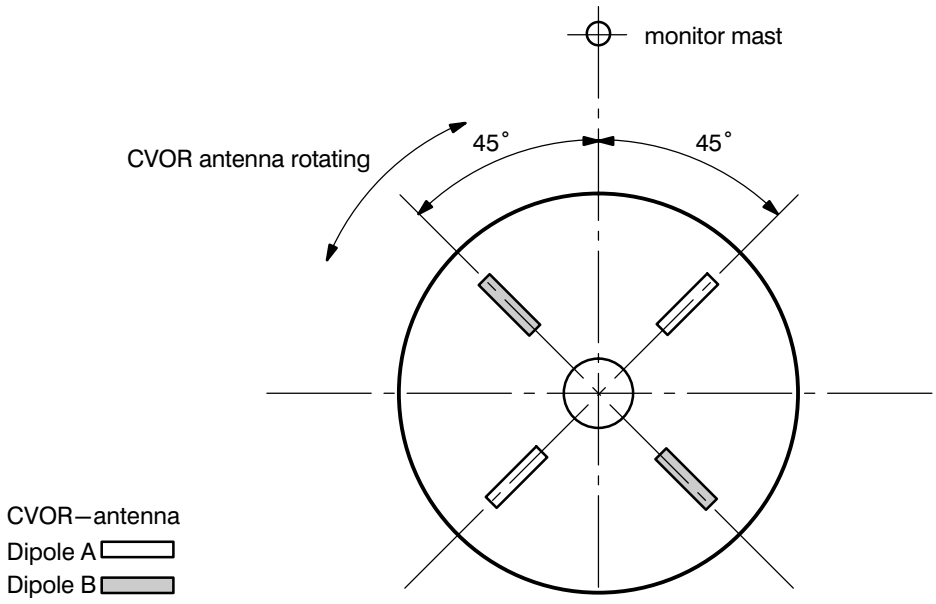
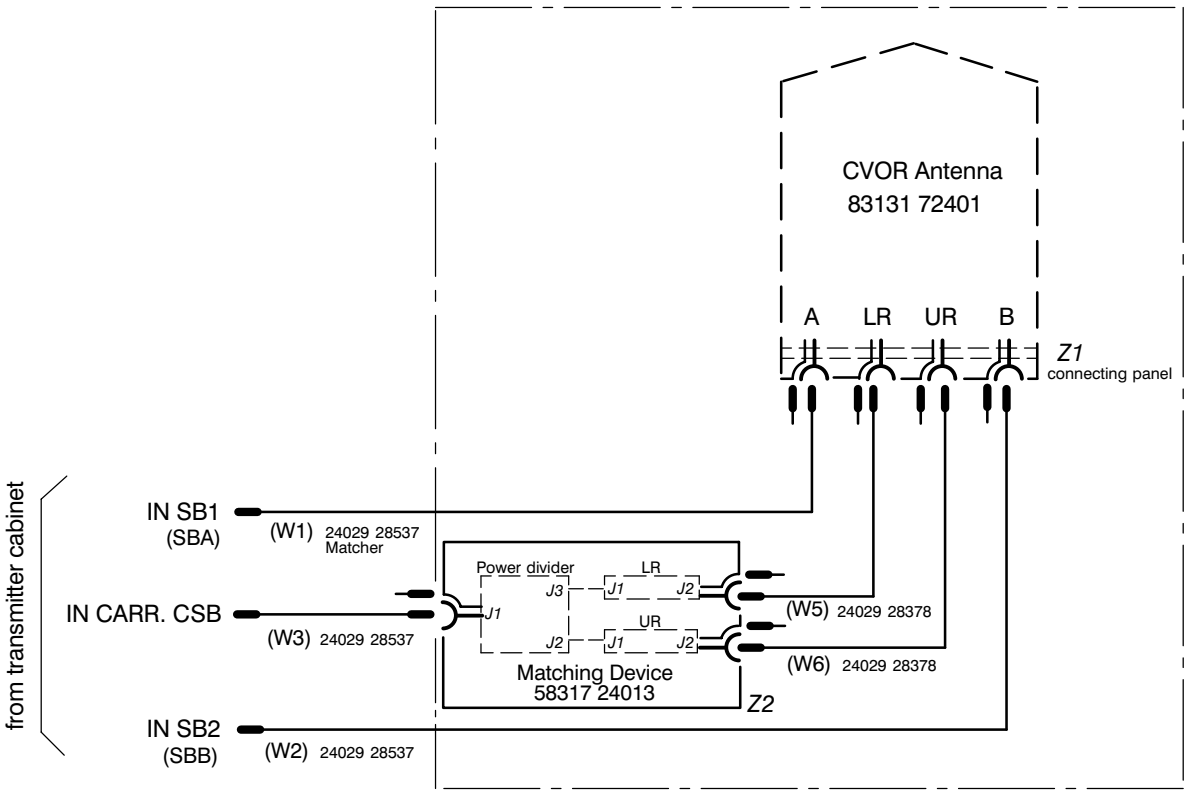


Fig. 2–12 Mechanical alignment of the CVOR antenna



NOTE: The antenna should be connected to the matching device and the transmitter as shown in the diagram. The matching device plate is located underneath the shelter roof next to the circular opening for the CVOR antenna.

Fig. 2−13 Connecting diagram for CVOR antenna

2.2.3.3 Assembly of an Obstruction Light

If the antenna has to be fitted with obstruction lighting, the procedure is as follows:

- Remove the cover plate and keep in a safe place.
- Position the adapter for the obstruction light (Fig. 2−14) and screw to standard tightness.
- Lay the supply cable in the inner tube.
- Connect the lamp socket.
- Screw the lamp housing to the PG16 thread (PG16 = 16 mm armored thread).
- Connect the supply cable in the shelter.

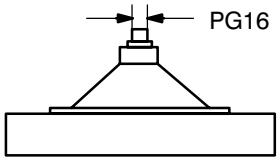


Fig. 2−14 Adapter for obstruction light (Ref. no. 38150 28182)

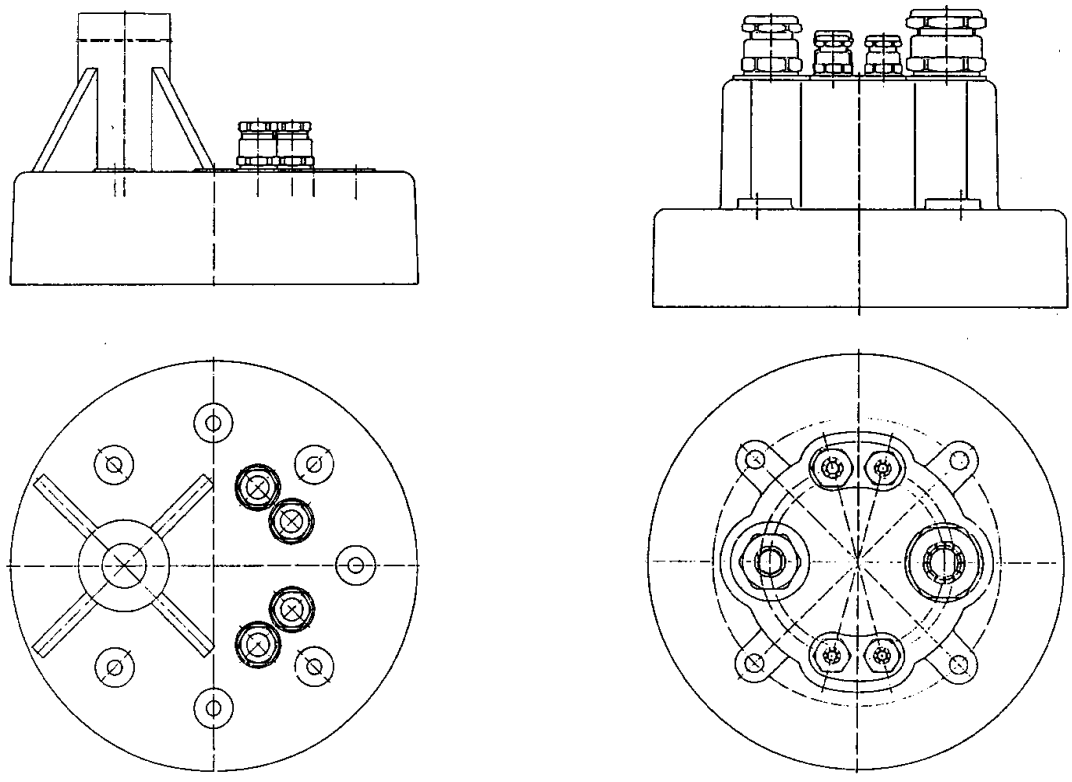
2.2.3.4 Antenna Combinations

See Fig. 2−15.

The antenna can be combined with other antennas by mounting various adapters on the antenna dome. In addition to the standard cover (antenna cover), Ref. no. 32436 28075, the following adapters are available:

− Adapter for DME antenna ANS 96/86 + 87) Ref. no..32436 28078
− Adapter for TACAN antenna cable Ref. no. 32436 28077

Refer also to Section 2.7 Installation of DME antenna.



Adapter for DME antenna (ANS 96/86+87)
Ref. no. 32436 28078

Adapter for TACAN antenna cable
Ref. no. 32436 28077

Fig. 2−15 Adapter for CVOR antenna

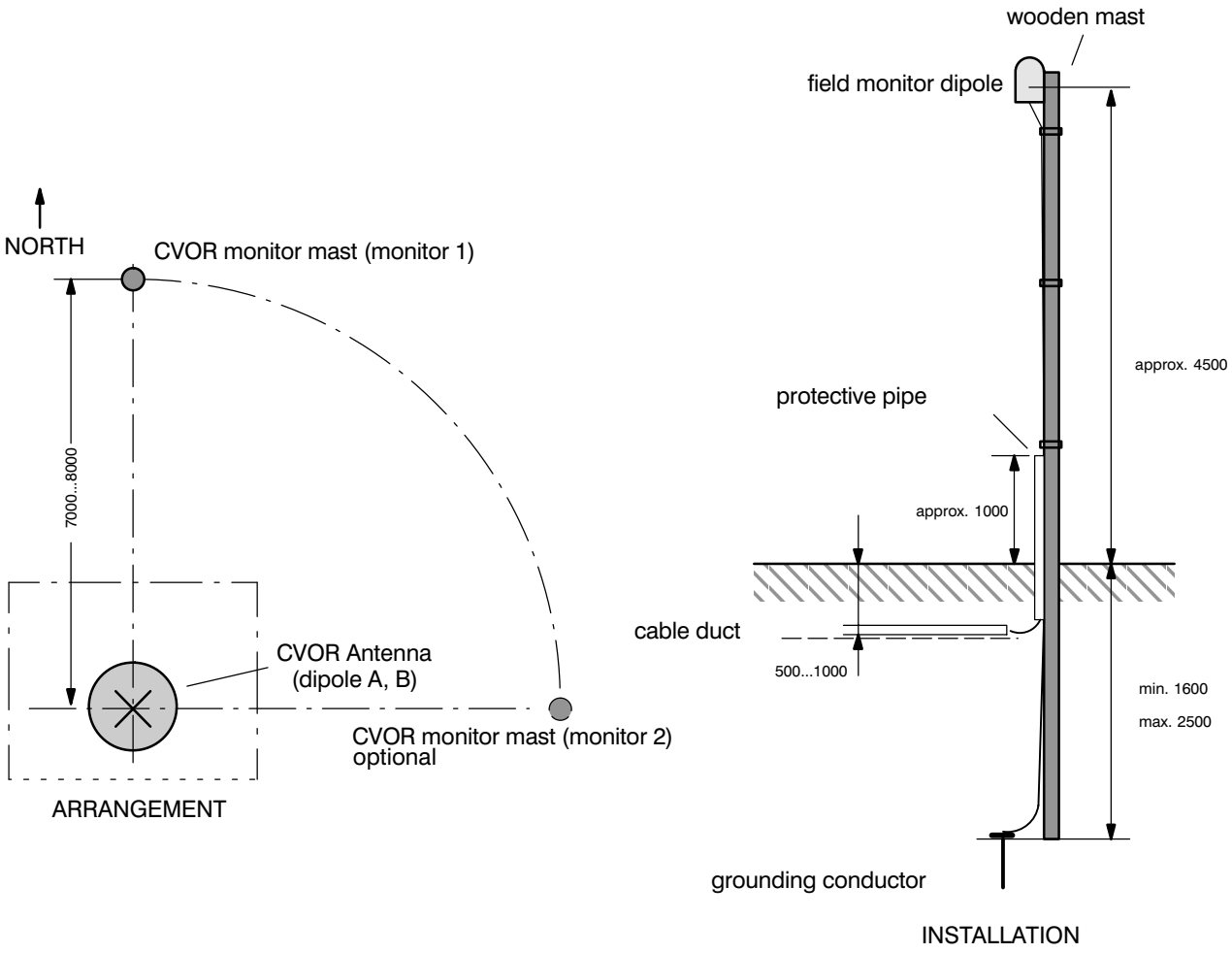
2.2.4 Installation of the Field Monitor and Monitor Mast

See Fig. 2−16.

Install the CVOR field monitor to a mast at a distance of 7...8 m from the center at the north side, e.g. between the dipole A (SBA) and dipole B (SBB).

Two monitors at an angle of 90° may be used optionally.

The required mast shall have the following characteristics: length approx. 7000 mm, ø130...180 mm, material: wood; it is normally supplied by the customer. The mast can also be supplied by Thales (Ref. No. 83130 03442).



(dimensions in [mm])

Fig. 2−16 Arrangement and installation CVOR field monitor (example)

2.2.5 Installation of the Monitor Dipoles for 8 Point Ground Check Option

See Fig. 2−17.

To perform the installation of the monitor dipoles for CVOR 8 point ground check option, mounting kits are available for the CVOR cabinet (Ref.No. 83135 12050) and the additional monitor dipoles (Ref.No. 83131 72412). For the monitor dipoles, the kit comprises one dipole, mast support and RF cable. This means seven kits are necessary for a 8 PGC installation. The standard diole is further in use. To install the monitor dipoles for the 8 point ground check option proceed as follows:

- The CVOR antenna system is completely installed.
- The monitor dipoles for 8 point ground check are mounted to the counterpoise edge or, for existing CVOR counterpoise installations with no mounting facilities, on masts next to the counterpoise edge. The installation position of the monitor dipoles above the counterpoise is recommended to be about 800 mm (standard height). The dipoles are normally installed at the counterpoise edge. For example, the dipoles can be fixed each on a GFK mast tube, which is mounted with clamps at the edge of the counterpoise or on to wooden masts next to the counterpoise edge like the mounting of the standard monitor dipole (Fig. 2−17).

  NOTE: For correct measurement it is essential that the dipole are arranged correctly one to another in a angle distance of 45° related to the centre of the counterpoise. This should be regarded when aligning the CVOR antenna to North or the position of the first standard dipole.

- The additional monitor cables are fed in a appropriate manner to the shelter.

The installation at the CVOR cabinet side is described in section 2.4.

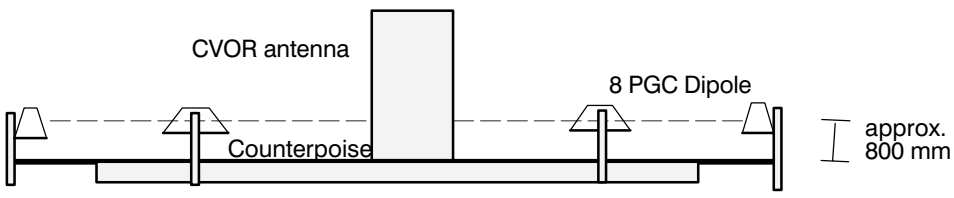


Fig. 2−17 Height position of 8 PGC monitor dipoles

2.3 INSTALLATION AT THE RACK IN THE SHELTER

2.3.1 General

This chapter describes the connections at the transmitter rack: power supply, RF connections, interface connections and connection of a Remote Control (RMMC).

NOTE: For the Thales shelter delivered with the navaids system all fuses are preinstalled. If the shelter is provided by the customer, he will be responsible for the installation including a mains fuse box with arrester and a battery fuse box. Following fuse protection is recommended: external mains fuse for transmitter cabinet F= C20A, for battery fuse F20= K50A (power) and F21= G0.2A (sensor lines), regard also Fig. 2−6.
For a mains voltage of 115 VAC the standard mains wiring concept allows up to 3 ACC modules. For a 115 VAC supply with 4 modules provided, standard mains wiring has to be adapted concerning diameter of supply cables, size of mains terminals and mains filter.

2.3.2 Power Supply

2.3.2.1 Power Connections

See Figs. 2−18, 2−19 and 2−26.

The terminal blocks for electrical and signal connections as listed below are installed on the BCPS connection plate and the C−bar, which are located at the lower back side of the transmitter cabinet, or on the transmitter cabinet bottom plate. They are accessible after opening the rear door of the rack:

BCPS connection plate:
- 6 mains terminals L1, L2, L3, N, PE (Protective Earth) and FPE (Functional Protective Earth)
- 1 Speedy connector 26pin for control signals to/from the BCPS from TX
- 2 single terminal blocks for battery (+ and −), factory wired
- 2 single terminal blocks for NAV equipment, factory wired
- 5 terminals for measuring lines to the battery, factory wired

C−bar:
- 2 single terminal blocks for connecting the battery (+B,−B)
- 5 terminals (2,1, F, F, 0) for measuring lines to the battery BAT2, BAT1, 2 BFUSE and BAT0
- 4 terminals (+D,−D; +R,−R) for connecting collocated DME and Radio Link (RL) equipment
- 1 single terminal block (+N,−N) for connecting the NAV equipment, factory wired

Bottom plate:
- 5 mains terminals L1, L2, L3, N, PE
- mains filter with mains terminals 4 In/4 Out/1 PE (european version only)

NOTE: The BCPS is a unit designed for ”stationary operation”, and its main connection and protection measures should conform to VDE 0875*, Table 2, Paras. 6 and 7. The unit fulfils the protection class I of EN 60950. The following should be noted in particular:
(* German industrial guide line for electrical installations)

- A permanently wired mains connection is recommended. The 230 VAC supply system must be able to supply approx. 110 V in minimum, with an internal resistance of the supply system < 0.5 ohms.
- If the wiring is not permanent, the plug−in connection must be protected against incorrect connection (e.g. Perilex or CEE connectors).
- The ground cable must be laid separately, and connected permanently to the FPE terminal and to the connecting bolt (BSE) of the rack.
- A ground fault interrupter must be provided for a rated fault current of 30 mA.

The connection must be done in the following sequence:

WARNING

Before connecting the cables check that the mains lead is dead and that the battery is not connected.

– Set the ON/OFF switches of the ACC 54 units to OFF. Remove the units.
– Remove the rear panel.
– Connect a cable between the terminal FPE and the potential equalization bus.
– Connect the mains leads (nom. 115 to 230 VAC/50 Hz, single phase) to the terminals designated L1, N and PE located on the bottom plate and from there to the corresponding terminals on the BCPS connection plate. If a mains filter is installed on the bottom plate (European version only) connect the mains leads to the corresponding terminals on the mains filter and from there to the terminals on the BCPS connection plate. The protective earth should be connected to PE.
– Connect the cables to the battery terminals BAT+ and BAT– located on the C–bar taking care not to connect them the wrong way round.
– Connect the measurement lines to the battery terminals BAT0, BAT1, BAT2 and BFUSE (2x) located on the C–bar if an auxiliary contact is available on the battery main switch.
– Connect the ground bolt (BSE) of the rack (Fig. 2–23) to the ground points and/or the potential equalization bus of the shelter.

2.3.2.2 Connection of Battery Set

See Figs. 2–18, 2–19 and 2–26.

CAUTION

When connecting the DC supply observe the correct polarity (+ and –).

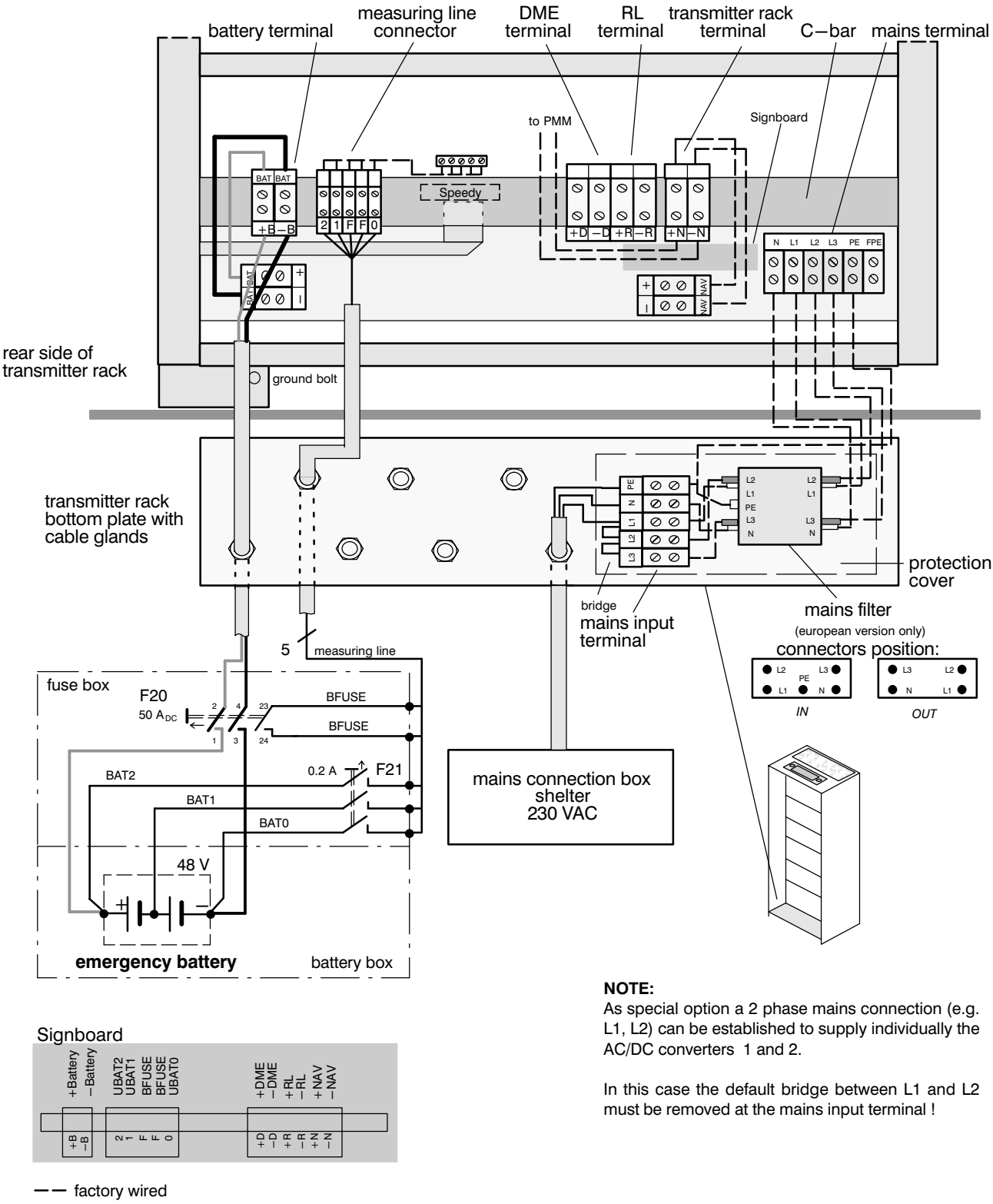
The battery set is connected via two pvc–insulated copper cables as per DIN 57281 with a cross–sectional area of 16 mm^2. The length of this connection is restricted to a maximum of 10 m for electrical reasons.

(* German industrial standard for electrical installations)

Connect the leads to the terminals BAT (+) and BAT (–) on the C–bar. In order to protect the battery, the positive line must have a 50 A fuse, if the battery monitoring program is used, and an automatic overcurrent device (F20/50 ADC, in fuse box) with signalling contact.

Connect the signalling contacts to the terminals BFUSE of the measuring line connector. Install the following cables for measuring purposes:

– from battery plus–pole via terminals of fuse switch F21 (in fuse box) to terminal BAT2 of measuring line connector
– from the middle of the battery set via terminals of fuse switch F21 (in fuse box) to terminal BAT1 of the measuring line connector
– from battery minus–pole via terminals of fuse switch F21 (in fuse box) to terminal BAT0 of the measuring line connector



NOTE:
As special option a 2 phase mains connection (e.g. L1, L2) can be established to supply individually the AC/DC converters 1 and 2.

In this case the default bridge between L1 and L2 must be removed at the mains input terminal !

Fig. 2–18 Connections at the BCPS connection plate, C–bar and bottom plate

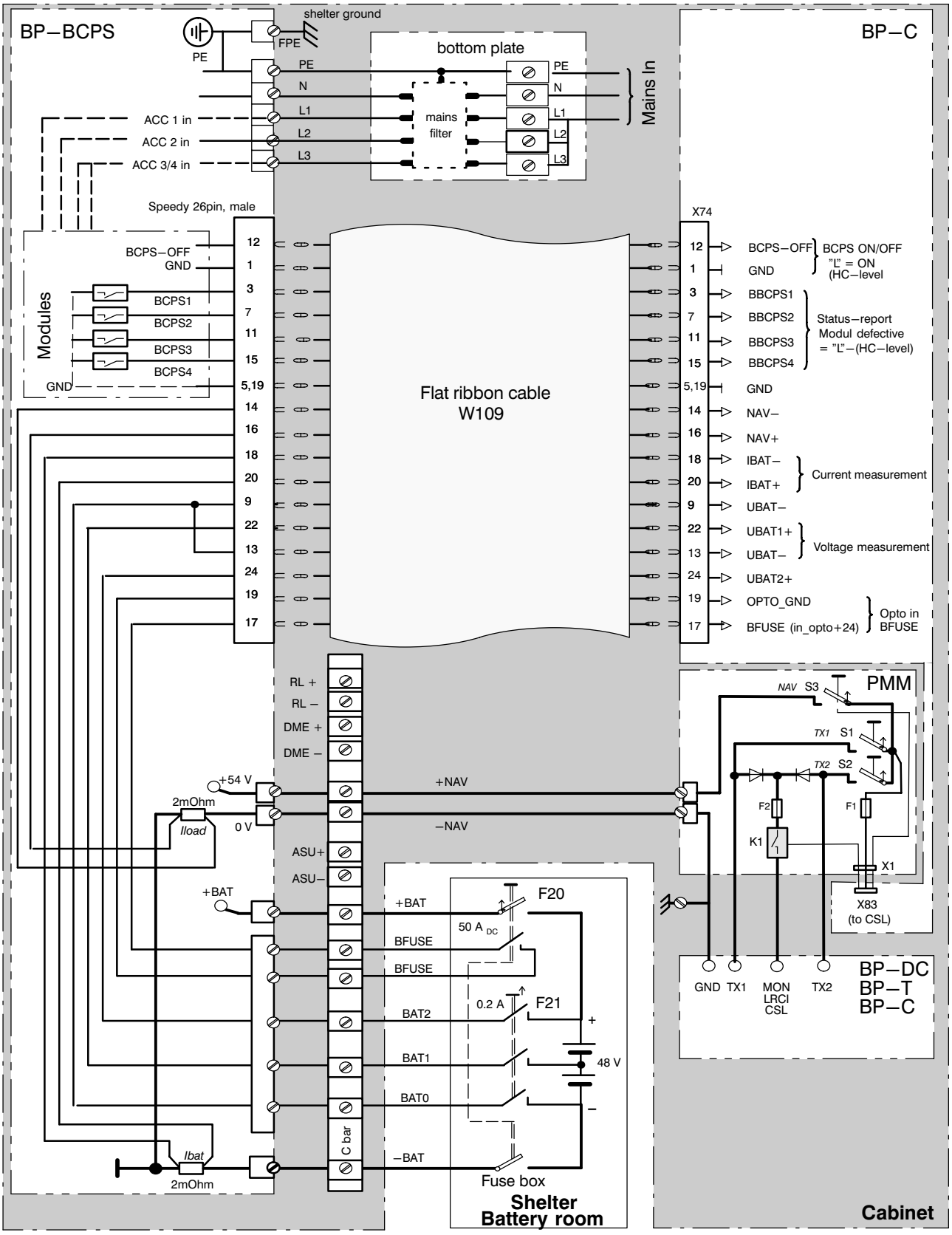


Fig. 2–19 Power supply cabling: BCPS connection plate, C–bar and bottom plate, PMM

2.3.3 RF−Connections at Transmitter Rack

See Fig. 2−20, 2−26.

Make the following cable connections:

Transmitter Rack	Cable No.	Antenna Base	Matching Device
SB1	W1 (SBA)	A	
SB2	W2 (SBB)	B	
CSB	W3		IN CSB

Make the following cable connections, if one field monitor dipole is used:

Transmitter Rack	Cable No.	CP1 (T−piece)	Cable No.	Monitor Dipole
MON1		CP1 out		
MON2	W7	CP1 out		
		CP1 IN	W4	Monitor Dipole

Make the following cable connections, if two field monitor dipoles are used:

Transmitter Rack	Cable No.	CP1 (T−piece)	Cable No.	Monitor Dipole
MON1	W4	–	–	Monitor Dipole 1
MON2	W5	–	–	Monitor Dipole 2

The cable to the monitor(s) is fed from the monitor mast through a cable entry (bottom of the shelter).

NOTE: Connections for 8 point ground check refer to section 2.4.

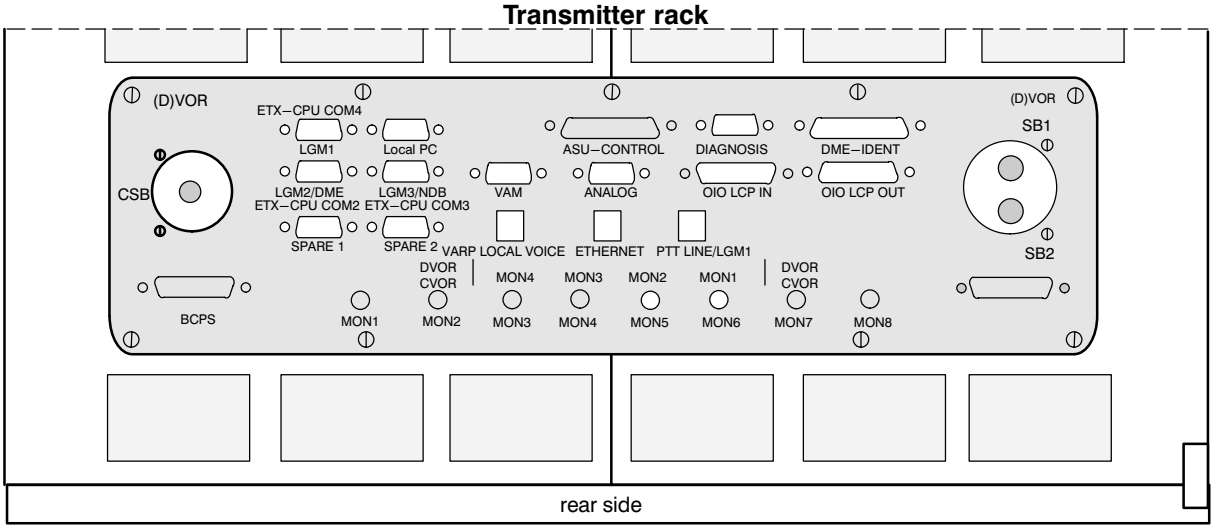


Fig. 2−20 CVOR Transmitter rack, top view, connectors

2.3.4 Connection of optional ETX−CPU board in the cabinet

See Figs. 2−20, 2−21.

The interconnection of the optional ETX−CPU board within the cabinet is shown below.

NOTE:
The parts to install the ETX−CPU option are contained in the MCS TCP/IP Local Kit Ref. No. 58351 00090. The kit comprises:

Cable W10...13 (speedy 10pin)	Ref. No. 24009 28239
Cable W20...22 (speedy10/SubD9)	Ref. No. 24009 28171
Cable W1 (RJ45)	Ref. No. 24009 28003
Modular coupling connector RJ45	Ref. No. 24314 28197
ETX−CPU board	Ref. No. 84045 84300
Extender board for ETX−CPU	Ref. No. 84045 84150

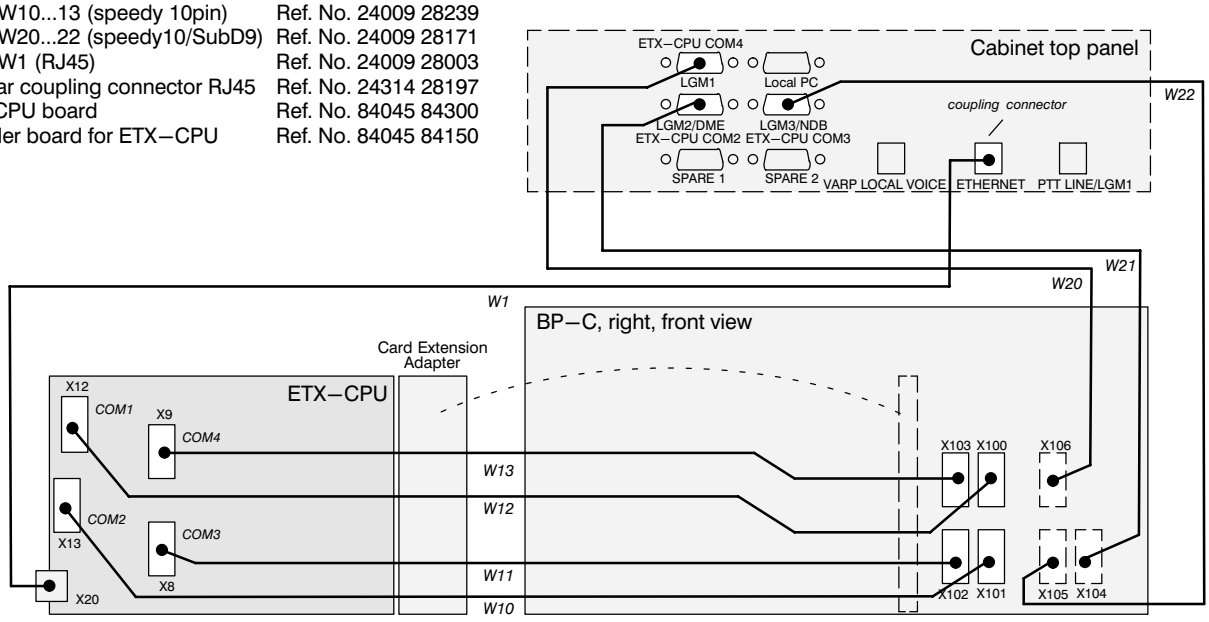


Fig. 2−21 ETX−CPU board, connection to motherboard BP−C and cabinet top

2.3.5 External Interface Connections and Pin Assignments

See Fig. 2−20, 2−23.

The following connectors are additionally available on the top and front of the transmitter cabinet:

– DME−IDENT	analog DME interface
– DIAGNOSIS	communication interface diagnostics
– LGM1/	dedicated line connection (to RMMC) with use of LGM 1200MD or PTT connection (optional) or serial communication interface;
ETX−CPU COM4	serial communication interface (used with MCS*); GPRS connection
– LGM2/DME/	PTT connection (LGM 28.8) or serial communication interface DME;
ETX−CPU COM2	serial communication interface (used with MCS*)
– LGM3/NDB/	PTT connection (LGM 28.8) or serial communication interface NDB;
ETX−CPU COM3	serial communication interface (used with MCS*)
– ANALOG	measurement purposes
– Local PC	local operation (used as standard with ADRACS or MCS)
– VAM/	optional, voice or ATIS connection, e.g. from tower
VARP LOCAL VOICE	optional, Voice Amplier and voice Record/Playback
– ETHERNET	optional, LAN RJ45 connection (used with MCS*)
– PTT LINE/LGM1	optional, RJ11 connector PTT line, selectable to internal LGM1.. 3
– OIO LCP IN	spare in, optocoupler
– OIO LCP OUT	spare out, optocoupler

* optional, with use of MCS software and ETX−CPU board option

2.3.5.1 DME−IDENT

SubD, 37pin, male, from connector X85 BP−C. Refer to section 2.6.

2.3.5.2 DIAGNOSIS

SubD, 9pin, male, from connector X86 BP−C

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	DCD	6	DSR
2	RXD	7	RTS
3	TXD	8	CTS
4	DTR	9	RI
5	GND		

2.3.5.3 LGM1 or ETX−CPU COM4

SubD, 9pin, male, from connector X92 or X97 or X106 BP−C; X92 = LGM modem output

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	La	6	E
2	Lb	7	not used
3	A2	8	not used
4	B2	9	not used
5	GND		

X97 = TTL (direct) or X106 = RS232

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	DCD	6	DSR
2	RXD	7	RTS
3	TXD	8	CTS
4	DTR	9	RI
5	GND		

2.3.5.4 LGM2/DME or ETX−CPU COM2

SubD, 9pin, male, from connector X93 or X98 or X104 BP−C; X93 = LGM modem output

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	La	6	DSR
2	Lb	7	RTS
3	A2	8	CTS
4	B2	9	RI
5	GND		

X98 = TTL/RS232 (direct) or X104 = RS232

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	DCD	6	DSR
2	RXD	7	RTS
3	TXD	8	CTS
4	DTR	9	RI
5	GND		

X98 = RS422 (direct)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	TXD+	6	RXD+
2	TXD−	7	RXD−
3	not used	8	not used
4	not used	9	not used
5	not used		

2.3.5.5 LGM3/NDB or ETX−CPU COM3

SubD, 9pin, female, from connector X94 or X99 or X105 BP−C; X94 = LGM modem output

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	La	6	DSR
2	Lb	7	RTS
3	A2	8	CTS
4	B2	9	RI
5	GND		

X99 = TTL/RS232 (direct) or X105 = RS232

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	DCD	6	DSR
2	RXD	7	RTS
3	TXD	8	CTS
4	DTR	9	RI
5	GND		

X99 = RS422 (direct)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	TXD+	6	RXD+
2	TXD−	7	RXD−
3	not used	8	not used
4	not used	9	not used
5	not used		

2.3.5.6 ANALOG

SubD, 9pin, female, from connector X84 BP−C

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	ANALOG−IN1	6	ANALOG−IN2
2	ANALOG−IN3	7	ANALOG−IN4
3	ANALOG−IN5	8	ANALOG−IN6
4	15 VN−A (−15 V)	9	15 VP−A (+15 V)
5	AGND		

2.3.5.7 Local PC

SubD, 9pin, male, from connector X4 of LCP

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	DCD	6	DSR
2	RXD	7	RTS
3	TXD	8	CTS
4	DTR	9	RI
5	GND		

2.3.5.8 VAM

SubD, 9pin, female, from connector X95 BP−C

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	LV1	6	LVG
2	LV2	7	
3	SYNCH	8	
4	SYNCR	9	
5	GND		

2.3.5.9 VARP LOCAL VOICE

RJ11, 6pin, from connector X107 (VARP modem) BP−C, optional, not assembled
RJ11, 6pin, connector X110 at BP−C

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1,2	n.c.	4	Lb
3	La	5,6	n.c.

2.3.5.10 ETHERNET

RJ45, 10pin from connector X20 ETX−CPU, optional

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	TXTP+	6	RXTP−
2	TXTP−	7,8	n.c.
3	RXTP+	9,10	SHLD
4,5	n.c.		

2.3.5.11 PTT−LINE/LGM1

RJ11, 6pin, from connector X115 at BP−C, optional, not assembled (allocatable to LGM1 to 3)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1,2	n.c.	4	Lb
3	La	5,6	n.c.

2.3.5.12 OIO LCP IN

SubD, 25pin, male, to connector X2 of LCP via X82 BP−C

PIN	ASSIGNMENT		PIN	ASSIGNMENT	
1	GND		14	VCC (+5 V)	
2	TTLOUT3	(internal use)	15	IAUX0	
3	IAUX1		16	IAUX2	
4	IAUX3		17	IAUX4	
5	IAUX5		18	IAUX6	
6	IAUX7		19	IAUX8	
7	IAUX9		20	IAUX10	
8	IAUX11		21	IAUX12	
9	IAUX13		22	IAUX14	
10	IAUX15		23	TTLIN0	(internal use)
11	TTLIN1	(internal use)	24	TTLIN2	(internal use)
12	TTLOUT4	(internal use)	25	TTLIN3	(internal use)
13	GND				

2.3.5.13 OIO LCP OUT

SubD, 25pin, female, from connector X2 of LCP via X82 BP−C

PIN	ASSIGNMENT		PIN	ASSIGNMENT	
1	COM3 (common connect 3)		14	COM4 (common connect 4)	
2	TTLOUT2	(internal use)	15	OAUX0	
3	OAUX1		16	OAUX2	
4	OAUX3		17	OAUX4	
5	OAUX5		18	OAUX6	
6	OAUX7		19	COM1 (common connect 1)	
7	OAUX8		20	OAUX9	
8	OAUX10		21	OAUX11	
9	OAUX12		22	OAUX13	
10	OAUX14		23	OAUX15	
11	COM2 (common connect 2)		24	TTLOUT0	(internal use)
12	TTLOUT1	(internal use)	25	VCC (+5 V)	
13	GND				

2.3.6 External Interfaces, Cable Connections

2.3.6.1 Connection of Remote Control RMMC

– Dedicated line modem LGM1200MD: Connect a two wire line from RMMC to pins 1 and 2 of a SubD, 9pin connector and connect to connector LGM1 on top of the cabinet.

  NOTE: For LGM1200MD the ends of the dedicated line (station and remote side) have to be terminated (600 ohms/47 nF parallel). The RC combination may be soldered to the 9pin SubD connector together with the two wire line.

– Switched line modem: Connect a two wire line from PTT/RMMC to pins 1 and 2 of a SubD, 9pin connector and connect to connector LGM1 (or LGM2, LGM3, if modem assembled) on top of the cabinet.

  Alternatively the RJ11 connector X115 at the BP–C can be used for the PTT line connection. The RJ11 connector has to be allocated to LGM1 connection with jumper X120/121 at the BP–C. Optionally an adapter is available, which comprises a snap–in RJ11 connector to be assembled to the top panel (location PTT LINE/LGM1) and a connection cable to the RJ11 connector at BP–C.

– GPRS* modem: Optional ETX–CPU is assembled. LGM1/ETX–CPU COM4 is internally connected to connector X106 at BP–C. Connect a serial cable with SubD, 9pin from GPRS modem to LGM1/ETX–CPU COM4 connector on top of the cabinet.

* GPRS = General Packet Radio system, used for wireless communication

2.3.6.2 Connection of a local PC or Laptop

Standard configuration: Connect V.24 cable (0-modem cable) with SubD, 9pin from PC to connector Local PC on top of cabinet.

NOTE: With use of MCS in the standard configuration the GUI software and the proxy agents are running on the laptop used.

Optional configuration with ETX–CPU: Connect crossover Ethernet cable from Ethernet connector at the Laptop to connector ETHERNET on top of cabinet which is internally connected to X20 of the ETX–CPU. In addition, a DHCP client has to be installed at the laptop.

NOTE: With use of MCS in the optional configuration the proxy agents are loaded to the ETX–CPU board and the GUI software is running on the laptop used.

2.3.6.3 Connection of Voice Signal for VAM

Connect a two wire line from incoming voice service (e.g. from Tower) to pins 1 and 2 of a SubD, 9pin connector and connect to connector VAM on top of the cabinet.

The VARP option is normally not implemented and the correspondent connector on top of cabinet not assembled.

2.3.6.4 Connection of auxiliary Inputs/Outputs (LCP)

The Navaids installation contains an auxiliary interface (on LCP board) with 16 optocoupler inputs and 16 optocoupler outputs for additional signals which is at the user's disposal. The external wiring of the OIO connectors is shown in Fig. 2–22.

2.3.6.5 Connection of auxiliary Analog and Temp inputs (CSL)

Connect optional voltage measurement lines (user defined) to plug SubD, 9pin and connect to connector ANALOG on top of the cabinet. Connect sensor PT1000 for temperature measurement via cable and tabs to X81/1,2 or 3,4, rear BP–C. The wiring is shown in Fig. 2–23. The results are indicated in 'LRCI Measurements' – 'Analogue in 1...6' and 'Temperature 1...2' in the PC User Pogram.

IAUX 0...7 and IAUX 8...15 when active low

IAUX 8...15 when active high
(selectable with jumpers J1...4, refer to 6.2.5.1)

OAUX 0...3/4...7/8...11/12...15

NOTE:
Only voltages in the SELV range (up to 60 VDC) must be connected to connectors OAUX .
(SELV = Safety Extra Low Voltage)

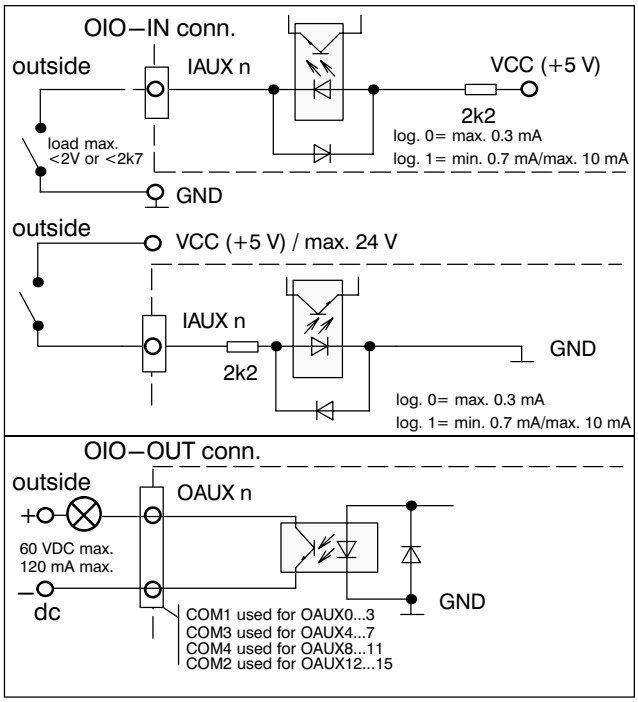


Fig. 2–22 External wiring of auxiliary OIO connectors of LCP

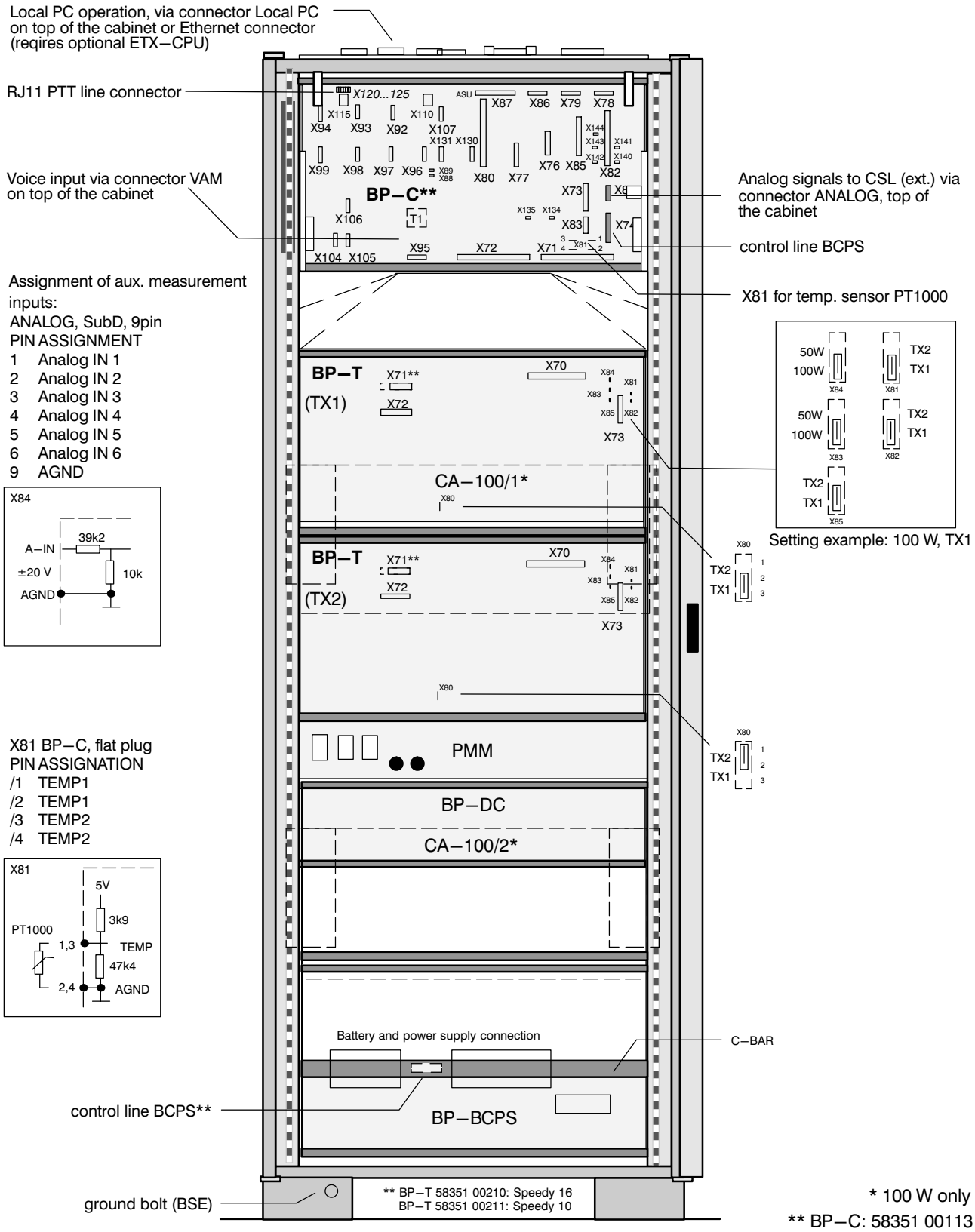


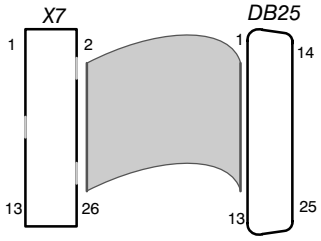
Fig. 2–23 Transmitter cabinet, rear side, interface connections

2.3.7 ETX CPU option, Pin Assignment of Connectors

The signals assigned to the pins of the sockets of X7 to X13 (component side view) and the corresponding connected plugs is as folllows. Refer to section 6.2.5 for location of connectors.

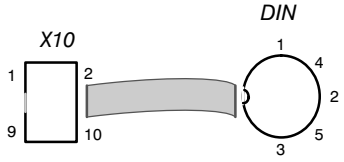
X7 – INC panel connector (parallel printer port):

Pin X7	DB25	Signal	Pin X7	DB25	Signal
1	1	/STB	14	20	/AFD
2	14	D0	15	8	/ERR
3	2	D1	16	21	/INIT
4	15	D2	17	9	/SLIN
5	3	D3	18	22	GND
6	16	D4	19	10	GND
7	4	D5	20	23	GND
8	17	D6	21	11	GND
9	5	D7	22	24	GND
10	18	/ACK	23	12	GND
11	6	BUSY	24	25	GND
12	19	PE	25	13	GND
13	7	SLCT	26	–	GND



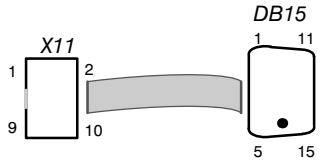
X10 – keyboard/mouse connector:

Pin X10	DIN	Signal	Pin X10	DIN	Signal
1	–	–	6	1	KeybClk
2	–	GND –	7	4	GND
3	–	MouseClk	8	5	+5V
4	–	MouseDat	9	–	UBAT
5	2	KeybDat	10	–	PowerGood (Reset CPU)



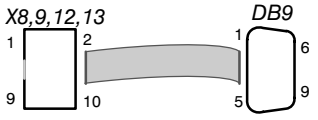
X11 – VGA connector:

Pin X11	DB15	Signal	Pin X11	DB15	Signal
1	1	Red	6	6	GND
2	4	GND	7	13	HSYNC
3	2	Green	8	7	GND
4	5	GND	9	14	VSYNC
5	3	Blue	10	8	GND



X12,13,8,9 – COM1 to COM4:

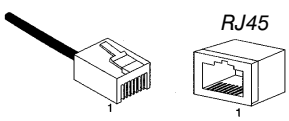
Pin X	DB9	Signal	Pin X	DB9	Signal
1	1	DCD	6	8	CTS
2	6	DSR	7	4	DTR
3	2	RxD	8	9	RI
4	7	RTS	9	5	GND
5	3	TxD	10		–



X14 – USB interface(s), V1.0 standard PC host controller

Pin	Signal	Pin	Signal
1	Vcc+	3	Data +
2	Data –	4	Vcc–

X20 – Ethernet connector:
Pin assignment see section 2.3.5.10



2.4 INSTALLATION OF 8 PGC OPTION AT THE CVOR RACK

2.4.1 General

The CVOR antenna system is completely installed. The 8 PGC monitor dipoles are installed according section 2.2.5.

To install the 8 point ground check (8 PGC) option to one equipment the following parts are required:

– 2 MSP–CD 83135 22302 (incl. adapted SW–EPROM)

NOTE: The MSP–CD p/n 83135 22302 replaces the MSP–CD p/n 83135 22301 that has replaced the previously used MSP–V8 (83134 22600 or 83135 22600). If the MSP–CD, 83135 22302 is already installed it is **not** replaced.

– 1 MDS–V8 83135 20700 (incl. adapted SW–EPROM)

– Semi–rigid cables, pre–formed:

W12	24026 29071	(used for connection MDS to MSP/2)
W16	24026 29075	(used for connection MDS to MSP/1)
W70 to W77	24026 29276 to 29283	(used for connection MON1...8 to MDS)

– Disassembling tool 24339 28050 (used for RF cable connectors)

– Site files and LKE files (used for station definition)

– PC User Program SW adapted to CVOR 8 PGC option (used for operation and monitoring)

2.4.2 Installation Procedure

See Fig. 2–24, 2–25.

To change over the standard CVOR 431 to the CVOR 431 with optional 8 point ground check monitor perform the following steps:

CAUTION

Before performing any change or replacement to the CVOR equipment, switch power off.

– Switch main power off for the CVOR installation.

– If the MSP–CD p/n 83135 22302 (or MSP–CD p/n 83135 22301) is already installed, it is not replaced. Old systems only: Remove both modules MSP–VD, p/n 83135 22300.

– Remove semi–rigid monitor cables W56 and W57 (TNC connector female). Use disassembling tool 24339 28050 to remove coaxial connectors from the backpanel (Fig. 2–25).

– Loosen all RF and AF connections from the connector plate on top of the cabinet.

– Push out the pre–punched holes for the additional TNC–connectors used for 8 PGC.

– Connect all loosened RF and AF cables to the prepared connector plate as before.

– Assemble cables W70 to W77 to the backpanel BP–C and to the connectors MON1 to MON8 on top of the cabinet (see Fig. 2–25).

– Assemble cables W12 and W16 into the backpanel BP–C (see Fig. 2–25, connection MDS to MSP's).

– Adjust coaxial connectors central to the hole in the insulating part of the connector.

– Put new modules MSP–CD, part–No. 83135 22302 in the MSP position. This is not necessary if the current MSP–CD is already installed.

– Put module MDS–V8, part–No. 83135 20700 in the MDS position.

– Connect monitor dipole antennas to the inputs MON1 to MON8. Maximum input level is –8 dBm, minimum input level is –35 dBm.

NOTE: The Monitor takes the signals of 8 monitor dipoles at the edge of the counterpoise. The dipole MON1 may be replaced by the conventional monitor field dipole.
All dipoles have to be within a 45° raster. Deviations up to ±5° may be adjusted by the calibrate function of the software.

– Finally check correct cabling and tight fitting of RF cables.

2.4.2.1 Connections at Transmitter Rack

See Fig. 2–24.

The cable to the monitor dipoles is fed from the monitor masts or fastenings through a cable entry of the shelter (bottom of the shelter).

Make the following new cable connections within the transmitter rack, rear side (Fig. 2–25):

Connector cover plate, Backpanel BP–C

Connector	**Cable No.**	**Module**	(Monitor Dipole)
MON1	W70	MDS	8 PGC Monitor Dipole 1 or standard monitor
MON2	W71	MDS	8 PGC Monitor Dipole 2
MON3	W72	MDS	8 PGC Monitor Dipole 3
MON4	W73	MDS	8 PGC Monitor Dipole 4
MON5	W74	MDS	8 PGC Monitor Dipole 5
MON6	W75	MDS	8 PGC Monitor Dipole 6
MON7	W76	MDS	8 PGC Monitor Dipole 7
MON8	W77	MDS	8 PGC Monitor Dipole 8

Backpanel BP–C

Connector	**Cable No.**	**Module**	(Signal)
MDS–V	W12	MSP–CD/1	RFMON1
MDS–V	W16	MSP–CD/2	RFMON2

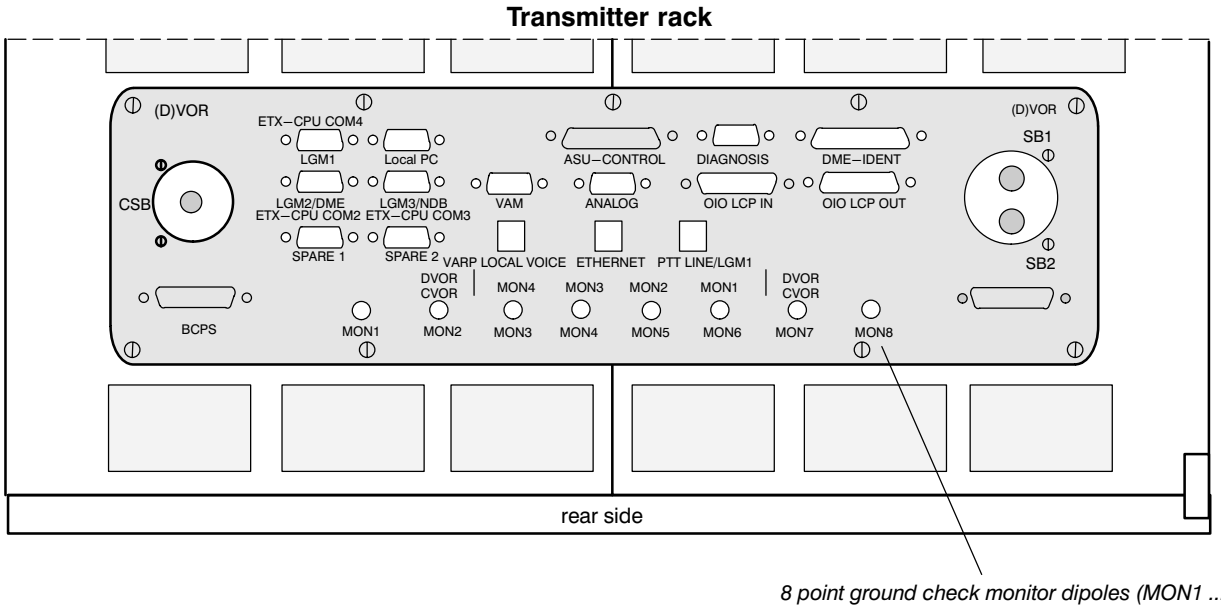
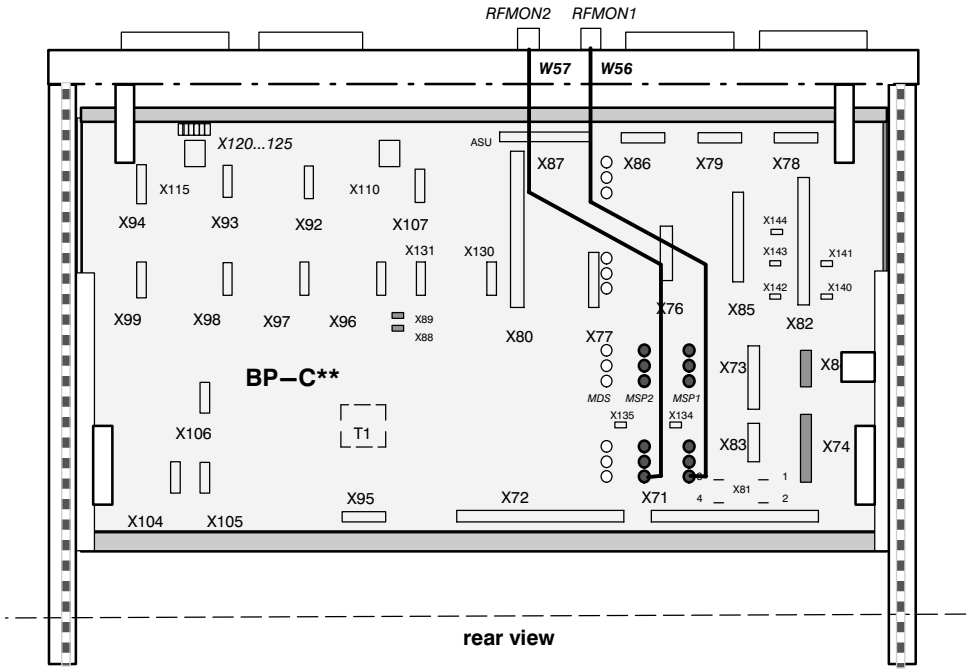


Fig. 2–24 CVOR transmitter rack, top view, replaced cover with additional connectors

CVOR standard connections

Remove:
W56 : 24026 29125
W57 : 24026 29116

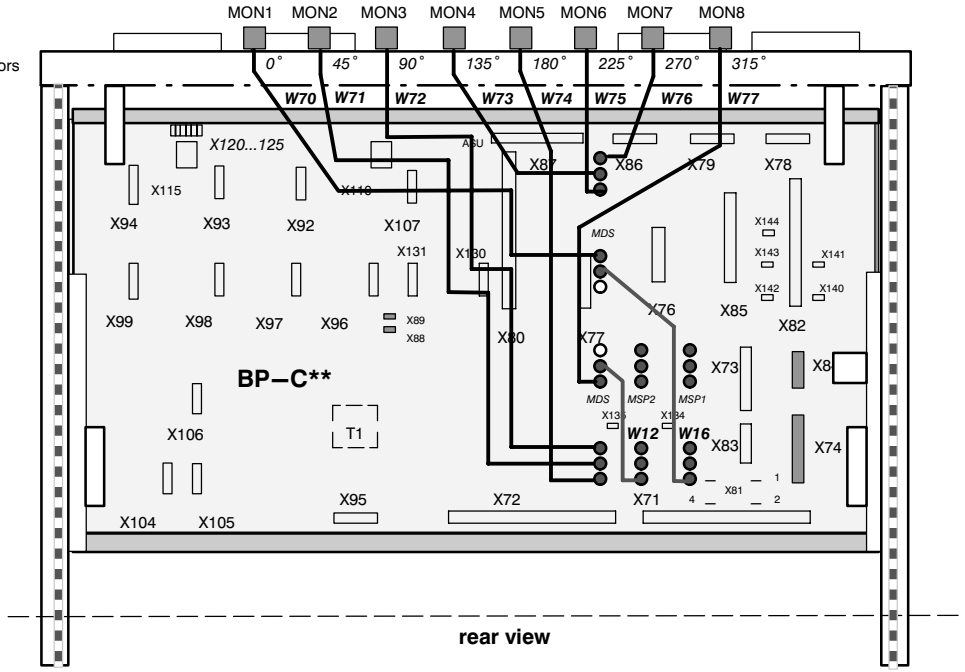


CVOR 8 PGC connections

Replace:
cover plate by new cover plate
remount connectors
mount additional monitor input connectors

Connect:
W12 : 24026 29071
W16 : 24026 29075

W70 : 2402629276
W71 : 24026 29277
W72 : 24026 29278
W73 : 24026 29279
W74 : 24026 29280
W75 : 24026 29281
W76 : 24026 29282
W77 : 24026 29283



** BP–C: 58351 00113

Fig. 2–25 Transmitter cabinet, new cabling for 8 point ground check option

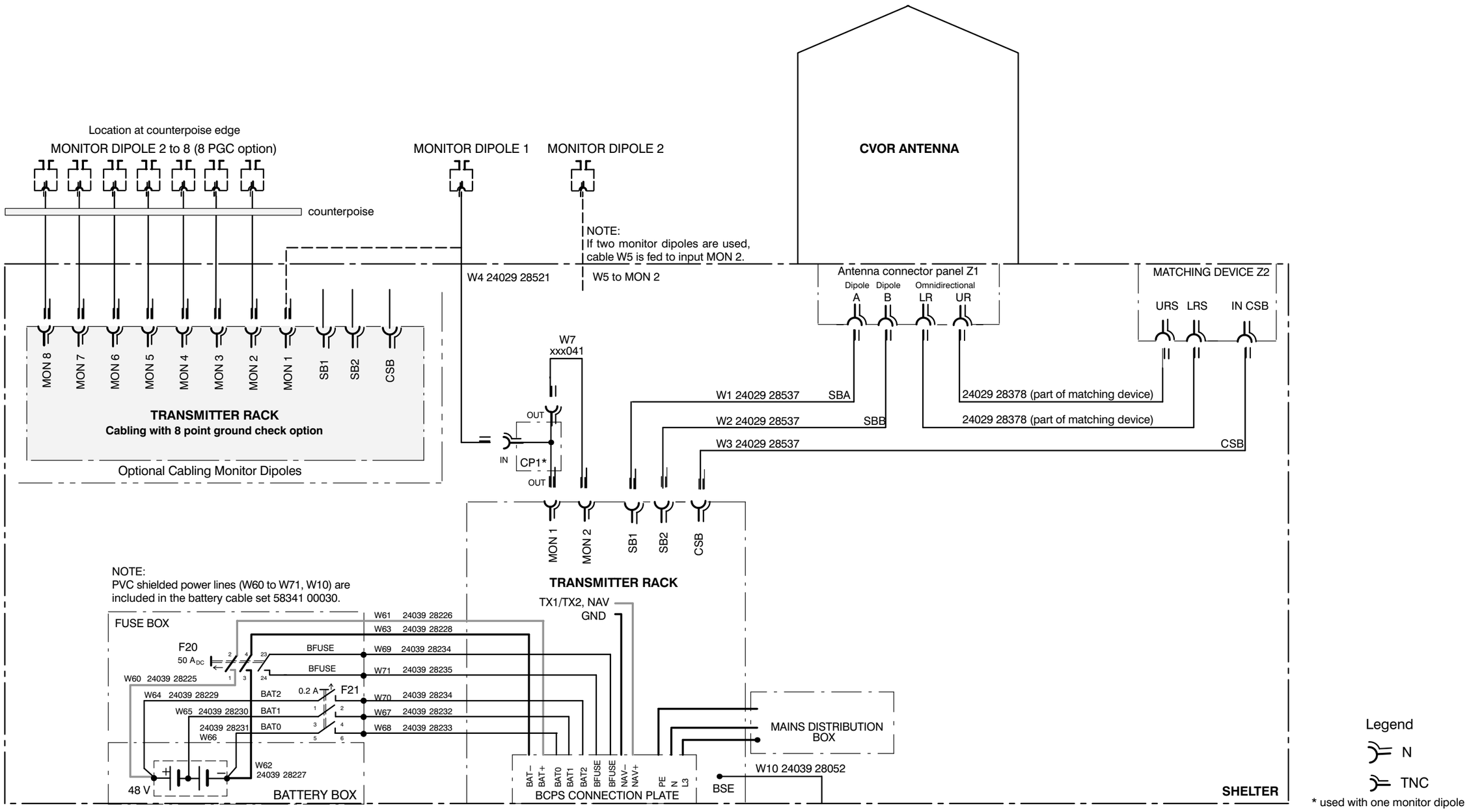


Fig. 2–26 System cabling CVOR

2.5 GROUNDING

2.5.1 General

The type of grounding implemented is dependent on the local terrain. Consequently it is only possible to provide general guidelines here. Grounding conductors or rods are metallic elements of a particular form which are either driven into the ground or laid in the ground so as to cover a relatively large area. All connections in the ground must be welded and protected against corrosion. The ground resistance required for a CVOR (or other navigation installations) can be given as $\leq$ 5 ohm. This resistance can only be measured precisely with the aid of special ground resistance measuring equipment. The exact measuring procedure is described in the operating instructions for these devices. Universally valid instructions are given in Section 2.5.6. Sufficient grounding can generally be obtained if the installation suggestions described below and the terrain conditions are paid attention to. When estimating the ground resistance the length and extent of the network laid are the crucial points, not the cross−sectional area of the conductors. Favorable resistance conditions are provided by arable land and loamy ground (ground resistivity 100 ohm per meter). The data specified below applies to these conditions. With other types of terrain the factors below must be taken into consideration (increase in the resistance with respect to the basic values stated).

Moist sandy soil	2x
Dry sandy soil	5 to 10x
Gravel or stones	up to 30x

If the ground is not chemically neutral, e.g. if it is salty, it may be necessary to coat all metal parts laid in the ground with lead or to use a sufficiently non−corrosive steel (e.g. V2A). The different types are as follows:

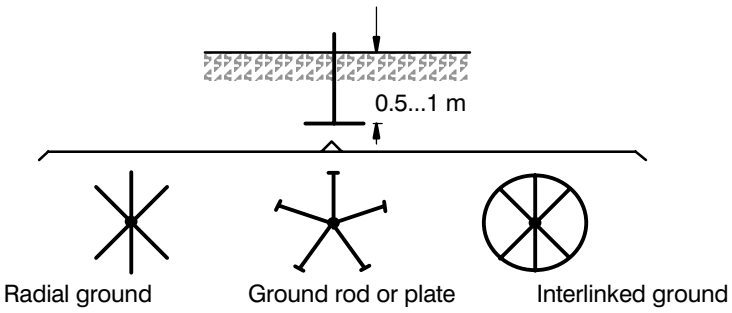


Fig. 2−27 Different types of ground conductor configuration

2.5.2 Strip or mesh Ground Conductors

Strip ground conductors take the form of a strip, round material or cable laid in the ground at a depth of 0.5 to 1 m so as to cover a relatively large area.

Materials:

- Steel strip (hot galvanized) 100 mm^2, min. thickness 3 mm
- Copper strip 50 mm^2, min. thickness 2 mm
- Copper cable (not finely stranded) 135 mm^2

The network should be laid as symmetrical to the CVOR station as possible. The necessary length and extension when laid in a straight line, should be estimated from the basic data below.

Strip length	Ground resistance
25 m	10 ohm
50 m	5 ohm
100 m	3 ohm

2.5.3 Ground Rods

Ground rods are either pipes or U, L or T−shaped profiles driven vertically into the ground and 1 to 2 m in length. It is necessary to connect several ground rods together in order to reduce the grounding resistance. The minimum spacing is twice the length of each ground rod. The material, cross sectional areas and grounding resistance of the connecting leads to the shelter should be as for strip ground conductors, (see Section 2.5.2). When pipe−type grounding rods are fastened with clamps, screws at least M10 in size should be used.

– Material: Steel (hot galvanized)	Pipe	30 x 3 mm
	Bracket	L 65 x 65 x 7 mm
	U−profile	U 65 DIN 1026
	T−profile	T 60 DIN 1024
– Probable grounding resistance of a rod:	Length 1 m, approx. 70 ohm	
	Length 2 m, approx. 40 ohm	

2.5.4 Ground Plates

Ground plates are solid perforated sheet metal plates with dimensions of approx. 0.5x1 m or 1x1 m, which are embedded vertically in the ground. The top edge of the plates should always be at least 1 m below the surface. Several ground plates must be connected in parallel in order to reduce the grounding resistance. The minimum spacing should be 3 m. Material:

– Sheet steel (hot galvanized)	min. thickness 3 mm
– Sheet copper	min. thickness 2 mm

The ground resistance of a plate 1 m^2 is approx. 30 ohm. The data for the connecting conductors is specified in the tables in Section 2.5.2.

2.5.5 Estimating the Ground Resistance

The resistance of each rod, each plate and each supply line used should be determined on the basis of Section 2.5.2 to 2.5.4. They should be considered as parallel resistances. The resulting grounding resistance should then be calculated as follows: $1/R_{res} = 1/R_1 + 1/R_2 + 1/R_3 + ... + R_n$. Taking into account the nature of the terrain (for factors see Section 2.5.1) satisfactory grounding conditions can be assumed if the ground resistance calculated from the base data is < 5 ohm. If the value calculated is 5 ohm or more, we recommend measuring the ground resistance.

2.5.6 Measuring the Ground Resistance

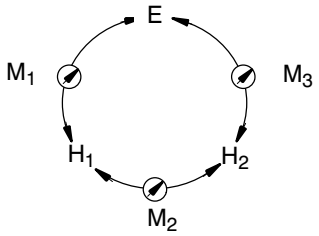
See Fig. 2−28.

Three measurements must be performed over a large area in order to determine the ground resistance precisely. The distance between 2 auxiliary grounds required must be large in relation to the complete ground network of the navigation installation.

Two steel rods approx. 1 m long should be used as auxiliary grounds (reinforcing bars); these should be driven into the ground with only a few centimeters remaining at the designated points. It is essential that the rods are of equal length and are driven in to the same depth.

Measurements are performed as shown in the diagram below:

E	=	Installation ground
H_1	=	Auxiliary ground 1
H_2	=	Auxiliary ground 2
M_1	=	Measured value 1
M_2	=	Measured value 2
M_3	=	Measured value 3



Measured value 1: Resistance between installation ground and auxiliary ground 1
Measured value 2: Resistance between auxiliary ground 1 and auxiliary ground 2
Measured value 3: Resistance between installation ground and auxiliary ground 2

When the three measurements have been performed the ground resistance is calculated as follows:

$$\text{Ground resistance} = \frac{\text{Corr. meas. value 1} + \text{corr. meas. 3} - \text{corr. meas. value 2}}{2}$$

The measurement is falsified by the resistance of the 2 test leads. The cross−sectional area of the test leads should not be less than 1.5 mm^2 in order to ensure an adequate breaking strength. With this cross−sectional area and an assumed length of 2 x 25 m = 50 m, the falsifying resistance would be 0.58 ohm. This resistance should therefore be measured and deducted from measured values 1, 2 and 3. The measured values corrected in this manner are entered into the above formula.

Example of a CVOR plate ground with 5 x 2 plates, each 1 m^2. The drawing is not to scale. A theoretical ground resistance of approx. 2 ohm (good) would be obtained on the basis of the 10 plates, connecting conductors and assumed terrain conditions (e.g. arable land) in accordance with the formula in Section 2.5.5.

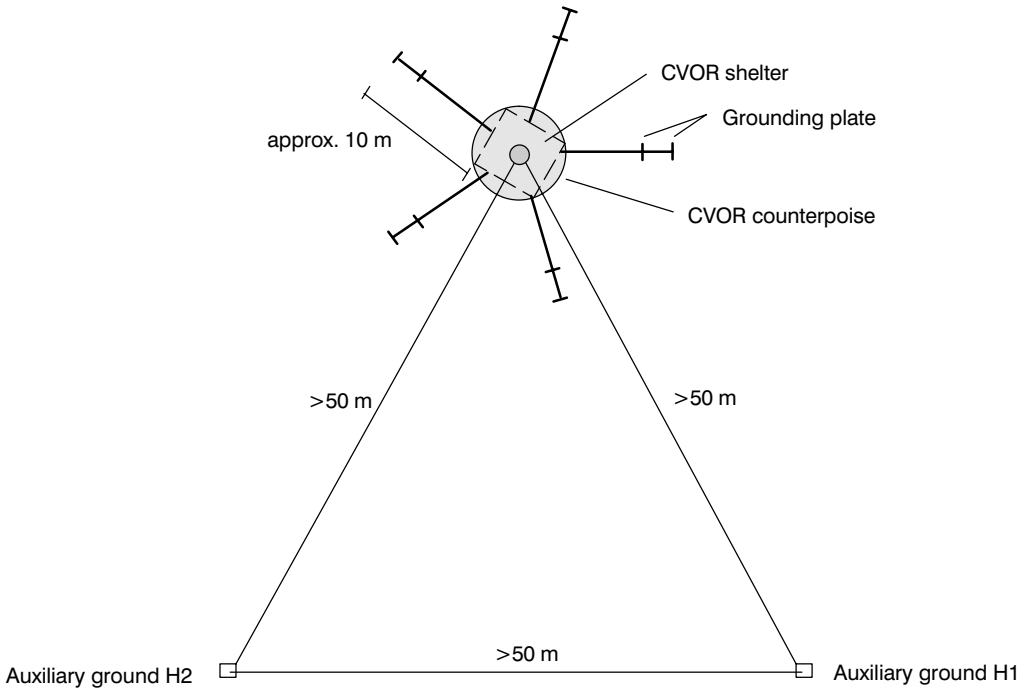


Fig. 2−28 Determining of the ground resistance

2.5.7 Earthing System

The site dependent modifications of the arrangement have been taken from the project engineering documentation. Regard also the following remarks to lightning protection of the installation.

NOTE: Lightning protection of a Navaids installation (shelter and antenna) comprises all measures which are used to avoid damage of the antenna, the connected equipment as well as injury to persons caused by overvoltage or overcurrent through atmospherical discharges and static. Common practise is the use of galvanic earthing of all antenna and equipment components, if required via chokes or resonant circuits, overvoltage arrester, special lightning protection air−termination rods as well as structural measures such as suitable design or sufficient diameter of endangered parts.

Because of its primary HF−functionality, the installed earthing network or counterpoise may represent not really a sufficient lightning protection.

Implementation of a functional lightning protection system requires the application of normatively tested components and devices. The components are to be selected and duely applied by the installer of lightning protection systems in accordance with the requirements at the installation site. In addition to the mechanical necessities, the electrical criteria of the present state of lightning protection engineering are to be considered and complied with lightning protection air−termination rods.

2.6 COLLOCATION WITH DME/TACAN

2.6.1 Overview

See Figs. 2−30, 2−43, 2−44, 2−48.

This description concerns to the collocation of DME FSD 40/45, DME 415/435 or TACAN FTA 43 with a CVOR 431. The DME or TACAN equipment is normally located in the CVOR shelter. To synchronize the identification, the collocated DME (TACAN) uses an interface with the CVOR system. To transfer ”Maintenance” and ”Status” of the DME (TACAN) a RS 232−cable connection is established between CVOR and DME (TACAN) if these are not connected with an individual modem (internal or external) to the Tower resp. RCSE 443 via a 2 wire lines connection. These examples are shown in Fig. 2−43, 2−44 and 2−48. The terminal points in the AF−distribution box, which may be used for 2 wire connection, are shown in Fig. 2−30.

Further information to the DME FSD 40/45 will be found in the Technical Manual Ref.No. 8BR 02016 1000 DEGFA, to the DME 415/435 in the manual Ref.No. 955 900 031C, Volume 1, Sept. 2005 or previous edition 8BR 0212 1000 DEGFA, Volume 1, Dec. 1998.

2.6.2 Connection FSD 40/45 to CVOR 431

See Figs. 2−29, 2−31, 2−34.

The FSD 40/45 is installed in two versions: a CSB−version and an IOM−version. The CSB−version itself is built in a version with the connector panel (I/O−panel) mounted at the rear side of the cabinet, and another version with the connector panel mounted on top of the cabinet (Fig. 2−31, 2−34).

The CSB−versions are described in Section 2.6.2.1 and 2.6.2.2, the IOM−version in Section 2.6.2.3. Fig. 2−29 shows the pin assignment of the DME−IDENT and LGM2 interface (VOR) used to connect the DME. Regard the configuration of the subassembly CSL of the CVOR in Section 2.6.2.4. Corresponding information to the DME (TACAN) will be found in the corresponding manual.

2.6.2.1 CSB−Version, I/O−panel at the rear of cabinet

See Figs. 2−31, 2−32, 2−33.

- Lay the ID−cable (Ref.No. 24009 28148) in the shelter cable duct. Connect it to the connector VOR(SK26) on the rear side of the DME cabinet and to connector DME−IDENT on top of the CVOR cabinet (Fig. 2−31 and 2−32).
- To establish the RS 232 connection plug adapter Ref.No. 97243 28211 (Fig. 2−31 and 2−33) to connector PL1 at the DME I/O panel, rear side.
- Place the RS 232−cable (Ref.No. 97240 28166) in the shelter cable duct. Connect it to the adapter (DME cabinet) and to connector LGM2 on top of the CVOR cabinet.

2.6.2.2 CSB−Version, I/O−panel on top of the cabinet

See Figs. 2−34, 2−35, 2−36.

- Lay the ID−cable (Ref.No. 24009 28148) in the shelter cable duct. Connect it to the connector IFV/SK10 on top of the DME cabinet and to connector DME−IDENT on top of the CVOR cabinet (Fig. 2−34 and 2−35).
- To establish the RS 232 connection plug adapter Ref.No. 97243 28211 (Fig. 2−34 and 2−36) to connector PL1 at the DME I/O panel, on top of the cabinet.
- Place the RS 232−cable (Ref.No. 97240 28166) in the shelter cable duct. Connect it to the adapter (DME cabinet) and to connector LGM2 on top of the CVOR cabinet.

2.6.2.3 IOM−Version

See Figs. 2−37, 2−38, 2−39.

– Lay the ID−cable (Ref.No. 24009 28148) in the shelter cable duct. Connect it to the connector VOR(SK26) on the rear side of the DME cabinet and to connector DME−IDENT on top of the CVOR cabinet (Fig. 2−37 and 2−38).

– To establish the RS 232 connection plug adapter Ref.No. 97243 28214 (Fig. 2−37 and 2−39) to connector ”AUX1” on the DME IOM, at the rear side of the cabinet, lower section.

– Place the RS 232−cable (Ref.No. 97240 28168) in the shelter cable duct. Connect it to the adapter (DME cabinet) and to connector LGM2 on top of the CVOR cabinet.

2.6.2.4 Configuration of CVOR 431 and DME FSD 40/45 or TACAN FTA 43

– CVOR 431:
Set switch S5 (see Section 6.2.5) on front of the CSL (Ref.No. 83135 23100), which is set for standard use of the CVOR, to position ”ASSOC.” for the application with a collocated DME FSD 40/45.

– DME FSD 40/45:
Refer to Technical Manual, Ref.No. 8BR 020 161000 DEGFA.

– TACAN FTA 43:
Refer to Technical Manual, Ref.No. SNR DE 0360071−18/1E.

2.6.3 Connection TACAN FTA 43 to CVOR 431

See Figs. 2−40, 2−41, 2−42.

– Lay the ID−cable (Ref.No. 24009 28148) in the shelter cable duct. Connect it to the connector VOR(SK3) on the rear side of the TACAN cabinet and to connector DME−IDENT on top of the CVOR cabinet (Fig. 2−40 and 2−41).

– To establish the RS 232 connection plug adapter Ref.No. 97243 28214 (Fig. 2−40 and 2−42) to connector ”AUX1” on the TACAN IOM, at the rear side of the cabinet, upper section.

– Place the RS 232−cable (Ref.No. 97240 28168) in the shelter cable duct. Connect it to the adapter (TACAN cabinet) and to connector LGM2 on top of the CVOR cabinet.

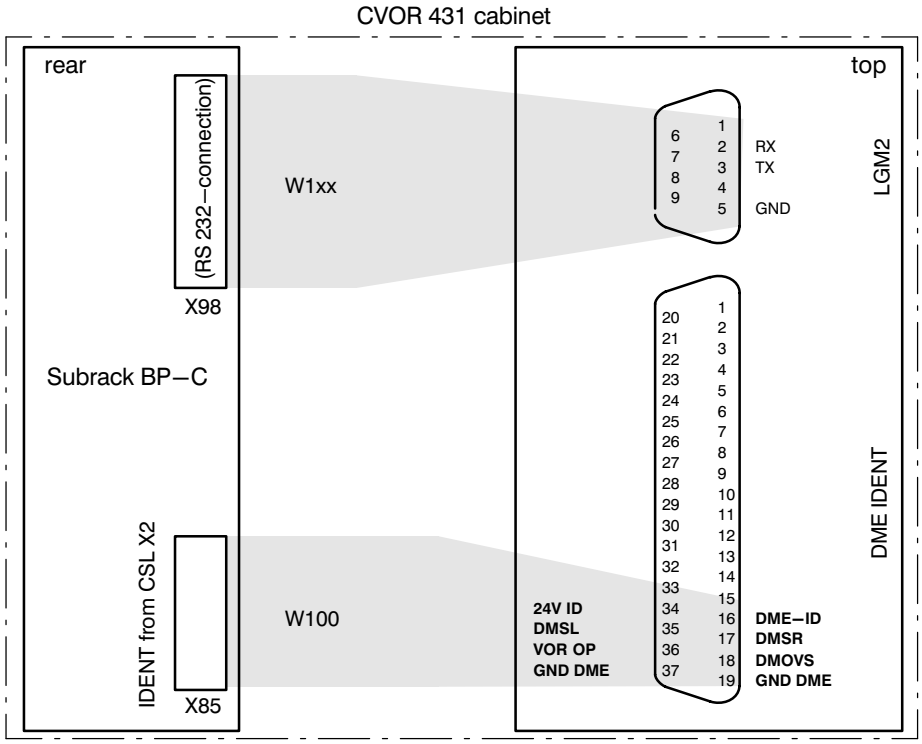


Fig. 2−29 Interface Assignment of LGM2 and DME−Ident in CVOR 431

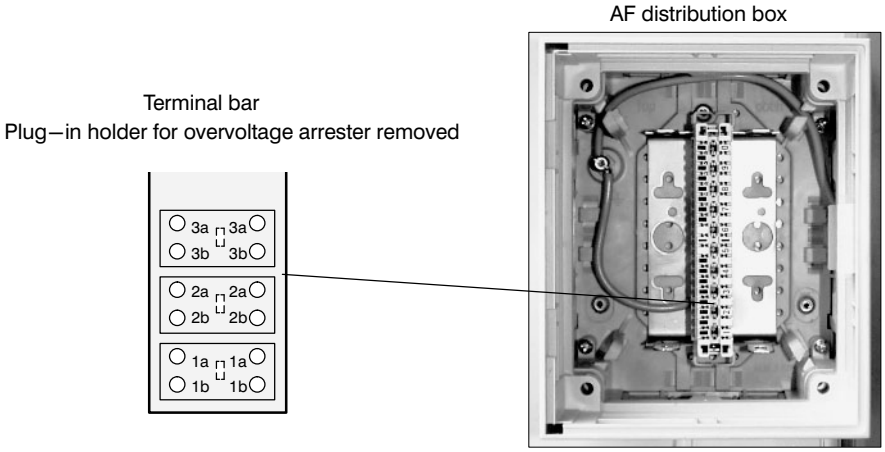


Fig. 2−30 AF−distribution box, assignment of terminals (example)

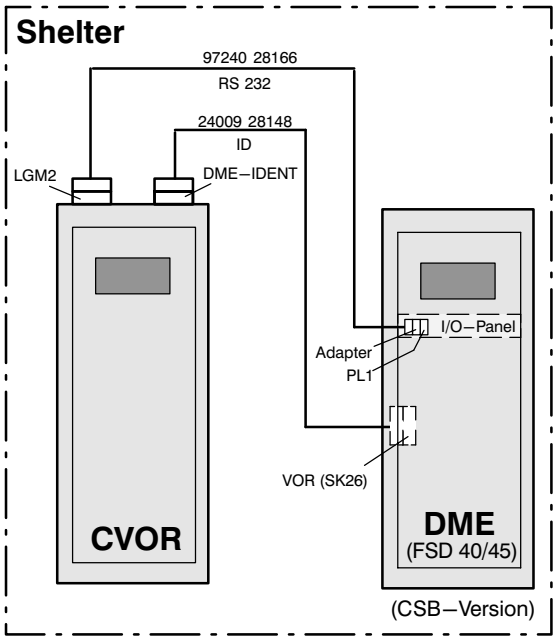


Fig. 2–31 CSB–Version, I/O panel at cabinet rear side, connection CVOR to DME

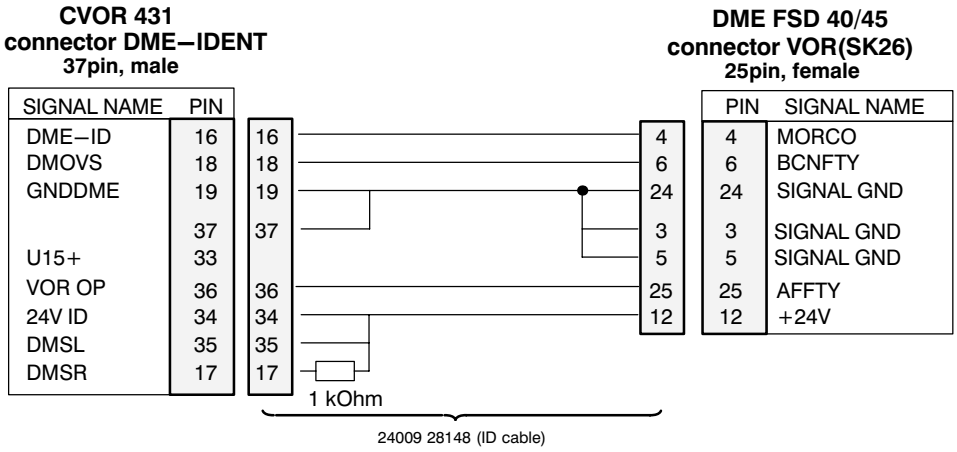


Fig. 2–32 CSB–Version, I/O panel at cabinet rear side, ident connection CVOR to DME

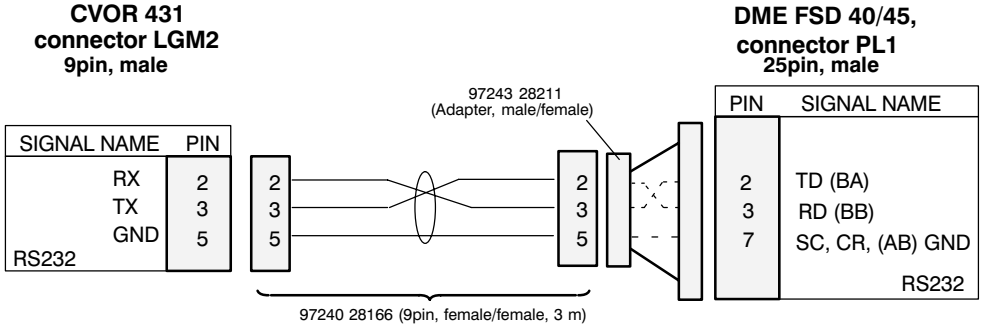


Fig. 2–33 CSB–Version, I/O panel at cabinet rear side, RS 232 connection CVOR/DME

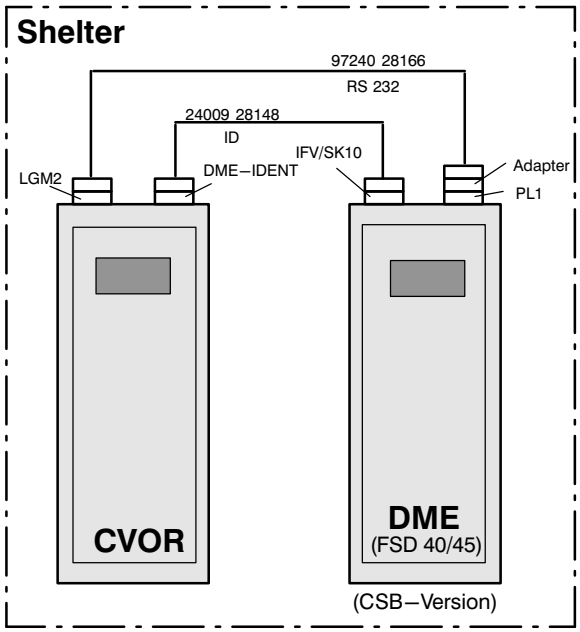


Fig. 2−34 CSB−Version, I/O panel on cabinet top, connection CVOR to DME

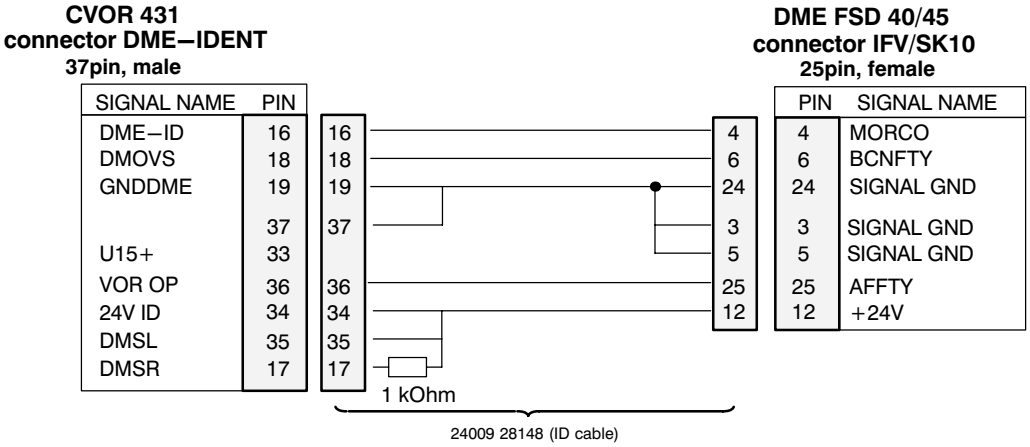


Fig. 2−35 CSB−Version, I/O panel on cabinet top, ident connection VOR/DME

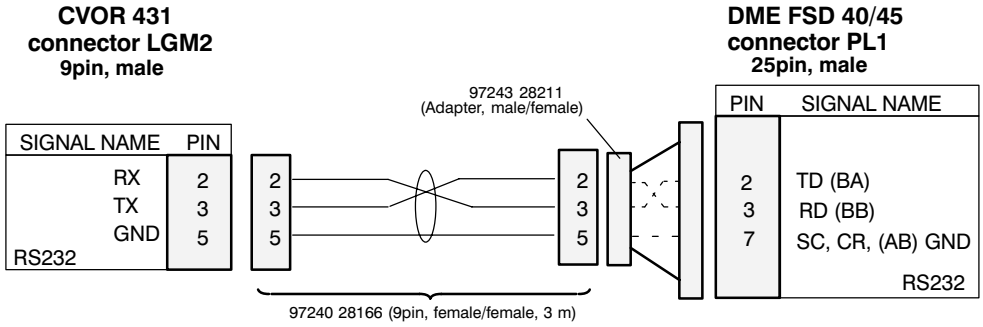


Fig. 2−36 CSB−Version, I/O panel on cabinet top, RS 232 connection CVOR/DME

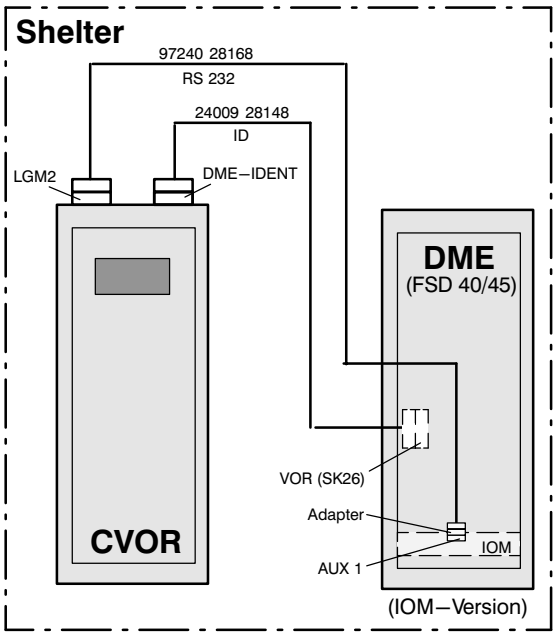


Fig. 2−37 IOM−Version, connector panel at cabinet rear side, connection CVOR to DME

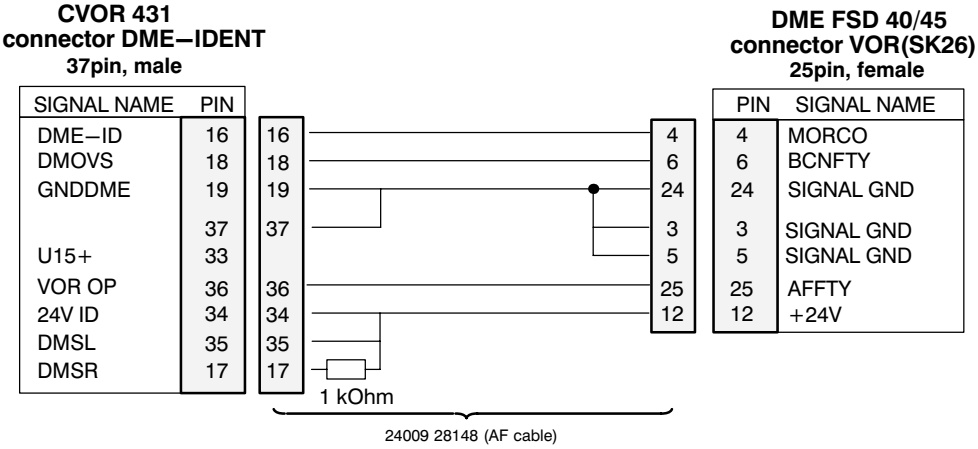


Fig. 2−38 IOM−Version, connector panel at cabinet rear side, ident connection CVOR/DME

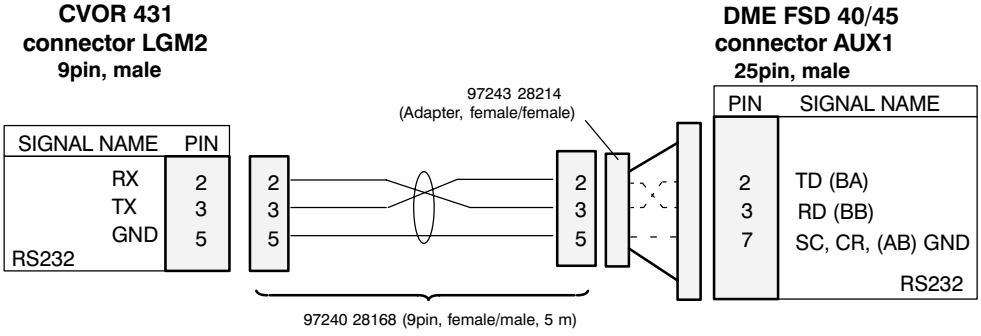


Fig. 2−39 IOM−Version, connector panel at cabinet rear side, RS 232 connection CVOR/DME

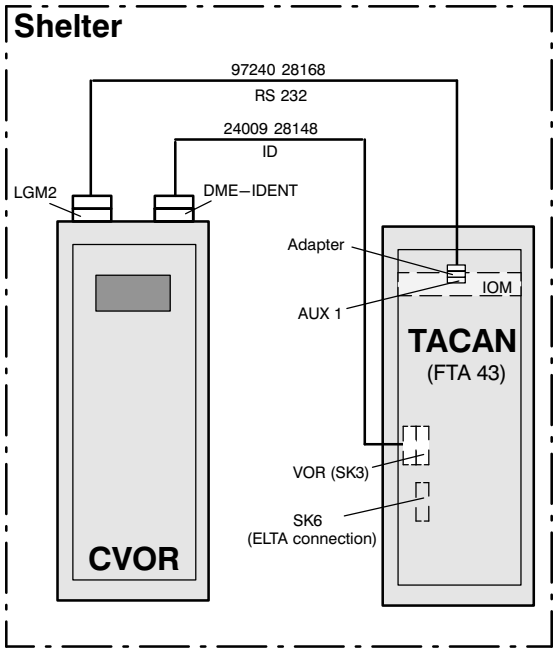


Fig. 2−40 Cable connection CVOR to TACAN

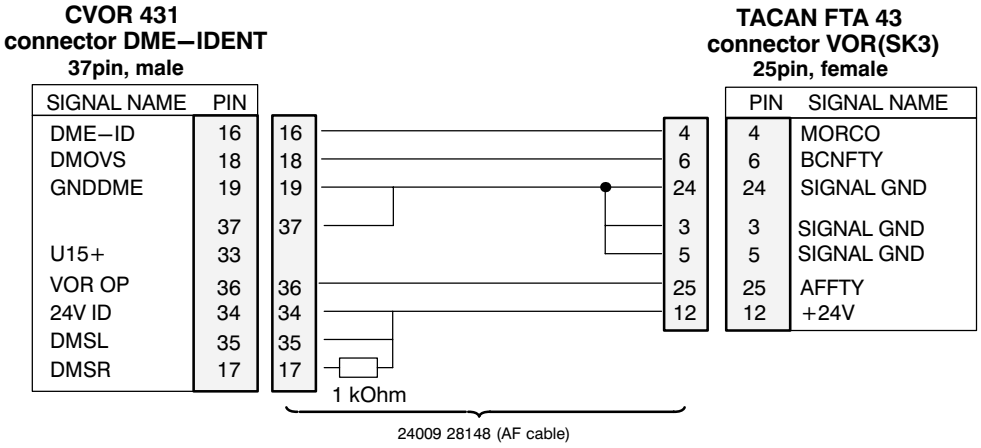


Fig. 2−41 Ident connection CVOR/TACAN

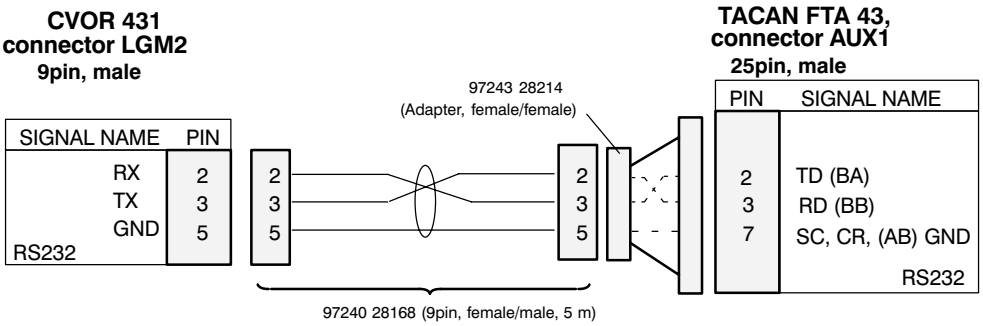
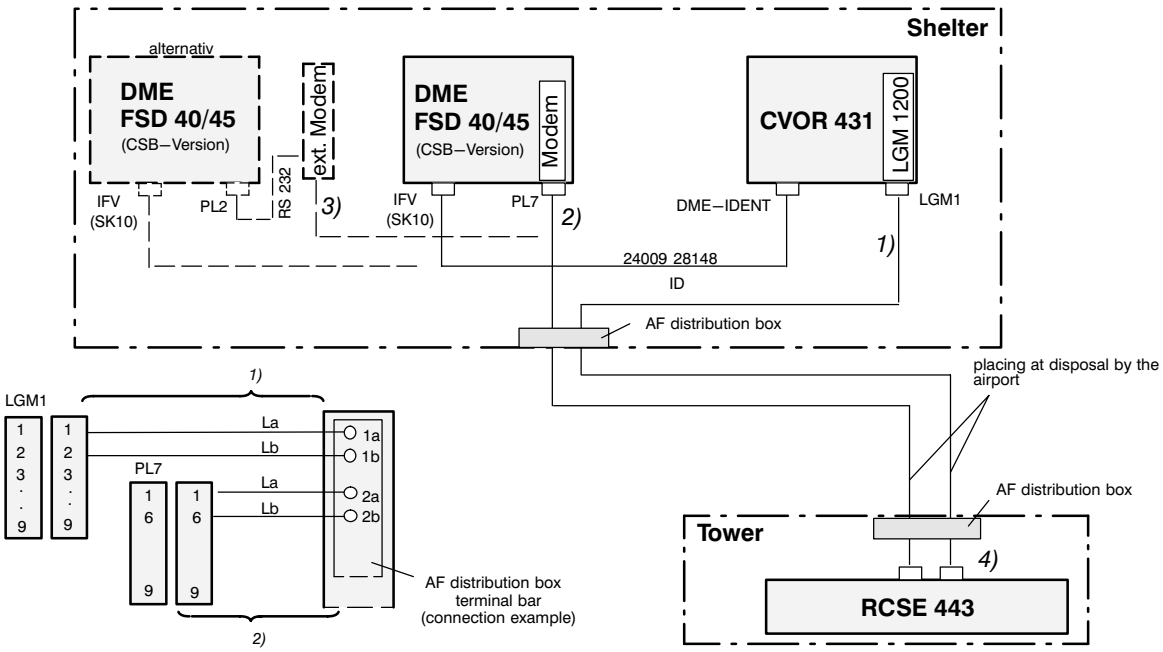
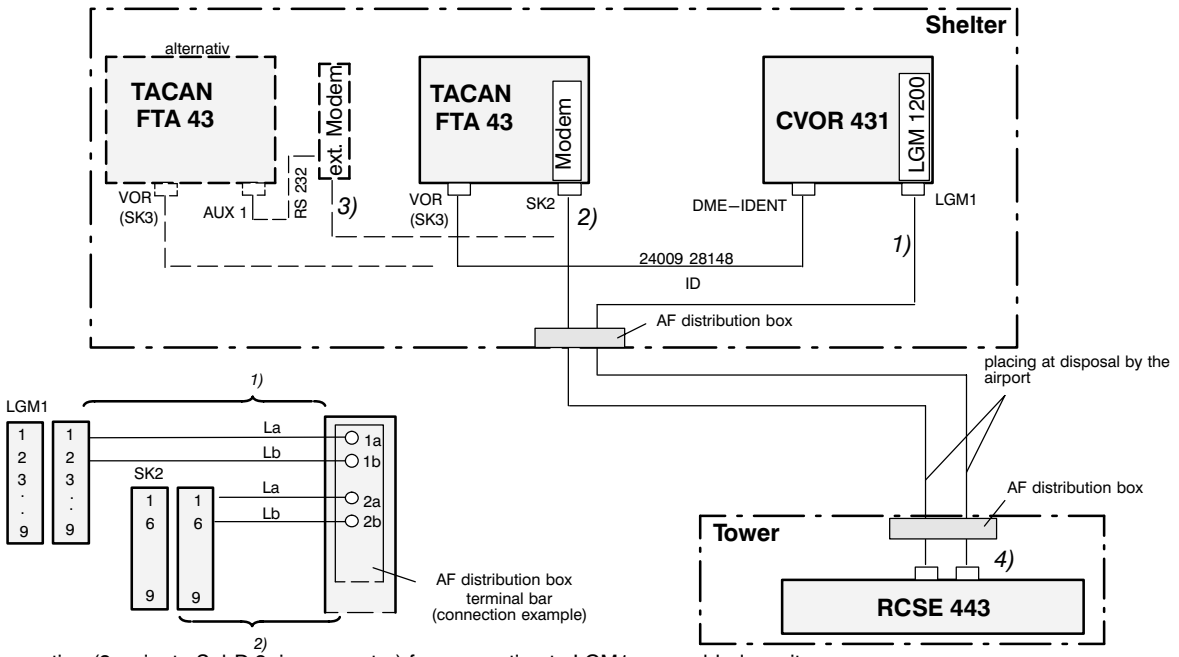


Fig. 2−42 RS 232−connection CVOR/TACAN



Note:
1) Line connection (2–wire to SubD 9pin connector) for connection to LGM1, assembled on site
2) Line connection (2–wire to SubD 9pin connector) for connection to PL7, assembled on site
3) Connection of 2–wire line according to modem documentation, assembled on site
4) Connection refer to Technical Manual of RCSE 443

Fig. 2–43 Cable connections to CVOR and DME 40/45 (DME with individual internal or external modem for RC connection)



Note:
1) Line connection (2–wire to SubD 9pin connector) for connection to LGM1, assembled on site
2) Line connection (2–wire to SubD 9pin connector) for connection to SK2, assembled on site
3) Connection of 2–wire line according to modem documentation, assembled on site
4) Connection refer to Technical Manual of RCSE 443

Fig. 2–44 Cable connections to CVOR and TACAN (TACAN with individual internal or external modem for RC connection)

2.6.4 Connection of DME 415/435 to CVOR 431

2.6.4.1 Ident and RS232 connection

See Fig. 2−45 to 2−47

- Lay the ID−cable (Ref. No. 24009 28149) in the shelter cable duct. Connect it to the connector SK4/AF1 on top of the DME cabinet and to connector DME−IDENT on top of the CVOR/DVOR cabinet (Fig. 2−45 and 2−46).
- To establish the RS 232 connection plug adapter Ref.No. 97243 28211 (Fig. 2−45 and 2−47) to connector PL1/Port 3 on top of the DME cabinet.
- Place the RS 232−cable (Ref.No. 97240 28166) in the shelter cable duct. Connect it to the adapter (on top of DME cabinet) and to connector LGM2/DME on top of the CVOR/DVOR cabinet.

NOTE: Ground (DME IDENT, Pin 19) is not connected to DME. Shielding of ID cable is connected one−sided to DME connector ground.

The adapter 97243 28211 can be ommitted if a RS 232 cable is used with 1:1 through connection (not crossed).

2.6.4.2 Configuration of CVOR 431 and DME 415/435

VOR 431, setting switches or jumper of CSL (Ref. No. 83135 23100, see Section 6.2.5):

- Set switch S5 to position ASSOC. (NAV 400 is Master) for the collocation with DME 415/435.
- Set X25 to position *2−3*, DME−OP via signalling line.
- Set X11/X12 to position *2−3* (optocoupler only) as default for CVOR/DVOR.
- All other are set according *default* or *normal position* as shown in Section 6.2.5.

DME 415/435: Refer to Technical Manual, Ref.No. 955 900 031C, Volume 1, Sept. 2005 or previous edition 8BR 02012 1000 DEGFA, Volume 1, Dec. 1998:

- Configuration of AFI: Regard that path M5, M2, M3 is set to ”Internal Source” (delivery position)
- Enter in user SW program:

AF Status	*Low*
ID Code/trigger from AF	*Low*
DME Status	*Low*
Morse Code	*Slave Trigger* / *Slave Code*
Ident Recovery	*On Sensing*

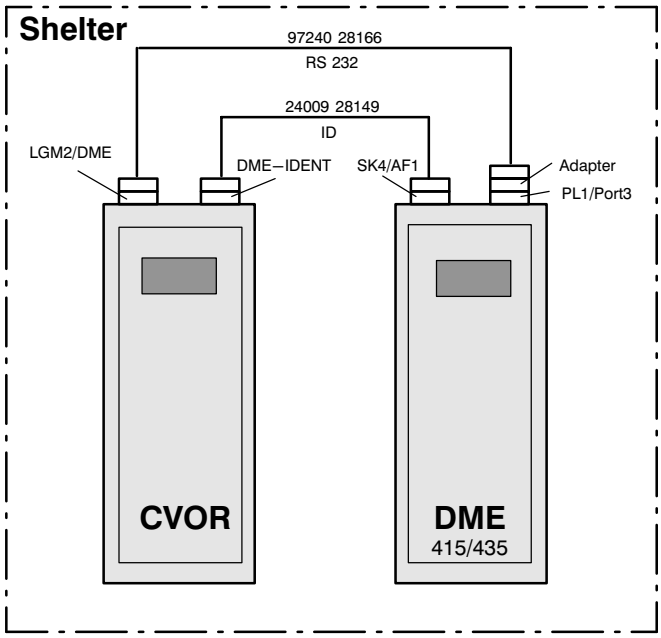
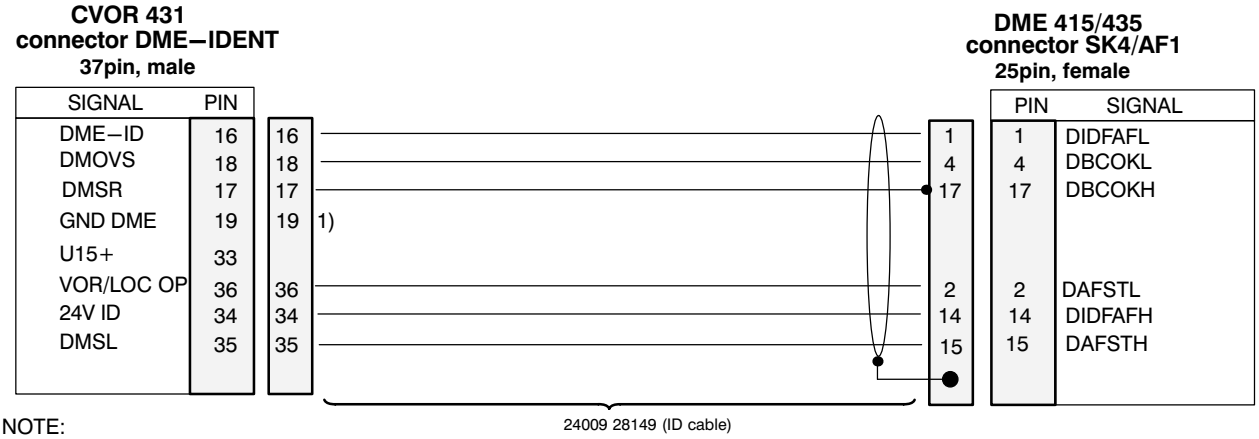
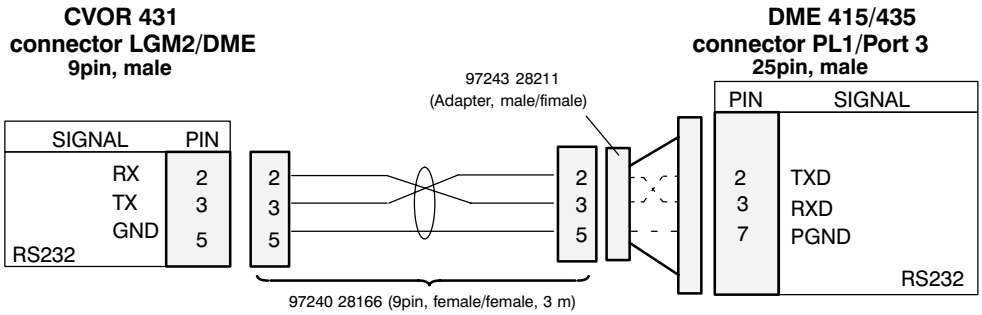


Fig. 2−45 Collocation CVOR/DVOR with DME 415/435



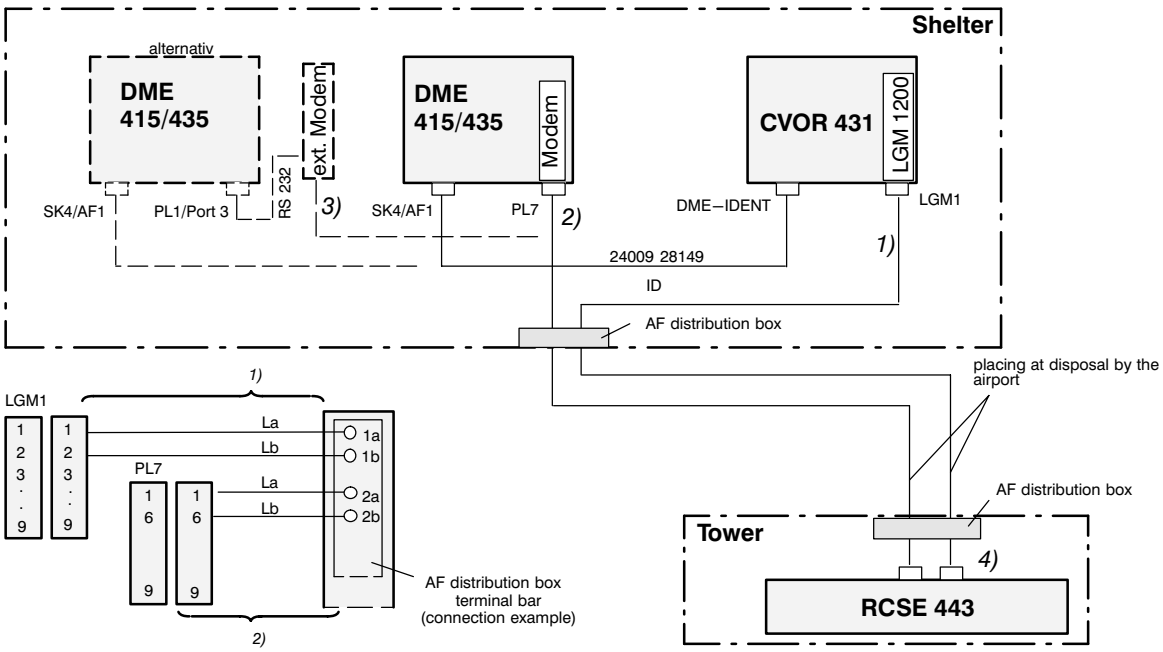
NOTE:
1) Ground not connected between CVOR (pin 19) and DME

Fig. 2−46 Ident connection CVOR/DVOR to DME 415/435



NOTE:
The adapter can be ommitted, if other RS 232 cable is used, which has no crossed lines between pin 2 and 3

Fig. 2−47 RS232 connection CVOR/DVOR to DME 415/435



Note:
1) Line connection (2–wire to SubD 9pin connector) for connection to LGM1, assembled on site
2) Line connection (2–wire to SubD 9pin connector) for connection to PL7, assembled on site
3) Connection of 2–wire line according to modem documentation, assembled on site
4) Connection refer to Technical Manual of RCSE 443

Fig. 2–48 Cable connections to CVOR/DVOR and DME 415/435 (DME with individual internal or external modem for RC connection)

2.7 INSTALLATION OF THE DME ANTENNA

See Fig. 2−15, 2−49.

The DME antenna is mounted on top of the CVOR antenna radome onto a special adapter (Fig. 2−15). Twin obstruction lights are part of the antenna. Refer also to the correspondent Technical Manuals for DME FSD 40/45 or DME 415/435.

WARNING

Before connecting the obstruction light supply cable check that mains is switched off and mains lead is dead.

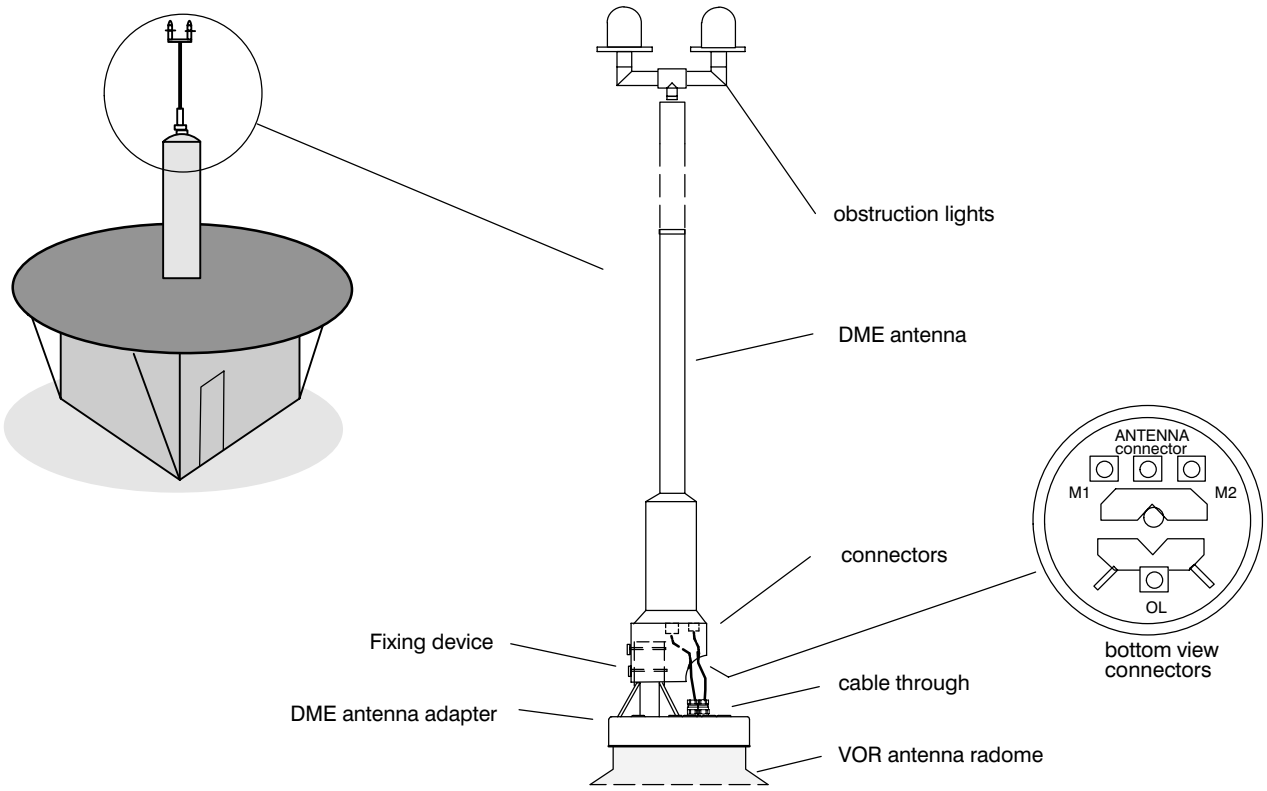


Fig. 2−49 Arrangement and installation of the DME antenna (example AAN 96/86), principle view

CHAPTER 3
OPERATION

3.1 GENERAL

Standard operation is normally carried out via a remote control interface with the user program ADRACS installed on a PC. For local operation only a few functions are operable with the local control panel (LCP). It consists of a Local Control CPU board (LC CPU) and the Local Control Interface (LCI) for main status indication, equipment status and measurement data and manual controls (switch commands) for basic control functions. The alignment procedure and the maintenance are performed with a locally connected PC.

3.2 LOCAL CONTROL INTERFACE (LCI)

See Fig. 3−1.

The Local Control Interface (LCI) provides different indication and control components:

- three indication lamps for the main status of the system (ALARM, WARNING, NORMAL)
- a menu driven liquid crystal display screen (16 lines x 40 characters) for indication of station name and type, status of monitor(s) and transmitter(s) and measurement data
- four control buttons to perform simple activities like change−over or disconnect the transmitter(s)
- a key−lock switch to select different operational modes of the station, i.e. disable/enable local and remote control of the station (REMOTE, LOCAL, MAINTENANCE). Using the key, it is not removable in position LOCAL.

A serial connector RS 232 (Local PC) is located on the top of the transmitter rack to interconnect a local PC/laptop. A test of the three indication lamps of the LCI is provided by pressing the two middle control buttons simultaneously.

NOTE: A buzzer sounds for a short time whenever one of the control buttons is pressed.

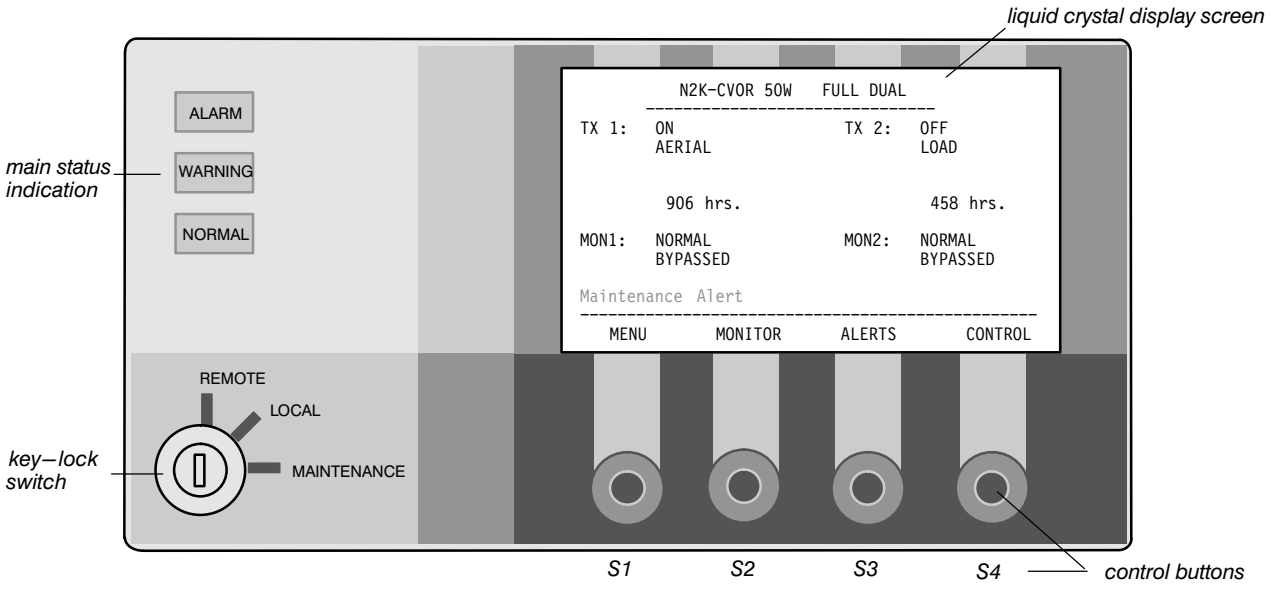


Fig. 3−1 Local Control Interface (LCI), example

3.2.1 Indicators and Controls on LCP Front Panel

Indicator	Color	Function if indicator lights	Remarks
ALARM	red	Monitor 1 and Monitor 2 are in ALARM state (i.e. relevant signals are out of tolerance). *or* Monitor 1 and 2 are in Bypass/Maintenance Mode	
WARNING	yellow	The station is supplied by battery or has a BITE warning.	
NORMAL	green	All transmitter and monitor equipment is switched on, initialized and serviceable for the intended category of operations (no WARNING and no ALARM).	

NOTE: If the status of the indicators (red, yellow, green) is changing the buzzer on the LCP is beeping for 5 s if the audible alarm feature is enabled in the 'Control' window of the LCP menu. This feature is only available and visible in key switch position 'LOCAL' or 'MAINTENANCE'. It can be disabled in the 'Control' window.

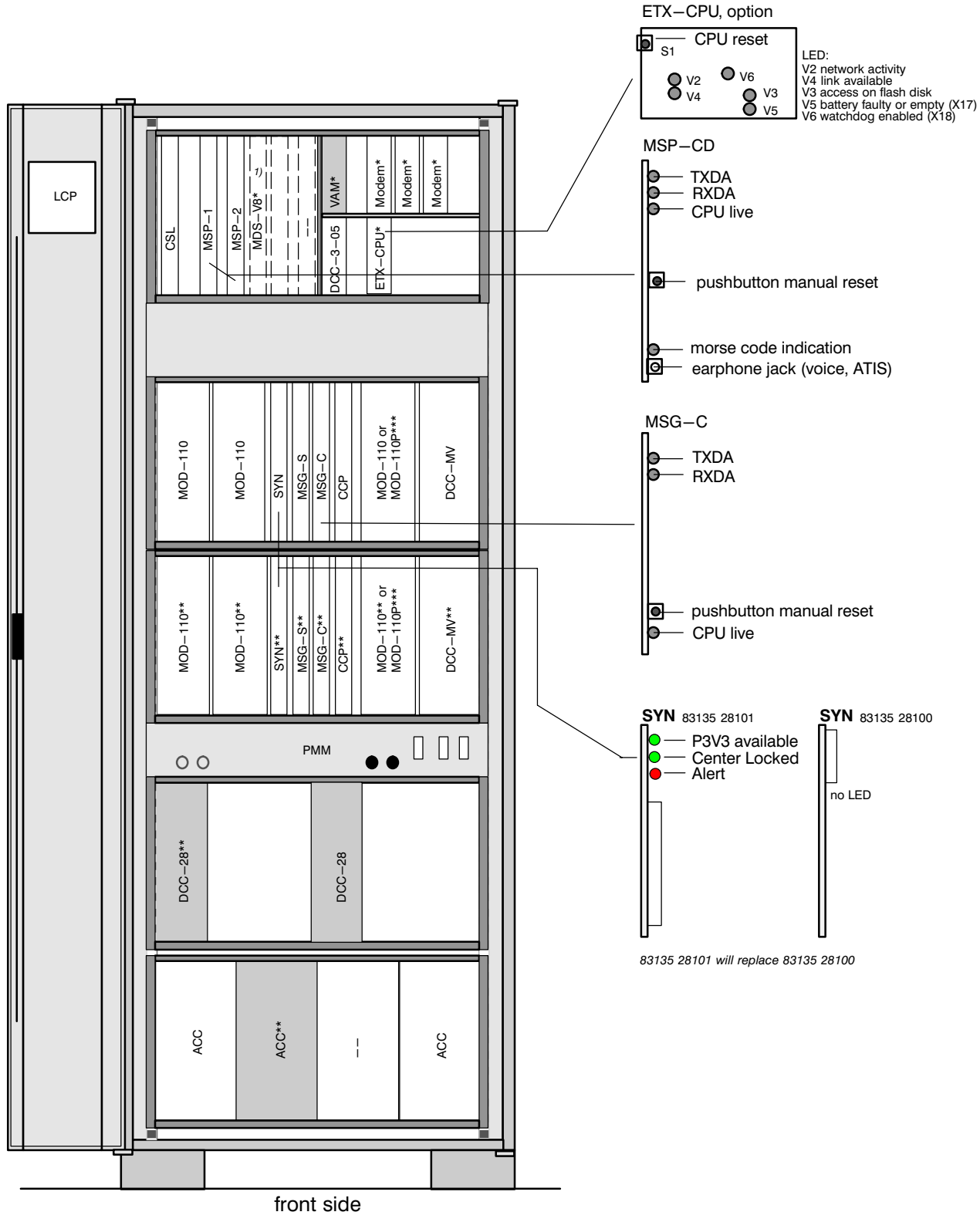
Control	Position	Function	Remarks
Key−Lock Switch	REMOTE	System enabled for remote control	local disabled, i.e. no local control on LCP menu Control.
	LOCAL	System enabled for local operation	remote disabled
	MAINTENANCE	System set to maintenance mode	Mon. Bypass set; Alarm indication lights.
Push button	S1,S2,S3,S4	Function keys meaning defined per SW menu	
	S2+S3 simult.	Lamp test and audible device test if simultaneously pressed	
	S1+S4 simult.	Call up of LCP control menu, if simultaneously pressed during LCP reset or system restart	Service activity

3.3 CONTROLS AND INDICATIONS ON THE SUBASSEMBLIES

The controls and indications of individual subassemblies are shown in Fig. 3−2 and 3−3.

Board	Indicator	Color	Control	Function of control or indicator (lit or flashing)
MSP−CD	LED LED LED LED	green green green green	 Reset key Jack 3.5 mm	TXDA, indicates communication activity RXDA, indicates communication activity CPU is alive morse code indication Performs a reset of the MSP processor used for acoustic test of voice or ATIS signal
SYN a): 83135 28101 / b): 83135 28100	a): LED / b): none a): LED / b): none a): LED / b): none	green green red		a): indicates P3V3 ok / b): not available a): indicates Center locked / b): not available a): Alert, indicates SYN failure / b): not availab.
MSG−C	LED LED LED	green green green	 Reset key	TXDA, indicates communication activity RXDA, indicates communication activity CPU is alive Performs a reset of the MSG processor
CSL		yellow yellow red red	 Pushbutton Pushbutton Pushbutton Pushbutton BCD−Switch Assoc./Indep.	TX1 ON TX2 ON MON1, Monitor fault MON2, Monitor fault manual TX1 on manual TX1 off manual TX2 on manual TX2 off 0 to F; test signal select on TSG, see 3.3.1 Used with DME collocation
LCP	LED HD LED	green red	 Reset key R1	Indicates LC−CPU is alive HD−r/w operation (RAM), flashes if access (n.a. with LCP 83135 21004) Restarts the LCP processor and software Controls brightness of the LCD screen
DCC−28*	LED, Input state	green		Normaly on; DC input voltage available
DCC−MV	LED, Input state	green		Normaly on; DC input voltage available
ACC−54	LED, Input state	green	 Mains Switch R32	Normaly on; DC input voltage available Switches ACC−54 to mains (ON/OFF) Allows fine adjust of battery charging voltage
PMM			NAV TX1 TX2 Fuses: F1 F2	main switch for power on main switch for power on of transmitter 1 main switch for power on of transmitter 2 T1.0H, 250 V, protects 48 V to CSL T6.3H, protects DC supply to MON, LRCI, CSL

* 100 W version only
NOTE: Indicators and controls of optional subassemblies, i.e. modem and ETX−CPU are shown only in Fig. 3−2, 3−3.



* optional ** not used in single version *** 50 W version only 1) 8PGC option Version 100 W

Fig. 3–2 Indications and controls on the subassemblies inside the rack (1)

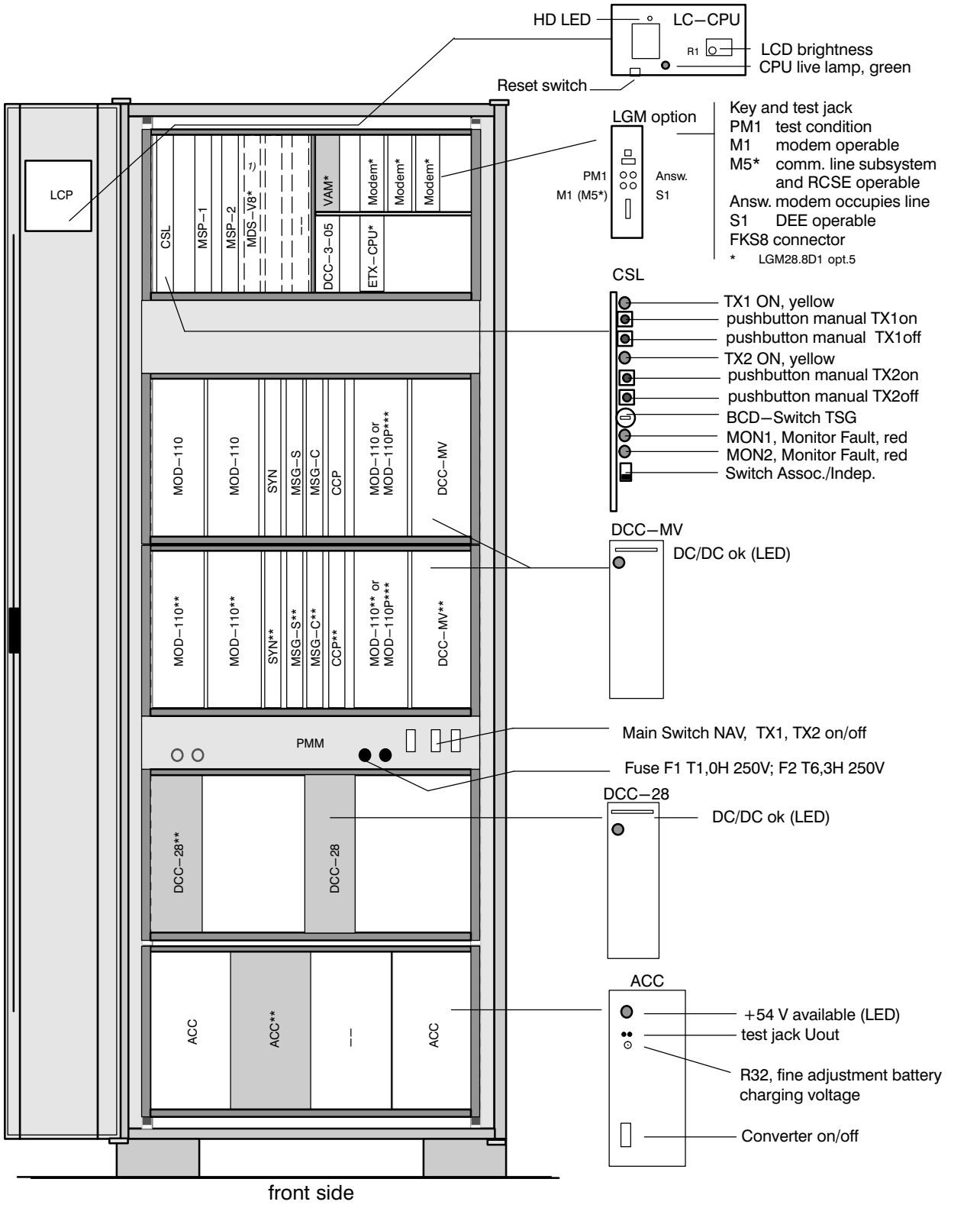


Fig. 3–3 Indications and controls on the subassemblies inside the rack (2)

3.3.1 Subassembly CSL, Setting BCD−Switch for TSG−operation

The following signals are assigned to the BCD switch positions 0 to F in the CVOR/DVOR range:

Position	AM	AM	FM	FM	AZ
0	30 Hz AM, 30 %	9960 Hz AM, 30 %	30 Hz FM	Mod.−Index=16	Azimuth= 0 degrees
1	30 Hz AM, 30 %	9960 Hz AM, 30 %	30 Hz FM	Mod.−Index=16	Azimuth= 45 degrees
2	30 Hz AM, 30 %	9960 Hz AM, 30 %	30 Hz FM	Mod.−Index=16	Azimuth= 90 degrees
3	30 Hz AM, 30 %	9960 Hz AM, 30 %	30 Hz FM	Mod.−Index=16	Azimuth=135 degrees
4	30 Hz AM, 30 %	9960 Hz AM, 30 %	30 Hz FM	Mod.−Index=16	Azimuth=180 degrees
5	30 Hz AM, 30 %	9960 Hz AM, 30 %	30 Hz FM	Mod.−Index=16	Azimuth=225 degrees
6	30 Hz AM, 30 %	9960 Hz AM, 30 %	30 Hz FM	Mod.−Index=16	Azimuth=270 degrees
7	30 Hz AM, 30 %	9960 Hz AM, 30 %	30 Hz FM	Mod.−Index=16	Azimuth=315 degrees
8	30 Hz AM, 0 %	9960 Hz AM, 30 %	30 Hz FM	Mod.−Index=16	Azimuth= − degrees
9	30 Hz AM, 30 %	9960 Hz AM, 0 %	30 Hz FM	Mod.−Index=−	Azimuth= 0 degrees
A	30 Hz AM, 30 %	9960 Hz AM, 30 %	30 Hz FM	Mod.−Index=15	Azimuth= 0 degrees
B	30 Hz AM, 30 %	9960 Hz AM, 30 %	30 Hz FM	Mod.−Index=17	Azimuth= 0 degrees
C	30 Hz AM, 30 %	9960 Hz AM, 30 %	30 Hz FM	Mod.−Index=25	Azimuth= 0 degrees
D,E,F	Spare				

3.4 NORMAL OPERATION

3.4.1 Switching On

CAUTION

Never switch on the installation unless the antenna or an adequate dummy load is correctly connected! Make sure that the switches on the AC/DC converter are in ON position.

After the alignment procedure is completed use the DC main switch NAV and then TX1 and/or TX2 on PMM to switch on the transmitter. The LCP initializes, the status window is shown in the screen, the main status indication is set. NORMAL should light for operation.

3.4.2 Set to Remote Mode (on LCP)

The remote mode is used in the normal operational configuration. To change over from local control to remote control use the key—lock switch on the LCP. Set key—lock switch (Fig. 3—1) to ”REMOTE”. Remote mode means that the system is under control of the remote facility, e.g. RCSE 443 or other.

— The monitor system is enabled. It can change over or shutdown the transmitter on alarm condition.

— Control from the remote site (e.g. RCSE, MCS) is enabled. Data from the installation received by the Remote Unit (e.g. RCSE) are indicated on the front panel (INC) and/or displayed on a PC with the PC User Program running (ADRACS or MCS) connected to the Remote Unit (eg. RCSE).

— In remote mode local controls are disabled on the LCP and in the PC User Program running on the locally connected PC. Display of data is enabled both on LCP screen and the connected PC.

3.4.3 Change over from Remote to Local (on LCP)

To change over from Remote Control to Local Control use the key—lock switch on the LCP. Set key—lock switch (Fig. 3—1) to ”LOCAL”. Local mode is a maintenance configuration controlled with the LCD screen:

— The monitor system is enabled but can be locally disabled in the control menu.

— Control from the remote site (e.g. RCSE or MCS) is disabled. Remote Unit (e.g. RCSE) status data are disabled except for Maintenance data. The PC User Program (ADRACS or MCS) connection with the Remote Unit facility (e.g. RCSE) is disabled.

— Local control on the LCP and via locally connected PC and the PC User Program (ADRACS or MCS) is enabled. Also the local PC User Program display (ADRACS or MCS) is enabled.

3.4.4 Change Over to Maintenance Operation

Maintenance operation is only necessary when operational values have to be adjusted on the transmitter or when a maintenance check has to be performed. It is carried out using the maintenance control unit (PC). Set key—lock switch (Fig. 3—1) to ”MAINTENANCE”. Alarm indication is set caused by monitor bypass setting in maintenance mode.

— The monitor system is enabled but can be locally disabled in the control menu.

— Control from the remote site (e.g. RCSE or MCS) is disabled. Remote Unit (e.g. RCSE) status data are disabled except for Maintenance data. The PC User Program (ADRACS or MCS) connection with the Remote Unit facility (e.g. RCSE) is disabled.

— Local control on the LCP and via locally connected PC and the PC User Program (ADRACS or MCS) is enabled. Also the local PC User Program display (ADRACS or MCS) is enabled.

3.4.5 Change over to Monitor Bypass

Bypass operation is only necessary when operational values have to be adjusted on the monitor. It is carried out using the maintenance control unit (PC).

Bypass operation is only necessary when operational values have to be adjusted on the monitor. It is carried out using the maintenance control unit (PC) remotely or the LCP control menu locally: Set key−lock switch (Fig. 3−1) to ”LOCAL”.

3.4.6 Monitoring ATIS or Voice

An earphone (600 Ohm) can be connected to a 3.5 mm jack on the MSP to listen to ATIS information.
(ATIS = Automatic Terminal Information System)

3.4.7 Functional Check of Indications

When the two middle buttons of the control buttons of the LCP (S2 and S3) are pressed simultaneously all indications light up simultaneously and the buzzer sounds for optical and acoustical test purposes. Since the monitor carries out normal checks of function and accuracy, the operation of the installation is faultless when the liquid crystal display screen of the LCP indicates NORMAL. If however the display screen shows WARNING or ALARM, a check of the installation via PC is possible if operation mode “LOCAL” has been set by the key−lock switch on the LCP.

3.4.8 Switching Off

Use the DC main switch NAV on PMM to switch off the installation. Switches TX1 and TX2 are used to switch off transmitter 1 and/or 2. The indications on the LCP extinguish.

NOTE: The LRCI (LCP and modem) is neither switched off via the remote nor the local control interface, so that it can receive switch−on commands as long as any of the switches TX1 and TX2 are on. Main switch NAV must not be off in this case.

3.5 LCP AND LCD SCREEN FOR SYSTEM DISPLAY AND CONTROL

3.5.1 General Structure

The liquid crystal display (LCD) screen is used to indicate the system status with details to the monitor status, the transmitter status and the status of maintenance data (e.g. power supply). Additionally the display screen provides simple control activities to change the system state. These control activities are only accessible in ”Local” mode.

After switching on the equipment the application is started and the Status window appears on the display screen (see Fig. 3−6), which contains information about the actual system status and operational mode. Starting from this Status window the user is able to change to the other windows via the control buttons S1 to S4 below the LCD screen. The meaning of the buttons changes for the selected window. The general window structure is shown in Fig. 3−4. The hierarchy of all LCP windows is given in Fig. 3−5.

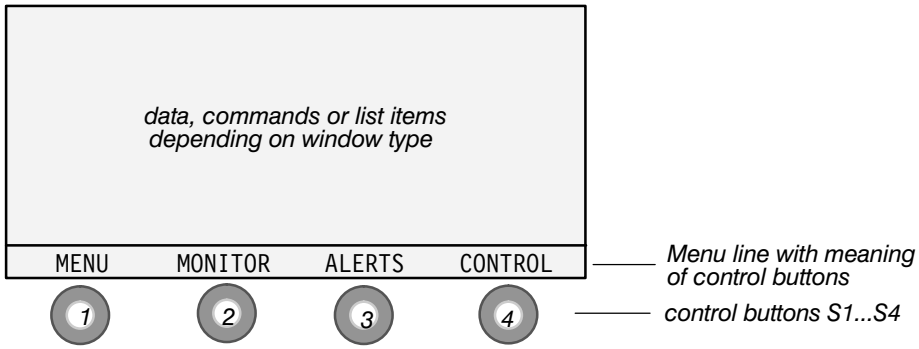


Fig. 3−4 Structure of an LCP window (example)

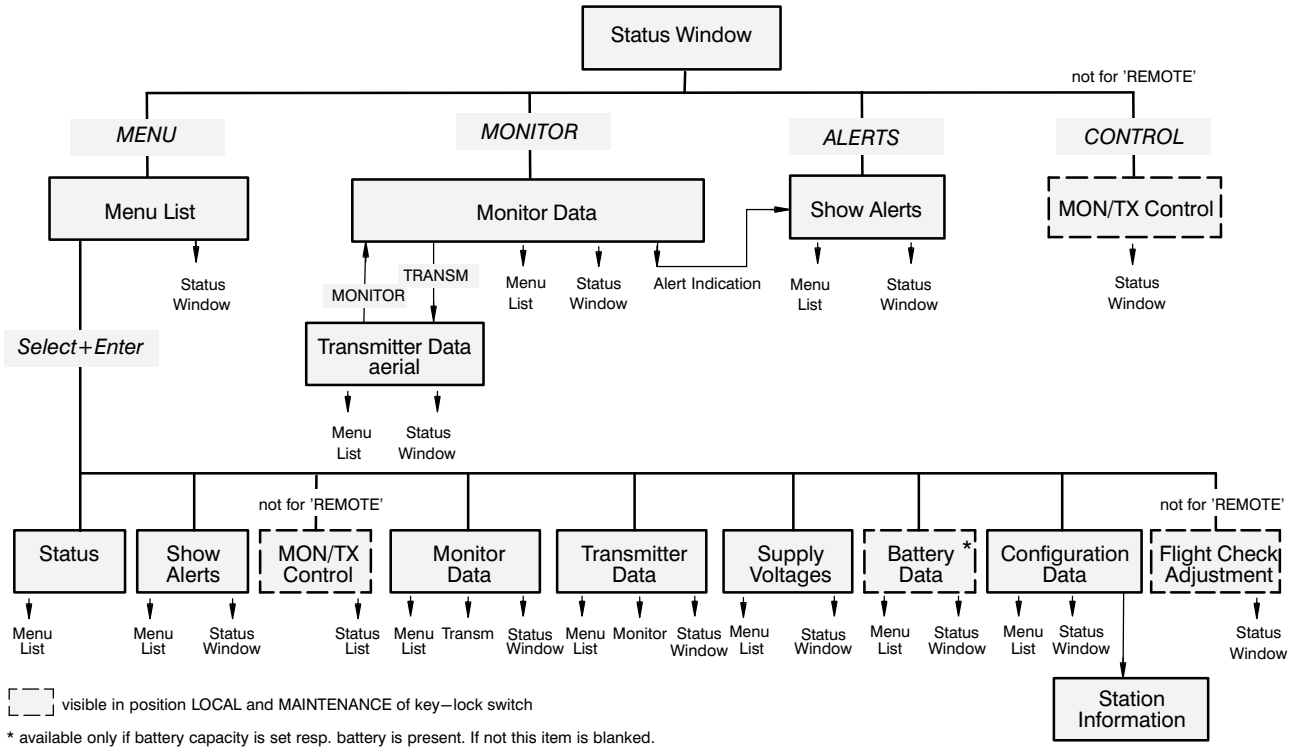


Fig. 3−5 Hierarchy of all LCP windows

3.5.2 Principle Operation of the Menu

Figures 3−6 to 3−20 show the examples of the selectable windows. The examples show windows of a CVOR 431 50 W standard system.

In the Status window the following button definitions are used:

S1	MENU	used to go to the Menu List window (see Fig. 3−12)
S2	MONITOR	used to go to the system data quick access windows (see Figs. 3−7, 3−8)
S3	ALERTS	used to get information about pre−alarms or alarms (see Fig. 3−9)
S4	CONTROL	used to go to the MON/TX Control window (see Fig. 3−11)

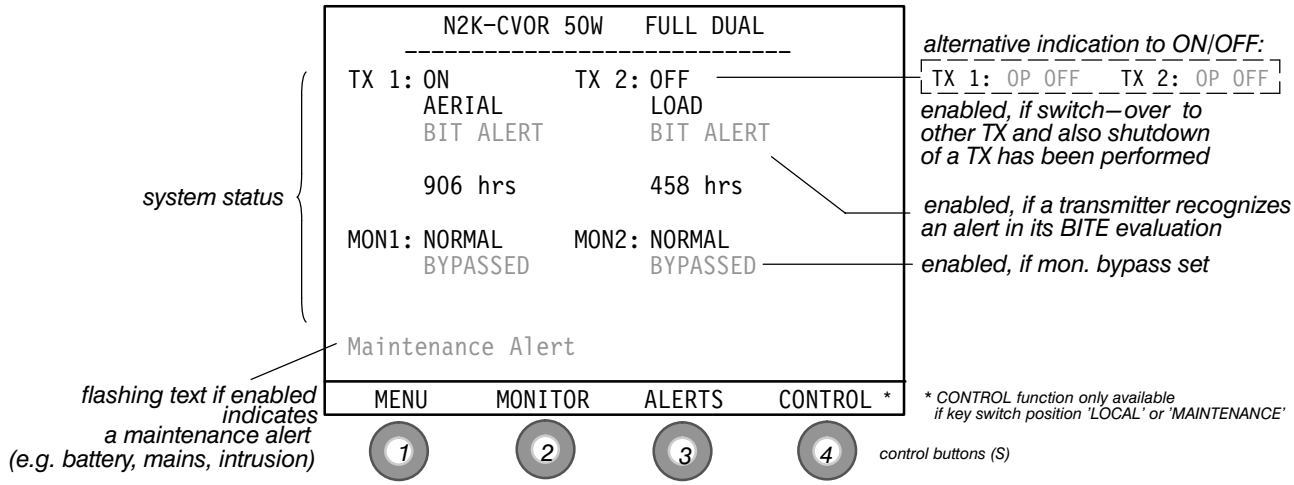
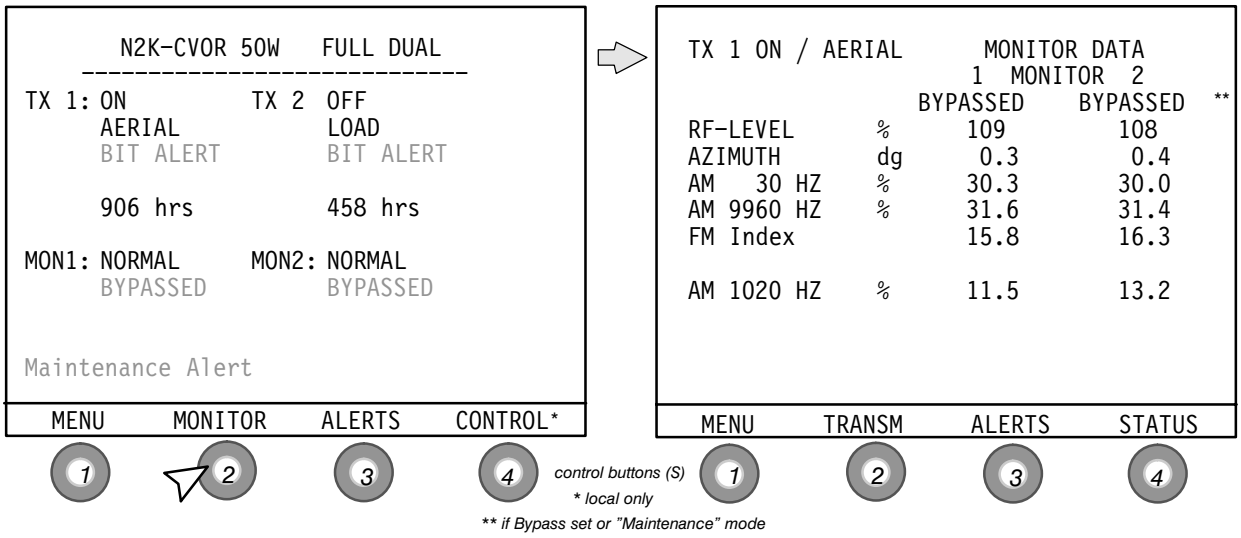


Fig. 3−6 Status window after start of application (example, main state NORMAL)

The following quick access windows provide system data on 4 different windows:

− In the Monitor Data window the following button definitions are used:

S1	MENU	used to go to Menu List window (see Fig. 3−12)
S2	TRANSM	used to change to Transmitter data window (see Fig. 3−8)
S3	ALERTS	used to get information about pre−alarms or alarms (see Fig. 3−9)
S4	STATUS	used to return to the Status window (see Fig. 3−6)



Remark: If a measurement value exceeds a limit it is indicated by PA (Pre−alarm) or AL (Alarm).

Fig. 3−7 MONITOR select and Monitor Data window (example)

– In the Transmitter Data window the following button definitions are used:

S1	MENU	used to go to Menu List window (see Fig. 3–12)
S2	MONITOR	used to change to Monitor Data window (see Fig. 3–7)
S3	ALERTS	used to get information about pre–alarms or alarms (see Fig. 3–9)
S4	STATUS	used to return to the Status window

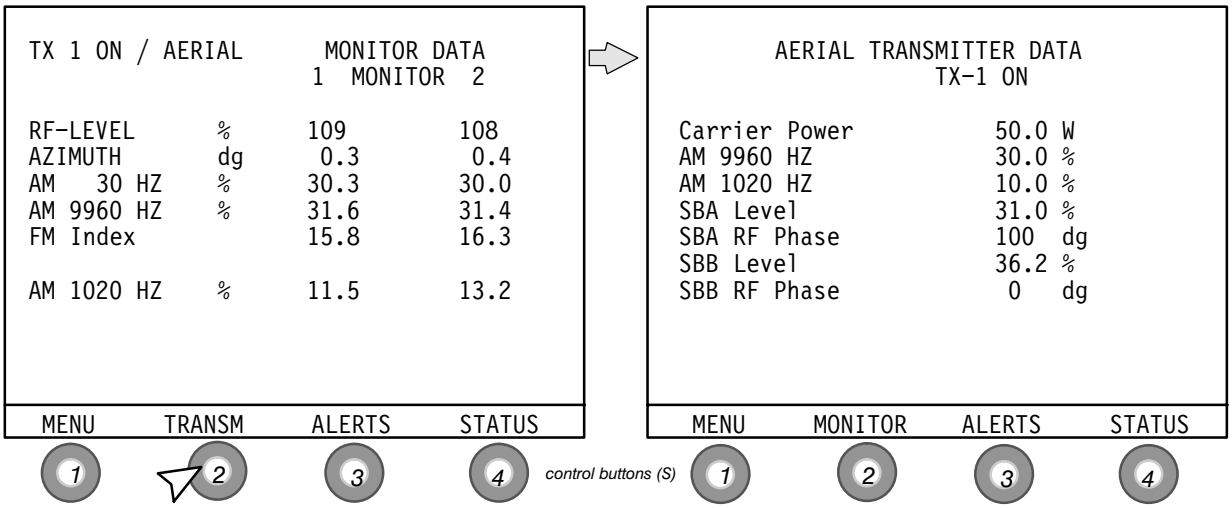


Fig. 3–8 TRANSM select and Transmitter Data window (example)

– In the Alerts window the following button definitions are used:

S1	MENU	used to go to Menu List window (see Fig. 3–12)
S2	↑	used to select item, upwards
S3	↓	used to select item, downwards
S4	STATUS	used to return to the Status window (see Fig. 3–6)

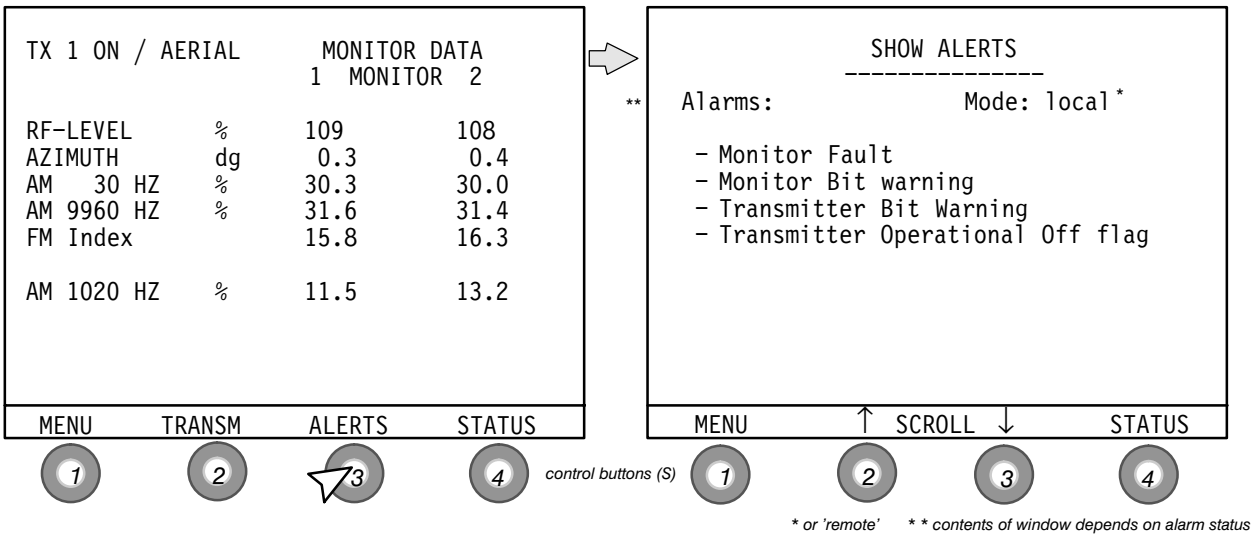


Fig. 3–9 ALERTS select and Show Alerts window (example)

Possible alert indications to the user (if existing) are shown as follows. If no alerts exist the message 'All parameters OK !' is displayed.

The Show Alerts window presents the following alarms/pre−alarms to the user (if existing):

– Monitor Bypass On
– Monitor Fault
– Monitor Bit Warning
– Monitor Pre−Alarm
– Monitor Alarm
– Monitor Non−Exec Alarm

– Aerial Transmitter Off
– Transmitter Operational Off flag
– Transmitter Bit Warning
– Transmitter Fault
– Remote Control Communication Lost

– BCPS 1 Failure
– BCPS 2 Failure
– BCPS 3 Failure
– BCPS 4 Failure
– Mains OFF
– Battery Capacity warning
– System Current warning
– Battery Disconnected
– Battery Voltage Warning
– Battery Current Warning
– GND MV failure
– CSL Ref. +2.5V failure
– CSL Ref. +15V failure
– CSL Ref. −15V failure

– User Def. BITE Alert
– Temperature 1 Alarm (user def. 11)
– Temperature 2 Alarm (user def. 12)

– MON−1 Data Communication Error
– MON−2 Data Communication Error
– TX−1 Data Communication Error
– TX−2 Data Communication Error

– Configuration Mismatch
– Monitors Disagree
– Battery Capacity Forced OFF
– LRCI Battery Warning

– Intrusion Alarm
– Smoke Alarm
– Ext. Temp Alarm

The Show Alerts window also indicates the actual operational mode (following 'Mode:'):

– "remote" Remote mode enabled
– "remote maint." Remote mode with maintenance activity enabled
– "local" Local operation enabled

To return to the Status window each selected window provides also the STATUS button on S4:

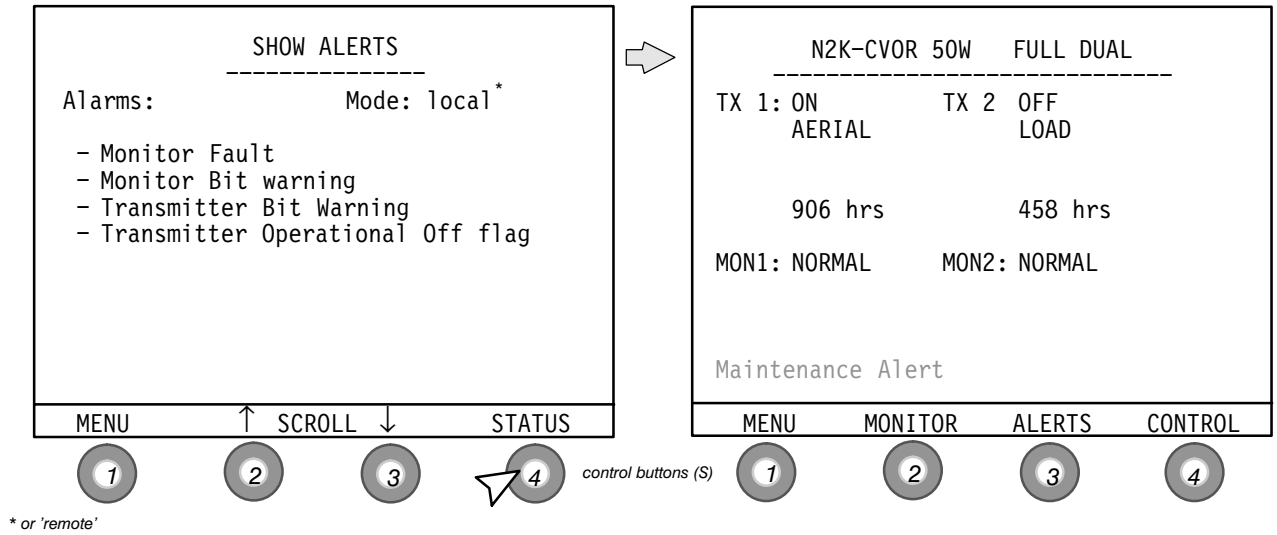


Fig. 3–10 STATUS select and return to Status window (example)

In the MON/TX Control window following button definitions are used (available and visible in key switch position 'LOCAL' or 'MAINTENANCE' only):

S1	SWITCH	used to switch selected item to on/off or 1/2; if once used the STATUS field indication in the display shows the new state.
S2	↑	used to select item, upwards
S3	↓	used to select item, downwards
S4	STATUS	used to return to the Status window (see Fig. 3–6)

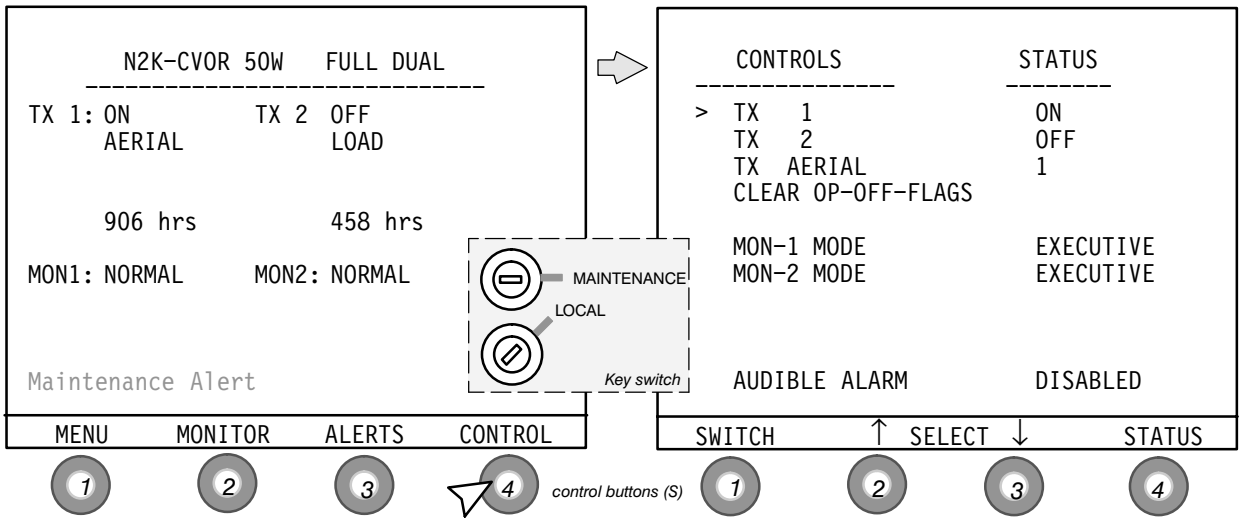


Fig. 3–11 CONTROL select and MON/TX Control window (example)

In the Menu List window the following button definitions are used:

– S1 ENTER used to enter/confirm selected item in the Menu List
– S2 ↑ used to select menu item, upwards, selected item is pointed with >
– S3 ↓ used to select menu item, downwards, selected item is pointed with >
– S4 STATUS used to return to the Status window (see Fig. 3–6).

The menu item BATTERY DATA is blanked if the battery is absent and no 'battery capacity' is set.

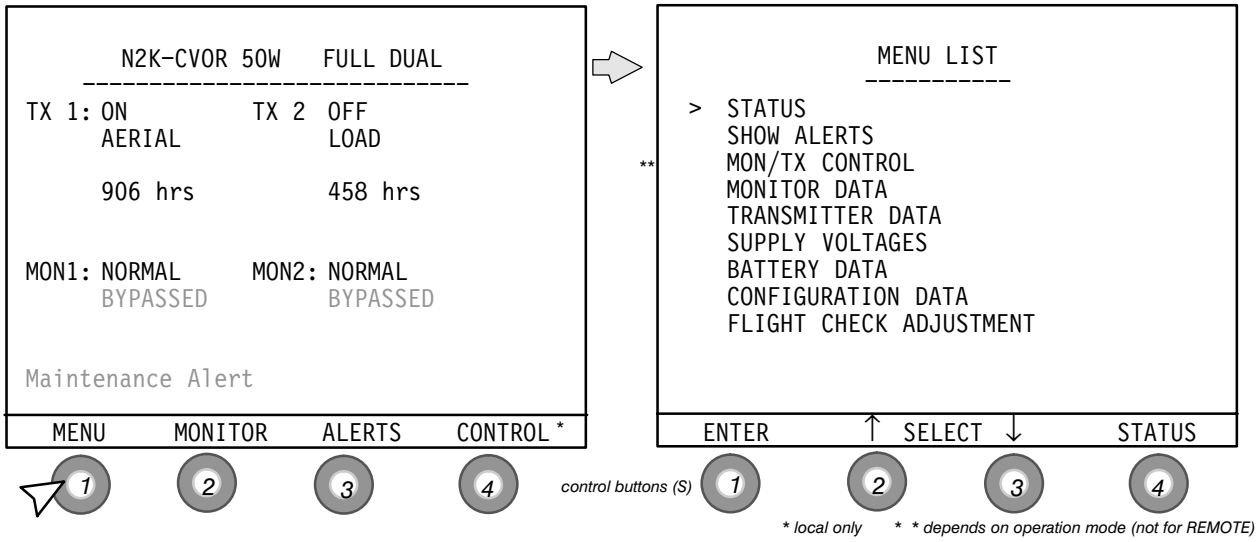


Fig. 3–12 MENU select and Menu List window (example)

The windows shown after selection of the Menu List items STATUS, SHOW ALERTS, MON/TX CONTROL, MONITOR DATA and TRANSMITTER DATA are described and shown in Figs. 3–6 to 3–11.

Following Figs. 3–13 to 3–20 show/describe the windows of the other Menu List items.

In the Supply Voltages window the following button definitions are used:

– S1 MENU used to return to the Menu List window
– S2 *blank* not used in this menu item
– S3 *blank* not used in this menu item
– S4 STATUS used to go back to the Status window (see Fig. 3–6).

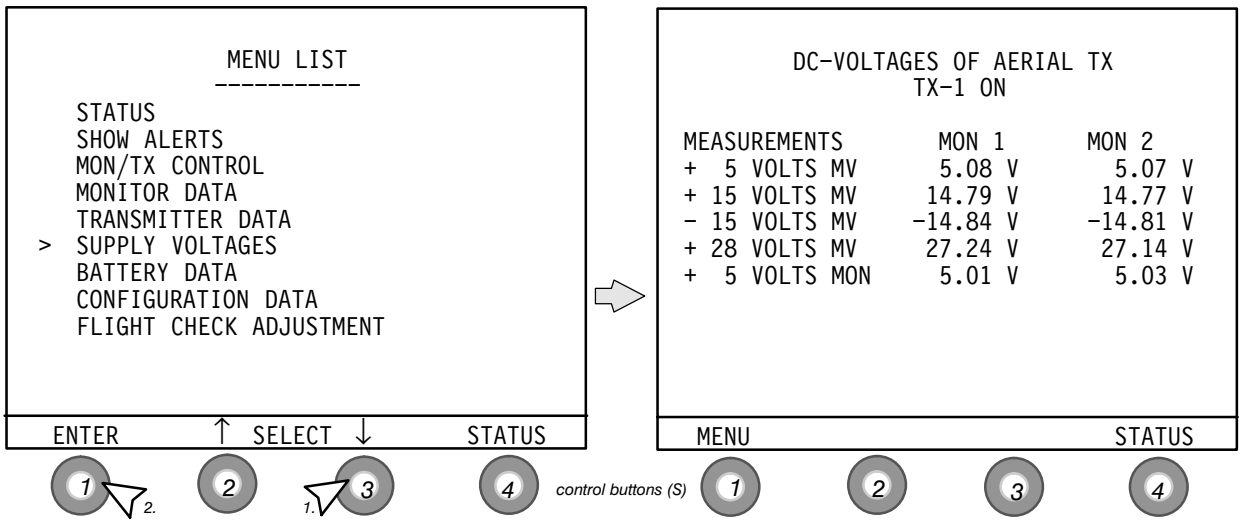


Fig. 3–13 SUPPLY VOLTAGES select and Supply Voltages window (example)

In the Battery Data window the following button definitions are used:
– S1 MENU used to return to the Menu List window
– S2 *blank* not used in this menu item
– S3 *blank* not used in this menu item
– S4 STATUS used to go back to the Status window (see Fig. 3–6)

NOTE: The menu item Battery Data is visible if a battery is present and a 'battery capacity' is set; if not, the item is blanked.

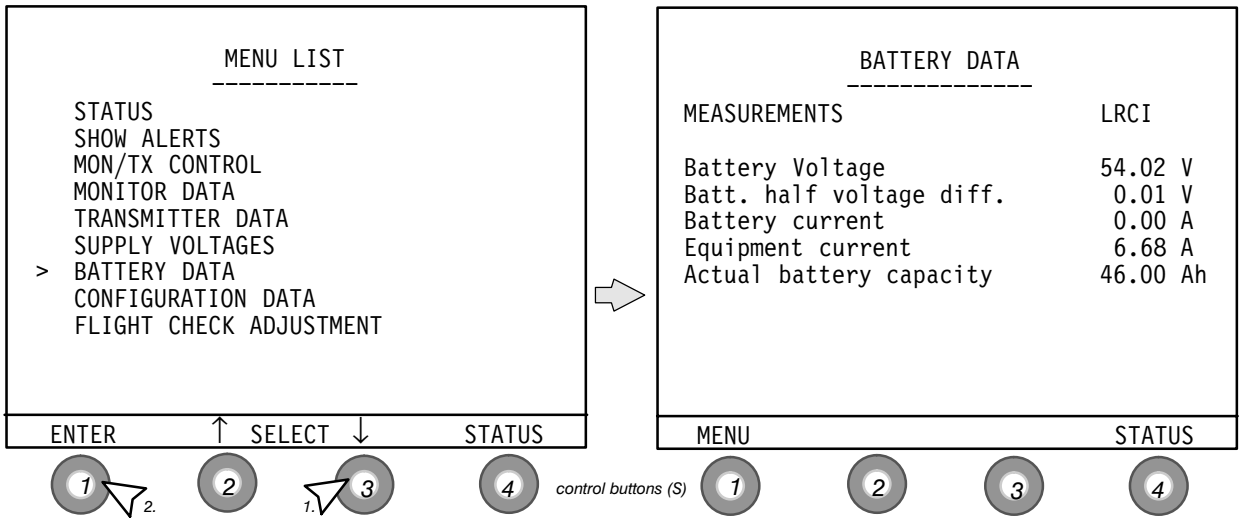


Fig. 3–14 BATTERY DATA select and Battery Data window (example)

In the Configuration Data window the following button definitions are used:
– S1 MENU used to return to the Menu List window
– S2 *blank* not used in this menu item
– S3 INFO used to go to the Station Information window (see Fig. 3–20)
– S4 STATUS used to go back to the Status window (see Fig. 3–6)

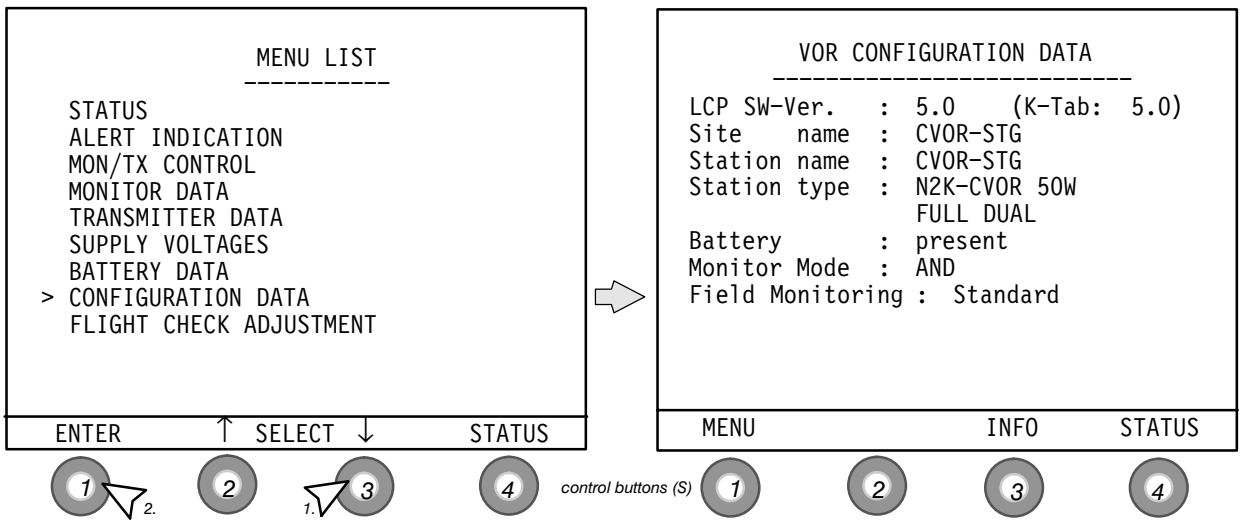


Fig. 3–15 CONFIGURATION DATA select and Configuration Data window (example)

For adjustments during flight check, the LCP menu comprises an additional menu item, which is available and visible in key switch position 'LOCAL' or 'MAINTENANCE'. This feature is used for quick access to some settings. The feature needs three steps (3 windows) to perform the settings.

In the Flight Check Adjustment window (1st step) the following button definitions are used:

– S1 ENTER used to confirm selected item in the Flight Check Adjustment window
– S2 ↑ used to scroll parameters upwards, selected item is pointed with >
– S3 ↓ used to scroll parameters downwards, selected item is pointed with >
– S4 STATUS used to go back to the Status window (see Fig. 3–6)

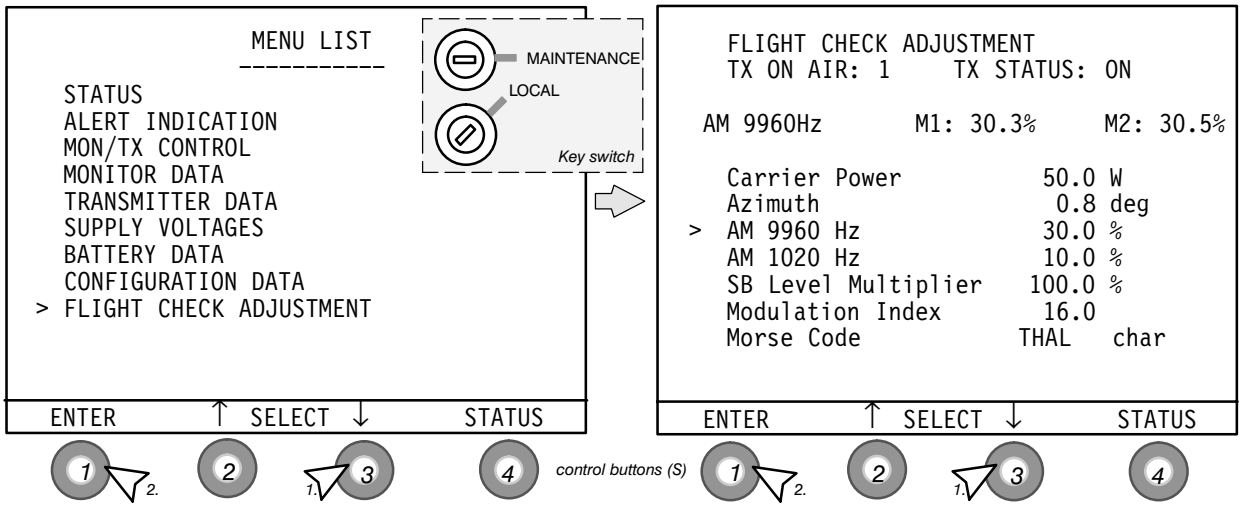


Fig. 3–16 FLIGHT CHECK ADJUSTMENT select and 1st step window (example)

Use ENTER to select the parameter to be adjusted. The next window (2nd step) with changed buttons appears. This 2nd step window uses the following button definitions:

– S1 READY used to enter set value and to indicate close of enter procedure
– S2 ↑ used to scroll selected digit (value) upwards
– S3 ↓ used to scroll selected digit (value) downwards
– S4 SEL–DIGIT used to select digit to be changed (scrolling through parameter digits)

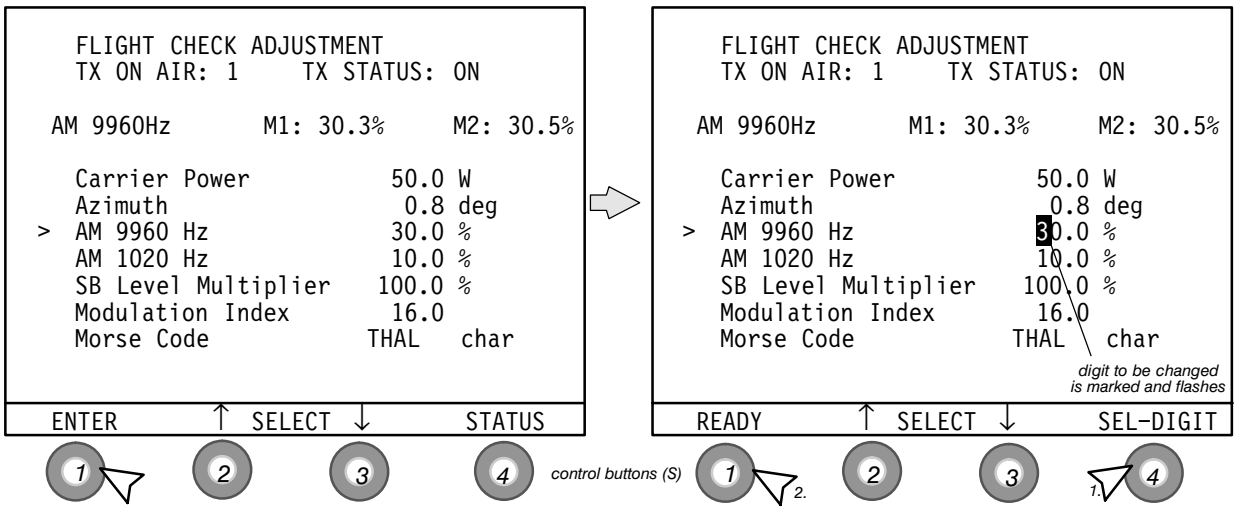


Fig. 3–17 Select parameter to change in Flight Check Adjustment 2nd step window (example)

Select the digit of parameter to be changed with SEL—DIGIT. Change value of digit with SCROLL buttons (up/down). Use READY to finish the setting procedure. The next window (3rd step) with changed buttons appears.

This window (3rd step) uses the following button definitions:

- S1 PROGRAM used to confirm/program the changed value of the selected parameter
- S2 ↑ not used in this window
- S3 ↓ not used in this window
- S4 ABORT used to abort the adjustment procedure without change of values

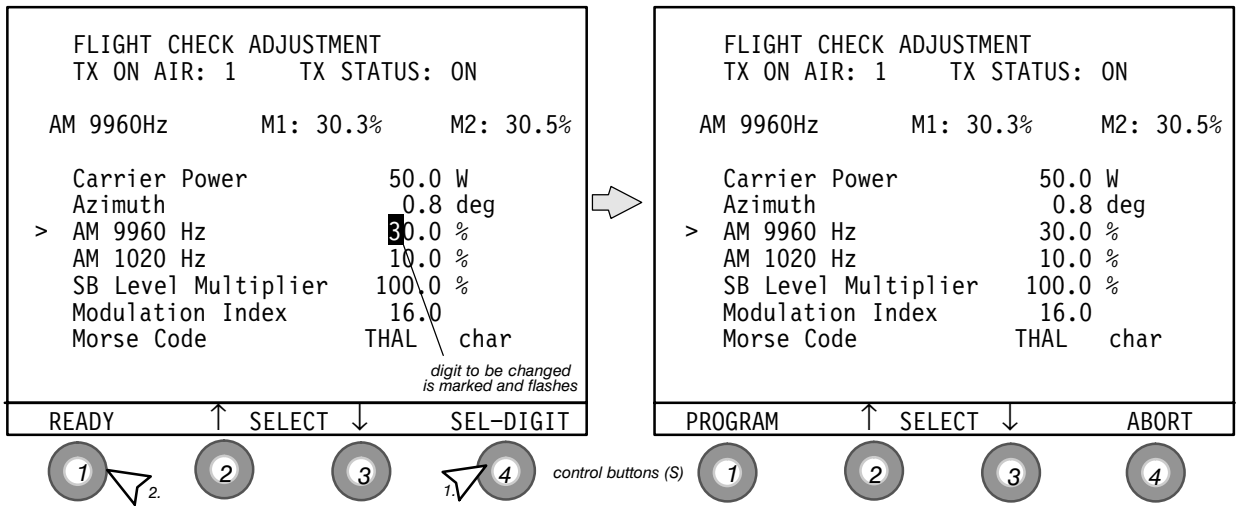


Fig. 3—18 Select digit and change value in Flight Check Adjustment 2nd step window (example)

Select PROGRAM in window (3rd step) to perform the change or ABORT to reject the change. Both selections return automatically to the 1st step window.

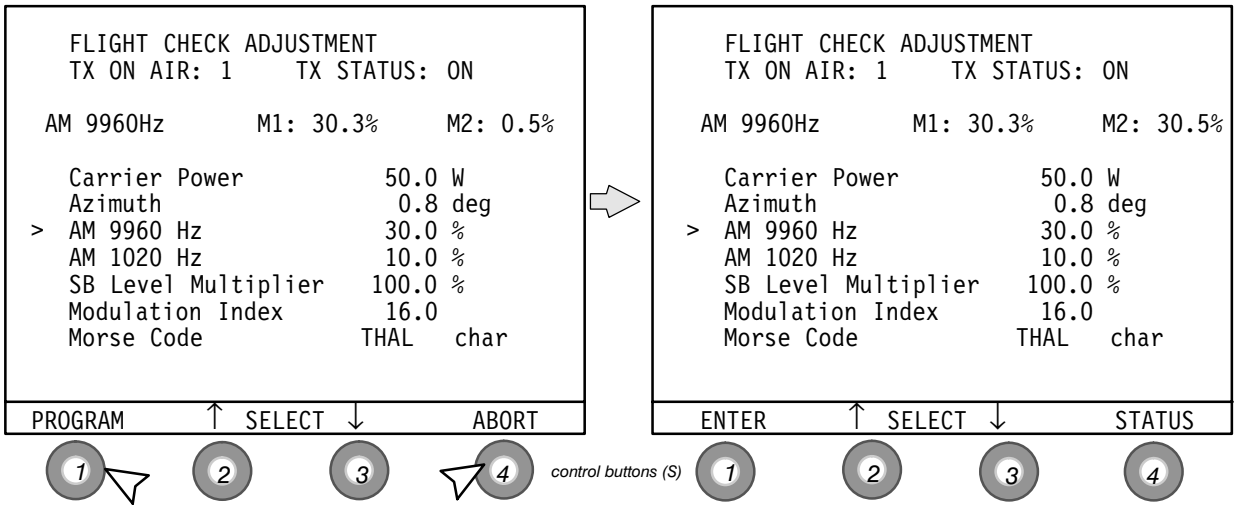


Fig. 3—19 Confirm/abort changes in Flight Check Adjustment 3rd step window (example)

In the Station Information window the following button definitions are used:

S1	MENU	used to go to Menu List window (see Fig. 3−12)
S2	CONFIG	used to return to Configuration Data window (see Fig. 3−15)
S3	ALERTS	used to go to Show Alerts window (see Fig. 3−10)
S4	STATUS	used to return Status window (see Fig. 3−6)

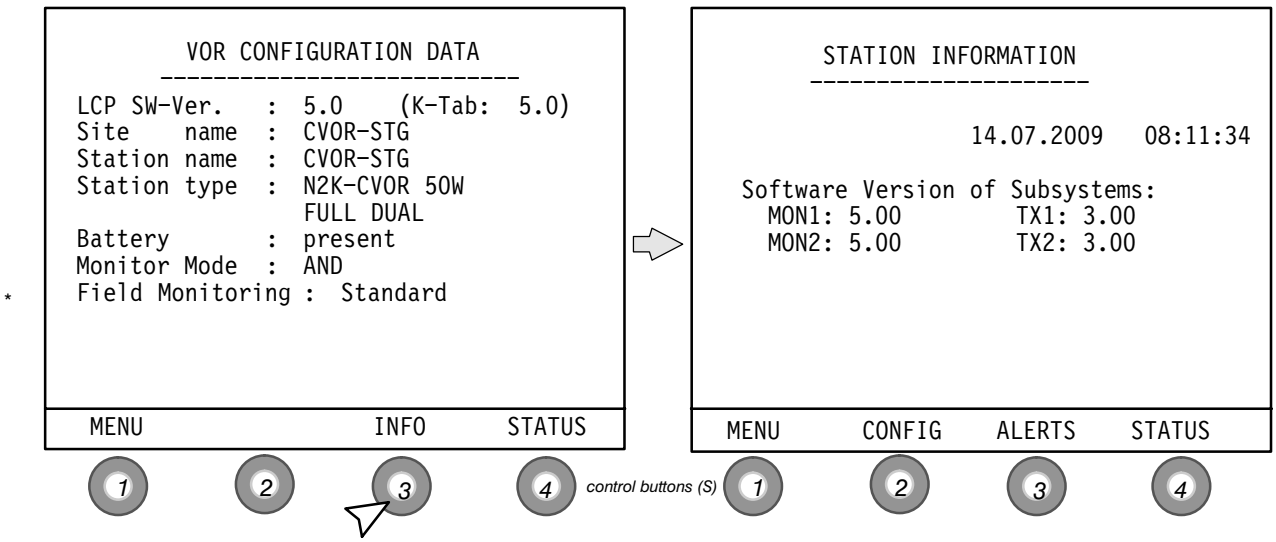


Fig. 3−20 INFO select and Station Information window (example)

CHAPTER 4
ALIGNMENT PROCEDURE

The alignment procedure of a CVOR including the general prerequisites is described in a step by step manner starting with 4.1. The following list is a summary and also a detailed table of contents.

NOTE: The procedures if the eight point ground check option is used are described in an Annex to this chapter.

4.1 GENERAL PREREQUISITES

This chapter is a step by step field alignment procedure. It assumes that the transmitter cabinet has been factory aligned and tested.

4.1.1 Local Operation via Personal Computer

A standard or Laptop PC is used to perform locally the first alignment of the installation. Usually suitable PC equipment is already available at site. Otherwise it can be delivered on request as an option. A user program for controlling the Navaids station has to be installed on the PC. The adjustment of the transmitter and monitor parameters is performed via this PC/laptop using the corresponding functions/windows of the user program.

Two different PC user programs for controlling the Navaids station are available at the moment, the MCS user program or the ADRACS user program.

4.1.1.1 PC with MCS User Program

The locally connected PC/Laptop with the MCS User Program can occupy the roles CWP (Controller Working Position) or MCWP (Mediator Controller Working Position), see Technical Manual MCS (Ref. No. 83140 55325).

In the standard application the local PC/Laptop is used as MCWP, i.e. the MCS application GUI, the SNMP proxy agents and the Direct Connect option are installed to the PC/Laptop. The PC/Laptop is connected to the connector 'Local PC' on top of the cabinet.

In an optional application (currently only available for DVOR/CVOR systems) the local PC/Laptop is used as CWP, i.e. the MCS application GUI is installed to the PC/Laptop and the SNMP proxy agents are installed to a built−in intelligent board, the optional ETX−CPU board. The PC/Laptop is connected to the connector 'ETHERNET' on top of the cabinet which is fed to the ETX−CPU board.

The corresponding MCS application software should be installed on the available PC/Laptop. For installation procedure refer to the Technical Manual MCS.

CAUTION

Do not use both connections simultaneously to avoid confusion in the data management!

The PC/Laptop used for the CWP role or MCWP role should be built by a quality PC manufacturer and must meet the following requirements:

	CWP	**MCWP**
– Processor; clock	Intel P4, AMD K7; 2 GHz (or better)	Intel P4, AMD K7; 2 GHz (or better)
– Power supply units	1	2
– Main memory	512 MB (or better)	512 MB (or better)
– VGA memory	32 MB (or better)	32 MB (or better)
– HDD	20 GB (or better)	2x 20 GB (or better)
– CDROM	x	x
– Input via mouse	x	x
– Serial connector	–	1 per connected Navaids device
– USB connector	recommended	recommended
– Network adapter	x	x
– Operating system	WinNT, W2K, WindowsXP, Fedora Core 4 (FC4), Red Hat 9 (RH9)	Fedora Core 4 (FC4), Red Hat 9 (RH9)
– Free disk space for MCS	100 MB (without Data Base option), min. 10 GB (with DB option)	100 MB (without Data Base option), min. 10 GB (with DB option)
– SUN Java VM	1.5.0 (or higher)	1.5.0 (or higher)

4.1.1.2 PC with ADRACS User Program

The PC with the ADRACS user program should meet the following requirements:

– Processor; clock	min. Pentium I, 90 MHz or better (IBM PC/AT compatible)
– Main memory	min. 32 MB RAM
– Graphics and memory	VGA, min. 2 MB; color monitor, resolution min. 800x600
– Hard disk	min. 1 GB HDD
– CDROM	available, min. speed 4x
– Floppy drive	3.5” FDD (1.44 MB), recommended
– Control input	via mouse or comparable pointing device
– Serial interface	two serial interface connectors available
– Network adapter	–
– USB interface	recommended, useful for memory sticks
– Operating system	any 32 bit version of Microsoft WINDOWS operating system
– Free disk space	min. 10 MB on HDD

The ADRACS software should be installed on the available PC. For installation procedure refer to the Technical Manual ADRACS (Ref. No. 83140 55324).

4.1.2 Recommended Measuring Equipment

– 1 Multimeter
– 1 Thruline power meter with 1 W, 10 W and 100 W probes, range of frequency 108...118 MHz
– 1 Attenuator 10 dB/10 W
– 3 Attenuators 20 dB/1 W
– 3 Terminating resistors 50 ohm/1 W
– 1 RF phasing cable (55˚/113 MHz), TNC (M–f); approx. 5 phasing pieces TNC (M–f)
– 1 measuring dipole with tripod and 2x 30 m RF cable
– Various adaptors N–TNC and measuring cables
– 1 Monitor Signal Simulator (option, Ref. No. 83134 31600) with VHF–attenuator 30 dB/100 W
– 1 Monitor Signal Simulator 8PGC (option, Ref. No. 58351 00500 with cable kit) and optional 1 VHF–attenuator 26 dB 50/100 W, 2 VHF–attenuators 20 dB/10 W

4.1.3 Status of Installation

Before operation, the system must complete as follows:

– Transmitter cabinet, installed,
– Power supply, installed,
– Batteries, installed,
– Antenna system and Monitor dipole, installed and cabling complete.
– Mains voltage must be in accordance with assigned input voltage range of BCPS (nominal 115 to 230 VAC).
– Cabinet has to be fully equipped with all plug–in units.
– Jumpers and DIP switches of the pertinent pc boards (refer also to chapter 6, section 6.2.5) have to be in accordance with the system version. To enable battery backup on specific pc boards refer to 4.2.1.1.
– The MCS resp. ADRACS application software has been loaded to the Laptop/PC (refer to 4.1.1).

4.1.4 Special Setups for Alignment without Antenna System

If the alignment is carried out on dummy loads proceed as follows: Arrange simulator setup according to Fig. 4−9. For 8PGC Monitor Simulator, refer to Fig. A4−7 in the Annex to Chapter 4.
If a Monitor Signal Simulator is available (for supply by Thales, see Section 4.1.2) proceed as follows, see also Fig. 4−10:

- Connect CSB−signal to CSB IN of Monitor Signal Simulator and terminate CSB OUT by UHF power attenuator 30 dB/100 W.
- Connect SB1− or SB2−signal to SB1(2) IN of Monitor Signal Simulator and terminate SB1(2) OUT to 50 ohm/10 W dummy load.
- Terminate SB1−OUT or SB2−OUT via attenuator 10 dB/10 W with a 50 ohm/1 W dummy load.
- Terminate unused SB signal of CVOR cabinet directly by 10 W dummy load.
- Connect MON1− and MON2−connectors of CVOR−cabinet with corresponding MON−connectors of simulator. Depending on the RF level, connect an attenuator between the cables.

Then the alignment of transmitter and simulator can be carried out as described below with the following exceptions: Omit sections 4.3, 4.4, 4.6.1e) to j), 4.6.2.1, 4.6.2.4, 4.6.4.1a) to b), 4.7 and 4.11.

NOTE: If the 8PGC Monitor Simulator is used, perform RF phasing according 4.1.4.1 to 4.1.4.3.

4.1.4.1 RF Phasing (SBA to CSB) with 8 PGC Monitor Simulator

8 PGC Monitor simulator is installed and connected according Fig. A4−7.

a) Check or set parameters in window 'TX1 − Adjustments':
   - 'Carrier power' (CSB) : 50/100 W
   - 'SBA level' : 50 %
   - 'SBB level' : 0 %
   - 'FM Index' (30 Hz FM) : 16
   - '9960 Hz AM' : 30 %

b) ADRACS: Open window 'Monitor1 − Measurement 8PGC'. Open dialog 'Monitor1 − Calibration 8PGC'. Set parameter 'AGC Adjust' of Dipole 1 ('0.0') to 'RF−Level' indication of 100 %.

   MCS: Open dialog 'Monitor1−Measmt 8 PGC−RF Level'. Open dialog 'Monitor1−Cal 8 PGC−Calibration Agc Adjustment'. Set parameter 'Calibration AGC Adjustment' of Dipole 1 ('0.0') to 'RF−Level' indication of 100 %.

c) Set SBA phase in order to get a 30 Hz mod. depth minimum: Open window 'Monitor1 − Measurement Main (Measurements/Limits)', read parameter '30 Hz AM Depth'. Open window 'TX1 − Adjustments', set parameter 'SBA Phase'.

   NOTE: Range of values: 0...359.

d) Add or subtract 90 to the value found in c) and enter new value.

   NOTE: Note value.

e) Set parameter 'SBA Level' in window 'TX1 − Adjustments' so, that 30 Hz modulation depth becomes 30.0 %. Record setting phase and amplitude.

   NOTE: Range of values: 0...99.9. Note value .

4.1.4.2 RF Phasing (SBB to CSB) with 8 PGC Monitor Simulator

a) Check or set parameters in window 'TX1 − Adjustments':
   - 'Carrier power' (CSB) : 50/100 W
   - 'SBA level' : 0 %
   - 'SBB level' : 50 %
   - 'FM Index' (30 Hz FM) : 16
   - '9960 Hz AM' : 30 %

b) ADRACS: Open window 'Monitor1 — Measurement 8PGC'. Open dialog 'Monitor1 — Calibration 8PGC'. Set parameter 'AGC Adjust' of Dipole 3 ('90.0') to 'RF—Level' indication of 100 %.

MCS: Open dialog 'Monitor1—Measmt 8 PGC—RF Level'. Open dialog 'Monitor1—Cal 8 PGC—Calibration Agc Adjustment'. Set parameter 'Calibration AGC Adjustment' of Dipole 3 ('90.0') to 'RF—Level' indication of 100 %.

c) Set SBB phase in order to get a 30 Hz modulation depth minimum: Open window 'Monitor1 — Measurement Main (Measurementss/Limits)', read parameter '30 Hz AM Depth'. Set parameter 'SBB Phase' in window 'TX1 — Adjustments'.

NOTE: Range of values: 0...359.

d) Add or subtract 90 to the value found in c) and enter new value.

NOTE: Note value.

e) Set parameter 'SBB Level' in window 'TX1 — Adjustments' so, that '30 Hz AM Depth' in window 'Monitor1 — Measurement Main (Measurements/Limits)' becomes 30.0 %. Record setting phase and amplitude.

NOTE: Range of values: 0...99.9. Note value.

4.1.4.3 Check of Sense of Rotation

a) Open window 'Monitor1 — Measurement Main (Measurements/Limits)', open window 'TX1 — Adjustments'. Set parameter '9960Hz AM Depth' to an indication of 30 % for '9960Hz AM Depth'.

b) Set parameter 'Modulation Index (FM Index)' in window 'TX1 — Adjustments' to a 'FM Index' indication of 16.

c) Check readout of 45°, 135°, 225°, 315° for correct indication.
If the readout shows 180° Azimuth error 'Azimuth', add or subtract 180° to/from the parameter 'SBA Phase' in 'TX1 — Adjustments'.

4.1.5 Labelling of Parameters, Access to Adjustment Windows (from ADRACS software V3.8 and MCS software V1.8)

From ADRACS software version 3.8 and MCS software V1.8, the user interface implements changes which clearify some labels to improve handling. The first alignment procedure and the parameters to be adjusted are mostly identically to those used up to software version 3.6. The improvement concerns the labels of some parameters and the access to adjustment windows. In detail, the design of previously used 'data window' has been replaced by a more distinct 'dialog window'.

The (LRCI) 'Station Configuration' window has a special characteristic: the parameter values entered within this data window are first checked by ADRACS regarding consistency and integrity, and then sent as a whole data set to the station after clicking on 'Program'. The text string "Programming accepted" appears in the left part of the 3rd information line in the 'Controlling' window for confirmation.

An example is the new dialog window 'Station Configuration' used to enter station configuration parameter (Fig. 4−1). Refer also to description in the Technical Manual ADRACS.

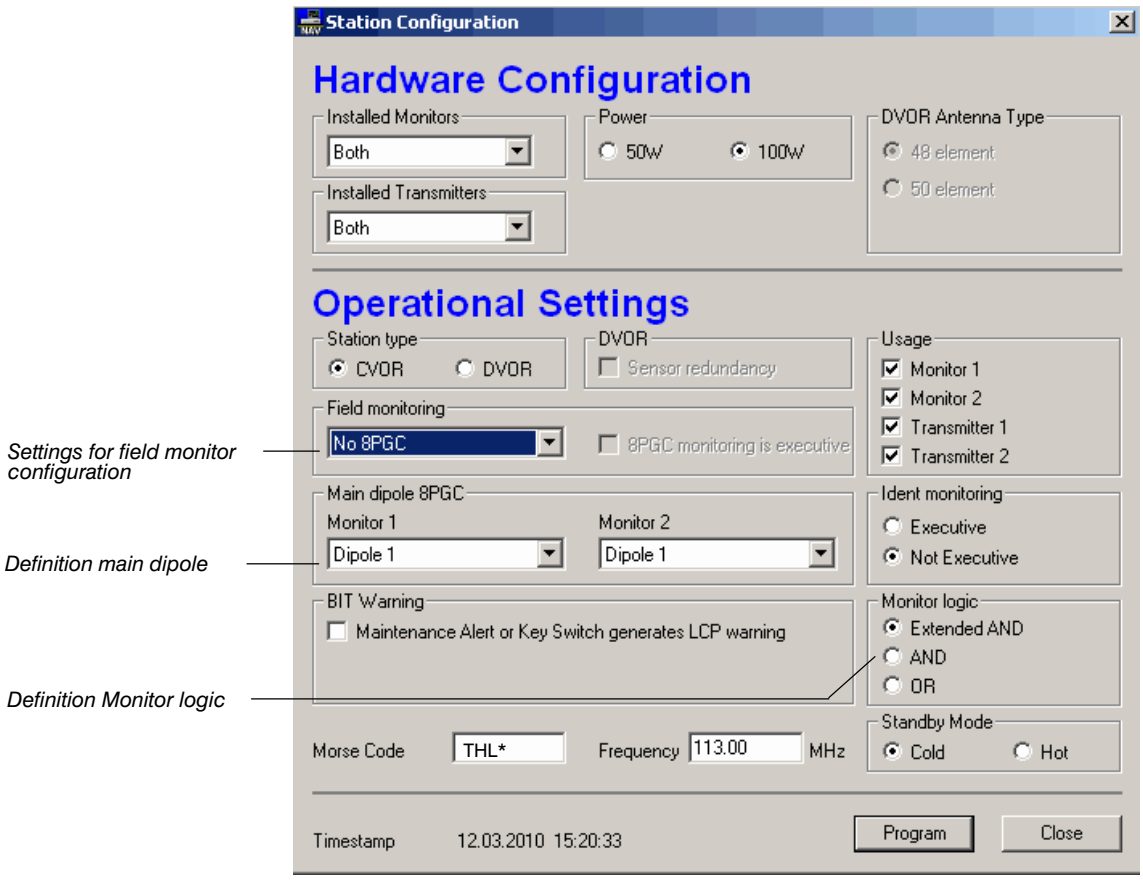


Fig. 4−1 Example of dialog window 'Station Configuration' (ADRACS)

4.2 FIRST SWITCHING ON

4.2.1 Status of the System

– Mains OFF (mains distribution box, shelter)
– Battery fuse switches open (used for emergency battery, battery fuse box, shelter)
– Power switches on BCPS (ACC modules, transmitter cabinet) in position OFF (0)
– PMM: switches NAV, TX1, TX2 (transmitter cabinet) in position OFF

4.2.1.1 Special Jumper Settings before Start Up

Individual jumpers have to be set before the first switching on. These are concerned with the enabling of backup batteries for non volatile memory (LCP, MSP–CD/1,2, MSG–C/1,2) and the emergency battery management (CSL). The location of jumpers is shown in chapter 6, section 6.2.5:

– LCP: Set jumper X36 (enabling backup battery for RTC).
– MSP–CD: Set jumper X7 on both boards (enabling backup battery, if need be).
– MSG–C: Set jumper X7 on both boards (enabling backup battery).
– CSL: Set jumper X18 (enabling cutoff for over discharge protection of emergency battery).
– CSL: Set jumper X22 (enabling automatic restore).
– CSL: Select minimal battery voltage with jumper X19,20,21 for standard over discharge protection.
– ETX–CPU option (if available): Check if jumper X17 is set (default).

4.2.2 Switching On

a) Connect PC serial interface connector (e.g. COM1) to connector 'Local PC' on top of the cabinet with a 'zero modem cable' (RX/TX crossed) or use Ethernet connection if opt. ETX–CPU is used.

   NOTE: If the PC has no serial interface, use adapter USB to Serial. Refer to TM ADRACS, chapter 1.

b) Switch on mains and set power switches of BCPS (ACC modules, cabinet) to position ON (I).

c) Close battery fuse switches (battery fuse box, inside shelter).

   NOTE: Matching the charging voltage of BCPS modules to environmental conditions: Refer to 5.3.3.

d) Set switches TX1/TX2 on PMM (cabinet, front side) to position ON.

e) Set main switch NAV on PMM (cabinet, front side) to position ON. During initialization of the LCP a buzzer signal is set.

f) Switch to local control with the key–lock switch on the Local Control Interface (LCI).

4.2.3 General Remarks to the PC User Program Handling

The use of the PC user program (ADRACS or MCS) is described in the Technical Manuals ADRACS respectively MCS (chapter 2 each). It is recommended to become familiar with the menues of the user program before performing the first alignment procedure. The user program specific actions/procedures are described in detail in the ANNEX 'PC User Program–specific Procedures' in this manual. This concerns:

– start user program/perform login/select station,
– commands to switch a transmitter on/off or aerial, or to set monitor bypass on/off, and
– commands to open a dialog for parameter reading and setting.

NOTE: Names of dialogs/parameters in MCS different to ADRACS are given in brackets ( ).

4.2.4 Preparing the Installation SITE with PC User Program

NOTE: It is assumed, that the transmitter cabinet has been factory−aligned and tested. Therefore the site−specific configuration files are already stored in the equipment. The following procedure is only necessary, if the configuration has to be modified.

4.2.4.1 Use of MCS

NOTE: For users of the MCS user program, currently the 'MCS File Transfer' tool is used.

a) Switch on the PC and run the Linux operating system.

b) Start the File Transfer tool: click on desktop start button, select 'System Tools', select 'MCS File Transfer (ILS, VOR, FFM, Marker)'. The dialog window 'ADR_MAIN−DOS in a BOX' appears.

c) Select menu item 'LOGIN' of the MASTER MENU. Enter *REU* as 'UserName' and confirm blank characters in 'Password'.

d) Select 'FILE TRANSFER' of the MASTER MENU, select menu command 'COPY PC FILE TO SITE'.

e) Select configuration files (**.sit, *.lke* (*see NOTE*)*, *.ptt, *.oio*) and enter.

   NOTE: The **.lke*−file is used in systems before current NAV2K−SW. It is replaced by a conversion table file (*konv_dat.dat*) which is loaded together with the LCP−SW (from V3.x). From SW V5.x this file is implemented in the *LCP.ZIP* file. It has not to be copied.

f) Select menu item 'RESET SITE' of the MASTER MENU to activate entered files and data.

   NOTE: The File Transfer tool is closed due to the reset. It has to be restarted manually.

g) Run 'MCS File Transfer' tool again. Perform Login.

h) Select 'DATE & TIME' in the MASTER MENU. Select menu item 'SET SITE DATE & TIME'. Enter date and time.

i) Select function 'EXIT' in the MASTER MENU to shut down the File Transfer tool.

4.2.4.2 Use of ADRACS

a) Switch on the PC and run WINDOWS.

b) Start the ADRACS user program: click 'Start' button, select 'Programs', select program group 'Adracs Remote Controlling', select program 'Adracs Remote Controlling Software'.

c) Perform login procedure at the PC. Acknowledge 'User1, Level 5' with 'OK' button.

d) Click button 'Control' in the 'Main Status' window.

e) Select 'File Transfer' in window 'RC Management'. Select 'Copy PC file to RAM'.

f) Copy configuration files (**.sit, *.lke* (*see NOTE*)*, *.ptt, *.oio*) from PC to site.

   NOTE: The **.lke*−file is used in systems before current NAV2K−SW. It is replaced by a conversion table file (*konv_dat.dat*) which is loaded together with the LCP−SW (from V3.x). From SW V5.x this file is implemented in the *LCP.ZIP* file. It has not to be copied.

g) Click 'Reset SITE' of menu 'File Transfer' to activate entered files and data.

   NOTE: The 'Adracs Remote Controlling Software' is closed due to the reset. It has to be restarted manually.

h) Run 'Adracs Remote Controlling Software' again. Perform Login.

i) Click screen button 'Control' in the 'Main Status' window.

j) Select 'DateTimeREU' in window 'RC Management'. Enter date and time and acknowledge with button 'Set New'. Shut down window 'DateTimeREU'.

k) Click 'Exit' in the 'Main Status' window to shut down ADRACS.

4.2.5 Check and Enter Station Configuration Data

NOTE: Normally these data may be already set in the equipment.

a) Start user program, perform login and select station. The detailed view on the CVOR station appears.

b) Switch both TX on and set all Monitor Bypass on.

Using ADRACS:

a) Open dialog 'LRCI—Station Configuration'.

NOTE: This dialog window (refer to example in section 4.1.5) represents a summary of the station configuration data. It summarizes the station parameter of the data windows 'TX1 Configuration', 'TX2 Configuration' and 'Monitor-1 Configuration, 'Monitor-2 Configuration''. With the 'Program' button in the dialog window, the correspondent settings become effective also in the data windows. The parameter settings change the entries in the data windows.

b) Check parameters within the area 'Hardware Configuration':
'Installed Monitors', 'Power'. If need be, select the correct parameter value.

c) Check parameters within the area 'Operational Settings':
Check or set parameter 'Field Monitoring' according to the existent configuration. Use the pull—down menu.

d) Open dialog 'Monitor-1—Configuration'. Check parameters 'Station type', 'Frequency' and 'Identification Morse Code'. Verify that the 'Single Channel Mode' is set to 'off'. If need be, enter correct parameter value(s). Repeat this for monitor 2.

e) Open dialog 'TX1—Configuration'. Check parameters 'Station type', 'Frequency' and 'Morse Code'. If need be, enter correct parameter value(s). Repeat this for TX2.

NOTE: The station parameter set in b) or c) of the dialog window 'LRCI—Station Configuration' can also be changed in the fashion of d) and e), but this entry has no effect on the entries in the dialog window. The station parameter entered in the dialog window 'LRCI—Station Configuration' must match to the settings in d) and e). If not, a mismatch alert may be issued. Verify this with the indication to MON or TX configuration in the data window 'LRCI—Detailed Status'.

Using MCS:

a) Open dialog in the 1st Equipment Level window by selecting menu item 'Station Configuration' in menu 'Operation'.

b) Check parameters of station: 'Installed Monitors', 'Power', 'Frequency', 'Station Type' and 'Morse Code'.

c) Check or set parameter 'Field Monitoring' according to the existent configuration.

Finally: Switch both TX off.

REMARK:

In an installation with 8PGC option, the standard alignment procedure may be performed also with connected 8 PGC monitor dipoles and the dialog or data windows which are used with 8PGC in the Annex to chapter 4. Depending on the monitor configuration (with or without 8PGC) the dialog or data windows differ in their contents. It concerns mainly to:

— Data window 'MON1(2)—Configuration' with 8PGC; it comprises 3 additional items concerning 8PGC: Definition of Main Dipole for MON1 and MON2, 8PGC monitoring executive yes/no

— Dialog 'Alarm Limits' without 8PGC: Azimuth Alarm Limits for standard field dipole (= dipole1)

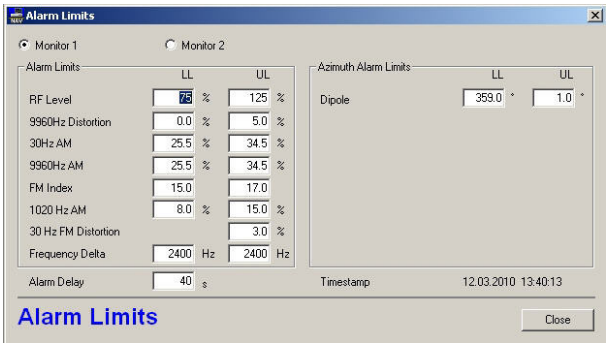
— Dialog 'Alarm Limits' with 8PGC: Azimuth Alarm Limits for dipole1 to 8

– Dialog ’Calibration’ without 8PGC: AGC Adjust, Digital Attenuation, Cal 30 Hz AM Depth for standard field dipole (= dipole1, 0.0˚ in 8PGC)

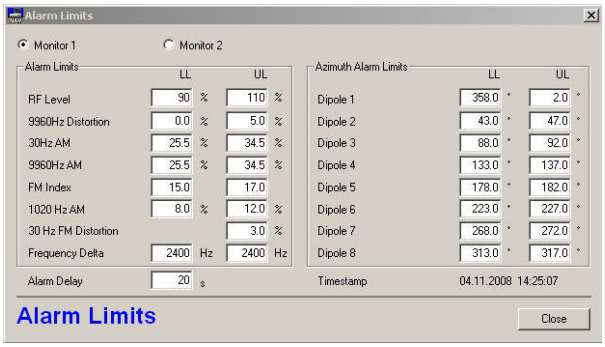
– Dialog ’Calibration’ with 8PGC: AGC Adjust, Digital Attenuation, Cal 30 Hz AM Depth for 8PGC dipoles1 to 8 (0.0˚,45.0˚,..., 315.0˚)

Examples of the dialog windows are presented in Fig. 4−2.

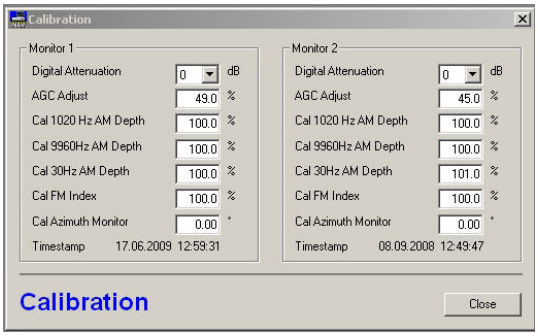
Example dialog window ’Alarm Limits’: *without 8PGC*



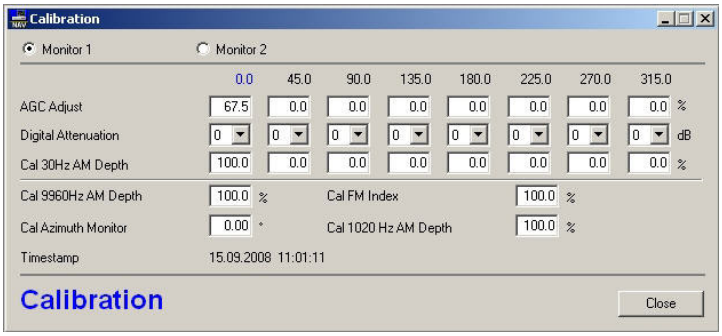
with 8PGC



Example dialog window ’Calibration’ *without 8PGC*



with 8PGC



(shown values are examples only)

Fig. 4−2 Examples of dialog window ’Alarm Limits’ and dialog window ’Calibration’

4.3 ANTENNA ALIGNMENT

NOTE: Both SB1, SB2 (or USB, LSB) and SBA, SBB are used as term for sideband signals in CVOR/DVOR systems. SBA, SBB are used normally for CVOR (signals to dipole A or B), the terms SB1, SB2 (also USB, LSB) are generally used in other Navaids 400 systems. The PC user program MCS uses the terms USB, LSB, the user program ADRACS uses the terms SBA, SBB.

4.3.1 Mechanical Presettings

a) Remove the two antenna radome shells from counterpoise.

b) Loosen the 8 screws at the antenna foot (accessible from inside the shelter) to enable the antenna to be rotated.

NOTE: Do not remove screws.

c) Set length of dipole slots for correct station frequency according to Fig. 4−3.

d) Set all capacitors (feeding capacitors C_F and corner capacitors C_C, Fig. 4−5a) of both omnidirectional radiators for station frequency according to Fig. 4−4.

4.3.2 Matching

NOTE: Because two different PC user programs (ADRACS or MCS) can be used, the user program−specific actions/procedures are described in detail in the ANNEX 'PC User Program−specific Procedures'.

4.3.2.1 Dipole A

a) Arrange following test setup:

Disconnect SBA and SBB feeder cables from antenna and terminate SBB with 50 ohm. Connect CSB feeder cable via Thruline power meter with dipole−A input. Insert a 10 W probe, set for reflected wave measurement, into Thruline power meter.

b) Rotate antenna, so that longitudinal axis of dipole A points into middle of radome openings.

c) Switch TX1 on.

d) Set CSB power to 10 W reading at the power meter: Open window 'TX1 − Adjustments', set parameter 'Carrier Power'.

e) Replace 10 W probe by a 1 W probe and set to reflected position.

f) Set 'SBA Level' to 0.

g) Set 'SBB Level' to 0.

h) Adjust all slots of dipole A equally for a minimum reading at the Thruline power meter.

NOTE: Minimum < 0.15 W (> 18 dB matching).

i) Switch TX1 off.

4.3.2.2 Dipole B

Connect CSB feeder cable via Thruline power meter with dipole B and perform matching of dipole B as described for dipole A in 4.3.2.1.

NOTE: Rotate longitudinal axis of dipole B into radome openings.

4.3.2.3 Lower Radiator (LR)

a) Connect CSB feeder cable via Thruline power meter with LR input of antenna. Terminate UR input with 50 ohm.

NOTE: SBA and SBB feeder cables remain disconnected and should be terminated with 50 ohm.

b) Switch TX1 on.

c) Tune feeding capacitors C_F (both same direction) for a minimum reading at the Thruline power meter.

NOTE: Minimum < 0.15 W (> 18 dB matching).

d) Switch TX1 off.

4.3.2.4 Upper Radiator (UR)

Connect CSB feeder cable via Thruline power meter with UR and perform matching of UR as described for LR in 4.3.2.3.

4.3.2.5 Decoupling Dipole A — B

Perform here measurement of section 4.3.6 b) to f). Omit 4.3.6 a), g).

4.3.3 Decoupling and Circular Pattern of LR

4.3.3.1 Decoupling LR — Dipole A

a) Arrange test setup for level calibration according to Fig. 4—6. Connect CSB OUT of cabinet via the Thruline power meter with 10 W probe and 1 attenuator 10 dB/10 W in series with 3 attenuators 20 dB/1 W using RF measuring cable.

NOTE: Verify that CSB power is 10 W and SBA and SBB feeder cables are still disconnected.

b) Switch TX1 on.

c) Open window* 'Monitor1 — Measurement Main (Measurements/Limits)', open dialog 'Monitor1 — Calibration'. Set parameter 'AGC Adjust (Calibration AGC Adjustment)' to 'RF—Level' indication of 100 %.

* *Without 8PGC option, this window is assigned as 'Monitor1 — Measurement (s/Limits)'.*

d) Switch TX1 off.

e) Change test setup according to Fig. 4—7. Connect CSB OUT of cabinet via Thruline power meter with 1 W probe for reflected wave measurement directly to LR. Connect dipole A via 30 dB attenuator (10 dB + 20 dB) to input of monitor 1. Terminate UR with 50 ohm.

f) Switch TX1 on.

g) Tune for minimum RF—level reading (decoupling) by means of the trimmers located in radiation direction of dipole A. Minimum reading must be less than 30 %, i.e. decoupling >50 dB.
At the same time watch reflected signal on power meter. If reflected signal increases tune both trimmers C_F in same direction to keep it below 0.15 W.

NOTE: For decoupling tune trimmers in opposite sense, i.e. one in cw—, the other in ccw—direction. For measurement of decoupling, the person taking measurements on the counterpoise has to move into null of dipole.

h) Switch TX1 off.

4.3.3.2 Decoupling LR — Dipole B

a) Repeat 4.3.3.1a) to d)

b) Connect dipole B via 30 dB attenuator (10 dB + 20 dB) to monitor 1 instead of dipole A.

c) Switch TX1 on.

d) Tune as described in 4.3.3.1g) using trimmers located in radiation direction of dipole B.

e) Switch TX1 off.

4.3.3.3 Circular Pattern of LR

a) Complete the field measuring test setup as follows, see Fig. 4—8:
Set measuring dipole on tripod (height: 2 m) about 50...60 m from VOR shelter and connect it via RF cable with input of monitor 1.

NOTE: Terminate dipole A and B with 50 ohm.

b) Rotate CVOR antenna so that C_F points in direction of measuring dipole.

c) Switch TX1 on.

d) Set CSB power to nominal value (50 W or 100 W): Open window 'TX1 — Adjustments', set parameter 'Carrier Power'.

e) Open window 'Monitor1 — Measurement Main (Measurements/Limits)', read 'RF—Level' (of measuring dipole).

f) Open dialog 'Monitor1 — Calibration', set parameter 'AGC Adjust (Calibration AGC Adjustment)' to 'RF—Level' indication of 100 %. If necessary, activate additional attenuation at the monitor input: set parameter 'Digital Attenuation' from 0 to 16 dB.

g) Rotate antenna slowly one turn (±90° min.). Reading must not change more than ±4 %, otherwise correct settings of both C_C according to Fig. 4—5. If settings of C_C had to be changed, then correct C_F the same amount in opposite direction (from C_C) for min. reflection (< 0.8 W).

NOTE: Tune both C_C equally (same direction) and then both C_F equally (in opposite direction). If corrections were necessary in 4.3.3.3g), repeat 4.3.3 until the required values for decoupling, circular pattern and matching are achieved.

h) Reset parameter 'Carrier Power' in dialog 'TX1—Adjustments' to 10 W.

i) Switch TX1 off.

4.3.4 Decoupling and Circular Pattern of UR

Perform for UR as described for LR in 4.3.3.

4.3.5 Fine Matching of Omnidirectional Radiator

4.3.5.1 LR

a) Arrange following test setup:
Close radome provisionally. Connect CSB OUT of cabinet via Thruline power meter with 1 W probe (for reflected wave measurement) to input of LR matcher. Output of LR matcher must be connected to LR. Terminate UR with 50 ohm.

NOTE: CSB should be 10 W at first.

b) Switch TX1 on.

c) Alternately adjust C1 and C2 of LR matcher for minimum reflection on Thruline power meter.

d) Set CSB Power to nominal value: Open dialog 'TX1 — Adjustments', set parameter 'Carrier Power'.

e) Repeat matching (see c)) until reflected power is less than 0.05 W.

NOTE: Matching $\geq$ 30 dB.

f) Reset CSB power to 10 W: Set parameter 'Carrier Power' in window 'TX1 — Adjustments'.

g) Switch TX1 off.

4.3.5.2 UR

Change CSB feeder cable via Thruline power meter to UR matcher and perform matching of UR matcher as described for LR matcher in 4.3.5.1.

NOTE: Output of UR matcher must be connected normally with UR.

4.3.5.3 Matching Device Input

a) Complete cabling between CSB OUT of cabinet, Matching Device, LR and UR normally, but insert Thruline power meter with 1 W probe for reflected wave measurement at input of Matching Device.

b) Switch TX1 on.

c) Set CSB power to nominal value: Open window 'TX1 — Adjustments', set parameter 'Carrier Power'.

d) Reflected power must be < 0.8 W resp. 1.6 W, otherwise check matching of individual matchers again (4.3.5.1 and 4.3.5.2) and check cabling.

NOTE: Matching >16 dB. In 100 W system use 10 W probe if necessary.

e) Reset CSB power to 10 W: Set parameter 'Carrier Power' in window 'TX1 — Adjustments'.

f) Switch TX1 off.

g) Remove Thruline power meter from CSB supply cable.

4.3.6 Decoupling Dipole A — B

a) Repeat 4.3.3.1a) to d).

b) Connect CSB OUT of cabinet via cable directly with dipole B.

NOTE: Verify that CSB power is 10 W.

c) Connect dipole A via 30 dB attenuator to input of monitor 1.

d) Switch TX1 on.

e) Reading must be less than 50 %. Otherwise dipole plates of antenna have to be adjusted (nominal 90˚).

NOTE: Measure with provisionally closed radome. Nominal decoupling >45 dB.

f) Switch TX1 off.

g) Close antenna radome properly again.

4.4 RF—PHASING OF OMNIDIRECTIONAL RADIATOR LR — UR

4.4.1 Test Setup

a) Connect all RF cables between cabinet outputs, matching device and antenna normally.

b) Rotate the antenna so that field—strength maximum of dipole A points to the measuring dipole in the field.

NOTE: Verify that the measuring dipole is still connected to monitor 1.

4.4.2 RF Phasing of UR — Dipole A

4.4.2.1 TX1

a) Terminate LR output of coupler in matching device with 50 ohm/10 W and input of LR matcher with 50 ohm/1 W.

NOTE: UR is radiating.

b) Switch TX1 on.

c) Set CSB power to 10 W: Open window 'TX1 — Adjustments', set parameter 'Carrier Power'.

d) Set 'SBA Level' to 10 %.

e) Set 'SBB Level' to 0.

f) Open dialog 'Monitor1—Measurement Main (Measurements/Limits)', open dialog 'Monitor1 — Calibration'. Set parameter 'AGC Adjust (Calibration AGC Adjustment)' to 'RF—Level' indication of 100 %.

g) If the RF phasing of UR — Dipole A has to be done a second time, continue with i) to j) and then with 4.4.3.

h) Set SBA phase so that 30 Hz modulation depth becomes a minimum: Open window 'Monitor1 — Measurement Main (Measurements/Limits)', read parameter '30 Hz AM Depth'; open window 'TX1 — Adjustments', set parameter 'SBA Phase'. Change SBA Phase by 90° and note down 'Azimuth' reading in window 'Monitor1 — Measurement Main (Measurements/Limits)'.
Set SBA phase back to quadrature as before. The next point is j).

i) Set 30 Hz modulation depth again to minimum by means of phasing pieces at the input of UR.

j) Switch TX1 off.

4.4.3 RF Phasing of LR — Dipole A

a) Connect LR path inside matching device normally, but with additional inserted 55°—cable.

NOTE: The phasing is performed in a finite distance (e.g. 50 to 60 m) and a fixed height of 2 m using the standard shelter dimensions of 5 m CP diameter and 2.5 m height. In a distance of 50 m a differential phase of —40° has been measured bettween UR and LR. To get an equiphase condition at this nearfield point the temporary cable of 55° (40°+15°) has to be inserted into the LR feed line of the complete network.

b) Terminate UR output of coupler in matching device with 50 ohm/10 W and input of UR matcher with 50 ohm/1 W.

NOTE: LR is radiating.

c) Switch TX1 on.

d) Open window 'Monitor1 — Measurement Main(s/Limits)', open dialog 'Monitor1 — Calibration'. Set parameter 'AGC Adjust (Calibration AGC Adjustment)' to 'RF—Level' indication of 100 %.

e) Set 30 Hz modulation depth again to minimum by means of phasing pieces at the input of LR matcher. If this is possible, continue with point g).
If phasing pieces have to be inserted into the SBA dipole, continue with point f).

f) Set SBA phase so that 30 Hz modulation depth becomes a minimum: Open window 'Monitor1 – Measurement Main (Measurements/Limits)', read parameter '30 Hz AM Depth'; open window 'TX1 – Adjustments', set parameter 'SBA Phase'.

g) Change SBA phase by 90° and check that 'Azimuth' reading in window 'Monitor1 – Measurement Main (Measurements/Limits)' is the same (±1°) as in 4.4.2.1h).
If approx. 180° different continue with j).

h) Switch TX1 off. Remove 55°–cable, but leave added phasing pieces at the input of LR matcher.
If SBA phase had to be changed in point f), start again with 4.4.2.

i) Reconnect UR path inside matching device normally again, but including possibly added phasing pieces. Continue with 4.5.

NOTE: The following steps should normally not be necessary. They are performed, if there is a 180° difference in step g). This ensures a correct rotation sense of the antenna.

j) Swap feeder cable from power divider J3 to matcher of LR with cable (+105°) from power divider J2 to matcher of UR, but leave 55°–cable in LR path.

k) Shorten cable (105°) in order to achieve minimum 30 Hz modulation (approx. 200 mm).

l) Remove 55°–cable.

4.5 CHECK OF MONITORS (OPTIONAL)

REMARK: Normally it is not necessary to perform this check for the first alignment procedure. The built−in test generator on the CSL can be used for validation of monitors if there is a problem or an assumption of a fault. Before performing the check verify position of jumper X17: open = D/CVOR.

4.5.1 Preparations

a) Switch TX1 on.

b) Set test generator with BCD switch S6 (front of CSL) to position 0.

c) Open window 'Monitor1 − Measurement TSG'. Reading 'TSG Level (Signal Level)': 100 % ±1%.

4.5.2 Monitor 1

4.5.2.1 30 Hz AM Modulation Depth

a) Reading 'TSG 30 Hz AM Depth (30 Hz AM Depth)': 30 % ±1 %.

b) Set test generator to position 8: 'TSG 30 Hz AM Depth (30 Hz AM Depth)' has to be 0 %.

c) Set test generator to position 0.

4.5.2.2 9960 Hz Modulation Depth

a) Reading 'TSG 9960Hz AM Depth (9960 Hz AM Depth)': 30 % ±1%.

b) Set test generator to pos. 9: 'TSG 9960 Hz AM Depth (9960 Hz AM Depth)' has to be 0 %.

c) Set test generator to position 0.

4.5.2.3 30 Hz FM Modulation Index

a) Reading 'TSG FM Index (FM Index)': 16 ±0.5.

b) Set test generator to position A: 'TSG FM Index (FM Index)' has to be 15.
Set test generator to position B: 'TSG FM Index (FM Index)' has to be 17.
Set test generator to position C: 'TSG FM Index (FM Index)' has to be 25.

c) Set test generator to position 0.

4.5.2.4 Azimuth

a) Reading 'TSG Azimuth (Azimuth)': indication of 0° ±0.5°.

b) Set test generator to position 0: 'TSG Azimuth (Azimuth)' has to be 0°.
Set test generator to position 1: 'TSG Azimuth (Azimuth)' has to be 45°.
Set test generator to position 2: 'TSG Azimuth (Azimuth)' has to be 90°.
Set test generator to position 3: 'TSG Azimuth (Azimuth)' has to be 135°.
Set test generator to position 4: 'TSG Azimuth (Azimuth)' has to be 180°.
Set test generator to position 5: 'TSG Azimuth (Azimuth)' has to be 225°.
Set test generator to position 6: 'TSG Azimuth (Azimuth)' has to be 270°.
Set test generator to position 7: 'TSG Azimuth (Azimuth)' has to be 315°.

c) Set test generator to position 0.

4.5.3 Monitor 2

Repeat 4.5.2 for Monitor 2; after that, switch both TX off.

4.6 SETTING OF TRANSMITTERS AND MONITORS

REMARK: For the following 4.6.1 and 4.6.2, the measuring dipole must still be connected to Monitor1. The CVOR antenna must be rotatable. See Section 4.4.1.

4.6.1 Adjustment of Carrier Power TX1/TX2

a) Connect the Thruline power meter to the CSB output.

b) Switch TX1 on.

c) Set the CSB power to nominal value: Open window 'TX1 — Adjustments', set parameter 'Carrier Power'.

d) Measure the power.

NOTE: If there is a difference between the nominal power and the measured power (more than 10 % below nominal value), adjust the power with R1 of the corresponding Control Coupler (CCP—V), see Fig. 4—12 (BP—T, X16). Priority of the setting should be to achieve identical values of both transmitters.

e) Switch TX2 on.

f) Set TX2 on aerial.

g) Set the CSB power to nominal value: Open window 'TX2 — Adjustments', set parameter 'Carrier Power'.

h) Repeat adjustment d) for TX2. Adjustment at the corresponding Control Coupler with R1.

i) Set TX1 on aerial.

j) Switch both TX off.

4.6.2 RF—Phasing (SBA/SBB to CSB), 30 Hz AM and Sense of Rotation of TX1

4.6.2.1 Preparations

a) Switch TX1 on.

b) Open window 'Monitor1 — Measurement Main (Measurements/Limits)', open dialog 'Monitor1 — Calibration'. Set parameter 'AGC Adjust (Calibration AGC Adjustment)' to 'RF—Level' indication of 100 %.

c) Open window 'TX1 — Adjustments', set parameter 'SBA Level' to 0 and disconnect the feeder cable from dipole A.

d) Set 'SBB Level' to 50 %.

e) Rotate the antenna for maximum '30 Hz AM Depth' reading. The reading must be > 20 %. If not, change RF phase: Change parameter 'SBB Phase' in window 'TX1 — Adjustments'.

NOTE: Range of values: 0...359

f) Rotate the antenna for minimum reading.

NOTE: Range of value: < 1 %

g) Set 'SBB Level' to 0 and disconnect the feeder cable from dipole B.

4.6.2.2 RF Phasing (SBA to CSB) and 30 Hz Modulation Depth Setting

a) Connect the feeder cable to dipole A and set SBA to 50 %.

b) Set SBA phase in order to get a 30 Hz mod. depth minimum: Open window 'Monitor1 — Measurement Main (Measurements/Limits)', read parameter '30 Hz AM Depth'. Open window 'TX1 — Adjustments', set parameter 'SBA Phase'.

NOTE: Range of values: 0...359.

c) Add or subtract 90 to the value found in b) and enter new value.

NOTE: Note value.

d) Set parameter 'SBA Level' in window 'TX1 — Adjustments' so, that 30 Hz modulation depth becomes 30.0 %.

NOTE: Range of values: 0...99.9. Note value .

e) Rotate antenna for 30 Hz modulation depth minimum.

NOTE: Range of values: $\leq$ 1 %

f) Set parameter 'SBA Level' to 00.0 % and disconnect feeder cable at dipole A.

4.6.2.3 RF Phasing (SBB to CSB) and 30 Hz Modulation Depth Setting

a) Reconnect feeder cable to dipole B and set SBB power to 50 %: Open window 'TX1 — Adjustments', set parameter 'SBB Level'.

b) Set SBB phase in order to get a 30 Hz modulation depth minimum: Open window 'Monitor1 — Measurement Main (Measurements/Limits)', read parameter '30 Hz AM Depth'. Set parameter 'SBB Phase' in window 'TX1 — Adjustments'.

NOTE: Range of values: 0...359.

c) Add or subtract 90 to the value found in b) and enter new value.

NOTE: Note value.

d) Set parameter 'SBB Level' in window 'TX1 — Adjustments' so, that '30 Hz AM Depth' in window 'Monitor1 — Measurement Main (Measurements/Limits)' becomes 30.0 %.

NOTE: Range of values: 0...99.9. Note value.

e) Reconnect feeder cable to dipole A and set 'SBA Level' in window 'TX1 — Adjustments' to the noted value again.

4.6.2.4 Check of Sense of Rotation

a) Open window 'Monitor1 — Measurement Main (Measurements/Limits)', open window 'TX1 — Adjustments'. Set parameter '9960Hz AM Depth' to an indication of 30 % for '9960Hz AM Depth'.

b) Set parameter 'Modulation Index (FM Index)' in window 'TX1 — Adjustments' to a 'FM Index' indication of 16.

c) Rotate the antenna a few degrees counterclockwise (as seen from above) and check that parameter 'Azimuth' in window 'Monitor1 — Measurement Main (Measurements/Limits)' increases. If 'Azimuth' decreases, add or subtract 180° to/from the parameter 'SBA Phase' in 'TX1 — Adjustments'.

NOTE: Note down new value.

4.6.3 RF Phasing (SBA/SBB to CSB), 30 Hz AM and Sense of Rotation of TX2

Perform for TX2 as described for TX1 in section 4.6.2. Then remove measuring dipole.

NOTE: Switch TX1 off and switch TX2 on.

4.6.4 Setting of TX1 and Monitor 1

4.6.4.1 Preparation

a) Rotate antenna so, that each dipole (A and B) has an angle of 45° to the monitor dipole, then secure antenna by screws again, see Fig. 4—11.

b) Connect monitor field dipole(s) normally to the cabinet inputs MONITOR 1 and MONITOR 2.

c) Switch TX1 on.

4.6.4.2 RF Level Monitor 1

a) Open window 'Monitor1 — Measurement Main (Measurements/Limits)'. Open dialog 'Monitor1 — Calibration'. Set parameter 'AGC Adjust (Calibration AGC Adjustment)' to 'RF—Level' indication of 100 %.

4.6.4.3 30 Hz Modulation Depth Monitor 1

a) Open window 'Monitor1 — Measurement Main (Measurements/Limits)'. Open window 'TX1 — Adjustments'. Set 'SB Level Multiplier' so, that '30 Hz AM Depth' indication becomes 30.0 %.

NOTE: 80...120 Factor= 30 % x 100 %/reading above.

4.6.4.4 Subcarrier TX1 (9960Hz AM Depth, FM Index)

a) Set '9960Hz AM Depth' in window 'TX1 — Adjustments' so, that '9960Hz AM Depth' indication in window 'Monitor1 — Measurement Main (Measurements/Limits)' becomes 30 %.

NOTE: Range of values: 0...39.8.

b) Set 'Modulation Index (FM Index)' in window 'TX1 — Adjustments' so, that 'FM Index' indication in dialog 'Monitor1—Measurement Main (Measurements/Limits)' becomes 16.

NOTE: Range of values: 0...25.0.

4.6.4.5 Azimuth TX1

a) Set 'Azimuth Alignment' in window 'TX1 — Adjustments', to obtain an 'Azimuth' reading in window 'Monitor1 — Measurement Main (Measurements/Limits)' equal to monitor dipole location (e.g. 0.00 for North).

NOTE: Range of values: 0...359.9.

4.6.4.6 Identity and Voice

a) Set '1020Hz AM Depth' in window 'TX1 — Adjustments' to e.g. 10 %.

NOTE: Range of values: 0...20.0.

b) If applicable, set 'Voice AM Depth (Voice Modulation Depth)' to e.g. 20 %.

NOTE: Range of values: 0...40.0.

c) Switch TX1 off.

4.6.5 Setting of TX2 with Monitor 1

4.6.5.1 Control of TX2 with Monitor 1

a) Switch TX2 on.
b) Set TX2 on aerial.
c) Open window 'Monitor1 — Measurement Main (Measurements/Limits)'.
d) Check 'RF—Level'.

NOTE: Nominal value: 100.0 % (± 5.0%).

e) Check '30 Hz AM Depth'.

NOTE: Nominal value: 30.0 % (± 1.0 %).

4.6.5.2 Subcarrier, Azimuth, Identity and Voice

Set subcarrier, azimuth, identity and voice of TX2 in the same way as described for TX1 in 4.6.4.4 to 4.6.4.6. Continue use of monitor 1.

4.6.6 Setting and Check of Monitor 2

4.6.6.1 Monitor 2 with TX1 on Aerial

NOTE: TX2 is radiating.

Switch TX1 on. Set TX1 on aerial.

a) **RF level**
Open window 'Monitor2 – Measurement Main (Measurements/Limits)'. Open dialog 'Monitor2 – Calibration'. Set parameter 'AGC Adjust (Calibration AGC Adjustment)' to 'RF–Level' indication of 100 %.

b) **30 Hz AM Depth**
Set parameter 'Cal 30Hz AM Depth (Calibration 30 Hz AM Depth)' in 'Monitor2 – Calibration' so, that '30 Hz AM Depth' indication in 'Monitor2 – Measurement Main (Measurements/Limits)' becomes 30 %.
NOTE: Range of values: 50...200.0.

c) **Subcarrier, 9960Hz AM Depth**
Check '9960Hz AM Depth' in 'Monitor2 – Measurement Main (Measurements/Limits)'. If indication is out of tolerance, use calibration factor 'Cal 9960Hz AM Depth (Calibration 9960Hz AM Depth)' in dialog 'Monitor2 – Calibration'.
NOTE: Nominal value 30.0 % (±1.0 %).

d) **Subcarrier, FM Index**
Check 'FM Index' in 'Monitor2 – Measurement Main (Measurements/Limits)'. If indication is out of tolerance, use calibration factor 'Cal FM Index (Calibration FM Index)' in 'Monitor2 – Calibration'.
NOTE: Nominal value 16.0 (±0.5)

e) **Azimuth**
Check 'Azimuth' in 'Monitor2 – Measurement Main (Measurements/Limits)'. If indication is out of tolerance, use 'Cal Azimuth Monitor (Calibration Azimuth)' in dialog 'Monitor2 – Calibration'.
NOTE: Nominal value: same as in 4.6.4.5 (±0.2)

f) **Identity**
Check '1020 AM Depth' in 'Monitor2 – Measurement Main (Measurements/Limits)'. If indication is out of tolerance, use 'Cal 1020 Hz AM Depth' in dialog 'Monitor2 – Calibration'.
NOTE: Nominal value: same as in 4.6.4.6 a).

g) Switch TX1 off.

4.6.6.2 Monitor 2 with TX2 on Aerial

a) Switch TX2 on.

b) Set TX2 on aerial.

c) Open window 'Monitor2 – Measurement Main (Measurements/Limits)'. Check following Monitor2 indications:
ca) 'RF–Level (RF Level)'
cb) '30 Hz AM Depth'
cc), '9960Hz AM Depth'
cd) 'FM Index'
ce) 'Azimuth'

NOTE: Nominal values:

ca)	*100.0 % (±5.0 %)*	*cd)*	*16.0 (±0.5)*
cb)	*30.0 % (±1.0 %)*	*ce)*	*same as in 4.6.4.5 (±0.2)*
cc)	*30.0 % (±1.0 %)*		

d) Switch TX2 off.

4.7 GROUND CHECK

4.7.1 Preparation of Monitor 2

a) Switch TX1 on.

b) Open dialog 'Monitor2—Calibration'. Read and note down AGC value of parameter 'AGC Adjust (Calibration AGC Adjustment)' and setting of 'Digital Attenuation'.

NOTE: Important for 4.7.4b)

c) Read and note down Azimuth Offset value, parameter 'Cal Azimuth Monitor (Calibration Azimuth)'.

NOTE: Important for 4.7.4c)

4.7.2 Error Curve TX1

NOTE: TX1 is radiating. Use the same Monitor (e.g. 2) for Ground Check procedure with TX1 and TX2.

a) Hang portable monitor dipole in 0°—position at the counterpoise edge. The position is marked on the lower side of the counterpoise. Connect the cable of portable dipole to input of monitor 2.

NOTE: Terminate disconnected cable at monitor 2 input with 50 ohm.

b) Calibrate parameters 'RF—Level' and 'Azimuth' for the portable monitor dipole: Open window 'Monitor2 — Measurement Main (Measurements/Limits)'. Open dialog 'Monitor2 — Calibration'. Set parameter 'AGC Adjust (Calibration AGC Adjustment)' to 'RF—Level' indication of 100 %.

Set value of 'Cal Azimuth Monitor (Calibration Azimuth)' in dialog 'Monitor2 — Calibration' so, that the indication of 'Azimuth' is 0.0° in 'Monitor2 — Measurement Main (Measurements/Limits)'.

NOTE: Calibration Range: 355.1...4.9. Azimuth 0.0° is only valid, if 0° conforms to shelters north direction.

c) Record Azimuth reading on a test sheet as 1st value (see example below).

d) Hang portable monitor dipole in 20°—position (or 22.5°—position) at the counterpoise edge. The position is marked on the lower side of the counterpoise. Record Azimuth reading as 2nd value.

e) Continue this way until all 18 (or 16) measuring values have been recorded. The measured values have to increment in steps of 20°. Differences to these nominal values have to be considered as an error. The error spread should be < ±2°.

The following table is an example of a test sheet for error curve measuring results (in 20° steps):

M. Dip. Pos. [°]	360/0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340
reading TX1 [°]																		
reading TX2 [°]																		

Depending on counterpoise position marks, the error curve measurement may be also in 22.5°steps:

M. Dip. Pos. [°]	360/0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5
reading TX1 [°]																
reading TX1 [°]																

4.7.3 Error Curve TX2

NOTE: TX2 is radiating. Use the same Monitor (e.g. 2) for Ground Check procedure with TX1 and TX2.

Perform the error curve check for TX2 in the same way as described for TX1 in 4.7.1.

4.7.4 Reset of Monitor 2

a) Connect monitor 2 input to fixed field monitor dipole normally again.

b) Key in AGC value (parameter 'AGC Adjust') as noted in 4.7.1b) again.

NOTE: Verify that RF level reading is 100 % again. Check setting of 'Digital attenuation'.

c) Key in Azimuth Offset (parameter 'Cal Azimuth Monitor') as noted in 4.7.1c) again.

4.8 SETTING OF MONITOR ALARM LIMITS

4.8.1 Monitor 1

Open window 'Monitor1 — Measurements Main (Measurements/Limits)', and open additionally in ADRACS dialog 'Monitor1 — Alarm Limits'.

4.8.1.1 Azimuth

a) Select 'Azimuth' reading in 'Monitor1 — Measurement Main (Measurements/Limits)', equal to azimuth value of main monitor dipole 1.

b) **Upper limit:** Add 1.0° to 'Azimuth' reading and key in this value in 'Azimuth Alarm Limits' as 'UL' for 'Dipole 1'.

c) **Lower limit:** Subtract 1.0° from 'Azimuth' reading and key in this value in 'Azimuth Alarm Limits' as 'LL' for 'Dipole 1'.

NOTE: Range of values: 0...359.9; if during flight check azimuth of transmitters has to be changed, these azimuth alarm limits have to be readjusted.

4.8.1.2 RF—Level

a) Upper limit of 'RF Level', e.g. 129 %

b) Lower limit of 'RF Level', e.g. 71 %

NOTE: Range of values: Upper Limit 100...150, Lower Limit 50...100

4.8.1.3 Distortion 9960 Hz

a) Upper limit of '9960Hz Distortion', e.g. 5.0 %

b) Lower limit of '9960Hz Distortion', e.g. 0.0 %

4.8.1.4 30 Hz AM Signal

a) Upper limit of '30Hz AM', e.g. 34.5 %

b) Lower limit of '30Hz AM', e.g. 25.5 %

NOTE: Range of values: 0...39.9

4.8.1.5 9960 Hz Signal

a) Upper limit of '9960Hz AM', e.g. 34.5 %

b) Lower limit of '9960Hz AM', e.g. 25.5 %

NOTE: Range of values: 0...39.9

4.8.1.6 30 Hz FM Signal

a) Upper limit of 'FM Index', e.g. 17

b) Lower limit of 'FM Index', e.g. 15

NOTE: Range of values: 0...39.9

4.8.1.7 Identity AM Signal

a) Upper limit of '1020 Hz AM', e.g. 12 %

b) Lower limit of '1020 Hz AM', e.g. 8.0 %

4.8.1.8 Distortion 30 Hz FM

a) Upper Limit of '30 Hz FM Distortion ', e.g. 3.0 %

4.8.1.9 Carrier Frequency Difference

a) Upper limit of 'Frequency Delta', e.g. 2400 Hz

b) Lower limit of 'Frequency Delta', e.g. 2400 Hz

4.8.1.10 Alarm Delay

a) Set parameter 'Alarm Delay (Time)' to e.g. 20 s

NOTE: Range of values: 2...255

4.8.2 Monitor 2

Set alarm limits for Monitor 2 in the same way as described for Monitor 1 in Section 4.8.1.

4.9 BATTERY MONITORING

NOTE: The floating battery must be installed and connected. In dialog 'LRCI – Environmental Setup', the parameter 'Battery' (under 'Monitoring') must be enabled. Thus, inputs in 'Installed Battery Capacity (Installed Battery Rated Capacity)' are possible.

a) Enter installed battery capacity. Open dialog 'LRCI – Environmental Setup', set parameter 'Installed Battery Capacity (Installed Battery Rated Capacity)'.

b) When the battery is fully charged, open main menu 'Commands', select command 'More Commands...' . Next the dialog window 'Commands' appears. Then select command 'LRCI Commands' in menu 'LRCI'.

c) Select command 'Set actual battery capacity' and click button 'program LRCI'. Data window 'Battery Capacity' appears. In the entry field 'Actual battery capacity', the value of step (a) will appear after a few seconds.

d) Click button 'Program' and button 'Close' to shut down this data window. Click button 'Close' to shut down dialog window 'Commands'.

NOTE: Divide 'Installed Capacity' by 500 Ah. The battery is fully charged, when 'battery current' indicates this value.

e) Check alarm limits (UL and LL) for battery half voltage, battery full voltage and battery current.

4.10 NORMAL OPERATION

4.10.1 Prerequisites

a) Equipment has been aligned according to 4.2 to 4.8.

b) Mains and DC supply are switched on and PC login procedure has been executed.

c) Carry out 4.10.2 for TX1 as Main or alternatively 4.10.3 for TX2 as Main.

4.10.2 TX1 Main

a) Switch TX1 on. Set TX1 on aerial.

b) Check that no Monitor Alarm or BITE Warning is on, otherwise click on the 'Bite Warning' ('BIT Warning') field of subsystem 'Transmitter 1' ('TX—1') to get the list of BITE warnings and alarms.

NOTE: Allow system approx. 30 s for initialization.

c) Set all Monitor Bypass off.

d) Simulate monitor 1 and 2 alarm by e.g. disconnecting monitor inputs and check that after selected alarm delay TX1 is switched off and TX2 is switched on. Remove monitor alarm conditions immediately after change over.

e) Check that no Monitor Alarm or BITE Warning is on. Otherwise click on the 'Bite Warning' ('BIT Warning') of subsystem 'Transmitter 2' ('TX—2') to get the list of BITE warnings and alarms. Locate and eliminate fault.

f) Simulate monitor alarms again and check that after the selected alarm delay TX2 is switched off. Afterwards remove alarm conditions again.

NOTE: Both TX must be off now.

g) Switch TX1 on.

h) Set all Monitor Bypass off.

NOTE: Check that NORMAL indication is on.

4.10.3 TX2 Main

Carry out 4.10.2 for TX2.

4.11 FLIGHT—CHECK

The following describes a standard flight—check—procedure. However range and sequence of this procedure may vary depending on the individual flight check crew.

4.11.1 Prerequisites

a) System has been out of operation:

   aa) Switch on all AC/DC—Converter
   ab) Switch on fuse switches of batteries
   ac) Switch on switches TX1, TX2 and NAV on PMM
   ad) Switch both TX on.

b) System has been in NORMAL operation: Set all *MONITOR BYPASS* on.

4.11.2 Correction of TX1 and Monitor 1

NOTE: TX1 must be on "AERIAL", and both "MONITOR BYPASS" must be "ON". PC is connected.

4.11.2.1 30 Hz AM Modulation Depth

a) Check 30 Hz mod. depth indication: Open window 'Monitor1 — Measurement Main (Measurements/Limits)', check parameter '30 Hz AM Depth'.

b) Change desired 30 Hz modulation depth with SBA/SBB—multiplier: Open window 'TX1 — Adjustments', set parameter 'SB Level Multiplier'.

   NOTE: 80.0...120.0 = 30 % x 100 %/announcement of Flight Check Engineer.

c) Recalibrate 30 Hz AM modulation depth for 30 %: Open dialog 'Monitor1 — Calibration', set parameter 'Cal 30 Hz AM Depth (Calibration 30 Hz AM Depth)'.

   NOTE: Range of values: 50.0...200.0.

4.11.2.2 9960 Hz Modulation Depth

a) Check 9960 Hz modulation depth indication: Open window 'Monitor1 — Measurement Main (Measurements/Limits)', check parameter '9960Hz AM Depth'.

b) Change 9960 Hz modulation depth for desired value: Open window 'TX1 — Adjustments', set parameter '9960Hz AM Depth'.

   NOTE: Range of values: 0...39.8.

c) Recalibrate 9960 Hz modulation depth for 30 %: Open dialog 'Monitor1 — Calibration', set parameter 'Cal 9960Hz AM Depth (Calibration 9960Hz AM Depth)'.

   NOTE: Range of values: 50.0...200.0.

4.11.2.3 30 Hz FM Modulation Index

a) Check 30 Hz FM modulation index indication: Open window 'Monitor1 — Measurement Main (Measurements/Limits)', check parameter 'FM Index'.

b) Change 30 Hz FM modulation index for desired value: Open window 'TX1 — Adjustments', set parameter 'Modulation Index (FM Index)'.

   NOTE: Range of values: 0...25.0.

c) Recalibrate 30 Hz FM modulation index for 16.0: Open dialog 'Monitor1 — Calibration', set parameter 'Cal FM Index (Calibration FM Index)'.

   NOTE: Range of values: 50...200.

4.11.2.4 Azimuth

a) Check Azimuth indication: Open window 'Monitor1 — Measurement Main (Measurements/Limits)', check parameter 'Azimuth'.

b) Change azimuth for desired value according to announcement of Flight Check Engineer: Open window 'TX1—Adjustments', change parameter 'Azimuth Alignment'. Record 'Azimuth' indication in window 'Monitor1 — Measurement Main (Measurements/Limits)'.

NOTE: Range of values: 0...359.9. Note new value.

c) Add 1.0° to 'Azimuth' indication and key in this value as upper limit (UL); with ADRACS: open window 'Monitor1 — Alarm limits'.

d) Subtract 1.0° from 'Azimuth' indication and key in this value as lower limit (LL).

4.11.2.5 Identity Modulation Depth

a) Check Identity modulation depth indication: Open window 'Monitor1 — Measurement Main (Measurements/Limits)'. Check parameter '1020 AM Depth'.

b) Change Identity modulation depth for desired value according to announcement of Flight Check Engineer: Open window 'TX1 — Adjustments', change parameter '1020 AM Depth'.

NOTE: Range of values: 0...20.0.

c) Add 2 % to indication and key in this value as upper limit (UL); with ADRACS: open dialog 'Monitor1 — Alarm limits'.

d) Subtract 2 % from indication and key in this value as lower limit (LL); with ADRACS: open dialog 'Monitor1 — Alarm limits'.

4.11.2.6 Voice Modulation Depth

Change voice modulation depth for desired value according to announcement of Flight Check Engineer: Open window 'TX1 — Adjustments', change parameter 'Voice AM Depth (Voice Modulation Depth)'.

NOTE: Range of values: 0...39.8.

4.11.3 Correction of TX2 and Monitor 2

Correct TX2 in the same way as described for TX1 in 4.11.2, however set the 30 Hz AM and 9960 Hz mod. depth, 30 Hz FM mod. index, azimuth, identity and voice mod. depth of TX2 in order to get the same monitor indications as for TX1. Afterwards the settings of TX2 have to be confirmed by flight check.

NOTE: Switch TX1 off and then switch TX2 on. Verify that both MONITOR BYPASS are on.

4.11.4 Adjustment of Monitor 2 with TX1/2

Correct monitor 2 in the same way as described for monitor 1 in 4.11.2, but 4.11.2.1 to 4.11.2.4 without b). Omit 4.11.2.6.

4.11.5 Check of Monitor Alarm Limits

a) The monitor alarm limits can be checked either by means of TX1 or TX2. The following describes this check by means of TX1.

b) Change of alarm limits — if necessary — can be carried out as described in Section 4.8.

4.11.5.1 Azimuth Alarm

a) Check azimuth indication: Open window 'Monitor1 — Measurement Main (Measurements/Limits)' and window 'Monitor2 — Measurement Main (Measurements/Limits)'. Check parameter 'Azimuth'.

b) Open window 'TX1 — Adjustments', note value of parameter 'Azimuth Alignment'.

c) **Upper limit:**
Change noted azimuth value by approx. +1° until both monitors alarm.

d) **Lower limit:**
Change noted azimuth value by approx. −1° until both monitors alarm.

NOTE: Range of values: 0...359.9.

e) After check by Flight Check Engineer, key in noted azimuth value again, see b).

4.11.5.2 30 Hz AM Modulation Depth Alarm

a) Check 30 Hz AM modulation depth indication: Open window 'Monitor1 — Measurement Main (Measurements/Limits)' and window 'Monitor2 — Measurement Main (Measurements/Limits)'. Check parameter '30 Hz AM Depth'.

b) Open window 'TX1 — Adjustments', note value of parameter 'SB Level Multiplier'.

c) Reduce 30 Hz modulation depth with parameter 'SB Level Multiplier' by approx. 15 % until both monitors alarm.

NOTE: 80.0...120. = Alarm Limit x 100 % / Indication.

d) After check by Flight Check Engineer, key in noted down 'SB Level Multiplier' value again, see b).

4.11.5.3 9960 Hz Modulation Depth Alarm

a) Check 9960 Hz modulation depth indication: Open window 'Monitor1 — Measurement Main (Measurements/Limits)' and window 'Monitor2 — Measurement Main (Measurements/Limits)'. Check parameter '9960Hz AM Depth'.

b) Open window 'TX1 — Adjustments', note value of parameter '9960Hz AM Depth'.

c) Reduce noted value by approx. 15 % until both monitors alarm.

NOTE: Range of values: 0...39.8.

d) Upon completion of check, key in noted value of parameter '9960Hz AM Depth' again, see b).

4.11.6 Normal Operation

a) Set TX1 on aerial *or* Set TX2 on aerial

b) Switch (Standby) TX2 off *or* Switch (Standby) TX1 off.

c) Set all Monitor Bypass off.

d) Switch to REMOTE with key—lock switch on the Local Control Interface.

NOTE: *The data recorded during the flight test is the only data which is binding for operation of a navigation installation. A documentation is performed by the printer of the connected PC or in a file for the transmitter data and monitor data on the PC (.lda). The first data so—obtained of the basic adjustments of the alignment procedure at commissioning and flight check should be recorded and stored in a reference file or on a floppy disk.*

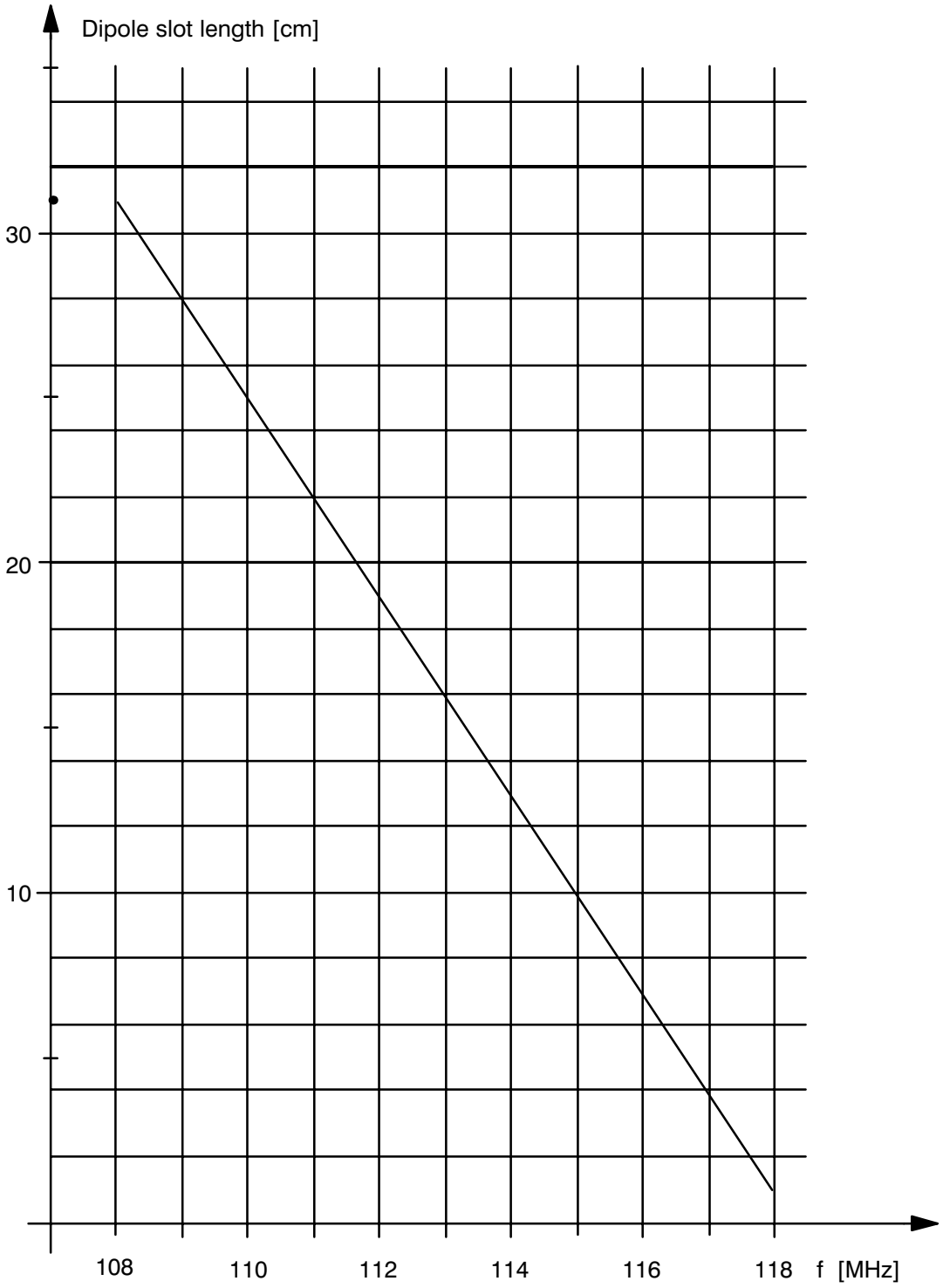
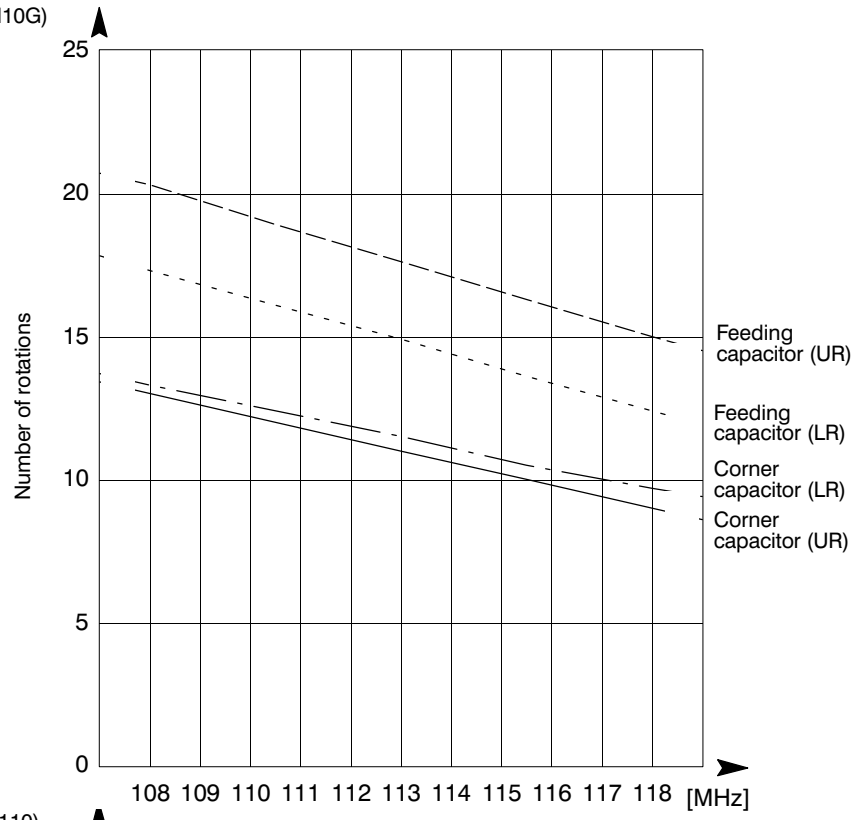
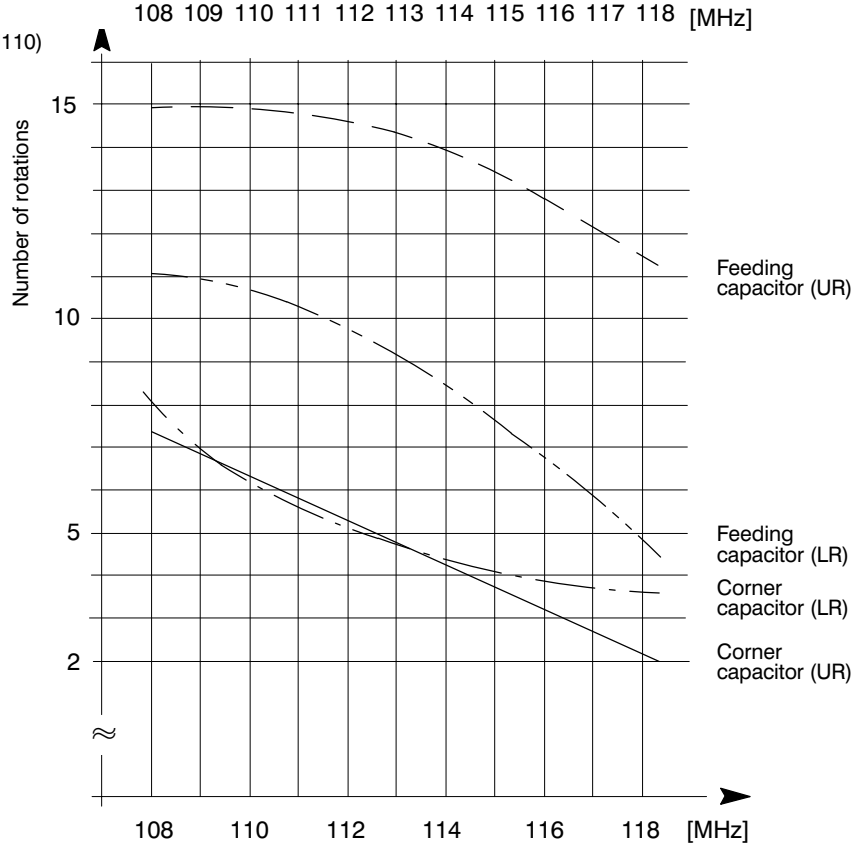


Fig. 4−3 Dipole slot length of CVOR antenna as a function of frequency

a) Trimmer (34−pitch, Voltronics QM10G)

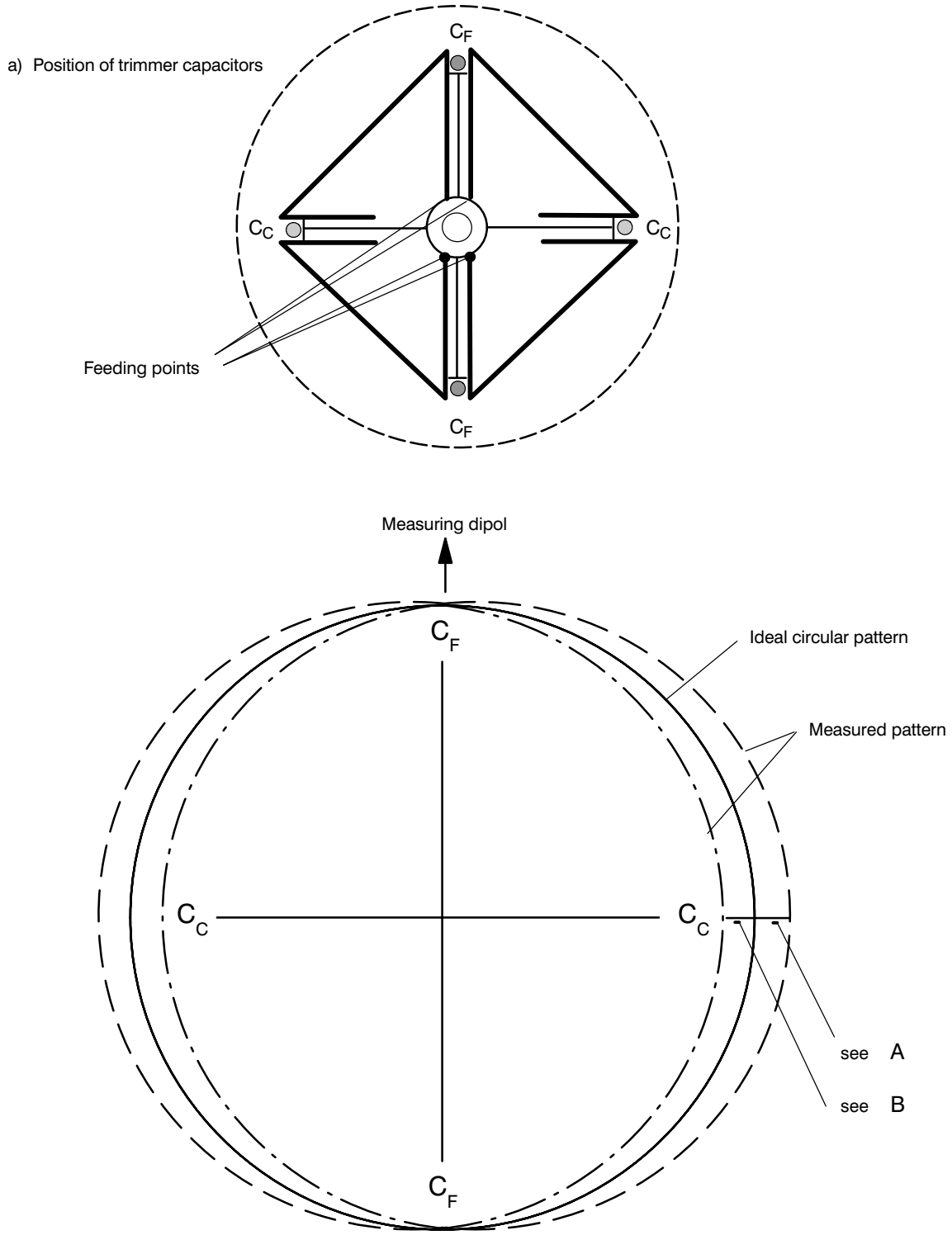


b) Trimmer (24−pitch, Stettner SQU110) not longer used



NOTE:
Piston fully turned out to stop= minimum capacitance

Fig. 4−4 Adjustment of the omnidirectional radiator capacitors as a function of the frequency



A per +1 % deviation: Turn C_C −1/2 turn (ccw) and turn C_F +1/2 turn (cw)*

B per −1 % deviation: Turn C_C +1/2 turn (cw) and turn C_F −1/2 turn (ccw)*

* Set C_F finally for min.reflection

Fig. 4−5 Alignment of circular pattern for LR and UR

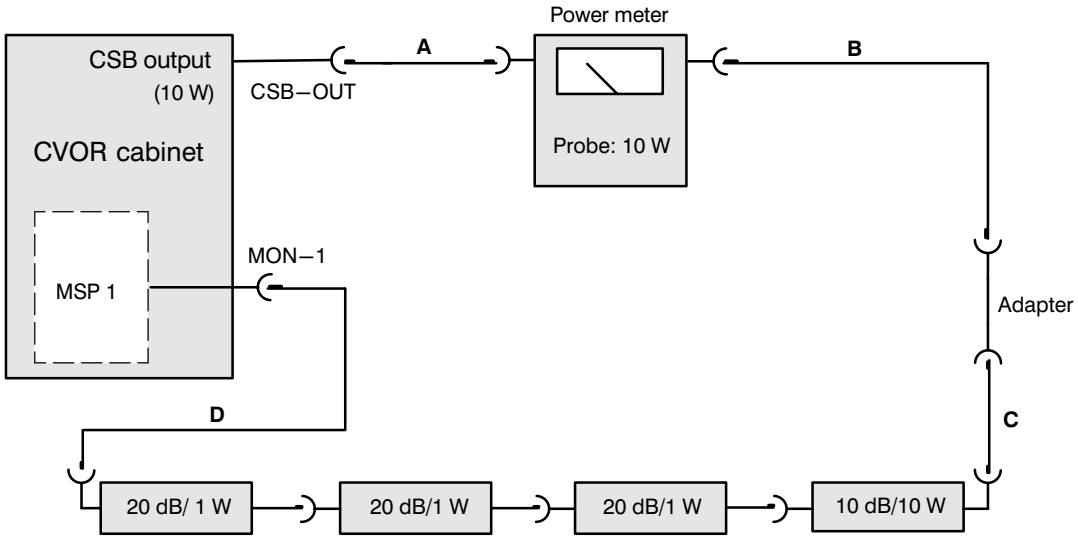
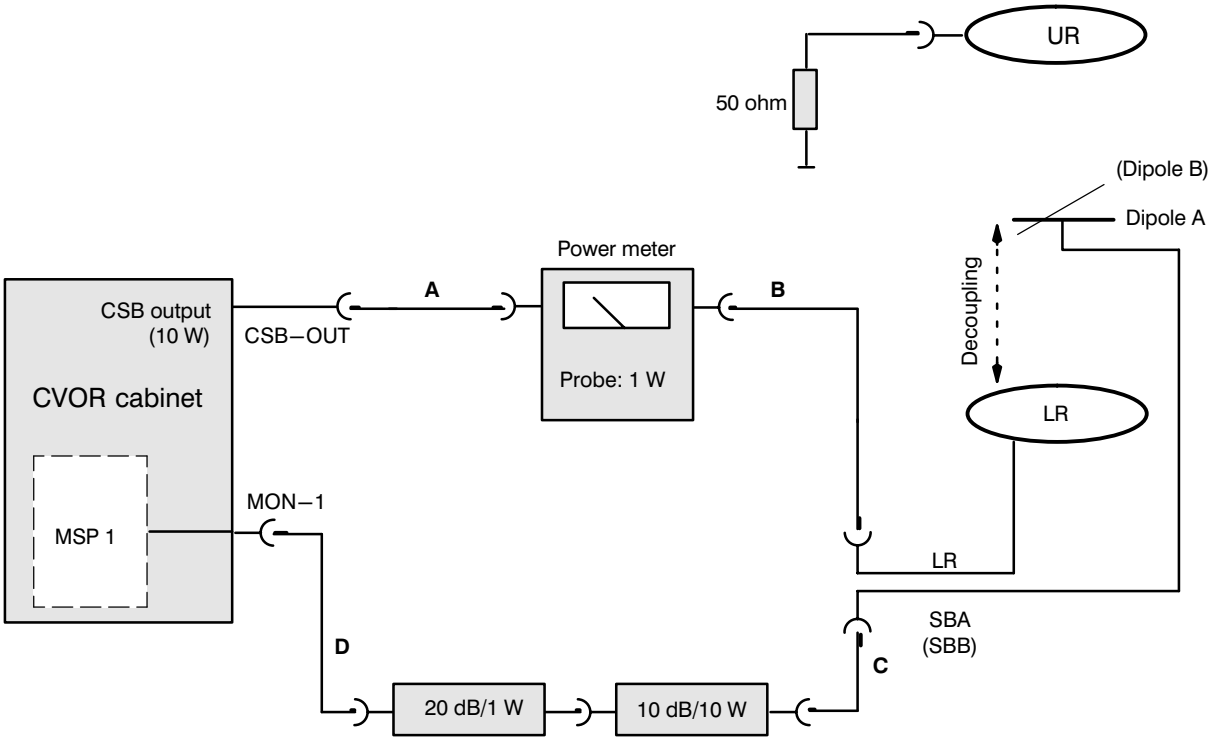


Fig. 4–6 Monitor calibration for measurement of isolation



NOTE: Test assembly for measurement of LR – – – dipole A (dipole B)
Test assembly for measurement of UR – – – dipole A (dipole B) corresponding

Fig. 4–7 Measurement of isolation

NOTE:
The measurement is based on standard counterpoise dimensions with 5 m diameter and 2.5 m height. The dimensions may differ (e.g. 5...6 m diameter and 2.5...3 m height) without significant changes in results.

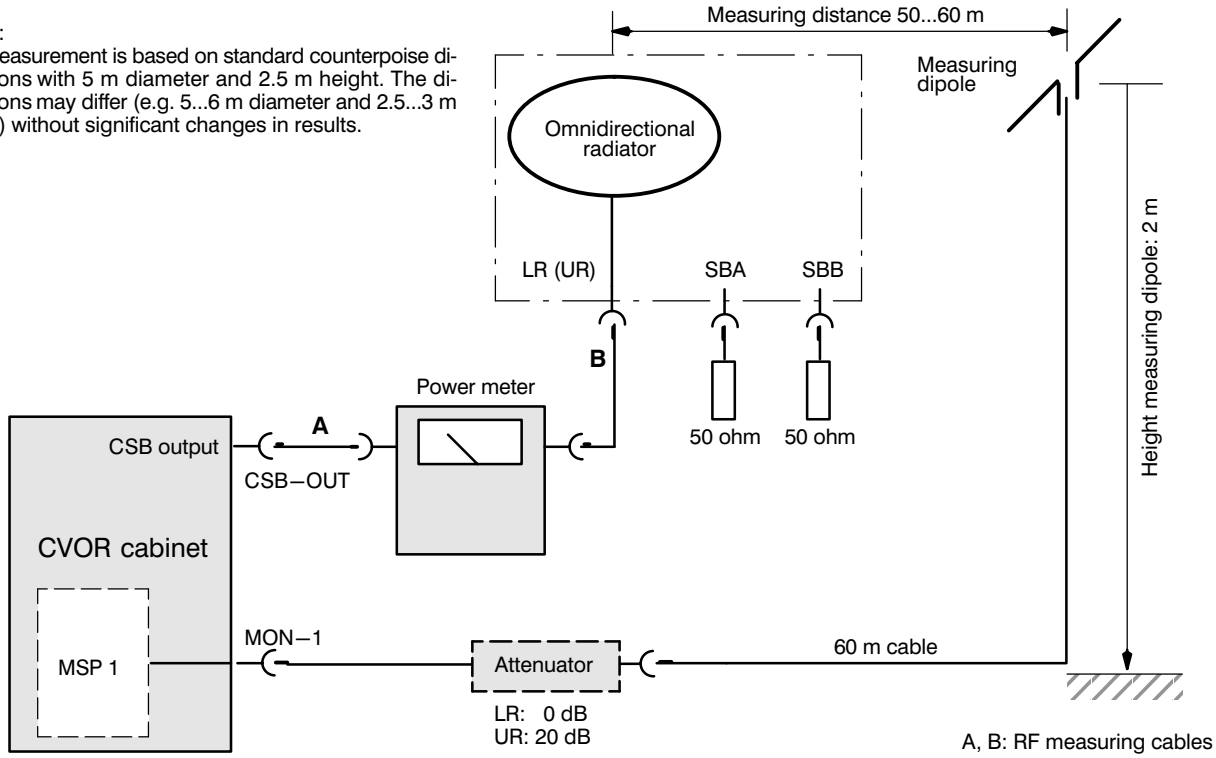


Fig. 4–8 Measurement of circular pattern of omnidirectional radiators

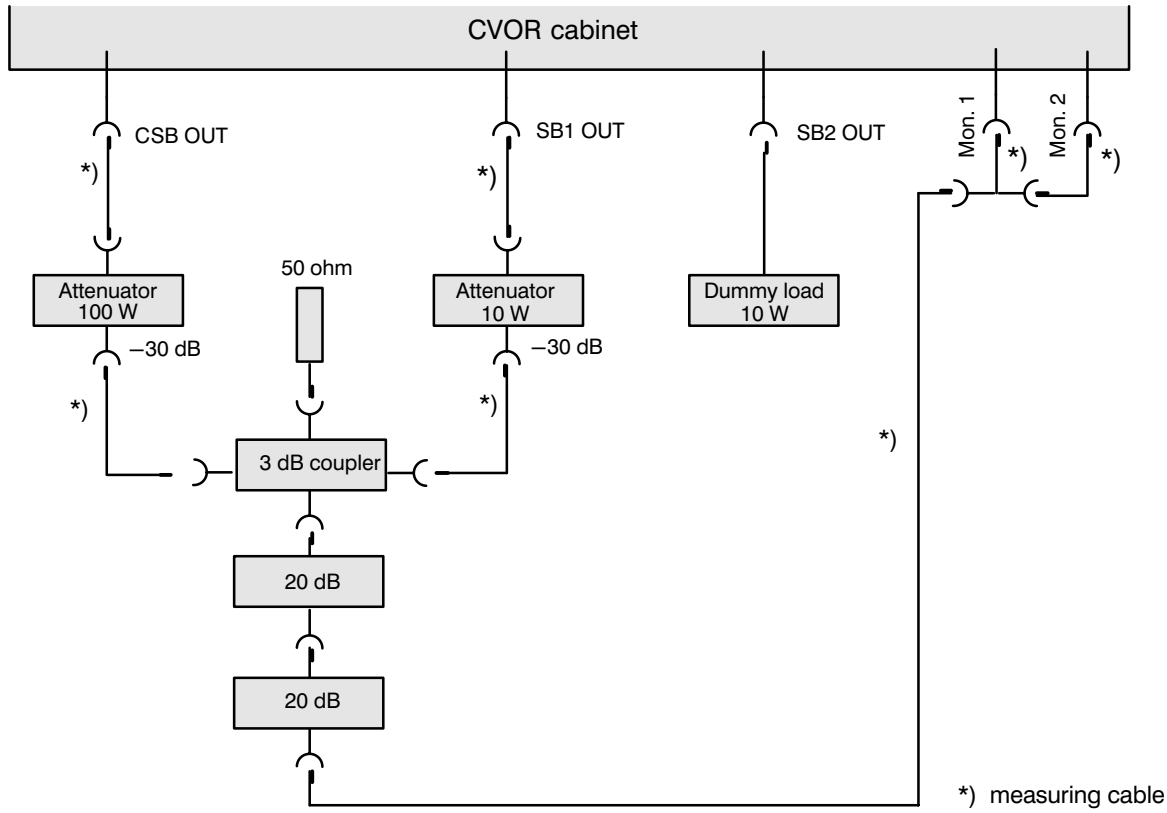
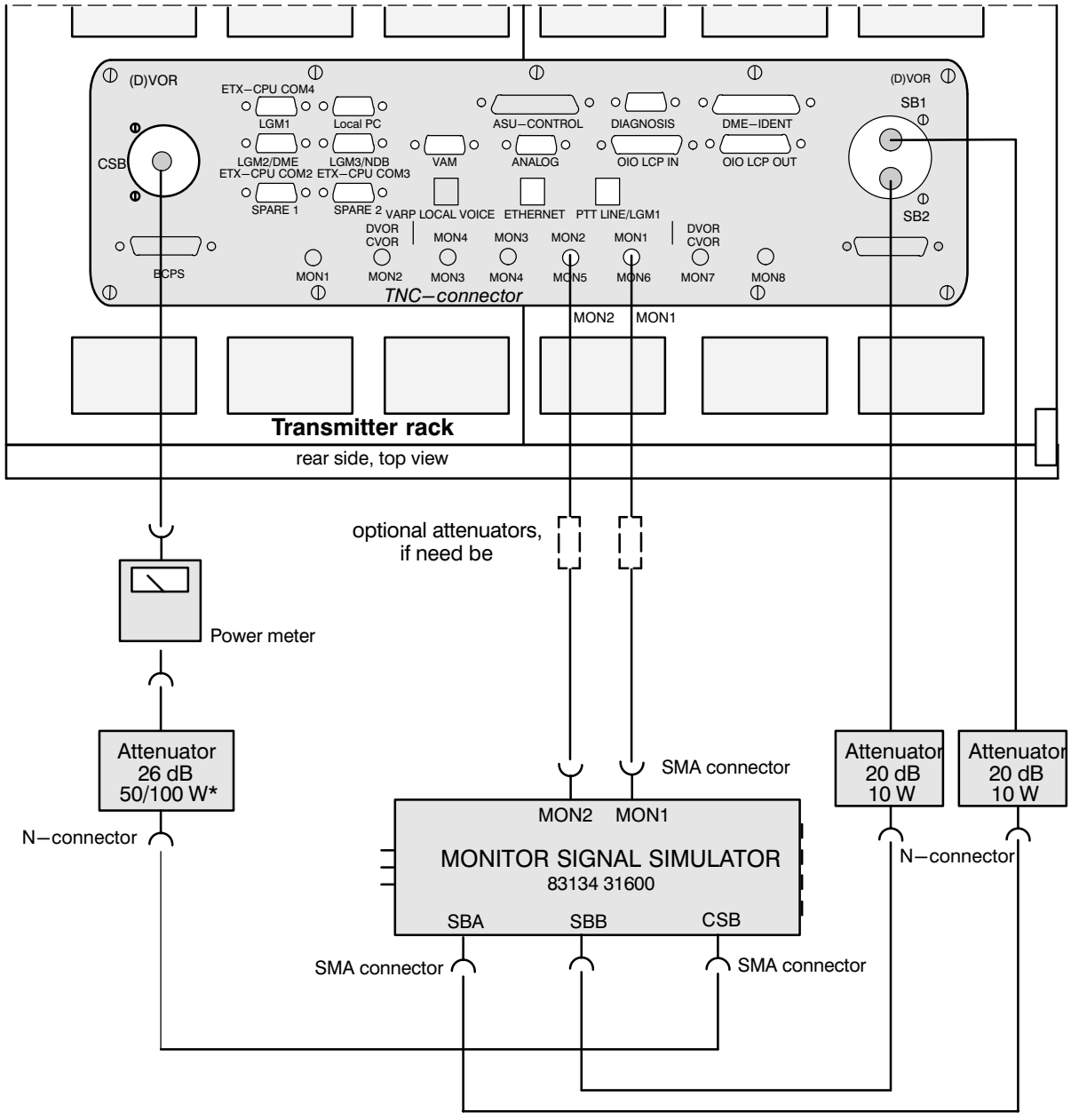


Fig. 4–9 Simulator test setup with individual components (1)



* depends on RF level

Fig. 4–10 Simulator test setup with Monitor Signal Simulator (2)

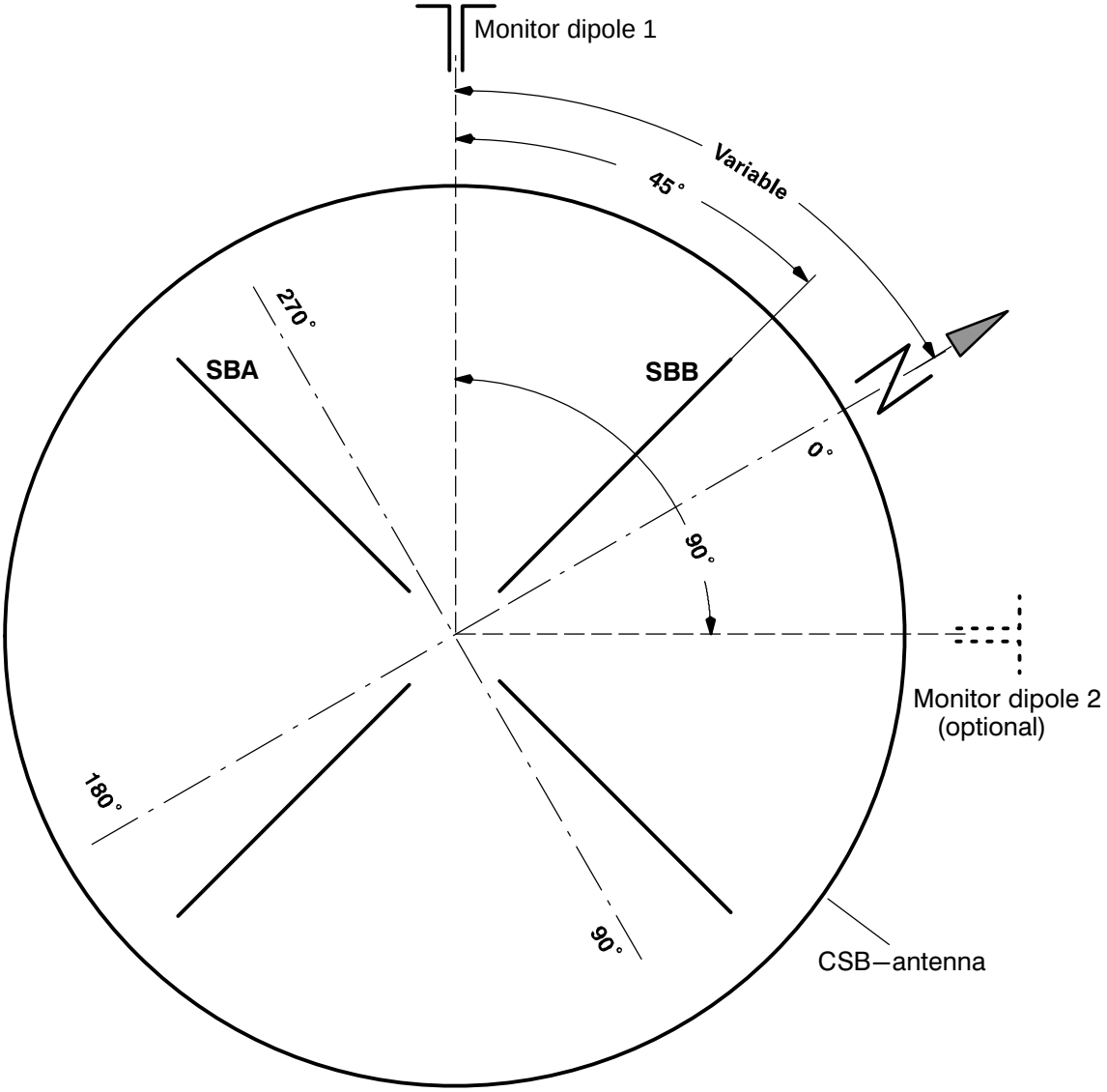


Fig. 4–11 Alignment of antenna

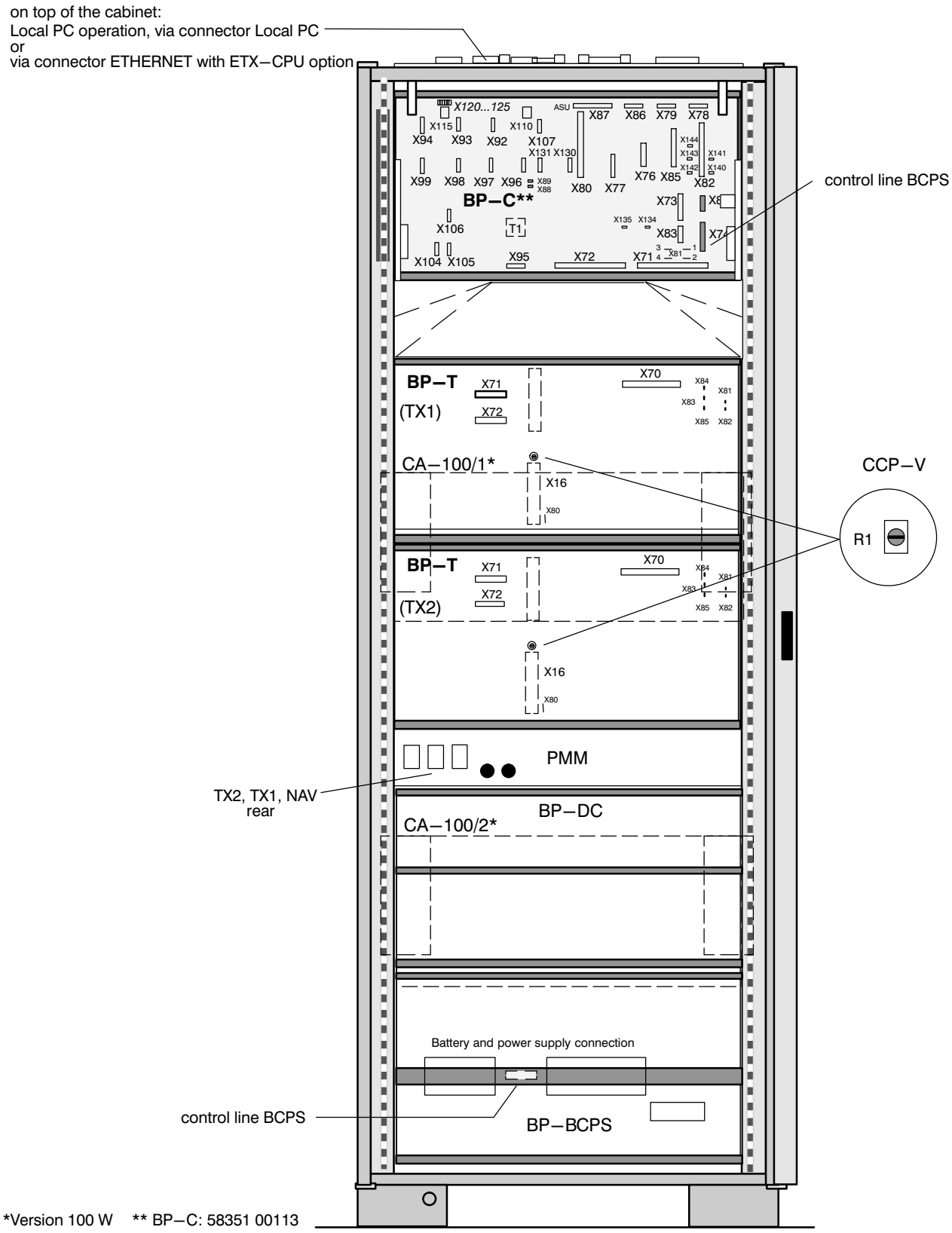


Fig. 4–12 Transmitter cabinet, rear side, potentiometers on CCP–V

4.12 RELATIONSHIP BETWEEN THE MONITOR DISPLAY OF THE RF LEVEL AND THE POWER

The CSB output power is displayed by the monitor as the RF level. This display does not correspond to the direct power but is a voltage display. The power must be converted to a voltage in order to be able to set an alarm limit, e.g. ±20 % power change.

dB= 10 log P_1/P_2 [1]

□ e.g. alarm limit for −20 % power change

dB =10 log P_1/P_2 ; $P_1 = 0.8\ P_2$

dB =10 log $0.8\ P_2/P_2$

dB =10 log 0.8

dB =−0.9691

□ e.g. alarm limit for +20 % power change

dB =10 log P_1/P_2 ; $P_1=1.2\ P_2$

dB =10 log $1.2\ P_2/P_2$

dB = 0.7918

Conversion of power change to a voltage change (*U* is used instead of *V*)

dB= 10 log P_1/P_2 ; $P_1= U_1^2/R$; $P_2= U_2^2/R$ (U is according to the RF−level)

dB = 10 log $(U_1^2/R) / (U_2^2/R)$

dB = 10 log U_1^2/U_2^2

dB = 20 log U_1/U_2

dB/20= log U_1/U_2

$10^{dB/20}= U_1/U_2$

U_1= $U_2 \times 10^{dB/20}$ [2]

If the above [1] and below [2] formulae are combined the result is as follows:

$U_1=U_2 \times 10^{0.5 \log P_1 / P_2}$

The conversion yields the following relationship: **$U_1^2/U_2^2 = P_1/P_2$** [3]

These formulae can be converted to determine the associated power change from the monitor display of the RF level.

$P_1= P_2 \times 10^{2 \log U_1 / U_2}$ [4]

ANNEX TO CHAPTER 4
ALIGNMENT PROCEDURE 8 POINT GROUND CHECK

CHAPTER 1

CHAPTER 2

CHAPTER 3

The above chapters headers are used for numbering reasons only.

CHAPTER 4
FIRST SETUP WITH 8 POINT GROUND CHECK OPTION

This Annex describes the settings for the 8 point ground check (8 PGC) option during first alignment of the CVOR installation which are different to those of the standard CVOR 431 without 8 PGC.

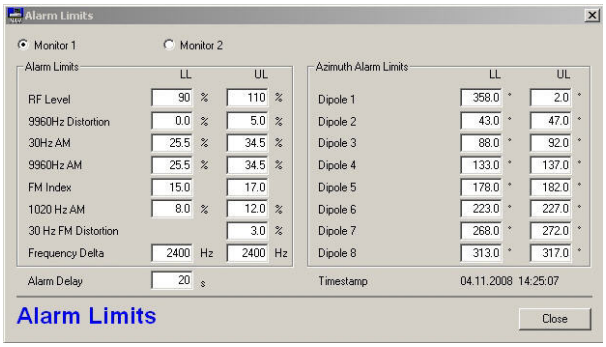
4.1 GENERAL

The following procedure is an excerpt from the standard Alignment Procedure. It is adapted to the use of the optional 8 point ground check feature.

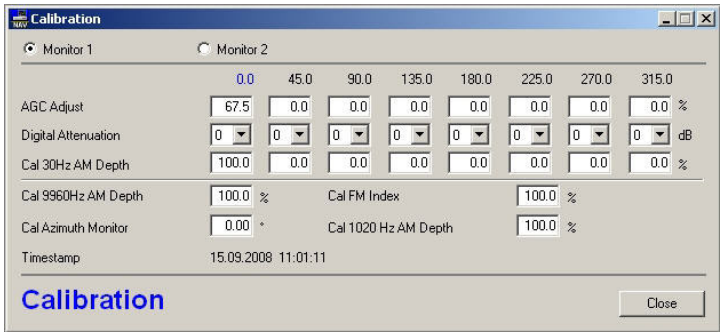
NOTE: The setup and alignment procedure which is described in chapter 4 can be performed with connected 8 PGC monitor dipoles. The masks in the PC User Program are adapted for 8 PGC in a way that the standard monitor dipole, if used as before, is assigned as *main dipole* (this is monitor dipole 1 of the 8 PGC option).

The differences in the procedure using the 8 PGC option are described in the following. 8 PGC adjustments concern mainly section 4.7 Ground Check. The 8 PGC monitor dipoles 2...8 are assigned in the correspondent calibration and measurement masks as dipole 045...315 according to the angle distance of the dipole location related to the main dipole (or dipole 000). The manually performed ground check procedure is replaced by the automatic ground check procedure with the 8 PGC option. All other standard procedures of chapter 4 remain valid if no other proceeding is described.

Example dialog window 'Alarm Limits': with 8PGC



Example dialog window 'Calibration' with 8PGC



(shown values are examples only)

Fig. A4–1 Example of dialog window 'Alarm Limits' and dialog window 'Calibration'

4.2 FIRST SWITCHING ON

4.2.1 Status of the System

4.2.2 Switching On

4.2.3 General Remarks to the PC User Program Handling

The above chapter headers are used for numbering reasons only. There is no change due to 8PGC.

4.2.4 Preparing the Installation SITE with PC User Program

4.2.4.1 Use of MCS

NOTE: For users of the MCS user program currently the 'MCS File Transfer' tool is used.

a) Switch on the PC and run the Linux operating system.

b) Start the file transfer tool: click on desktop start button, select 'System Tools', select 'MCS File Transfer (ILS, VOR, FFM, Marker)'. The dialog window 'ADR_MAIN−DOS in a BOX' appears.

c) Select menu command 'LOGIN' of the MASTER MENU. Enter *REU* as 'UserName' and confirm blank characters in 'Password'.

d) Select 'FILE TRANSFER' of the MASTER MENU, select menu command 'COPY PC FILE TO SITE'.

e) Select configuration files (**.sit, *.lke* (*see NOTE*)*, *.ptt, *.oio*) and enter.

NOTE: The **.lke*−file is used in systems before current NAV2K−SW. It is replaced by a conversion table file (*konv_dat.dat*) which is loaded together with the LCP−SW (from V3.x). From SW V5.x this file is implemented in the *LCP.ZIP* file. It has not to be copied.

f) Select menu command 'RESET SITE' of the MASTER MENU to activate entered files and data.

NOTE: The File Transfer tool is closed due to the reset. It has to be restarted manually.

g) Run 'MCS File Transfer' tool again. Perform Login.

h) Select 'DATE & TIME' in the MASTER MENU. Select menu command 'SET SITE DATE & TIME'. Enter date and time.

i) Select menu command 'EXIT' in the MASTER MENU to shut down the File Transfer tool.

4.2.4.2 Use of ADRACS

a) Switch on the PC and run WINDOWS.

b) Start ADRACS user program: click 'Start' button, select 'Programs', select program group 'Adracs Remote Controlling', select program 'Adracs Remote Controlling Software'.

c) Perform login procedure at the PC. Acknowledge "User1, Level 5" with 'OK' button.

d) Click screen button 'Control' in the 'Main Status'−window.

e) Select 'File Transfer' in window 'RC Management'. Select 'Copy PC file to RAM'.

f) Copy configuration files (**.sit, *.lke* (*see NOTE*)*, *.ptt, *.oio*) from PC to site.

NOTE: The **.lke*−file is used in systems before current NAV2K−SW. It is replaced by a conversion table file (*konv_dat.dat*) which is loaded together with the LCP−SW (from V3.x). From SW V5.x this file is implemented in the *LCP.ZIP* file. It has not to be copied.

g) Click 'Reset SITE' of menu 'File Transfer' to activate entered files and data.

NOTE: The 'Adracs Remote Controlling Software' is closed due to the reset. It has to be restarted manually.

h) Run 'Adracs Remote Controlling Software' again. Perform Login.

i) Click screen button 'Control' in the 'Main Status'–window.

j) Select 'DateTimeREU' in window 'RC Management'. Enter date and time and acknowledge with button 'Set New'. Shut down window 'DateTimeREU'.

k) Click 'Exit' in the 'Main Status'–window to shut down ADRACS.

4.2.5 Check and Enter Station Configuration Data

NOTE: Normally these data may be already set in the equipment. If

a) Start user program, perform login and select station. The detailed view on the CVOR station appears.

b) Switch both TX on and set all Monitor Bypass on.

Using ADRACS:

a) Open dialog 'LRCI–Station Configuration'.

b) Check parameters within the area 'Hardware Configuration':
'Installed Monitors', 'Power'. If need be, select the correct parameter value.

c) Check parameters within the area 'Operational Settings':
Check or set parameter 'Field Monitoring' according to the existent configuration: 'with 8PGC'. Use the pull–down menu.

Using MCS:

a) Open dialog in the 1st Equipment Level window by selecting menu item 'Station Configuration' in menu 'Operation'.

b) Check parameters of station: 'Installed Monitors', 'Power', 'Frequency', 'Station Type' and 'Morse Code'.

c) Check or set parameter 'Field Monitoring Mode' according to the existent configuration: 'with 8PGC'.

Finally: Switch both TX off.

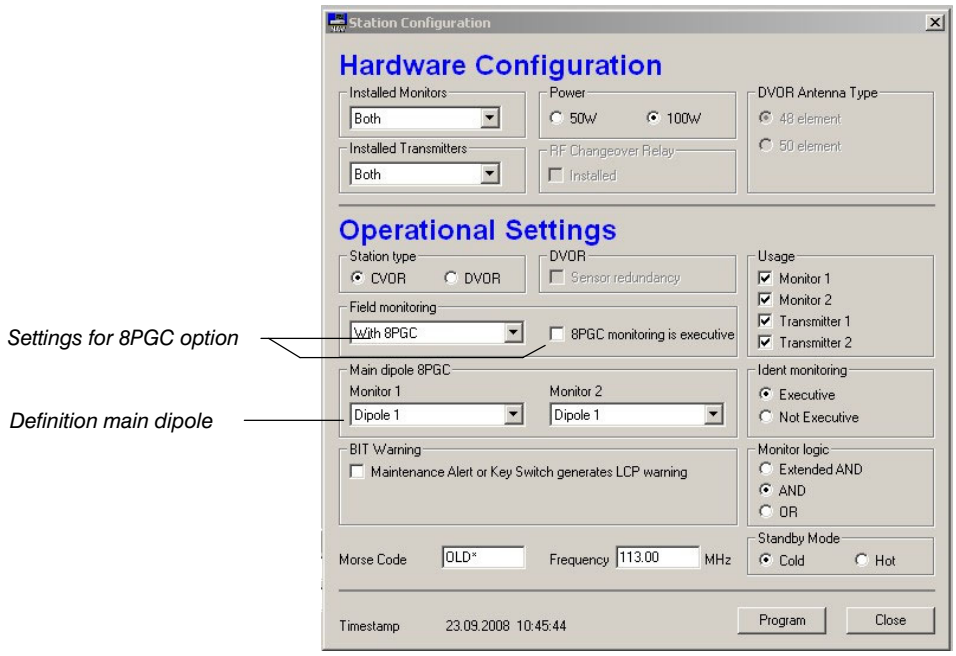


Fig. A4–2 Dialog window 'Station Configuration', used to enter station configuration parameter

4.3 ANTENNA ALIGNMENT

Perform the standard procedure. With 8PGC option, the following changes in the standard procedure text are to be regarded:

Section 4.3.3.3, Circular Pattern of LR (and following):

a) Set measuring dipole on tripod (height: 2 m) about 50...60 m from VOR shelter, and connect it via RF−cable with input MON1 on top of the cabinet.

b) Rotate CVOR antenna so that C_F points in direction of measuring dipole.

c) Switch TX1 on.
ADRACS: Open dialog 'LRCI−Station Configuration'. Check parameters within the area 'Hardware Configuration', 'Power': select the correct parameter value '50W' or '100W'. Check parameters within the area 'Operational Settings', select the correct parameter 'Field Monitoring' accordingly: 'with 8PGC'. Use the pull−down menu.

MCS: Open dialog in the 1st Equipment Level window by selecting menu item 'Station Configuration' in menu 'Operation'. Check parameters of station: 'Installed Monitors', 'Power', 'Frequency', 'Station Type' and 'Morse Code'. Check or set parameter 'Field Monitoring' according to the existent configuration.

Using the 8 PGC option, there is no individual monitor signal input for Monitor1 of TX1 and Monitor2 of TX2 on top of the cabinet as for the standard CVOR. For 8 PGC, the input MON1 is used for main dipole or monitor dipole 1 (monitor channel 0) which is fed via the MDS−V8 to the Monitor units of both TX1 and TX2. With this monitor dipole input signal, the installation is aligned as normal except Ground Check.

Continue with Section 4.3.3.3 d) of the standard procedure and from Section 4.6.4 with this Annex.

4.4 RF−PHASING OF OMNIDIRECTIONAL RADIATOR LR − UR

4.5 CHECK OF MONITORS

4.6 SETTING OF TRANSMITTERS AND MONITORS

4.6.1 Adjustment of Carrier Power

4.6.2 RF−Phasing (SBA/SBB to CSB), 30 Hz AM and Sense of Rotation of TX1

4.6.3 RF−Phasing (SBA/SBB to CSB), 30 Hz AM and Sense of Rotation of TX2

The above chapter headers are used for numbering reasons only. There is no change due to 8PGC. They are performed as described. Changes to the standard version start with the next section 4.6.4.

NOTE: If the 8PGC monitor simulator is used, perform RF phasing with 8PGC Monitor Simulator according Section 4.1.4.1 (setup see Fig A4−7), before proceeding with Section 4.6.4.

4.6.4 Setting of TX1 and Monitor 1

4.6.4.1 Preparation

a) Rotate antenna so that each antenna dipole (A and B) has an angle of 45° to the monitor dipole1 (Main Dipole, see Fig. A4−6). Secure antenna by screws.

b) Connect monitor dipole 1 (or standard field dipole) with the cabinet input labeled MON1. It means monitor channel 0, used as main.

c) Switch TX1 on.

d) ADRACS: Open dialog 'LRCI−Station Configuration'. Check parameters within the area 'Hardware Configuration', 'Power': select the correct parameter value '50W' or '100W'. Check parameters within the area 'Operational Settings', select the correct parameter 'Field Monitoring' accordingly: 'with 8PGC'. Use the pull−down menu.

MCS: Open dialog in the 1st Equipment Level window by selecting menu item 'Station Configuration' in menu 'Operation'. Check parameters of station: 'Installed Monitors', 'Power', 'Station Type'. Check or set parameter 'Field Monitoring' according to the existent configuration.

4.6.4.2 RF Level Monitor 1, Main Dipole Adjustment

a) ADRACS: Open window 'Monitor1 − Measurement Main'. Open dialog 'Monitor1 − Calibration'. Set parameter 'AGC Adjust' of Dipole 1 ('0.0') to 'RF−Level' indication of 100 %.

MCS: Open dialog 'Monitor1−Measmt 8 PGC−RF Level'. Open dialog 'Monitor1−Cal 8 PGC−Calibration AGC Adjustment'. Set parameter 'Calibration AGC Adjustment' of Dipole 1 (0.0) to 'RF−Level' indication of 100 %.

4.6.4.3 30 Hz Modulation Depth Monitor 1, Main Dipole Adjustment

a) ADRACS: Open window 'Monitor1 − Measurement Main'. Open dialog 'Monitor1 − Calibration'. Set parameter 'Cal 30Hz AM Depth' of Dipole 1 ('0.0') to '30 Hz AM Depth' indication of 30.0 %.

MCS: Open dialog 'Monitor1−Measmt 8 PGC−30 Hz Modulation Amplitude'. Open dialog 'Monitor1−Cal 8 PGC−Misc'. Set parameter 'Calibration 30 Hz AM Dipole (000)' so, that indication '30 Hz (mod.) AM main dipole 000' becomes 30.0 %.

NOTE: 80...120, Factor= 30 % x 100 %/reading above. It has to be regarded that the main dipole '0.0' has a distance of 8 m, otherwise the 30 Hz AM measurement is not correctly. Values of dipoles 045 to 315 are informatively only.

4.6.4.4 Subcarrier TX1 (9960Hz AM Depth, FM Index)

a) ADRACS: Open window 'Monitor1 − Measurement Main'. Open dialog 'Monitor1 − Calibration'. Set parameter 'Cal 9960Hz AM Depth' of Dipole 1 ('0.0') to '9960Hz AM Depth' indication of 30.0%.

MCS: Open dialog 'Monitor1−Measmt 8 PGC−9960Hz Modulation Amplitude'. Open dialog 'Monitor1−Cal 8 PGC−Misc'. Set parameter 'Calibration 9960Hz AM Dipole (000)' so, that indication '9960Hz (mod.) AM main dipole 000' becomes 30.0 %.

NOTE: Range of values: 0...39.8.

b) ADRACS: Open window 'Monitor1 − Measurement Main'. Open window 'TX1 − Adjustments'. Set 'Modulation Index' in window 'TX1 − Adjustments' so, that 'FM Index' indication in 'Monitor1−Measurement Main' becomes 16.

MCS: Open dialog 'Monitor1−Measurements/Limits'. Open window 'TX1 − Adjustments'. Set 'FM Index' in window 'TX1 − Adjustments' so, that 'FM Index' indication in 'Monitor1−Measurements/Limits' becomes 16.

NOTE: Range of values: 0...25.0.

4.6.4.5 Azimuth

a) Open window 'Monitor1−Measurement Main (Measurements/Limits)', open window 'TX1 − Adjustments'. Set parameter 'Azimuth Alignment' to obtain an azimuth reading 'Azimuth (main dipole)' equal to monitor dipole 1 location. Determine azimuth location of the main dipole 1 (MON1) using a compass for reading of value and enter value.

NOTE: Range of values: 0...359.9.

4.6.4.6 Identity and Voice

a) Open dialog 'TX1−Adjustments', set '1020Hz AM' to e.g. 10 %.

NOTE: Range of values: 0...20.0.

b) If applicable set 'Voice AM Depth' to e.g. 20 %.

NOTE: Range of values: 0...40.0.

c) Switch TX1 off.

4.6.5 Setting of TX2 with Monitor 1

4.6.5.1 Control of TX2 with Monitor 1

a) Switch TX2 on.

b) Set TX2 on aerial.

c) ADRACS: Open window 'Monitor1 − Measurement Main'. Check 'RF−Level' indication of Dipole 1 (0.0).

MCS: Open dialog 'Monitor1−Measmt 8 PGC−RF Level'. Check 'RF−Level' indication of of Dipole 1 (0.0).

NOTE: Nominal value: 100.0 % (± 5.0 %).

d) ADRACS: Open window 'Monitor1 − Measurement Main'. Check '30 Hz AM Depth' indication of Dipole 1 ('0.0').

MCS: Open dialog 'Monitor1−Measurements 8PGC−30 Hz Modulation Amplitude'. Check '30 Hz mod. AM main dipole (000)'.

NOTE: Nominal value: 30.0 % (± 1.0 %).

4.6.5.2 Subcarrier, Azimuth, Identity and Voice

Set subcarrier, azimuth, identity and voice of TX2 in the same way as described for TX1 in 4.6.4.4 to 4.6.4.6. Continue to use monitor 1.

4.6.6 Setting and Check of Monitor 2

4.6.6.1 Monitor 2 with TX1 on Aerial

NOTE: TX1 is radiating.

Switch TX1 on. Set TX1 on aerial.

a) **RF level**

ADRACS: Open window 'Monitor2 − Measurement Main'. Open dialog 'Monitor2 − Calibration'. Set parameter 'AGC Adjust' of Dipole 1 ('0.0') to 'RF−Level' indication of 100 %.

MCS: Open dialog 'Monitor2−Measmt 8 PGC−RF Level'. Open dialog 'Monitor2−Cal 8 PGC−Calibration Agc Adjustment'. Set parameter 'Calibration AGC Adjustment' of Dipole 1 (0.0) to 'RF−Level' indication of 100 %.

b) **30 Hz AM Mod. Depth**

ADRACS: Open window 'Monitor2 – Measurement Main'. Open dialog 'Monitor2 – Calibration'. Set parameter 'Cal 30Hz AM Depth' of Dipole 1 ('0.0') to '30 Hz AM Depth' indication of 30.0 %.

MCS: Open dialog 'Monitor2–Measmt 8 PGC–30 Hz Modulation Amplitude'. Open dialog 'Monitor2–Cal 8 PGC–Misc'. Set parameter 'Calibration 30 Hz AM Dipole (000)' so, that indication '30 Hz (mod.) AM main dipole 000' becomes 30.0 %.

NOTE: Range of values: 50...200.0.

c) **Subcarrier (9960Hz AM Depth, FM Index)**

ca) ADRACS: Open window 'Monitor2 – Measurement Main'. Check '9960Hz AM Depth'. If indication is out of tolerance, open dialog 'Monitor2 – Calibration'. Set parameter 'Cal 9960Hz AM Depth' of Dipole 1 ('0.0') to '9960Hz AM Depth' indication of 30.0%.

MCS: Open dialog 'Monitor2–Measmt 8 PGC–9960Hz Modulation Amplitude'. Check 'Mod. Depth 9960 Hz AM'. If indication is out of tolerance, open dialog 'Monitor2–Cal 8 PGC–Misc'. Set parameter 'Calibration 9960Hz AM Dipole (000)' so, that indication '9960Hz (mod.) AM main dipole 000' becomes 30.0 %.

NOTE: Nominal value 30.0 % (±1.0 %).

cb) ADRACS: Open window 'Monitor2 – Measurement Main'. Check 'FM Index' indication. If indication is out of tolerance, open dialog 'Monitor2 – Calibration'. Set 'Cal FM Index' so, that 'FM Index' indication in 'Monitor2–Measurement Main' becomes 16.

MCS: Open dialog 'Monitor2–Measmt 8 PGC–Mod. Index 30 Hz FM'. Check 'Mod. Index 30 Hz FM'. If indication is out of tolerance, open dialog 'Monitor2–Cal 8 PGC–Misc Calibration'. Set parameter 'Calibrate Mod. Index 30 Hz FM' to indication of 16 in 'Monitor2–Measmt 8 PGC–Mod. Index 30 Hz FM'.

NOTE: Nominal value 16.0 (±0.5)

d) **Azimuth**

ADRACS: Open window 'Monitor2 – Measurement Main'. Check 'Azimuth' of main dipole. If indication is out of tolerance, open dialog 'Monitor2 – Calibration'. Set parameter 'Cal Azimuth Monitor' to obtain nominal value.

MCS: Open dialog 'Monitor2–Measmt 8 PGC–Azimuth'. Check 'Azimuth main dipole'. If indication is out of tolerance, open dialog 'Monitor2–Cal 8PGC–Azimuth Calibration'. Set 'Calibration Azimuth Dipole 000' to obtain nominal value.

NOTE: Nominal value: same as in 4.6.4.5 (±0.2)

e) Switch TX1 off.

4.6.6.2 Monitor 2 with TX2 on Aerial

a) Switch TX2 on.

b) Set TX2 on aerial.

c) Open window 'Monitor2 – Measurement Main (Monitor2–Measurements 8PGC)'. Check following Monitor2 indications:

ca) 'RF–Level (RF Level main dipole 000)'
cb) '30 Hz AM Depth (30 Hz Mod. AM Main Dipole 000)'.
cc), '9960Hz AM Depth'
cd) 'FM Index'
ce) 'Azimuth'

NOTE: Nominal values:
ca) 100.0 % (±5.0 %)
cb) 30.0 % (±1.0 %)
cc) 30.0 % (±1.0 %)
cd) 16.0 (±0.5)
ce) same as in 4.6.4.5 (±0.2)

d) Switch TX2 off.

4.7 GROUND CHECK

NOTE: The Ground Check procedure is automatically performed using the 8PGC option. This is why this procedure is not performed manually any longer.

4.7.1 Calibration Dipole 045 to 315 with TX1 and Monitor1

NOTE: TX1 is radiating.

Switch TX1 on. Set TX1 aerial.

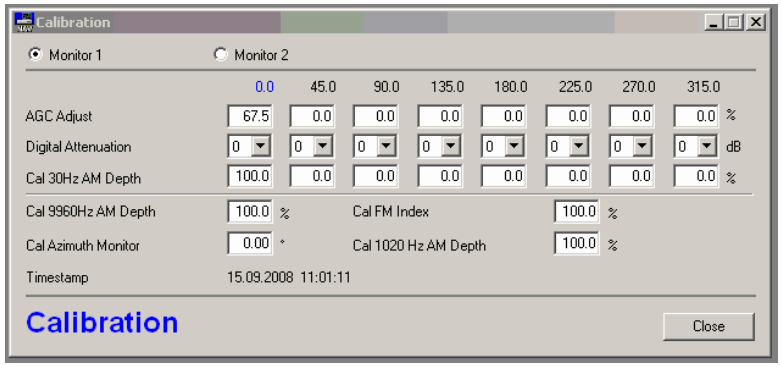
a) **RF level**
Open window 'Monitor1 – Measurements 8PGC (Measurements 8PGC)'. Open dialog window 'Monitor1 – Calibration (Calibration)'. Set 'AGC Adjust' value of monitor dipole 2 ('45.0') to 'RF level' indication of 100 % for '45.0'.

Perform this also for the monitor dipoles 3...8 *(... dipole 90.0 to 315.0).*

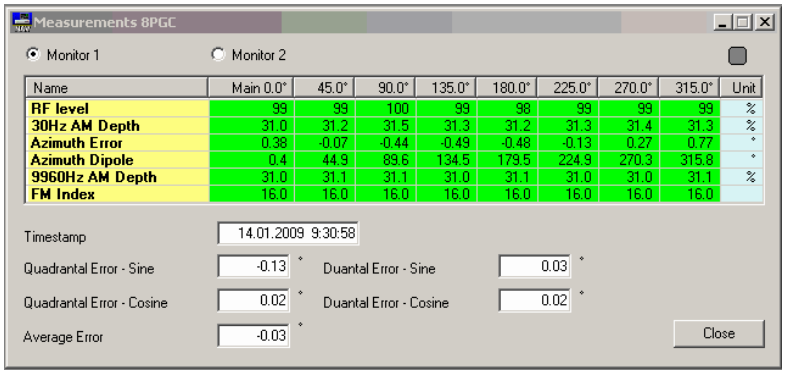
NOTE: If necessary, use setting 'Digital Attenuation' for correspondent monitor dipole (45.0 to 315.0).

Indications values for '30 Hz AM Depth' of dipole '45.0' and 90.0 ... 315.0 are informatively only.

dialog window 'Calibration' with 8PGC option (example)



dialog window 'Measurements 8PGC (example)



(shown values are examples only)

Fig. A4–3 Dialog windows 'Monitor1 – Calibration' and 'Monitor1 – Measurements 8PGC'

4.7.1.1 Check Calibration Dipole 045 to 315 with TX2

a) Switch TX2 on.
b) Set TX2 on aerial.
c) Use masks given above.
d) Check values for RF–level for the monitor dipoles 2...8 *(... dipole 045 to 315).*

4.7.1.2 Store 8PGC Measurement Result as Reference Data

The data obtained in the dialog window 'Measurements 8PGC' for Monitor 1 and Monitor 2 can be taken over to the 'Reference data 8PGC' window (see Fig. A4–4). This window is used as reference of the data obtained during first setup.

a) Open dialog window 'Monitor1 – Reference Data 8PGC'. Click the button 'Store' in the window 'Reference data 8PGC' to update its contents with the current measurement data 8PGC.

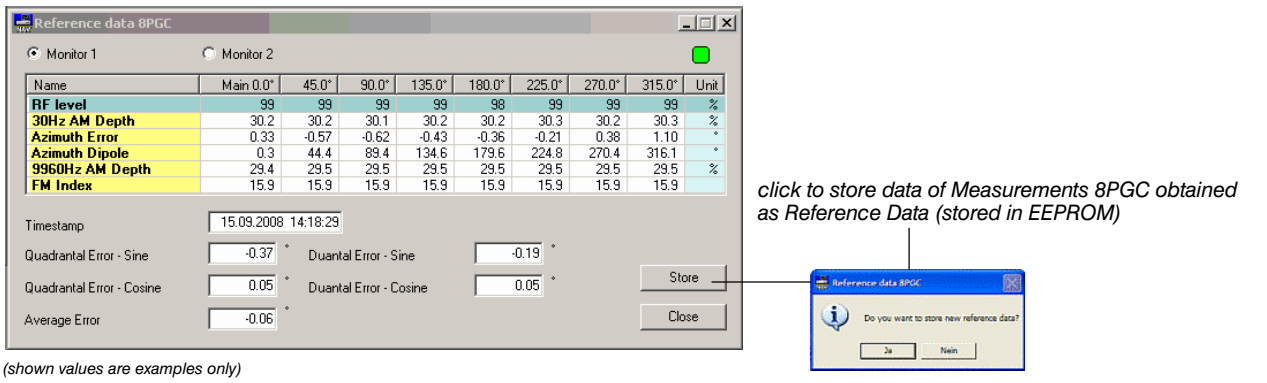


Fig. A4–4 Dialog window 'Monitor1 – Reference Data 8PGC'

4.7.2 Evaluation of Ground Check Measurement Results

The results of the automatic ground check measurement will be found in dialog 'Monitor1–Measurement 8PGC (Measmt 8 PGC–Misc)'. The results are indicated as:

- 'Quadrantal error term sine'
- 'Quadrantal error term cosine'
- 'Average error term'
- 'Duantal error term sine'
- 'Duantal error term cosine'

Fig. A4–5 shows an example of the error curve. Comments to these indications will be found in the chapter 5, section 5.2.7.

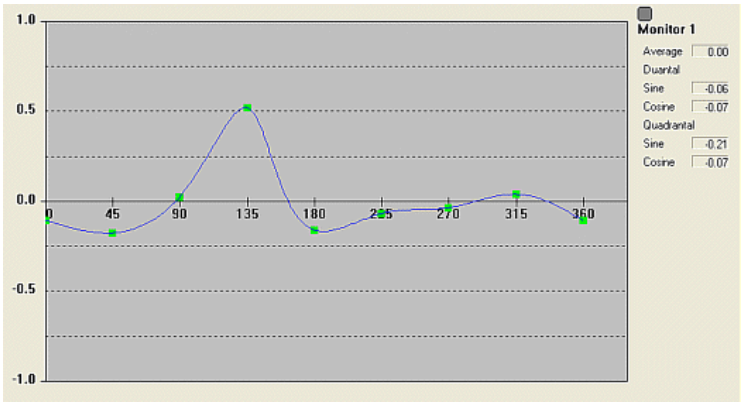


Fig. A4–5 Example of an 8PGC azimuth error curve

4.8 SETTING OF MONITOR ALARM LIMITS

4.8.1 Monitor 1

Open window 'Monitor1 – Measurements Main (Measurements/Limits)', and open additionally in ADRACS dialog 'Monitor1 – Alarm Limits'.

4.8.1.1 Azimuth

a) Select 'Azimuth' reading in 'Monitor1 – Measurements Main (Measurements/Limits)', equal to azimuth value of main monitor dipole (0.0). Use average value of the main dipole 1 to define alarm limits.

b) **Upper limit:** Add 1.0° to 'Azimuth' reading and key in this value in 'Azimuth Alarm Limits' as 'UL' for 'Dipole 1'.

c) **Lower limit:** Subtract 1.0° from 'Azimuth' reading and key in this value in 'Azimuth Alarm Limits' as 'LL' for 'Dipole 1'.

NOTE: Range of values: 0...359.9; if during flight check azimuth of transmitters has to be changed, these azimuth alarm limits have to be readjusted.

4.8.1.2 RF Level

a) Upper limit of 'RF Level', e.g. 129 %

b) Lower limit of 'RF Level', e.g. 71 %

NOTE: Range of values: Upper Limit 100...150, Lower Limit 50...100

4.8.1.3 Distortion 9960 Hz

a) Upper limit of '9960Hz Distortion', e.g. 5.0 %

b) Lower limit of '9960Hz Distortion', e.g. 0.0 %

4.8.1.4 30 Hz AM Signal

a) Upper limit of '30Hz AM', e.g. 34.5 %

b) Lower limit of '30Hz AM', e.g. 25.5 %

NOTE: Range of values: 0...39.9

4.8.1.5 9960 Hz Signal

a) Upper limit of '9960Hz AM', e.g. 34.5 %

b) Lower limit of '9960Hz AM', e.g. 25.5 %

NOTE: Range of values: 0...39.9.

4.8.1.6 30 Hz FM Signal

a) Upper limit of 'FM Index', e.g. 17

b) Lower limit of 'FM Index', e.g. 15

NOTE: Range of values: 0...39.9

4.8.1.7 Identity AM Signal

a) Upper limit of 'Mod. Depth Identity AM', e.g. 12 %.

b) Lower limit of 'Mod. Depth Identity AM', e.g. 8 %.

4.8.1.8 Distortion 30 Hz FM

a) Upper Limit of '30 Hz FM Distortion ', e.g. 3.0 %

4.8.1.9 Carrier Frequency Difference

a) Upper limit of 'Frequency Delta', e.g. 2400 Hz

b) Lower limit of 'Frequency Delta', e.g. 2400 Hz

4.8.1.10 Alarm Delay

a) Set parameter 'Alarm Delay (Time)' to e.g. 20 s

NOTE: Range of values: 2...255

4.8.2 Monitor 2

Set alarm limits for Monitor 2 in the same way as described for Monitor 1 in Section 4.8.1.

4.9 BATTERY MONITORING

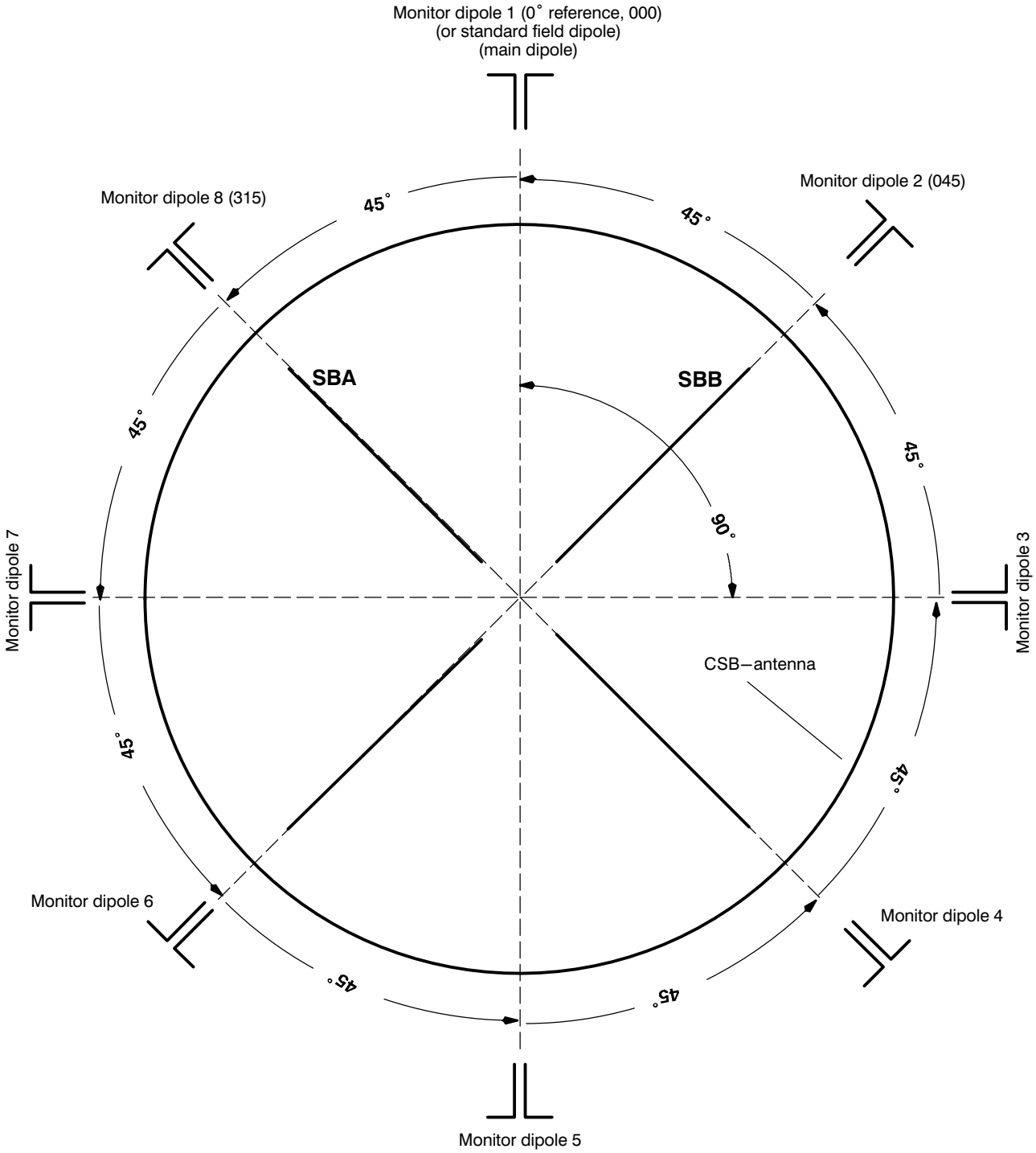
4.10 NORMAL OPERATION

The above chapter headers are used for numbering reasons only. There is no change due to 8 PGC. Changes to the standard version are mentioned in the next section.

4.11 FLIGHT CHECK

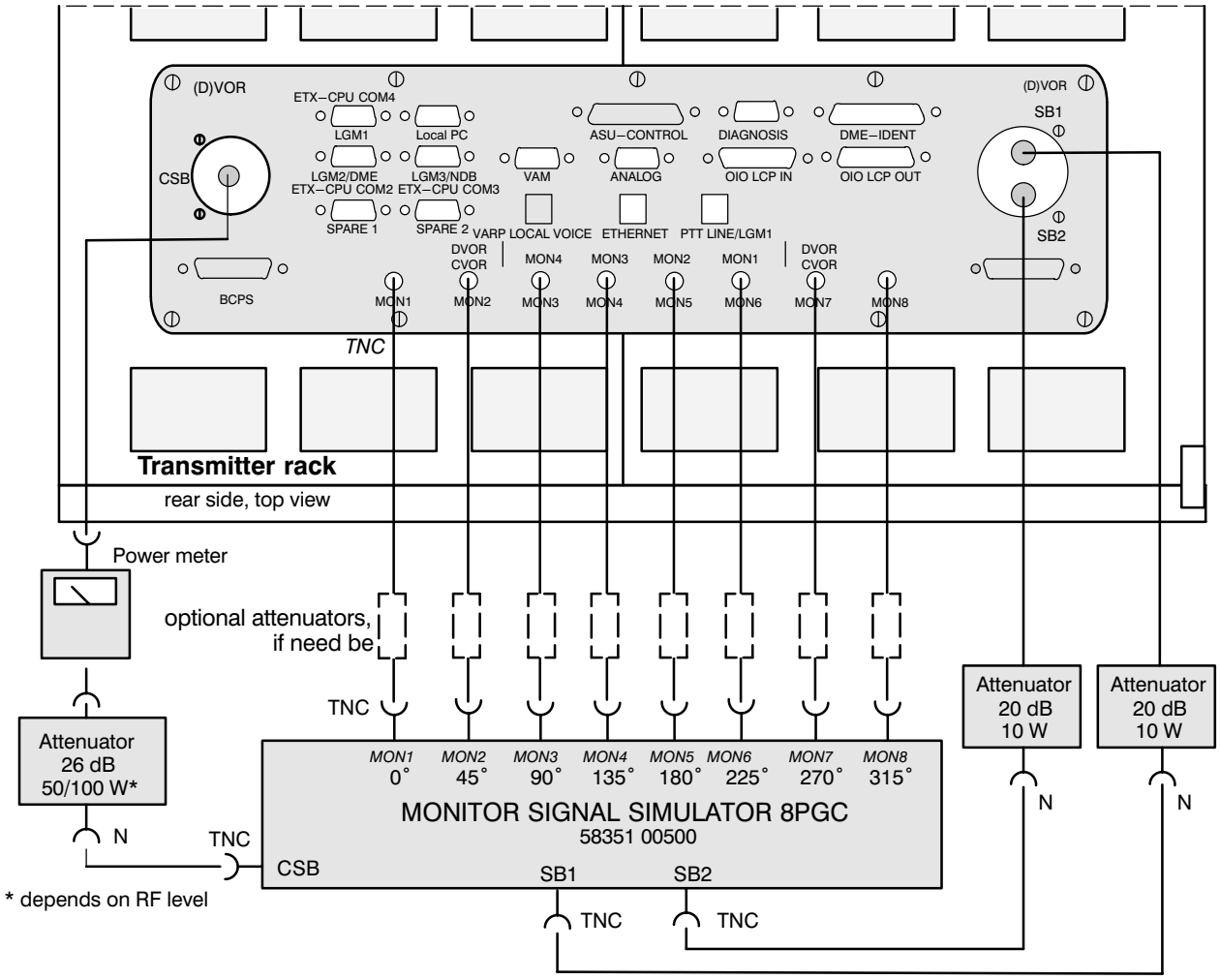
The Flight check procedure is as described in Section 4.11 of the standard procedure without 8PGC.

NOTE: If during flight check the azimuth indication of the main dipole 1 has to be corrected the other dipoles 2 to 8 are adjusted automatically according to the changed value.



Note:
Does a CVOR installation already exist, the CVOR antenna has to be rotated in a way that the range distance between maximum and zero of the sideband antennas is 45° related to the monitor main dipole 1.

Fig. A4–6 Alignment of antenna, arrangement 8 PGC dipoles



8 PGC Simulator

8PGC Simulator, cable kit

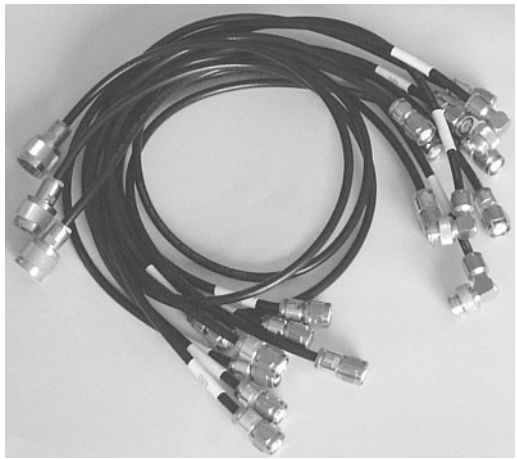


Fig. A4–7 Simulator test setup with Monitor Signal Simulator 8PGC

CHAPTER 5
MAINTENANCE

5.1 GENERAL

Maintenance of a system can be defined as preventive and corrective maintenance (corrective maintenance may also be defined as 'Repair' activity in case of a fault). Within this chapter two basic types of preventive maintenance are described, namely *periodic* maintenance and *normal* maintenance. It is essential to ensure that the radiated signals remain within the fixed tolerances at all times after the navigation system has been handed over for service to air traffic. With this aim in mind, ICAO recommends verifying the most important signal parameters of the ground station within the framework of periodic maintenance.

In case of a heavy snowfall, the snow should be removed from the counterpoise of the antenna.

NOTE: Change of parameters is allowed only by maintenance people with specific access level (i.e. > level 2) to the PC user program (ADRACS or MCS).

In Navaids 400, all the main parameters are maintained at the preset values throughout the entire life of the system by means of a microprocessor controlled transmitter, so that drift as a result of ageing should not normally occur. In addition, the radiated signals are checked by two high−precision microprocessor controlled monitors. These prevent fault signals from being emitted by either switching over to the standby transmitter or shutting down the system completely.

Since, moreover, no parts which are subject to mechanical wear and tear are used, the periodic maintenance intervals can be made longer than usual and the number of measurements restricted to a minimum. Due to the measurement facilities which are integrated in the system, only a few external instruments are required. In addition to the periodic maintenance tasks, there are a few activities of normal maintenance which should be performed as and when necessary.

NOTE: The responsible authorities (e.g. ATC/Controls) must be informed before commencing any maintenance work in accordance with national regulations!

5.1.1 Elimination of Static Charges

A grounding strip with a large cross−sectional area is connected between the shelter grounding terminal, the equipment racks and the worktable to act as the system ground and to eliminate electrostatic charges. It is firmly connected to the table and a grounding bus on the working surface. This system ground should not be connected to either the mains protective ground conductor or to housings and grounds of external consumers, i.e. consumers not associated with the worktable, except at the potential equalization bus for the overall installation.

The protective ground wire offered with mains cable or plug connections is not suitable for potential equalization of equipment on a worktable. Depending on local circumstances, it can carry quite high RF interference voltages. Mains−supplied equipment, power supplies and test equipment should be connected via two−wire cables and two−pin plugs.

For measures to be taken with respect to components sensitive to electricostatic charging (MOS, Low Power Schottky) please refer to the customer service documentation of the manufacturer. If an employee is required to handle subassemblies for transport purposes, he should place both hands flat on a grounded surface beforehand (e.g. on the ground bus of the work table).

The module can be picked up by its insulator immediately following this potential equalization. It is safer to avoid touching the terminals. Only remove short−circuit links where absolutely necessary. Place printed circuit boards only on tables with a conductive, grounded working surface. Leave individual subassemblies in the antistatic plastic bags for as long as possible.

5.2 PERIODIC MAINTENANCE

NOTE: The items marked with an asterisk (*) are normally performed continuously via the remotely connected RMMC system, or locally via a connected Laptop/PC.
Compare also measuring values with those of recorded data (refer to section 5.2.4)
Handling with subassemblies regard instructions in section 5.1.1.

We recommend performing the maintenance activities listed in the table below once every month or six months. The following measuring instruments are required for this:

- Personal Computer (Laptop or standard PC; used for maintenance on site)
- Headphones (600 ohms, 3.5 mm plug; for station identification)
- Portable field dipole
- RF terminating resistor (50 ohms, 1 W)
- Multimeter
- Battery maintenance equipment (acidimeter, acid syringe, areometer, thermometer, funnel).

No.	Monthly maintenance
1	Check system status/visual inspection (refer to 5.2.1 and 5.2.6).
2	Check station frequency of former master transmitter.*
3	Check station identification of former master transmitter.*
4	Check settings of both transmitters and monitors.*
5	Check measured values of former master transmitter and monitors.*
6	Check switch over function by simulating monitor alarm and changing master transmitter.*
7	Check station frequency of new master transmitter.*
8	Check station identification of new master transmitter.*
9	Check measured values of new master transmitter and monitors.*
No.	**Additional six—monthly maintenance**
10	Check ground error curve of former master transmitter (ref. to 4.7; evaluation 8 PGC opt.: 5.2.7)
11	Check ground error curve of new master transmitter (refer to 4.7; evaluation 8 PGC opt.: 5.2.7).
12	Remote control system (line loss): check LCD window 'Alerts' for remote control alert message.
13	Check lead batteries/visual inspection (refer also to section 5.3.2 and 5.4, if need be).
14	Check battery function by simulating a power failure (refer to 5.2.3).
15	Clean all equipment thoroughly (refer to 5.2.5).
No.	**yearly maintenance**
16	Take a complete memory readout of all possible parameters (5.2.4).
17	Check RF cable connections and all screwed connections, internal and external (refer to 5.2.1 and 5.2.6).

5.2.1 Damage check

The following system parts have to be checked visually for entirety and damage:

- shelter,
- counterpoise, antenna radome
- monitor dipole, monitor mast and cable
- obstruction lights
- fence around the station
- tight fitting of all RF cable connections (internal and external), perform it yearly only.
- tight fitting of all screwed connections (electrical and mechanical), perform it yearly only.

5.2.2 Check of Transmitter Parameters and Monitoring

There are various methods to validate periodically the transmitter– and monitor functions depending on the procedures laid down by the national customer procedures. The check of monitor parameter alarms is proposed to be done with a change of corresponding transmitter parameter.

NOTE: The procedures to change transmitter parameters and check of monitoring alarms can be performed locally via a connected Laptop/PC or remotely via the RMMC system. The check of transmitter and monitoring parameters is performed with the PC User Program.

5.2.3 Check of Battery Function

This check shall ensure that the battery is able to supply the installation in case of a mains interrupt. To check the battery function perform the following procedure:

a) Both TX are on. Switch off mains supply, e.g. switch off the ACC modules. The equipment should be supplied by the battery and runs without interruption. The LCD screen should indicate a maintenance alert with 'BCPS1 Failure' and 'BCPS2 Failure' (and 'BCPS3 Failure' or 'BCPS4 Failure', if equipped).

b) After a few minutes (e.g. about 5 min) switch on ACC modules again. The equipment should be supplied by the mains again and runs without interruption.

5.2.4 Documentation of System Data

The data recorded during the flight test is the only data which is binding for operation of a navigation installation. It is advisable to check this data in accordance with the chart for periodic maintenance. A documentation is performed by the printer of the connected PC or in a file for the transmitter data and monitor data on the PC (*.lda* files).

The first data so–obtained of the basic adjustments of the alignment procedure at commissioning and flight check should be recorded and stored in a reference file or on a floppy disk. One hardcopy of the data should be completed with date and signature. The same procedure should be followed when performing further checks, when the data recorded can be compared with the original flight check data.

5.2.5 Cleaning

CAUTION

Cleaning aids, such as brushes and dusters, must be made of antistatic material. See also the instructions in Section 5.1.1.

– Shelter

Brushes, dusters and a vacuum cleaner should be used to clean the transmitter rack and the rack for the battery–charged power supply. The transmitter room should not be cleaned with a broom, but rather using a vacuum cleaner. The floor should be washed regularly every 6 month. The detergent should be added in small quantities only to the water; no aggressive cleaning agents should be used. Floor cleaning agents should be avoided, since these have the same effect as a dielectric and encourage the build–up of static charges.

If the floor covering is made of a conductive material, then similarly only those cleaning agents expressly recommended by the manufacturer of the floor covering should be used.

The air filters of the fans, ventilation openings or air conditioners in the shelter should be checked from time to time in accordance with the volume of dirt which accumulates at the particular location.

The filters should be replaced by new ones before they become clogged. If no new filters are available, the dirt may – as an exceptional measure – be banged out of the old filter to permit the filter to be re–used. Damaged filters on the other hand, should not be re–used. If an air conditioner should become iced–up, switch it off and let it defrost. Observe the manufacturers maintenance recommendations.

The separate battery compartment should be dusted out once a year. Avoid transferring dirt from the battery compartment into the transmitter room.

– Transmitter rack

Only two types of alcohol, namely Ethyl alcohol or Glycol,or clean water should be used to remove layers of dirt on the LCP panel. Check that key–lock switch is not in position LOCAL so that unintentional control is avoided. Cleaning procedure: Moisten a cloth with one of the liquids mentioned above and remove dirt. Dusting of the subassemblies should only take place in conjunction with removal of a subassembly when this becomes necessary in any case for some other purpose. Even then, subassemblies should only be dusted if dust can be detected by means of a visual check. They should always be dusted using a soft brush, and if possible with the aid of a vacuum cleaner. During such operations it is essential to observe all precautionary measures described in Section 5.1.1 for voltage–sensitive semiconductors.

– Antenna and counterpoise (see section 5.2.6).

5.2.6 Cleaning and Maintenance of Antenna and Counterpoise

WARNING

Take appropriate safety measures when mounting and working on the counterpoise.
Avoid walking on the counterpoise outer parts during maintenance activities on the roof.

Do not work on the counterpoise in case of stormy weather and during tunderstorms.

The counterpoise, the RF cables, the ground wires with connections, and the antenna (PALESIT seal) should be subjected to a visual check for corrosion and cracks at intervals to be determined in accordance with the particular climatic conditions. Make a repair of damages if need be.

NOTE: Accessing the roof of the shelter for visual inspection or removement of snow, it should be remembered that the counterpoise must not be mounted via the lateral counterpoise sections.

In case of a heavy snowfall, the snow should be removed from the counterpoise of the antenna. Air traffic control should be informed before the counterpoise is mounted.

5.2.7 Evaluation of 8 Point Ground Check (8PGC) Measurement Results

The results of the automatic ground check measurement will be found in dialog window 'Monitor1 – Measurement 8PGC' and 'Monitor2 – Measurement 8PGC'. These results are indicated as:

- Quadrantal error term sine
- Quadrantal error term cosine
- Duantal error term sine
- Duantal error term cosine
- Average error term

To show the 8PGC azimuth error curve, use 'Commands' and '8PGC Azimuth Error'.

Error term	Prealarm Value	Cause	Action
Qs Quadrantal semi cardinal *(sine)*	> 1°	Bad quadrature of antenna pattern Bad quadrature between LF sine and cosine signal	Check the antenna system
Qc Quadrantal cardinal *(cosine)*	> 1°	Difference of RF level between side band sine and cosine (SBA and SBB) If Qc > 0 then SBsin > SBcos If Qc < 0 then SBsin < SBcos	Check the sideband SWR Adjust the RF phase between SBA and SBB Adjust the level of the side band to obtain the same level
Ds Duantal sine	> 1°	Zero of the pattern of the sine side band antenna is not in a same line. If Ds > 0 then lobe at 45° is less than lobe at 225°. If Ds < 0 then lobe at 45° is greater than lobe at 225°.	Check the antenna
Dc Duantal cosine	> 1°	Zero of the pattern of the sine side band is not in a same line. If Dc > 0 then lobe at 315° is less than lobe at 135°. If Dc < 0 then lobe at 315° is greater than lobe at 135°.	Check the antenna
Average error	> 1°	Bad adjustment of the phase between 30 Hz var. and ref. Bad adjustment of the probes	Adjust the phase or Adjust the probe position to the good place

NOTE: This table shows the value for a pre–alarm threshold (alarm does not exist), the origin of the problem and the possibility to repair, which are informative for operation and analysis.

Description of the data: Each time the 8PGC polls all the eight probes, the calculated azimuth of each points is compared with the geographic azimuth of the probe. Each data is recorded by the monitor software and 5 values are calculated from this data :

- Qc : Cardinal (1) Quadrantal error: Analyses the asymmetry between the levels of the sideband SBA and SBB
- Qs : Semi cardinal (2) Quadrantal error: Analyses the quadrature of the Sine sideband pattern (SBA) and Cosine side band pattern (SBB)
- Dc : Duantal error (cosine): Analyses the alignment of the cosine pattern.
- Ds : Duantal error (sine): Analyses the alignment of the sine pattern.
- Av : Average error: Gives the offset of the curve

1) The meaning of cardinal is in reference with the cardinal point (North, South, East West)
2) The meaning of semi cardinal is a same than cardinal but with a rotation of 45 degrees (NE, SE, SW, NW)

The 8 point ground check analyses the drift of the bearing and gives the causes of this drift. This analysis use the data coming from the eight probes arranged around the counterpoise. For each revolution, (8 points) the monitor software calculates 5 parameters. These parameters allows to determinate the origin of the drift (side band level, or adjustment of the antenna). It is possible for a specific application to put the probe at 20 meters around the station. The results obtained by the pooling of the 8 probes are similar. But in this case, the 8 point ground check analyses the behavior of the station and indicates if somebody or something goes into the area inside the circle of the probes.

5.3 NORMAL MAINTENANCE

5.3.1 Replacing the Lithium Batteries (MSG—C, MSP—CD, LCP)

To back up data in the non volatile RAM in case of a voltage drop, the subassemblies MSG—C, MSP—CD and LCP contain Lithium batteries. Lithium batteries have an extended life time. The battery voltage is checked by the BIT of the system. The individual batteries are soldered to the pc boards. The battery back up function is enabled via jumpers, set during first setup or before replacing the respective pc board. Always observe the label on the battery. The Lithium battery has to be replaced by the same battery type. Other types of lithium battery are not approved by Thales.
Recomended types of batteries:

- MSG—C, MSP—CD:
  Lithium Battery SL—389, 3.6V/1Ah, make Sonnenschein; Thales Ref. Nr. 54131 28002
- LCP:
  Lithium Battery LS 14250, 3.6V/0.95Ah, make SAFT; Thales Ref. Nr. 97991 28479

WARNING

Do not recharge, disassemble, heat above 100 ˚C or incinerate the lithium cell. Do not short circuit, or solder directly on the cell. Disregard of the norms regarding the use of lithium batteries may cause risk of fire, explosion or leaking out of toxid liquid and gas. Run—down batteries are objects that can pollute the environment and must be disposed of with proper precautions regarding the national regulations.

CAUTION

Contents of the RAM will be lost when the jumper is opened which enables battery voltage to the RAM device.

Replacing the Lithium battery:

We recommend switching the transmitter whose Lithium batteries are to be replaced over to standby operation and then switching it off. The other transmitter will remain switched onto the antenna. This will ensure that any interference resulting unintentionally from the replacement procedure will not affect the radiated signal. A soldering iron with a grounded soldering tip should be used. A battery short—circuit via the soldering iron for the duration of soldering is unlikely to harm the relatively high—impedance battery, but should however be avoided wherever possible. Regard also notes for handling electrostatic sensitive subassemblies in section 5.1.1.

The procedures is as follows:

- Back up the data of the respective transmitter being serviced.
- Draw out halfway concerned pc board (MSG and MSP only).
- Remove correspondent jumper (X7 on MSG—C, X7 on MSP—CD, X36 on LCP).
- Re—tin the soldering tags of the new battery in order to ensure a good soldered connection
- Unsolder the minus and plus pole of the old battery, and remove the battery from the pc board.
- Insert the new battery, and solder the minus and plus pole of the battery.
- Slide in concerned pc board again (MSG and MSP only).

NOTE: If the rack supply voltage needs to be disconnected during the period when the batteries are unsoldered, the charge stored in the circuit capacitors will protect the RAM contents for approx. 30 s. If the information is lost however, all transmitter parameters must be re—entered when the batteries have been resoldered.

5.3.2 Maintaining Emergency Battery

5.3.2.1 Battery Voltage

Measurement of the battery voltage is performed via the CSL and evaluated by the LCP processor. The voltage measured is that between the BAT1 or BAT2 terminals against GND (BAT0). The half voltage value should be exactly half the full value. Should unbalance occur, a fault is indicated. The deviation in the ratio of 2:1 for the half voltage measurement increases the further the aging process of a cell is advanced. If the deviation from the ratio of 2:1 is minimal, the battery can be maintained in service, but should be kept under observation. If the deviation is greater (from as little as a few tenths of one volt), each cell must be measured under load in order to determine the weak cell. This should be replaced by a new cell as soon as possible.

NOTE: Run−down lead batteries are objects that can pollute the environment and must be disposed of taking the proper precautions regarding the national regulations.

CAUTION

Before replacing the battery or individual cells, always check:
- Is the battery−charged power supply switched on ?
- If the BCPS is on, switch off fuse switch F20 (50 A) in battery fuse box.

The battery half to be examined may be determined as follows.

Voltage ratio:	locate faulty cell**:**
greater than 2:1 (e.g. 47: 23 V = 2.043:1)	between center and minus
smaller than 2:1 (e.g. 47: 24 V = 1.958:1)	between center and plus

5.3.3 Matching the Charging Voltage of BCPS Modules

5.3.3.1 Reasons for Voltage Matching

The BCPS has a fixed voltage of 54 V±3 % for parallel operation with lead batteries. It is not possible to vary the output voltage for operation with other types of battery, e.g. nickel cadmium batteries. An adjustment of ±1 V is however possible on the front panel of the slide in units. This is intended for optimization of the trickle charge. The most important parameter for operation of lead batteries at the BCPS is the trickle charge voltage. This voltage is 2.23 V/cell ±1% in accordance with VDE (registered society of german electrical engineers).

In the interests of optimizing the charge Thales has utilized the upper tolerance limits and fixed the trickle charge voltage at 2.25 V/cell. This results in a trickle charge voltage of 54 V for a battery with a rated voltage of 48 V. Strictly speaking however this fixed trickle charge value of 54 V is only valid at a temperature of 20 ˚C in the battery compartment. If the temperature rises above 20 ˚C, it is necessary to reduce the voltage in order to maintain a sufficient difference with respect to the gassing voltage of 2.4 V cell. If the temperature falls below 20 ˚C, it is necessary to increase the charging voltage in order to ensure optimum charging. The relationship between the temperature and the charging voltage is shown in the table below. It is valid for the types of battery proposed or provided by Thales. Please consult the manufacturer if using other types.

BATTERY TEMPERATURE IN ˚C	TRICKLE CHARGE VOLTAGE IN V
10	55.08
15	54.54
20	54.0
25	53.46
30	52.92

The internal temperature in the battery compartment is subject to fluctuations dependent on the time of day and time of year. The considerable mass of the batteries and the associated high thermal inertia mean that temperature fluctuations dependent on the time of day are insignificant and can be ignored. It is necessary on the other hand to determine the average temperature in the battery compartment during the hot and cold seasons or to estimate it on the basis of experience. The optimum charging voltage can be read off from the table when the average temperature has been calculated.

It is not necessary in moderate climatic zones to take seasonal fluctuations into account. If the batteries are accommodated inside a shelter or a building, the fluctuations between summer and winter are not very great, and the mean temperature will not deviate substantially from 20 °C. In such cases it is not necessary to optimize the trickle charge voltage as described here. This only becomes necessary if the batteries are installed outside the shelter or in hot or cold zones without an air—conditioned battery compartment.

If the mean annual temperature is known during the installation phase, adjustments can be carried out by the Thales installation team. Otherwise they should be carried out by the customer's own maintenance personnel as follows.

5.3.3.2 Matching the Voltage

NOTE: This procedure is performed once during installation or if other battery types are used.

The battery must be connected. Switch off the transmitters. Using the switches on the front panel switch off the ACC units except the outer left one, which has to be adjusted first. Beginning with left ACC unit adjust the ACC units as follows:

- Connect a digital voltmeter to the test jacks on the front panel of the switched on ACC unit.
- Set the desired voltage carefully at the potentiometer on the front panel with the aid of a calibration screwdriver. It should be possible to obtain the value specified in the table in 5.3.3.1 to within a tolerance of ±0.2 V.
- Switch off the adjusted ACC unit.
- Switch on the next ACC unit and adjust it in the same way.
- Adjust all installed ACC units in the same way.

When all units have been set in this way measurements should be performed as follows:

- Disconnect the battery.
- Perform measurements between +BAT and −BAT on the BCPS terminal plate using a digital voltmeter:

  First measurement : Transmitter off, BCPS without load
  Second measurement : Transmitter on, BCPS with load

The values should not deviate from the set value by more than ±1 %. If the deviation is greater, the relevant module can be determined by deactivating the power units individually and observing the voltage change. The voltage of this unit must then be corrected upwards or downwards. The BCPS is then ready for service.

5.4 STARTUP, CARE AND MAINTENANCE OF THE LEAD BATTERY

5.4.1 Startup Specifications for the Lead Battery in Navigation Installations

5.4.1.1 General

For countries in Europe, the sets of lead batteries in the navigation installations are normally supplied already filled and charged by the manufacturer. On site the batteries then merely need to be installed and connected to the power supply unit of the navigation installation. Batteries supplied in a non−filled state to their point of installation must be set up, filled and charged there in accordance with the manufacturers handling specifications. The batteries can be supplied non−filled in either a dry pre−charged state, or a non pre−charged state (see 5.4.1.3.2 and 5.4.1.3.3). The battery may not be removed from its transport packing until immediately prior to startup.

CAUTION

Maintenance−free batteries have to be set into operation within half a year after delivery to prevent drawback in the battery lifetime

The startup procedure comprises the following stages:

a) Installation on site, interconnection of the cells with the cell connectors and connection to the electrical installation;
b) Filling with accumulator acid;
c) Immediate subsequent charging or activation of the plates (see 5.4.1.3)
d) Immediate subsequent activation in standby parallel mode.

These instructions do not cover the installation work, but instead deal merely with filling and activation using tools which, even in remote areas, are either available or easily obtainable. They moreover apply only to batteries for which a rated acid density of 1.24 kg/l is specified by the manufacturer, e.g. Gro E, iron−clad and block batteries, and not to starter batteries or batteries with a fixed electrolyte. The aids required are as follows:

Accumulator acid — The acid must have a particular density. If this value is incorrect, the mixture should be made up of high−density sulphuric acid and specially purified water (see 5.4.1.2.2).

1 Acid syringe with areometer
1 Thermometer
1 Acid jug (non−metallic)
1 Funnel (non−metallic)
– Float acid level indicator
– Handling specifications

} supplied with battery

– Battery−charging power supply (BCPS), type FRAKO
– Various resistors
– Single−wire cables (2.5... 6 mm^2)
– Ammeter and voltmeter (accuracy <1 %)

5.4.1.2 Preliminary Operations

5.4.1.2.1 Accumulator Acid and Specially Purified Water

Diluted sulphuric acid and specially purified water are used for filling and topping up lead batteries. The regulations specified in VDE 0510 (regulations for accumulators and battery installations), according to which no components which may be harmful to the plates may be used, must be conformed with. Particularly harmful substances are chlorine, which is present both in the water and in the acid, and iron which is sometimes contained in the acid. These impurities can however easily be evidenced. Only specially purified water, i.e. water which has been distilled or fully desalted, may be used. It must moreover be clear, colorless and odorless

CAUTION

Boiled water, rainwater, well water, river water, tap water or condensation from machines, heating systems etc. are unsuitable.

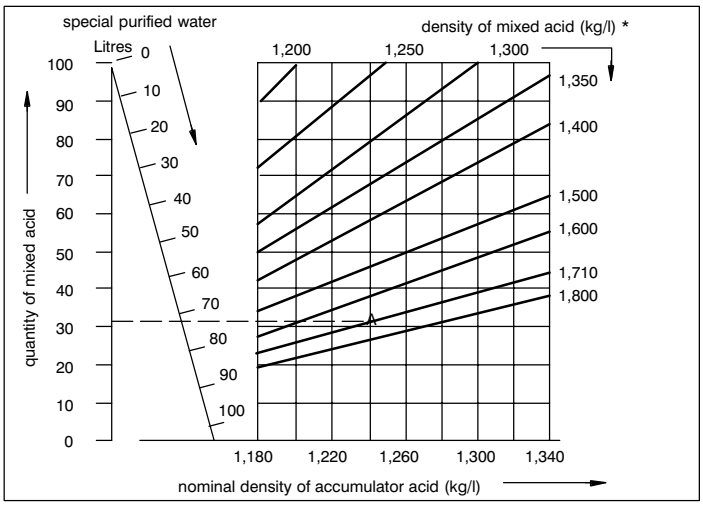
The sulphuric acid and the water should be kept in glass or plastic containers, which must be sealed and covered carefully. Dust and vapors which penetrate may contaminate originally pure liquids.

5.4.1.2.2 Mixing Sulphuric Acid

If the accumulator acid does not have a specified density, specially purified water should be mixed with a high−density acid (mixed acid) in order to obtain the values shown in the chart (Fig. 5−1).

WARNING

When mixing high−density acid with water the acid must be added to the water in a thin stream whilst stirring with a clean wooden rod. If the water is added to the acid, the latter will splash dangerously.



values at 20 ˚C (68 ˚F)

* mixed acid: available high−density acid

Fig. 5−1 Accumulator acid chart

Example for mixing accumulator acid:

100 l accumulator acid with a density of 1.24 kg/l is required. The mixing acid available has a density of 1.71 kg/l. The intersection A on the right−hand side of the chart (Fig. 5−1) is obtained as follows:

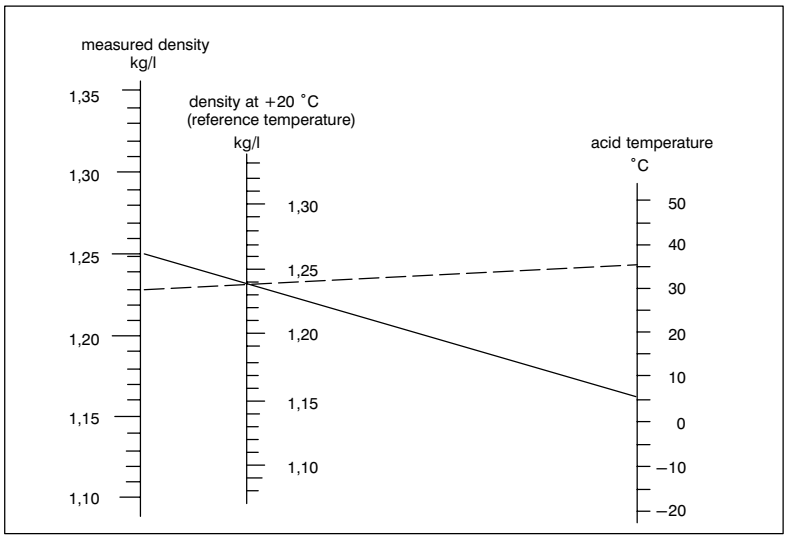
The slope *1.71* (density of mixed acid) intersects the vertical *1.24* (nominal density of accumulator acid). The horizontal through point A intersects the slope at *72 l* (specified purified water) and the vertical at *31 l* (quantity of mixed acid) in the left−hand section of the chart. The two quantities must then be mixed in order to obtain *100 l* acid with a density of *1.24 kg/l*. This chart is only valid for temperatures of +20 ˚C. For other operating temperatures see 5.4.1.2.3

When purchasing mixed acid it may be that the quantity is specified in kilograms on the container. The chart (Fig. 5−1) is however only valid for quantities specified in liters. Kilograms can be converted to liters as follows:

$$\text{Quantity in l} = \frac{\text{Quantity in kg}}{\text{Acid density in kg/l}}$$

5.4.1.2.3 Relationship between the Acid Density and the Temperature

The nominal acid density of fixed batteries is valid at an acid temperature of 20 ˚C. If the temperature increases the density will be reduced by 0.0007 kg/l per ˚C; if the temperature falls it will be increased accordingly. Thus if the temperature rises by 15 ˚C the density will be reduced by approx 0.01 kg/l; if the temperature falls by 15 ˚C the density will be increased by approx. 0.01 kg/l. The chart (Fig. 5−2) shows the acid densities for various temperatures in relation to a temperature of +20 ˚C.



Example:
– measured density=1.23 kg/l
– measured acid temperature =+35 ˚C
The line between the two points intersects the middle scale at 1.24 kg/l (density at reference temperature of +20 ˚C).

Fig. 5−2 Chart showing the relationship between the acid density and the temperature

5.4.1.2.4 Basic Rules for Handling Batteries

A few basic rules listed below should be observed when handling batteries:

WARNING

It is forbidden to use naked flames or incandescent bodies in the vicinity of accumulators. This is particularly dangerous during the charging procedure, since oxyhydrogen gas is produced when the gassing level of the accumulator acid is reached.

Caution should be observed when opening the inspection plugs. On no account should salt crystals or other foreign bodies be allowed to get into the acid is reached.

Caution should be observed when topping up with specially purified water and when measuring the acid density. Remove splashes of liquid, or conductive layers might form, allowing creepage. Seal the inspection plugs again.

Maintenance—free batteries need not to be refilled. No acid density check is necessary.

Caution should be observed when mixing high—density acid with water. The acid should be added to the water in a thin stream whilst stirring with a clean wooden rod. If water is added to the acid, the latter will splash dangerously.

Splashes of acid should be neutralized and salts removed using a lukewarm soda solution (100 g soda to 1 l water).

Care should be taken to ensure that no soda solution gets into the cells. After treating with the soda solution, clean with clear water and wipe dry.

Sufficient ventilation should be provided for the battery compartment. The acid vapors are aggressive; be careful of clothing.

Specially marked and stored test leads should be used for battery measurements on account of the acid residues which may be present.

NOTE: Run—down lead batteries are objects that can pollute the environment and must be disposed of taking the proper precautions regarding the national regulations.

The following points should be observed in order to prevent false acid density measurements with the areometer:

a) The areometer float should not stick to the side or hit the top, and should always be clean.

b) When the battery is charged or discharged a period of about 30 minutes should be waited before commencing measurements in order to allow time for the acid density between and above the plates to become uniform.

c) If specially purified water is used for topping up, no measurements should be performed for the next few hours.

d) If the temperature should deviate substantially from the reference temperature of +20 °C, thisshould be taken into consideration when performing measurements (the density decreases with higher temperatures and increases with lower temperatures).

5.4.1.2.5 Filling the Batteries with Acid

A particular quantity of accumulator acid is required for each battery type. This quantity is specified by the manufacturer or is defined by the cell levels (acid level indicator or max. marking on the cell box). The tolerance of the accumulator acid density is ±0.01 kg/l.The acid temperature should not exceed +35 °C, since heat is developed internally following filling, and higher acid temperatures may cause the maximum permitted battery temperature to be exceeded.

In hot climates with the associated high ambient temperatures it is particularly difficult to cool down the batteries during the day. We therefore recommend slowly filling the batteries half full in such regions, then filling them right up the next day after they have cooled down during the night.

NOTE: The battery should not be removed from its transport packaging until immediately prior to startup (see also Section 5.4.1.1).

5.4.1.3 Startup

Initial charging or activation.

5.4.1.3.1 General

The initial charging fully activates the plates, and for this special rules and data apply which deviate from the standard values for battery operation and charging procedures. If the initial charging procedure is not performed in accordance with the specifications, the plates will only be partly activated; coarse sulphates will be produced, and the batteries will not reach their full capacity. Such damage can only sometimes be eliminated by means of a time−consuming desulphating procedure.

As mentioned above in 5.4.1.1, the batteries may be supplied non−filled in either a dry pre−charged state, or a non pre−charged state. This is not apparent externally except from the color of the plates. The positive plate of activated batteries has a brown coloring (Pb O_2), whilst the negative plate is light grey (Pb).

5.4.1.3.2 Dry Pre−charged Batteries

Dry pre−charged batteries are activated by the manufacturer. They can be started up simply by filling the battery with accumulator acid of the specified acid density. The battery can then be operated in the navigation installation without any further delay. This however applies only to brand new batteries, since these batteries are extremely sensitive to climatic conditions.If dry pre−charged batteries are stored for some time without being filled with acid, the plates will gradually become deactivated. This process is accelerated in a moist or warm environment.They will be completely deactivated after about 6 months, and the battery must be treated and started up in almost the same way as a non−activated battery. The initial charging procedure will take more or less time depending on the storage period and the state of the plates.

5.4.1.3.3 Non Pre−charged Batteries

These batteries have the longest initial charging period. They can be recognized by the fact that the acid density drops substantially 1 to 2 hours after filling (density <1.15 kg/l), and/or the acid temperature rises by a few degrees.

5.4.1.3.4 Initial Charging

WARNING

There is a particular risk during the charging procedure, since oxyhydrogen gas develops in the gassing level of the battery acid is reached. It is therefore forbidden to use naked flames or incandescent bodies in the vicinity of accumulators. Sufficient ventilation should be provided for the battery compartment. The acid vapors are aggressive, therefore care should be taken of clothing.

The battery manufacturers specify various methods with settings and nominal data. The appropriate instructions are contained in the handling specifications accompanying with each battery. A constant current charge (I—characteristic) is used for the battery charged power supply in the navigation installation. Two test shunts, which generate a voltage drop of 2 mV/A, are installed in the BCPS. Current measurements can thus be performed via the software.

The acid density and temperature must be measured and noted once an hour during the charging procedure at every 6th or 3rd cell (test cells). The same applies to the battery voltage, which should be measured at the battery poles. For voltage measurements see Chapter 5.4.1.1).The duration of the charging procedure depends on the state of the plates, and should be at least 6 hours.The crucial factor for determining the end of the charging procedure is that the battery voltage and the acid density no longer rise over a test interval of 2 hours, and that the nominal values have been reached.If the acid density and the battery voltage do not reach their nominalvalues despite absolute conformance with the charging specifications, the charging procedure must be continued with the same charging data for a further 10 hours. If the acid density still does not reach its nominal value, the acid density must be adjusted. If the density is too low, higher—density acid (mixed acid) must be added. If the acid density is too high, specially purified water must be used for topping up. The temperature and acid level must be taken into consideration when measuring the density, in other words the nominal acid density is valid when the acid level indicator is at max.

If water is lost during the charging procedure on account of gassing, the acid must be topped up with specially purified water. If it is necessary to correct the acid density or acid level, the battery must be topped up beforehand with specially purified water. If it is necessary to correct the acid density or acid level, the battery must be charged again with the same charging values for approx. 1 hour in order to make sure the acid is properly mixed. This is ensured by means of the gassing which results.The acid temperature must be monitored during the charging procedure. This is particularly important in case of high ambient temperatures. The acid temperature may not exceed 55 °C. If a temperature of 50 °C is reached, a cooling period should be allowed until the temperature has dropped to 35 °C again.

The battery is ready for service when the nominal values have been reached and each cell has the correct acid level (max. marking of acid level indicator). Finally the outside of the battery should be cleaned with water to remove acid and dirt. The battery should then be installed immediately in the navigation installation, and operated in standby parallel mode. This procedure ensures that the battery is always charged, but that it is not operated close to the gassing level. The charge characteristic of the BCPS (current/voltage characteristic or I—U characteristic) ensures that the limit values specified by the battery manufacturer are conformed with, including subsequently charging and discharging operation. No further measures are necessary.

NOTE: Each battery cell/battery must have the same charge or discharge state on account of the series connection.

The following table summarizes the procedure.

No.	Procedure	Duration in hrs	Remarks
1	Filling with acid	–	See 5.4.1.2 (Preliminary Operations). Unscrew inspection plugs, but leave over the hole in order to prevent contamination whilst allowing gas to escape.
2	Interval	2	
3	Density measurements	–	The density provides information on the state of plates. Densities less than 1.15 kg/l mean that the battery has been stored for a long time or is not pre–charged. A higher charging current can be used in such cases.
4	Charging as per data, see also WARNING in section 5.4.1.3.4 .	6 ... 55	The acid density and battery voltage should be measured every 1 or 2 hours. Note the values and compare with previous measurements and nominal values. When the nominal values are reached, stop charging and continue at No. 5 in this table.
5	Interval	1	
6	Acid level correction	–	With purified water.
7	Charging with data as No. 4 in this table	2	Repeat Nos. 7 to 9 until the acid density and battery voltage cease to change when the previous measurements, and the nominal values are reached.
8	Interval	1	
9	Acid density and battery voltage measurements	–	
10	Set acid density and acid level to nominal values. Screw on inspection plugs.	–	If corrections are necessary, recommence at No. 7.
11	Clean battery with water (external surfaces) and grease poles.	–	See 5.4.1.2.4 (basic rules for handling batteries).
12	Operate battery in standby parallel mode.	–	

5.4.2 Care and Maintenance of the Lead Battery

5.4.2.1 Maintenance Accessories and Scope of Checks

The accessories below are required for monitoring and maintenance of the battery.

1 Acid syringe with areometer
1 Acid jug
1 Funnel
1 Container with specially purified water
} non–metal

Various cleaning agents (acid–resistant Vaseline, soda, cotton rags).

The maintenance chapters below refer to the scope of check to be carried out. The checks and related operations should be performed regularly every 2 to 3 months. The Basic Rules for Handling Batteries (see 5.4.1.2.4) should be observed.

5.4.2.1.1 Keeping the Lead Battery Clean

The battery box with batteries, boxes, terminals and connections should be kept clean and dry. When performing the regular check pay special attention to the poles and cell connections, since these are particularly subject to acid aggression and susceptible to the formation of salt crystals, especially at the plus−pole. The poles and cell connections should be greased slightly with an acid−resistant Vaseline following cleaning.

5.4.2.1.2 Measuring the Acid Density (not for maintenance−free batteries)

The acid density should be measured using the areometer. False measurements can be avoided by observing the rules see 5.4.1.2.4 . The density of accumulator acid is 1.24 ± 0.01 kg/l at 20 ˚C when the battery is charged. If the temperature deviates substantially from the reference temperature of 20 ˚C, this should be taken into account when measurements are performed.

5.4.2.1.3 Topping Up the Cells (not for maintenance−free batteries)

The cells should be topped up in good time with specially purified water. A visual check of the cells should be done approx. every 2 to 3 month. An acid level indicator with two markings 10 mm apart is incorporated in one of the cells for determining the nominal acid level. If this indicator is missing, the cells should be topped up to 15 mm above the top of the plates. It is not always possible to obtain specially purified or desalinated water of the required quality at the point of installation. In countries where the water quality is inadequate the specially purified or fully desalinated water in stock should be checked before use in accordance with the handling specifications of the battery manufacturer (test chemicals supplied if required). If the purified water does not meet the specifications, it must be post−treated (ion exchanger or distilling apparatus − supplied on request) or suitable water must be obtained.

CAUTION

The battery guarantee is only valid if the accumulator acid and water have the necessary degree of purity.

5.4.2.1.4 Measuring the Cell Voltage

The nominal voltage of the lead cells has been fixed at 2.0 V. The no−load voltage is 2.04 to 2.1 V depending on the acid density. The discharge voltage is dependent on the discharge current. The higher the discharge current, the lower will be the cell voltage and vice versa. Under normal operating conditions with trickle charging the cell voltage is 2.25 V.

In case of a failure or disconnection of the 230 or 115 V mains voltage resulting in discharging of the batteries, the cell voltage will be 2.1...1.75 V after about 5 minutes up to disconnection of the PMM. The cell voltage should not fall below 1.75 V during discharging. This is ensured by the supervision of the (D)VOR installation. The cell voltage can be measured either as described in 5.4.1.1 or using a multimeter. Only special test leads provided exclusively for battery measurements should be used, however, due to the acid residues which may be present at the battery poles. It is sufficient to check the voltage of all cells under charging current every 2 to 3 months.

CHAPTER 6
FAULT LOCATION AND REPAIR

6.1 FAULT LOCATION

6.1.1 General

Fault location in the CVOR System can be executed with the PC User Program (see Section 6.1.2) or with the fault location support procedure in Section 6.1.3. You should print out all settings, BITE values and monitor values of the transmitter, the monitor and LCP on the finally set system that has reached operating temperature. This data consists of the reference values, a knowledge of which will substantially facilitate troubleshooting. These values are assumed for the following troubleshooting procedure. If HF modules are replaced, the printout should be updated because HF modules have greater tolerances. This log of the ACTUAL state is a basis for the troubleshooting procedure.

NOTE: Both SB1, SB2 and SBA, SBB are used as term for sideband signals in CVOR/DVOR systems. SBA, SBB are used normally for CVOR (signals to dipole A or B), the terms SB1, SB2 are generally used in other Navaids 400 systems.

6.1.2 Fault Evaluation with PC and PC User Program

Any fault is stored in the system memory, which occurs in the installation and is acknowledged by the internal BIT and which leads to a WARNING or ALARM indication. Fault location in Navaids 400 can be performed by use of the BIT report in the PC User Program. This report is available in the configuration menu of the PC User Program:

– Move mouse cursor to field TRANSMITTER or MONITOR or LRCI.

– Click twice left mouse button for more information about transmitter or monitor or LRCI. The ensuing BIT results are displayed and can be interpreted or printed out.

6.1.3 Fault Location Support CVOR (50 W and 100 W)

In addition to the BIT fault report (see 6.1.2), the following fault location tables list typical faults, which may occur in a CVOR installation. The tables contain 5 columns: Step, Fault, A to C. To execute fault location in the following tables, start with left column and proceed to the right following A, B or C, and then from next row in A to C, if necessary.

6.1.3.1 Power Supply and Module Indicators

The BIT fault report (see 6.1.2) indicates faulty operating voltages, so that the defective module (AC/DC converter or DC/DC converter) can be defined and replaced. Before replacing the AC/DC converters, check mains power supply. Before locating a fault, try to define roughly the defective functional group, i.e. power supply, transmitter, antenna, monitor or LCP. A first localization is done by evaluating the LED indicators on the various modules (see Figs. 3–2, 3–3):

Step	Fault	A	B	C
1	ACC	LED out?	ACC switched to ON?	Check power supply to ACC or change ACC
2	DCC	LED out?	ACC switched to ON? TX1/TX2 at PMM switched on?	Check power supply to DCC or change DCC
3	LCP	Live–lamp out?	DC operating voltage ok?	Reset LCP
4	MSP–CD	Live–lamp out?	DC operating voltage ok?	Reset processor
5	MSG–C	Live–lamp out?	DC operating voltage ok?	Reset processor
6	CSL	MON1 LED lit? MON2 LED lit? TX1 ON LED out? TX2 ON LED out?	Monitor 1 faulty Monitor 2 faulty TX1 power supply on? TX2 power supply on?	Check according to following tables 6.1.3.2 ff.

6.1.3.2 Localization of the defective Equipment Part (1)

Step	Fault	A	B	C
1.1	Both monitors show the same fault.	Feed the transmitting antenna from the other transmitter. Are both monitors fed from the same dipole via one line?	If the fault disappears, search for it in the transmitter Is the transmitter correctly set?	 If yes, check the dipole and the line
1.2	The affiliation to the transmitter or monitor is still unclear.	The transmitting antenna or the HF lines to the antenna are defective.	Check the levels of the returning HF signals: TX1/2 BITE ADC—1: ACA1R too high ASB1R too high ASB2R too high Are the return signals in order when the transmitter is running on dummy load? If no success, search directly via the displayed monitor fault.	 Antenna or cable defective for: Carrier SBA (SB1) SBB (SB2) This is an indication of a fault in the antenna system.
1.3	Only one monitor shows a fault.	Continue searching for a monitor fault as from 8.1.		

6.1.3.3 Status Check of the Microprocessor of the MSG—C (2)

Step	Fault	A	B	C
2.1	Status check by LEDs.	The bottom LED on the MSG—C lights up continuously. This is the Live lamp. The bottom LED on the MSG—C is off or lights up with brief interruptions.	The processor is running, ok. The processor has stopped. Every interruption is an indication of a processor fault.	 Attempt a reset; if the processor stops again, the MSG—C is defective. Do not repeat this; the processor must start up itself and must not stop.
		The second LED from the top on the MSG—C lights up at brief intervals. The second LED from the top on the MSG—C stays permanently off.	The LCP polls the transmitter, ok. The LCP does not poll the transmitter, or the transmitter is not receiving the data.	1) Replace the MSG—C 2) Check the 64—pole flat ribbon cables from BP—C, connector X82, to LCP, and connector X71/TX1 (X72/TX2) to BP—T, connector X70. 3) Otherwise, replace the LCP
		The top LED on the MSG—C lights up at brief intervals. The top LED on the MSG—C stays permanently off.	The transmitter is not sending any data to the LCP The transmitter is not responding to the polling calls of the LCP.	1) The MSG—C is defective, and must be replaced 2) Check the 64—pole ribbon cable from BP—C (X71/TX1 or X72/TX2), to BP—T, connector X70.

6.1.3.4 RF—Level too low or missing (3)

* 100 W version only

Step	Fault	A	B	C
3.1	One monitor good, one monitor bad	Fault in the monitor dipole	Fault in the HF cable from monitor dipole to transmitter	Search for the fault in the bad monitor and continue with 8.1.
3.2	Both monitors show the same fault.	Search for the fault in the line from monitor dipole to transmitter or in the transmitter.		
3.2.1	Antenna or cable defective.	Measure the leading HF signal at the transmitter output. Check the returning signal at the transmitter output.	TX1/2 BITE ADC—1: ACA1 TX1/2 BITE ADC—1: ACA1R normal? Otherwise, check the impedance of the transmitter's termination.	If the rated value is good, examine the monitor. If the signal is too low, search for the fault in the transmitter.
3.2.2	Transmitter incorrectly set.	CSB power correctly set?	TX1/2—Adjustm. CSB—Power?	The nominal value should be set here.
3.2.3	Transmitter RF power off?	CSB power switched off via the control bit?	TX1/2 BITE Digital: CSB—Power State?	CSB—Power State must be ON.
3.2.4	Supply voltage for HF section?	One or several supply voltages considerably below the minimum?	MON1/2 BITE Measurement: DCC—MV TX1/2 (+28 V) supplies the modulators. TX1/2—BITE ADC—2: V281 (+28 V) supplies CA—100* .	Nominal voltage ±5 %; in the event of a fault, replace the power supply, DCC—MV or DCC—28*.
3.2.5.1	Synthesizer	Synthesizer operating outside of the frequency range from 108 to 118 MHz	MON1/2 Measurement: Carrier Frequency? Both monitors show a frequency error. Only one monitor shows a frequency error.	Replace the synthesizer. Replace corr. MSP—CD or check cable; see 8.6, 8.7.
3.2.5.2	Synthesizer	Synthesizer HF output level too low.	TX1/2 BITE Digital: Synth. Level CSB—Signal?	Replace the synthesizer.
3.2.6		Switched off because the control loop has a discontinuity.	TX1/2 BITE Digital: Loop Modulator CSB—1?	If yes, continue with 3.2.6.1.
3.2.6.1	Control loop of the transmitter has a discontinuity.	First set CSB=0 W. Then set CSB=5 W or less.	RF—Level >50 %: control loop open, thin HF cable has come off CA—100, or has been pressed out of CCP—V, Directional coupler in the CA—100* defective or has a discontinuity, MOD 110 for CSB is defective or CCP—V defective	– Check cable – Check cable – Replace CA—100* – Replace MOD—110 for CSB – Replace CCP—V
3.2.6.2	Check amplitude control loop.	First set CSB=0 W, Then set CSB=0.1 P_{nom}.	30 % < RF—Level <40 % Control loop is good. CA—100 only operating with partial power.	Modulation depth at nominal power is reduced Replace CA—100*.
3.2.7		Control signal from the MSG—S is too low. Set the transmitter's nominal power.	TX1/2 BITE ADC2: CSB_1S2, CSB_1_ST_6 at the nominal value?	Substantially less than the nominal value. Replace the MSG—S

6.1.3.5 Modulation Depth of the Carrier is too low (4)

Applicability: CVOR: 9960 Hz auxiliary carrier, identity and voice, not for 30 Hz AM composed of carrier and sideband.
DVOR: 30 Hz AM, identity and voice, not for the 9960 auxiliary carrier, which is composed of carrier and sideband.

* 100 W version only

Step	Fault	A	B	C
4.1	One monitor good, one monitor bad	Search for the fault in the bad monitor and continue with 8.1.	Condition: neither monitor may have more than 110 % RF level; otherwise, measuring errors may occur.	
4.2	Both monitors show the same fault.	Search for the fault in the transmitter.	Condition: neither monitor may have more than 110 % RF level; otherwise, measuring errors may occur. TX1/2 BITE ADC—1: ACA1R normal?	 Check the impedance of the transmitter's termination if ACA1R is substantially higher.
4.2.1	Adjustment error	Modulation depth correctly set?	— Mod. Depth 9960 Hz AM — Mod. Depth Voice AM* — Mod. Depth Identity AM	Correctly set modulation depths.
4.2.2	Limiting in the HF power section	CA—100* goes into limiting too early.	TX1/2 BITE ADC—1: ACM1 higher than normal? Halve the set power "Carrier Power": — Mod. depth is increased: — Mod. depth remains:	 Replace CA—100* CA—100* defective Other fault
4.2.3		Carrier modulator MOD—110 goes into limiting.	TX1/2 BITE ADC—1: ACM1 normal or lower? Halve the set power "Carrier Power": — Mod. depth is increased: — Mod. depth remains:	 Replace MOD—110 (CSB) MOD—110 (CSB) faulty Other fault
4.3	Control signals	Control signal from the MSG—S is not correct.	CSB_1_S2 normal? CSB_1_ST6 normal?	If no, replace MSG—S.
4.3.1		30 Hz FM index is wrong, too low or 0.	Is Mod. Index 30 Hz FM correctly set? The FM is generated on the MSG—C together with the MSG—S.	Replace MSG—C; if necessary, replace also MSG—S.
4.3.2		The modulation depth of the identity is wrong or is missing.	Transmitter Commands: — Is "Identity OFF"? — Is Mod. Depth Identity AM set correctly? Set output power to 0.5 P_{nom}: — Is the identity then OK? To recheck this, you may need to set Ident CW—Mode	Identity must be "ON". If yes, CA—100* or MOD—110 (CSB) are overdriven; see 4.2.2 and 4.2.3.

Step	Fault (4 cont.)	A	B	C
4.3.3		The modulation depth of the identity is wrong and, independently of the transmitted power, the control signal is wrong.	Re−check under 'TX1/2 BITE ADC−2': ID_ST_2 and ID_ST_5	If these signals are not good, replace MSG−S or MSG−C.
4.3.4		Ident Morse code is not working or is defective.	Is the code correctly set? The Morse code is generated completely on the MSG−C.	Replace MSG−C

6.1.3.6 Modulation by Sidebands too low or wrong (5)

This description concerns signals that are composed of carrier (CSB) and sideband signals (SB). Here, not only the right level conditions of CSB and SB must be ensured, but also the right phase. Errors of the sidebands almost always lead to azimuth errors. Both error types must be considered in relation to one another.

Step	Fault	A	B	C
5.1	One monitor good, one monitor bad	Search for the fault in the bad monitor and continue with 8.1.	Condition: neither monitor may have more than 110 % RF level; otherwise, measuring errors may occur.	
5.2	Both monitors show the same fault.	Search for the fault in the transmitter.	Condition: neither monitor may have more than 110 % RF level; otherwise, measuring errors may occur. TX1/2 BITE ADC−1: ACA1R normal? ASB1R and ASB2R normal?	 Otherwise, check the impedance at the corresponding transmitter termination.
5.2.1	Amplitude wrong	Level of the sideband set correctly? Phase of the sideband set correctly?	TX1/2 Adjustments: − SBA Power Level − SBB Power Level − SBA Phase Adjustment − SBB Phase Adjustment	
5.2.2		One or both SB modulator(s) is/are not producing enough modulation depth.	SB power too low? Check the test output for side band forward signal: TX1 BITE ADC−1: ASB1 and ASB2, right or too low? Carrier level too high. Check whether carrier power is correctly set; forward ACA1 right or too high?	If ASB1 and ASB2 deviate by less than ±5 % from the previously measured value in the same operating state, the output level is good, and the fault is presumed in the phase. Continue with 5.2.3 ff. Ensure the correct carrier level.
5.2.2.1		The synthesizer does not oscillate in the range from 108 to 118 MHz. Synthesizer output level too low	MON1/2 Measurement: Carrier Frequency? TX1/2 BITE Digital: Level SB1: BFSBA0 ok? Level SB2: BFSBA0 ok?	If the frequency is wrong, replace SYN. Level too low, replace SYN.

Step	Fault (5 cont.)	A	B	C
5.2.2.2		Supply voltage: The control signals at the output of the modulators ASB1 or ASB2 are lower than in the basic setting.	28V present? MON1/2 BITE Measurement: 28V DCC−MV > 26.5V?	Otherwise, replace DCC−MV.
5.2.2.3		The control signals at the output of the modulators ASB1 or ASB2 are lower than in the basic setting.	Compare the control signals SB1A_ST3 and SB2A_ST3 with the original values. If SB1A_ST3 and SB2A_ST3 are lower or zero, then control by the MSG−S is defective.	If SB1A_ST3 and SB2A_ST3 are equal to or more than originally, replace the corresponding modulator. The fault is unlikely to be caused by the CCP−V. Replace MSG−S, possibly replace MSG−C.
5.2.3	Side band and carrier phases do not match.			
5.2.3.1	Wrong carrier phase	First check the carrier phase.	TX−1 Measurement: CSB RF Phase Measurement Is the original value of ±5° reached? TX1/2 BITE ADC−1: BU_MOD_C1? TX1/2 Miscellaneous: MOD−CSB−1 Sign Control? Do both have the original value? BU_MOD_C1 should lie within the range from +2V to +8V. Phase adjustment of carrier is not possible ifBU_MOD_C1 lies between −0.5 and +1.5 V or between 9 and 27 V.	Replace: – MOD−110 (CSB) – CCP−V – (possibly MSG−C)
5.2.3.2	Wrong SBA phase	Check the side band phase.	TX1/2 Adjustments: SBA Phase Adjustm. TX1/2 Measurement: SBA RF Phase Measurement TX1/2 Miscellan.: MOD−SB1 Sign Control TX1/2 BITE ADC−1: BU_PH_SB1 The value must change with the phase setting of SB1.	Original value? Do both values agree to ±5°? Original value? Original value? In the event of a deviation, replace: – MOD−110 (SBA) – (possibly CCP−V) – MSG−S or MSG−C

Step	Fault (5 cont.)	A	B	C
5.2.3.3		Phase of sideband A wrongly set.	Set the level of sideband B to 0. Change the phase of SBA until Mod. Depth 30 Hz AM reaches a minimum. Add or subtract 90°. Mod. Depth 30 Hz AM must reach a maximum. Set the level of sideband B back to normal.	If a module has been replaced, first set the original value; only check the minimum and maximum. Change them only if required.
5.2.3.4	Wrong SBB phase	Check the sideband phase.	TX1/2 Adjustments: SBB Phase Adjustm. TX1/2 Measurement: SBB RF Phase Measurement TX1/2 Miscellan.: MOD−SB2 Sign Control TX1/2 BITE ADC−1: BU_PH_SB2 The value must change with the phase setting of SB2.	Original value? Do both values agree to ±5°? Original value? Original value? In the event of a deviation, replace: − MOD−110 (SBB) − (possibly CCP−V) − MSG−S or MSG−C
5.2.3.5		Phase of sideband B wrongly set.	Set the level of sideband A to 0. Change the phase of SBB until Mod. Depth 30 Hz AM reaches a minimum. Add or subtract 90°. Mod. Depth 30 Hz AM must reach a maximum. Set the level of sideband A back to normal.	If a module has been replaced, first set the original value; only check the minimum and maximum. Change them only if required.
		CAUTION: If the side band phase is offset from the right value by 180°, a perfect maximum is the result, but the azimuth angle rotates in the wrong direction. The original angle values must be restored before final commissioning.		

6.1.3.7 Wrong Carrier Frequency (6)

Step	Fault	A	B	C
6.1	One monitor good, one monitor bad	Search for the fault in the bad monitor and continue with 8.1.		
6.2	Both monitors show wrong frequency values.	Is the right frequency entered?	TX1/2 Adjustments: Transmitter Frequency?	Replace the synthesizer if the set and measured frequencies deviate from one another by more than 1.2 kHz.

6.1.3.8 Azimuth Indication (7)

Step	Fault	A	B	C
7.1	One monitor good, one monitor bad	Search for the fault in the bad monitor and continue with 8.1.		
7.2	Both monitors show wrong values.	Check the following values on both monitors:	TX1/2 Adjustments: Azimut Alignment correctly set? MON−1/2 Measurement: – Mod. Depth 9960 Hz AM – Mod. Index 30 Hz FM – Mod. Depth 30 Hz AM	 30 ±2 % ? 16 ±2 % ? 30 ±2 % ?
7.2.3		Measure the azimuth values as a function of the geographical angle. Feed one monitor input with the signal of the roof edge portable monitor dipole and record the azimuth values and 30 Hz AM in 45° increments.	The measured azimuth angle does not change continuously with the position of the monitor dipole, but has only two values that differ by 180°. The displayed azimuth values does not change continuously with the geographical measured angle. Has Mod. Depth 30 Hz AM Maxima and Minima?	One sideband is missing or has a phase offset by 90°. One sideband is too small or has a wrong phase.
7.2.3.1	Locate the defective sideband.	Check settings and measured values.	Check on the activated sideband: TX1/2 Adjustments: SBA/SBB Power Level TX1/2 Measurement: SBA/SBB Amplitude Measurem. TX1/2 Adjustments: SBA/SBB Phase Adjustment TX1/2 Measurement: SBA/SBB RF−Phase Measurem.	 Deviation from the settings? If yes, continue with 5.2.1 Deviation from the settings? If yes, continue with 5.2.3. Deviation from the settings? If yes, continue with 5.2.3. Deviation from the settings? If yes, continue with 5.2.3.
7.2.3.2		Is the direction of rotation of the azimuth correct?	When you walk around the system in clockwise direction, the azimuth angle must increase: Wrong direction of rotation? Mod. Depth 30 Hz AM constant over the azimuth?	Search for the position of the greatest azimuth error. Only set the sideband level to ”0” that does not influence Mod. Depth 30 Hz AM or only has a slight influence on it. Change the phase of the remaining sideband by 180°.

6.1.3.9 Fault in the Monitor (8)

The fault is presumed in the monitor. As both monitors are independent of one another, only one monitor will show the fault.

Step	Fault	A	B	C
8.1	Status check by LEDs	The third LED from above on the MSP—CD lights up continuously. This is the Live lamp. The third LED from above on the MSP—CD is off or lights up with brief interruptions.	The processor is running, ok The processor has stopped. Every interruption is an indication of a processor fault.	 Attempt a reset; if the processor stops again, the MSP—CD is faulty, replace.
		The second LED from the top on the MSP—CD lights up at brief intervals. The second LED from the top on the MSP—CD stays permanently off.	The LCP polls the monitor, ok. The LCP does not poll the monitor, or the monitor is not receiving the data.	 1) Replace MSP—CD 2) Replace LCP
		The top LED on the MSP—CD lights up at brief intervals. The top LED on the MSP—CD stays permanently off.	The monitor sends data to the LCP, ok The monitor is not responding to the polling calls of the LCP.	 The MSP—CD is defective; replace it.
		The bottom LED indicates the identity tone. See: 4.3.2 to 4.3.4.	The LED is bright when the 1020 Hz identifier tone is present.	
8.2	Check with the test generator	The test generator on the CSL generates normal navigation signals in 45° increments of the azimuth, as well as one without 30 Hz modulation and one without 9960 Hz auxiliary carrier. With the hexadecimally coded switch on the CSL, the corresponding channel is set and is fed into the monitor instead of the demodulated HF signal.	MON—1/2 Measurement: — TSG RF—Level — TSG Azimuth — TSG Mod.Depth 30Hz AM — TSG Mod.Depth 9960Hz AM — TSG Mod. Index 30Hz FM The MSP—CD is defective if one or several of these signals show(s) the same fault as in the case of the transmitter. **Before** replacing the MSP—CD, check the calibration of the incorrectly displayed value.	The MSP—CD module contains the complete signal processing and evaluation circuitry. In the event of a fault, replace the MSP—CD. Calibrate the new one.
8.3	Checking the HF branch of the MSP—CD	All TSG signals are displayed correctly, but the monitor shows incorrect signals of the transmitter.	The branches: band filter, HF amplifier, AGC setting and demodulator are not used by the TSG signals. These faults cannot be detected via the TSG. Change the AGC value until the RF level is at 100±5 %.	 If 100 % cannot be set, or only in the event of a considerably deviating AGC, the HF branch of the MSP is defective; replace and readjust the MSP—CD.
8.4	Both MSP—CD show the same value after 8.2.		The modules have been damaged, e.g. by a lightning strike.	Replace both MSP—CD.

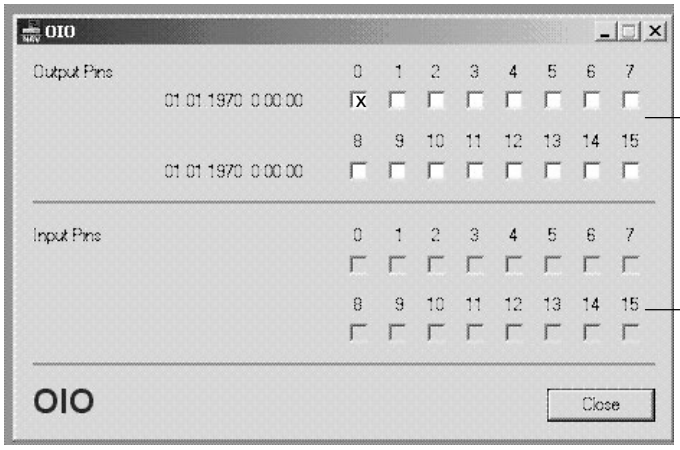
Step	Fault (8 cont.)	A	B	C
8.5	The identity is not displayed.	Is the second monitor working properly? If the modulation depth of the identifier is greater than 4%, the bottom green LED must indicate the identity tone.	One monitor is good. The second monitor does not detect the identity.	 The corresponding MSP is defective and must be replaced.
8.6	One monitor shows a wrong carrier frequency.	The monitor measures the frequency of both transmitters wrongly or shows 0 kHz.	MSP—CD defective	Replace MSP—CD.
8.7		Both monitors measure the frequency of one transmitter correctly, but measure the frequency of the other wrongly.	Wrong frequency, but f $\neq$ 0 Frequency 0 kHz or 0.1 kHz.	Synthesizer defective Synthesizer defective or 64—pole flat ribbon cable from BP—C, connector X71/TX1 (X72/TX2) to BP—T, connector X70, defective or has come loose.

6.1.3.10 Fault of the Local Control Panel (LCP) (9)

The LCP is the focal point for communication which interfaces the local PC and the Remote Control to the transmitters and monitors. The LCP evaluates directly the battery and the mains monitoring. The LCP consists of two boards: LC−CPU, LCI.

Step	Fault	A	B	C
9.1	Live lamp off	LCP board: live lamp on LC−CPU off. Liquid crystal display screen is dark. Keys do not function. ALARM and NORMAL remain lit, LCD screen is dark.	Standstill of LCP−processor or/and possibly no power supply. Reset Processor of LC−CPU board. ALARM and NORMAL indicators light simultaneously, until processor is initializing and extinguish after that. Execute lamp test: Press simultaneously keys XMTR and MON at front panel. Indicators must light, the buzzer gives a short tone. For this test the processor and software must run.	Measure at back panel BP−C the '5VK' voltage against GND: If 5VK is $\leq$ 4,9 V change DCC−3−05. If 5VK is $\geq$ 4,9 V, check 14−pole flat ribbon cable from CSL front (connector X4) to LCP (connector CT5). If lamp test is not successful though the 5VK voltage is ok, the LCP is faulty. Replace completely the LCP.
	LCI: LCD screen dark	LCP board: live lamp on LC−CPU on.	Check −15 V voltage supply from CSL.	If ok, replace LCI board with LCD display. If check fauls again, replace CSL.
9.2	Live lamp on	Transmitter rack, LCP: The display in MAIN STATUS field indicates WARNING.	At least one *.sit file is missing or damaged in the LCP. The RAM−check states a fault. Call in ADRACS 'RC Management' submenu 'Control', resp. start 'MCS File Transfer' tool, ⇒ select menu 'File Transfer' ⇒ select function 'Show RAM Directory'	All files available? If necessary, restore the floppy backup of the *.sit files.
9.3	Live lamp on	Transmitter rack, LCP: The LCD screen shows 'Actual Installation CVOR 431'. "Maintenance Alert Warning" in the LCD screen is indicated. Call Menu 'Alert Indication' for more information.	The *.sit files are ok. e.g. the battery at the LCP is weak, $U_{Bat} < 3.2$ V .	Backup data. Replace the Lithium battery at the LCP.
9.4	No communication between PC and LCP.	The LCP is ok. Indications and controls directly at the LCP are operating, but operation via PC is not possible.	Interface cable between PC and LCP is defective or contacts are contaminated. Configuration of PC is not ok: – Is the correct port used at the PC? – Is any other program running at this port? – PC User Program is missing or damaged?	Check cable? Are the original cable used: Connector 9−pole, 0−Modem cable? Check serial interface port at PC? Check programs. Re−load PC User Program if necessary.

Step	Fault (9 cont.)	A	B	C
9.5	No interrogations to monitor or transmitter.	RXDA LED (second from above) at the MSP−CD or MSG−C does not sparkle regularly (This LED indicates received interrogations from LCP to monitor or transmitter).	Transmitter and monitor are switched on? Check, if 64−pole flat ribbon cables from BP−C, connector X82 to LCP and from BP−C, connector X71/TX1 (X72/TX2) to BP−T, connector X70, are defective or have come loose.	The LCP interrogates only processors which are switched on. Replace or fix cables.
9.5 cont.		Both MSP−CD and both MSG−C are not interrogated. At least one MSP−CD and MSG−C communicates with the LCP.	The LCP is presumably defective. The fault can be located possibly in the LCP or in the transmitter or monitor subassemblies (MSP or MSG−C)	Replace the LCP completely. Replace first MSP−CD or MSG−C, than LCP (or LC−CPU) if replacement of MSG−C/MSP−CD was not successful.
9.6	LCP OIO in/out signals do not operate	Check line connection at connector OIO LCP IN or OUT. Refer to 2.3.5.12 or 2.3.5.13 for pin assignment. Do not short circuit the 5 Vdc at pin14 (OIO LCP IN) or 25 (OIO LCP OUT).	Connection is faulty or broken External connection is ok. Check internal connection: flat ribbon cable from LCP to connectors on top. Both are ok: Open dialog window 'LRCI − OIO' to check the in− or output lines (see example of ADRACS window below).	Repare the connection line Check ext. signalling device. If test failes, the flat ribbon cable is presumably defective. Reinstall software (application, *oio*−file) or the LCP is presumably defective. Replace the LCP completely.



Indication of the state of outputs:
output can be checked with activation per click in the correspondent field and measurement at the connector OIO LCP OUT.

Indication of the state of inputs:
shows input state at the connector OIO LCP IN.
No indication means no current flow

Dialog window LRCI − OIO for check of auxiliary LCP Input or Output

6.2 REPAIRS

6.2.1 General

The repair activities are designed to restore the ready condition of a faulty system in the shortest possible time. The system is repaired by replacing the defective subassembly. The defective subassemblies can then be sent to the manufacturer for repair.

NOTE: Subassemblies and components which are sent to the manufacturer for repair or returns must be packed in a way that no damage of the parts could arise. It is recommended to use the original packing, e.g. of the spare part, or a comparable packing in corresponding performance to ensure a safe shipping of defective subassemblies or components. Handling of subassemblies with electrostatically sensitive components see section 6.2.1.1.3 .

The mark (!) used in Fig. 6−3 (Adjustments after change) means an important action after repair. Indicated adjustments after change are normally performed using the PC User Program (measurement values) and if necesssary repeating the correspondent sections of the Alignment Procedure.

6.2.1.1 Safety Precautions

6.2.1.1.1 General Regulations

The safety regulations laid down by the local authorities (e.g. concerning accident prevention, work safety or operation of electronic equipment and navigation systems) must be observed at all times. The purpose of safety precautions is to protect persons and property, and they must always be heeded. See also Part 1, Section 1.4.

Work should not be carried out outside the shelter or on the antenna system during a storm, due to the danger of injury by lightning.

Station shutdown due to repair and maintenance: The responsible authorities must be notified of any work which may require operation of the system to be interrupted, in accordance with national regulations.

Change of parameters is allowed only by maintenance people with specific access level to the PC User Program (ADRACS or MCS). Changes to the established monitor alarm limits should only be done during flight check procedure.

6.2.1.1.2 Work on the Equipment

In order to avoid risks to persons and consequential damage to subassemblies, the relevant transmitter must be switched off with switch TX1 or TX2 prior to removing or inserting a subassembly or prior to removing a plug−in connector during the course of repair and maintenance activities (see Section 6.2.3.1 for exceptions). Switches TX1 and TX2 deactivate the DC converters for the transmitter 1 and transmitter 2 subassemblies respectively. The subassemblies which are common to both transmitters are exceptions: they can be switched on with TX1 or TX2 and off with TX1 and TX2. Switch NAV deactivates the complete equipment.

The battery−charged power supply (BCPS) must always be disconnected from the mains before any work, other than measuring the voltage is carried out on it.

Burned fuses must be changed only once. Use same type. If burned again check for short circuits!

RF cables must not be bent to a radius of less than 50 mm.

6.2.1.1.3 Handling Electrostatically Sensitive Subassemblies

The ILS and (D)VOR installations contain subassemblies (plug−in cards) equipped with components which are sensitive to electrostatic discharge. When replacing subassemblies and plug−in cards

containing electrostatically sensitive components, special precautionary measures should be taken during removal, transport and installation in order to prevent damage to the components. We refer to the customer documentation of the manufacturer.

Subassemblies which contain electrostatically sensitive components are marked with this symbol.

If any of the maintenance personnel need to touch one of these subassemblies, they should place both hands flat on a grounded conductive surface for a few seconds to eliminate static charges. The subassembly can be touched – preferably at an insulator (board edge, lever mechanism, etc.) – as soon as the potential has been equalized in this manner. It is advisable to avoid touching the contacts of the plug–in connectors, the conductor paths and the components themselves. Some of the subassemblies must be left in their antistatic packaging or plastic bags as long as possible. The special procedures described below should be followed when subassemblies and plug–in boards are replaced within the framework of repair and maintenance activities, due to the risk of damage to electrostatically sensitive components.

To remove a subassembly:

– Switch off the system before beginning the replacement procedure.
– Eliminate any static body charges by touching the frame of the grounded system (rack) with both hands.
– Remove the subassembly and lay it down on a bench with a grounded conductive worktop.
– Pack the subassembly in an antistatic plastic bag and send it off to the manufacturer for repair.

To install a subassembly:

– Eliminate any static body charges by touching the frame of the grounded system (rack) with both hands.
– Remove the subassembly from the antistatic plastic bag.
– Install the subassembly.
– Switch on the system again.

6.2.1.1.4 Components Containing Beryllium Oxide Ceramics

Some of the subassemblies are equipped with transistors containing beryllium oxide. These transistors are in line with the latest state of the art and are in use all over the world. They are absolutely harmless in a sealed, compact condition. Beryllium oxide dust, which is detrimental to health, may however be produced if the transistors are opened. They should not be dismantled or shattered. This applies likewise if they are scrapped or disposed of. The following subassemblies contain power transistors with beryllium oxide:

– Modulator 110 : Transistor types BLF242, BLF 245
  Modulator 110P : Transistor types BLF244, BLF 246
– CA–100C : Transistor type BLF248

6.2.1.1.5 Handling Lead Batteries

See chapter 5, Section 5.4 ff and Part 1, Section 1.4.

6.2.2 Correcting a Processor Standstill

See Fig. 6−1.

A processor standstill may result when subassemblies are removed under voltage or on account of static charges which are discharged from the operators to the rack. This condition is always the result of an operator error. It is therefore advisable to pinpoint the causes as soon as it happens. There are in fact only four possible causes, though these may occur in combination.

- Insufficient grounding of the rack
- Unsuitable and/or incorrectly cleaned floor covering
- Non−observance of clothing regulations by personnel
- Carelessness of the personnel due to inadequate information.

Any causes determined should be remedied immediately by means of appropriate measures: the symptom will not then recur. A distinction should be made in case of a processor standstill between a failure in the monitor processor and a failure in the transmitter processor. Both the behavior of the system and the measures to be taken are different.

6.2.2.1 Failure in the Monitor Processor

The LCP shows MON1 FAULTY or MON2 FAULTY due to to the failed processor. If both monitors fail, the transmitter will be shut down. Remedy:

- Open front door of the rack.
- CPU live lamp on the MSP must be lit. If the live lamp is off, press reset button on MSP.
- Close door again.
- Perform login and enter password if more commands must be entered, otherwise this step may be ignored.

The installation is then fully operational again.

6.2.2.2 Failure in the Transmitter Processor

If lamps light up on the system in a manner which has no meaning and cannot be interpreted, then go out again after a short time, then the processor has fallen out of synchronism temporarily on account of an interference pulse, but has been able to recover. If this symptom is encountered repeatedly, the causes should be determined. If the transmitter fails on account of a processor standstill, this is displayed by means of TX1 or TX2 WARNING on the LCP. Remedy:

- Open front door of the rack.
- CPU live lamp on the MSG−C must be lit. If live lamp is off, press reset button on MSG−C.
- Close door again.
- Perform login and enter password if more commands must be entered, otherwise this step may be ignored.

The installation is then fully operational again.

6.2.2.3 Failure in the LC−CPU Processor (LCP)

If the LCP screen is dark and keys on front panel do not function a LCP−processor fails on account of a processor standstill, a first measure is to reset the LC−CPU board. Remedy:

- Open front door of the rack.
- Live LED on LC−CPU must light. If it is off, press button board reset on LC−CPU.
- Close door again.

The installation should be fully operational again.

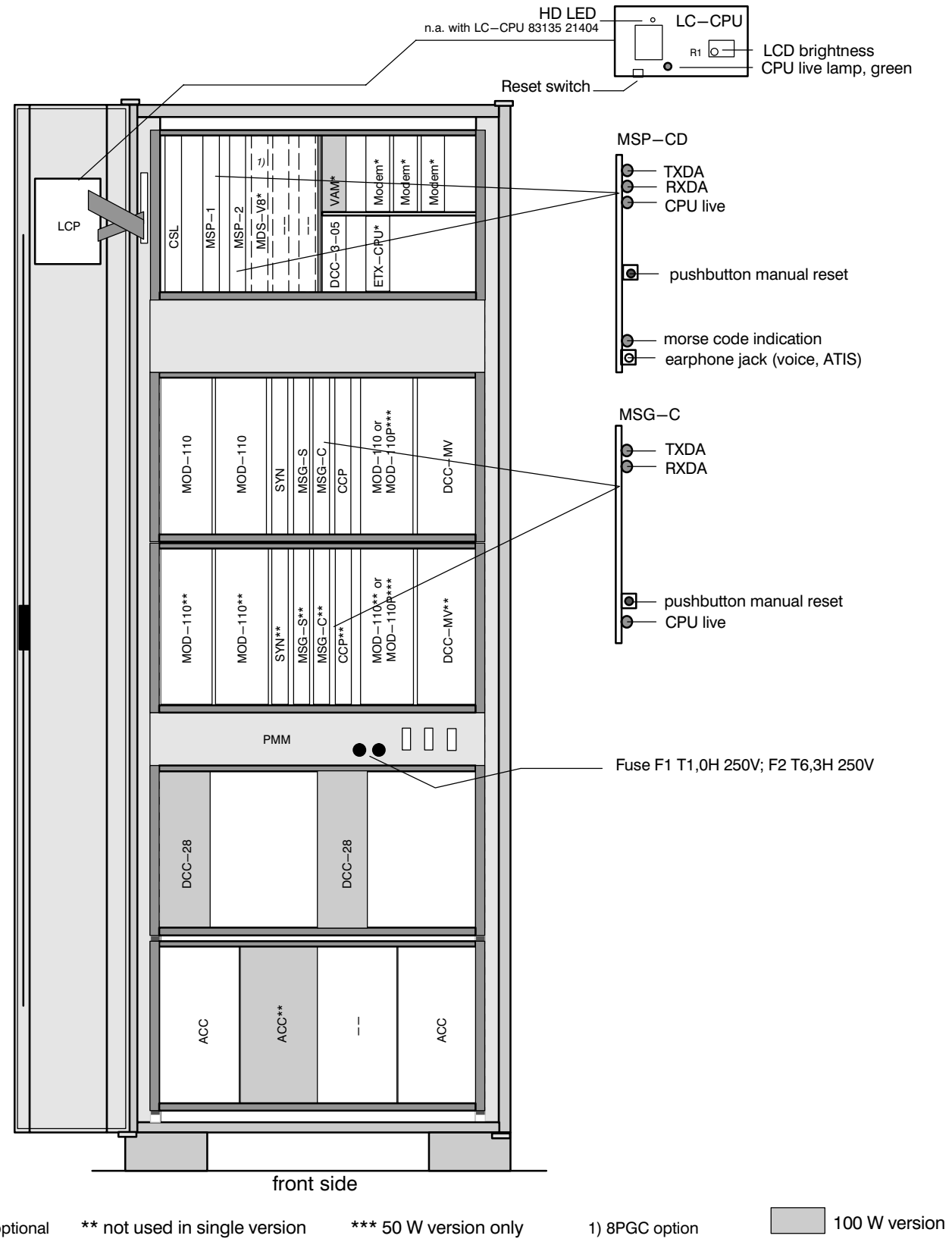


Fig. 6−1 Push buttons and indications on the subassemblies LC−CPU, MSP and MSG−C

6.2.3 Replacing Subassemblies

WARNING

The heat sinks of the modulators (MOD−110P) and of the carrier amplifier (CA−100C) may warm up during operation. This is normal and does not affect the function. When replacing these subassemblies it is recommended to let them cool down for a while or take suitable measures (e.g. gloves). When replacing the subassemblies SYN und CCP avoid touching the heat sinks of the MOD−110P.

6.2.3.1 Disconnecting the Voltage before Replacing Subassemblies

CAUTION

The voltage must always be disconnected before removing or installing subassemblies (subject to only a very few exceptions). It is sufficient to switch off all the transmitter subassemblies, the DCC−MV and the DCC−28 with either of switches TX1 or TX2 on the PMM subassembly. The transmitter subassemblies can also be switched off by means of a PC command.

Before replacing an ACC−module the BCPS must always be disconnected from mains.

If a monitor subassembly is affected (MSP−CD), the associated DCC subassemblies (DCC−3−05/1 and /2) must be switched off with both TX1 and TX2 on the PMM. The DCC−03−05 cannot be switched off individually.

If the CSL must be changed, both TX1 **and** TX2 must be switched off beforehand.
The VAM, MODEM and the DCC−3−05 subassemblies may be removed and installed when live. The special design of their contacts prevents damage from occurring.

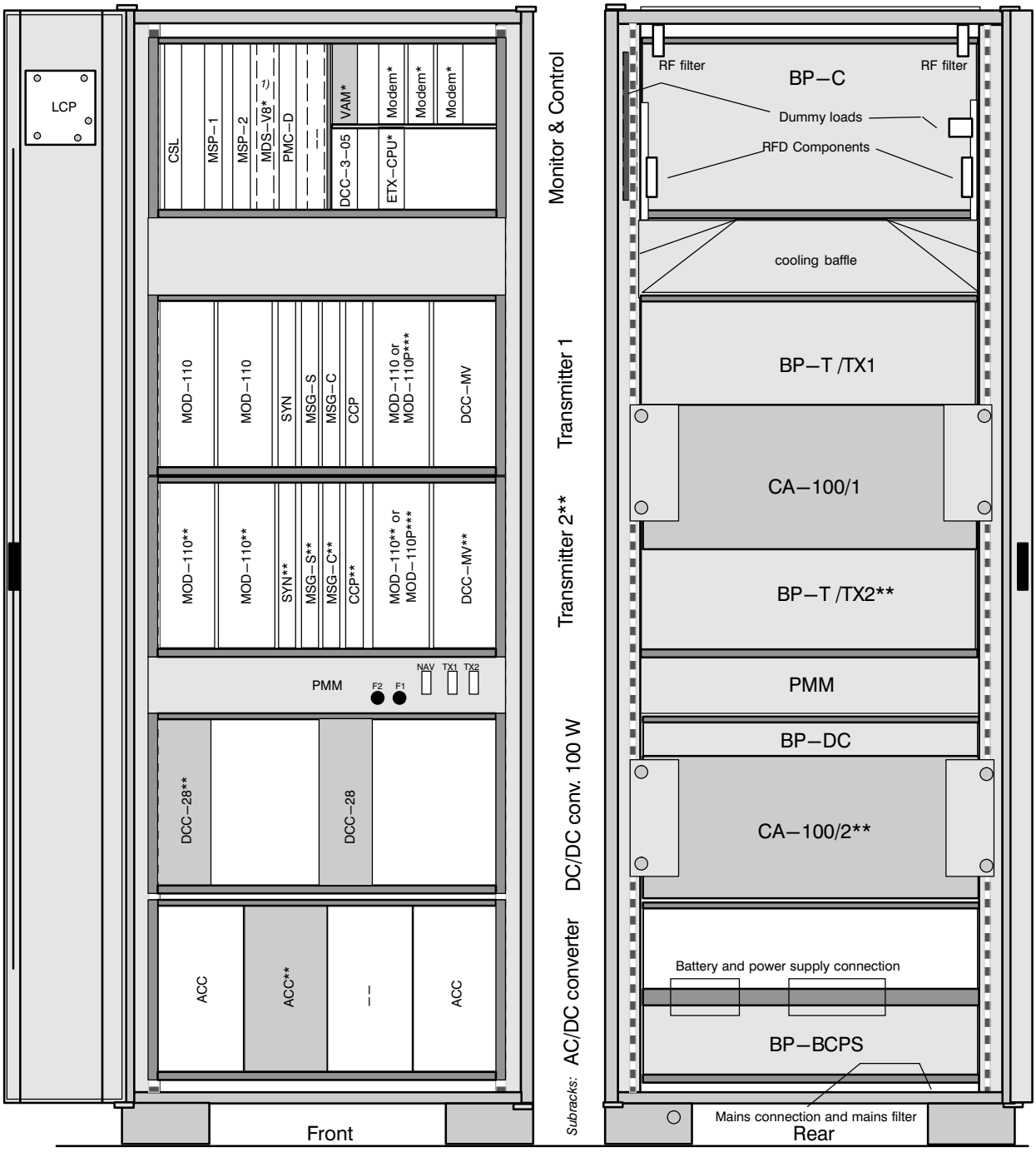
6.2.3.2 Subassemblies in the Transmitter Rack and Power Supply

The table in Fig. 6−3 lists the work which may be necessary after a subassembly has been replaced. Please also refer to Section 6.2.1.1 and 6.2.1.1.3 .

- The relevant transmitter must be de−energized before removing or installing subassemblies, preferably by switching it off on the PMM subassembly. It should be noted that the following subassemblies are only de−energized if both switches (TX1 and TX2) and switch NAV (for CSL) on the PMM are switched to off: LCP, DCC−3−05, CSL, MSP−CD, VAM.
- Several of the subassemblies have DIP switches or jumpers on their pc boards. It is essential to check that the switches or jumpers on the new subassemblies are set to the same positions as on the old subassemblies. Section 6.2.5 contains a list of the DIP switches and jumpers.
- To remove a printed circuit board assembly from the transmitter subrack release it with the front levers of the board if available. Remove it carefully from the subrack. Regard the weight of the MOD−110 and the CA−100C (100 W version) if removing them.
- Inserting the board regard the correct fitting to the guiding bars of the subrack. Press assembly carefully in the socket on the backpanel.
- Some subassemblies in the assembly carrier have plug−in RF connections. These subassemblies (e.g. MOD−110/110P, MSP, SYN, CCP etc.) may require some corrections to fit the RF connectors. Take care for correct fitting. Sometimes it is recommended to use a suitable defitting tool.

  The tool is used after withdrawing the respective subassembly to remove correctly the RF cables from connector at the backpanel and, after replacing the subassembly, to insert the RF cables one after the other.

– Check that all the RF cables have been connected correctly before switching the transmitter on again, and make sure that either the antenna or a dummy load is connected to the transmitter output signals (CSB, SB1, SB2).



* optional ** not used in single version *** 50 W version only 1) 8PGC option Version 100 W

Fig. 6–2 Locations in the CVOR rack

Subassemblies of the transmitter rack

Unit to be changed	Preparation *(see also Fig. 6–2)*	Adjustments after change
SYN	–	Adjust station frequency
MOD–110	–	check RF level, modulation depths, phasing
MOD–110P	–	check RF level, modulation depths, phasing
CA–100C	loosen 4 screws, remove cables	check output power
CCP	–	(!) readjustment of transmitter neccessary with calibrated MSP or external measuring equipment
RFD/Filter	loosen screws, remove cables	–
MSG–S	–	(!) adjust or load all transmitter data
MSG–C *	–	–
MSP *	–	(!) calibrate monitor
CSL *	–	–
MDS–V8 (8PGC opt.)	–	check AGC in MSP
LCP complete	remove cables, loosen 5 screws	(!) re–load installation type, configuration, site and PTT file, and user defined masks if available.**
LCP, LC–CPU	remove cables, loosen screws	
LCP, LCI	remove LC–CPU, loosen screws	–
VAM	–	check VAM settings
Modem LGM 28.8	–	check modem settings
Modem LGM 1200MD	–	check modem settings
ETX–CPU	remove interface cables	check settings; spare ETX–CPU SW is already configured in flash disk as standard
DCC–3–05	–	–
DCC–28	loosen screws on front panel	–
DCC–MV	loosen screws on front panel	–
PMM	loosen screws, remove cables	–
ACC–54	loosen screws on front panel	Check/match charging voltage

* Subassembly contains EPROM. Replacing EPROM refer to 6.2.3.2.1 and 6.2.3.2.2 .

** To reconfigure or update LCP software refer to 6.2.3.2.3 .

Fig. 6–3 Preparation and adjustments during a subassembly replacement

6.2.3.2.1 Replacing EPROM

NOTE: Before starting it is recommended to read out all parameters of the installation: Save all parameters in a file (with ADRACS 'Data' submenu 'Up−/Download Data', resp. with MCS 'Snapshot' submenu 'Save'), make a printout of all parameters or write down manually the indicated parameters if other measures are not possible. It is also recommended to generate a copy of the specific site files as backup:
- Using the PC User Program ADRACS, click on the 'Control' button in the Main Status window, select 'File Transfer' and 'Copy SITE file to PC' in the submenu.
  Using the 'MCS File Transfer' tool, select 'FILE OPERATIONS' in the MASTER MENU, select function 'COPY SITE FILE TO PC'.
- Copy all files with the extension:**.sit*, **.oio*, **.msk*, **.ptt or *.dat.*

The EPROM should always be replaced by qualified personnel only. The following subassemblies contain EPROM which may need to be replaced: MSG−C, MSP, CSL (test generator). The locations are shown in Section 6.2.5.

CAUTION

Since the EPROM are electrostatically sensitive components, the following safety precautions must always be observed (see also Section 6.2.1.1.3): The person replacing the EPROM should preferably not wear shoes with rubber or plastic soles, and should first eliminate any static charges by touching the transmitter rack with both hands.

a) Switch off both transmitters: set the TX1 and TX2 switches on the PMM to OFF.

b) Release the MSG−C resp. MSP or CSL with the lever mechanism and remove it from the slide−in chassis in the rack. Lay the subassembly down on an electronically conductive surface (e.g. on the special packaging provided).

c) Remove the EPROM:
Identify the EPROM to be replaced by means of its inscription and note its orientation (notch on one of the narrow sides). Lever the EPROM slowly out of the base by carefully applying a flat, pointed object (e.g. a screwdriver) to the narrow sides alternately.

d) Fit the new EPROM:
Fit the new EPROM into the empty base in the same position. If the EPROM is swapped from one unit to another, determine the correct orientation by comparing the two units. Before fitting the EPROM, check that all the pins are aligned exactly. Press the two rows of pins into the base one at a time.

e) Reinstall the MSG−C resp. MSP or CSL and lock it in position.

f) Execute the following checks after switching on the transmitter again:
- the live LED must light up (MSG−C, MSP)
- create new EPROM checksum for monitor 1 and 2 (refer to 6.2.3.2.2).
- all the transmitter and monitor settings must correspond to test reports.

6.2.3.2.2 Creating new Checksum for MSP EPROM in the PC User Program

Change of EPROM on MSP makes it necessary to create a new EPROM checksum:

- Select the station where the EPROM of MSP is changed.
- Using ADRACS: In the Detailed Status window, select menu 'Commands', menu item 'More Commands...'. The 'Commands' dialog window appears. Select in menu 'Monitors' the submenu 'Monitor Miscellaneous'. Select command 'create EPROM checksum'. Click button 'program MON 1/2' to create the new checksum. Click button 'Close' to close the 'Commands' window.

– Using MCS: In the 1st Equipment Level window (login–level: Maintenance), open the Monitor commands by a right mouse–click on the subsystem label 'Monitor'. Select command 'Compute EPROM Checksum'.

6.2.3.2.3 Replacing and Reconfiguring the Subassembly LCP

Before starting any replacement it is recommended to read out all parameters of the installation: Save all parameters in a file (with ADRACS 'Data' submenu 'Up–/Download Data', resp. with MCS 'Snapshot' submenu 'Save'), make a printout of all parameters or write down manually the indicated parameters if other measures are not possible.

It is also recommended to generate a copy of the specific site files as backup:

a) Using the PC User Program ADRACS, click on the 'Control' button in the Main Status window, select 'File Transfer' and 'Copy SITE file to PC' in the submenu.

   Using the 'MCS File Transfer' tool, select 'FILE OPERATIONS' in the MASTER MENU, select function 'COPY SITE FILE TO PC'.

b) Copy all files with the extensions **.sit*, **.oio*, **.msk*, **.ptt* or **.dat .*

The LCP subassembly contains routines which allow to configure the LCP to the system ILS 420 or CVOR/DVOR and which are used to update the firmware of basic ILS subassemblies. The LCP routine checks the LCP hardware. During LCP reset and system start, two LCP screen contents are available:

– the LCP Control Menu (Fig. 6–4a), if buttons S1 and S4 have been pressed and hold,
– the LCP Warning text (Fig. 6–4b), if the LCP has been replaced and no configuration is set.

CAUTION

Do not use function S2 of LCP Control Menu unfounded. This feature is intended for factory use only or if the drive must be cleaned up, or to delete faulty **.sit* or **.oio* files.

To copy the LCP software to the LCP (see 6.2.3.2.4) use commands of the PC user program:

– Using the PC User Program ADRACS, click the 'Control' button in the Main Status window, select 'File Transfer'. Select ADRACS command 'Copy PC file to RAM'.
– Using the 'MCS File Transfer' tool, select 'FILE OPERATIONS' in the MASTER MENU. Select MCS command 'COPY PC FILE TO SITE'.

NOTE: If there is no communication to the LCP with the PC user program, the LCP control menu offers to start a transfer routine with S3 to establish communication. Once the communication is available the LCP SW can be copied to LCP. If this fails, check the link to PC or replace the CPU board which possibly is faulty.

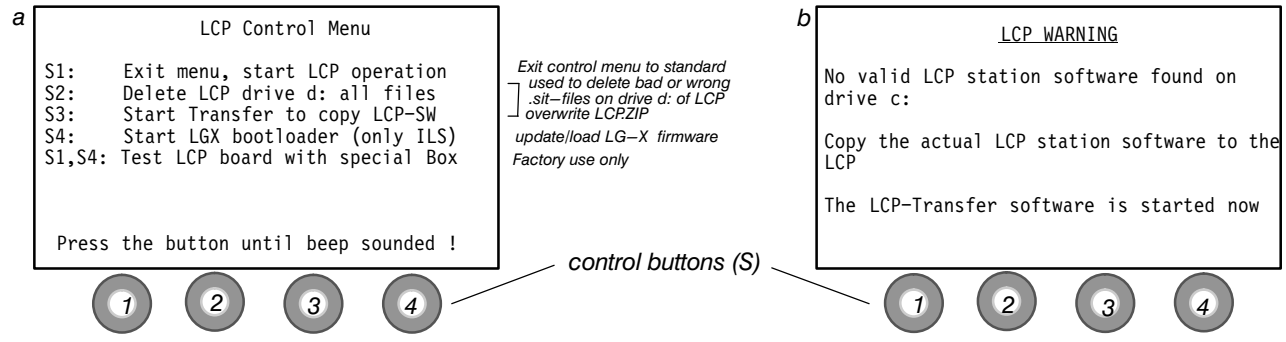


Fig. 6–4 LCP front panel with LCP Control Menu and LCP Warning text (example)

6.2.3.2.4 Reconfigure the LCP board

The spare subassembly LCP is not configured to a specific subsystem (i.e. ILS 420 or CVOR/DVOR). Configuration or update of the LCP software is performed with the PC user program.

NOTE: The LCP software upload comprises the file *LCP.ZIP* and in addition the conversion table file *konv_dat.dat* (used with current NAV2K−SW (2nd generation) and from LCP−SW V3.x). As a minimum also the **.sit* file of the station has to be uploaded. If needed, copied station files **.oio*, **.msk*, **.ptt* or **.dat* have to be transferred to the site again.

a) Restart the subsystem with power on. The LCP screen shows the warning text (Fig. 6−4b).

b) Copy the file *LCP.ZIP* for CVOR/DVOR to the LCP. The *LCP.ZIP* file is self extracting (extracted as *reu.exe*; this file is not compatible to *reu.exe* of RCSE). After end of this job the LCP is ready.

NOTE: This copy mode must only be performed for the *LCP.ZIP* file. Other files (e.g. **.sit*) would be copied to a wrong directory, if this copy mode is used. Do not rename the *LCP.ZIP* file!

c) From LCP−SW V3.x: Copy the conversion table file *konv_dat.dat* for CVOR/DVOR to the LCP.

NOTE: From SW V5.x this file is implemented in the *LCP.ZIP* file. It has not to be copied.

d) Further software upload *(*files: **.sit, *.oio*, **.msk*, **.ptt* or **.dat*) and configuration of the system is to be done with the PC user program (ADRACS or MCS) as described in Chapter 4 ”Alignment Procedure”, section 4.2.4.

e) Restart the system. Finally check all station settings in the LCP.

If the LCP software has been loaded, but not running correctly, it is recommended to reload or overwrite the *LCP.ZIP* file. This is performed with the LCP Control Menu and the PC user program:

a) Shutdown equipment with switches TX1 and TX2.

b) To start the special function menu, press buttons S1 and S4 simultaneously on the LCP immediately after power on with switches TX1 and TX2, and hold pressed until the LCP screen contains Control menu information (see Fig. 6−4a).

c) Press button S3 at least 1 s to select ”Start Transfer to copy LCP−SW” (Fig. 6−4a). This starts a routine to establish communication between PC (user program) and the LCP.
Copy the file *LCP.ZIP* for CVOR/DVOR to the LCP with the PC user program. After end of this job the LCP is ready.

d) From LCP−SW V3.x: Copy the conversion table file *konv_dat.dat* for CVOR/DVOR to the LCP.

NOTE: From SW V5.x this file is implemented in the *LCP.ZIP* file. It has not to be copied.

e) Further software upload *(*files: **.sit, *.oio*, **.msk*, **.ptt* or **.dat*) and configuration of the system is to be done with the PC user program (ADRACS or MCS) as described in Chapter 4 ”Alignment Procedure”, section 4.2.4.

f) Restart the system. Finally check all station settings in the LCP.

6.2.3.3 CVOR Antenna

A large number of settings must usually be re−made after replacing the CVOR antenna, the CVOR matching device or the CVOR monitor dipole. This can require to perform steps of the alignment procedure as described in sections 4.3 to 4.4. For mechanical alignment of the CVOR antenna refer also to section 2.2.3.2. If the CVOR antenna is replaced, a special flight test is also necessary.

6.2.4 Test after Repair

After repair, the installation is switched on as normal. The necessary adjustments indicated in Fig. 6−3 have to be performed. All parameters have to be within limits and the system state indicates NORMAL again. The system is then operable.

6.2.5 List of DIP Switches and Jumpers

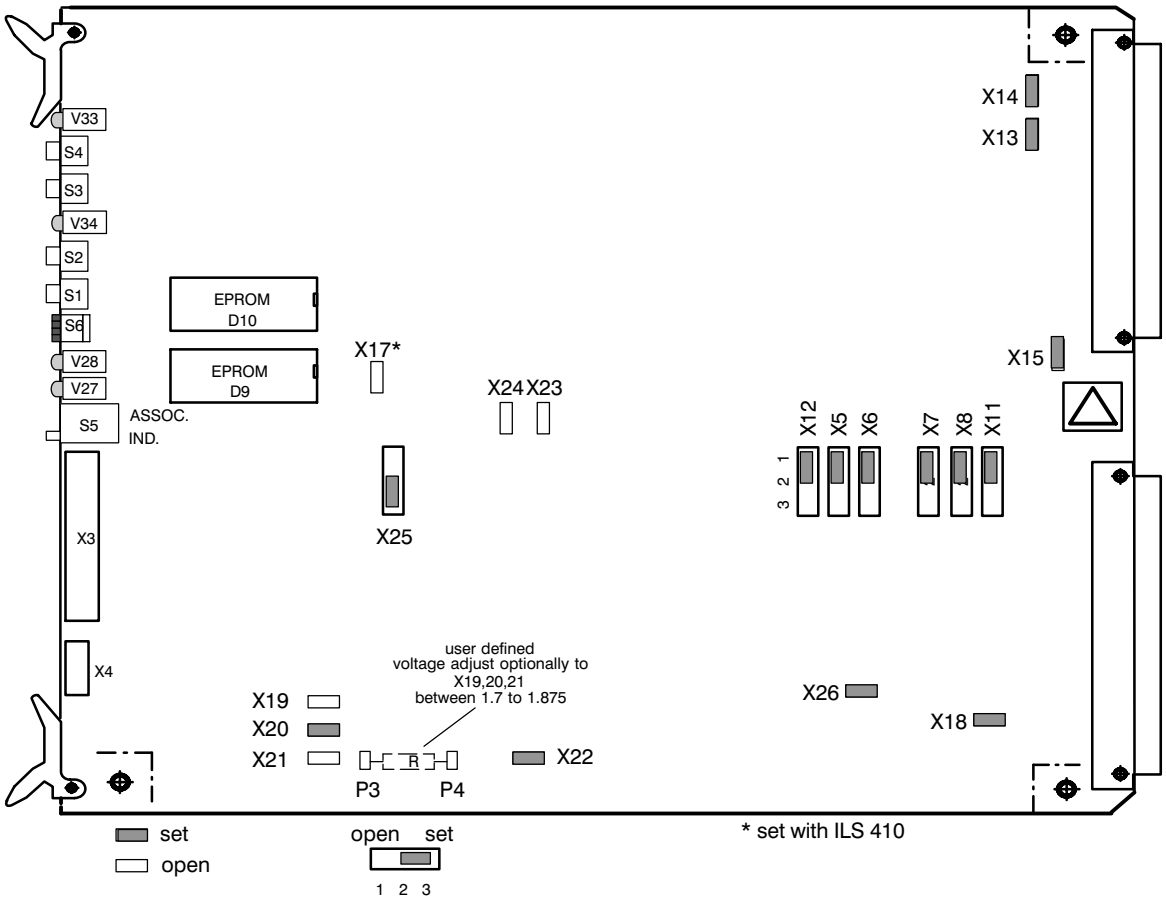
6.2.5.1 General

Some of the subassemblies have DIP switches or jumpers on the component side. The jumpers act either as on/off switches or as changeover switches. The DIP switches and jumpers can be set or placed to particular positions in order to adapt universal subassemblies to specific equipment types. Other switches or jumpers must be actuated for test and maintenance purposes, or in case of interconnection with a DME.

NOTE: Before installing a spare subassembly, check against the replaced subassembly and correct position of the DIP switches and jumpers if necessary.

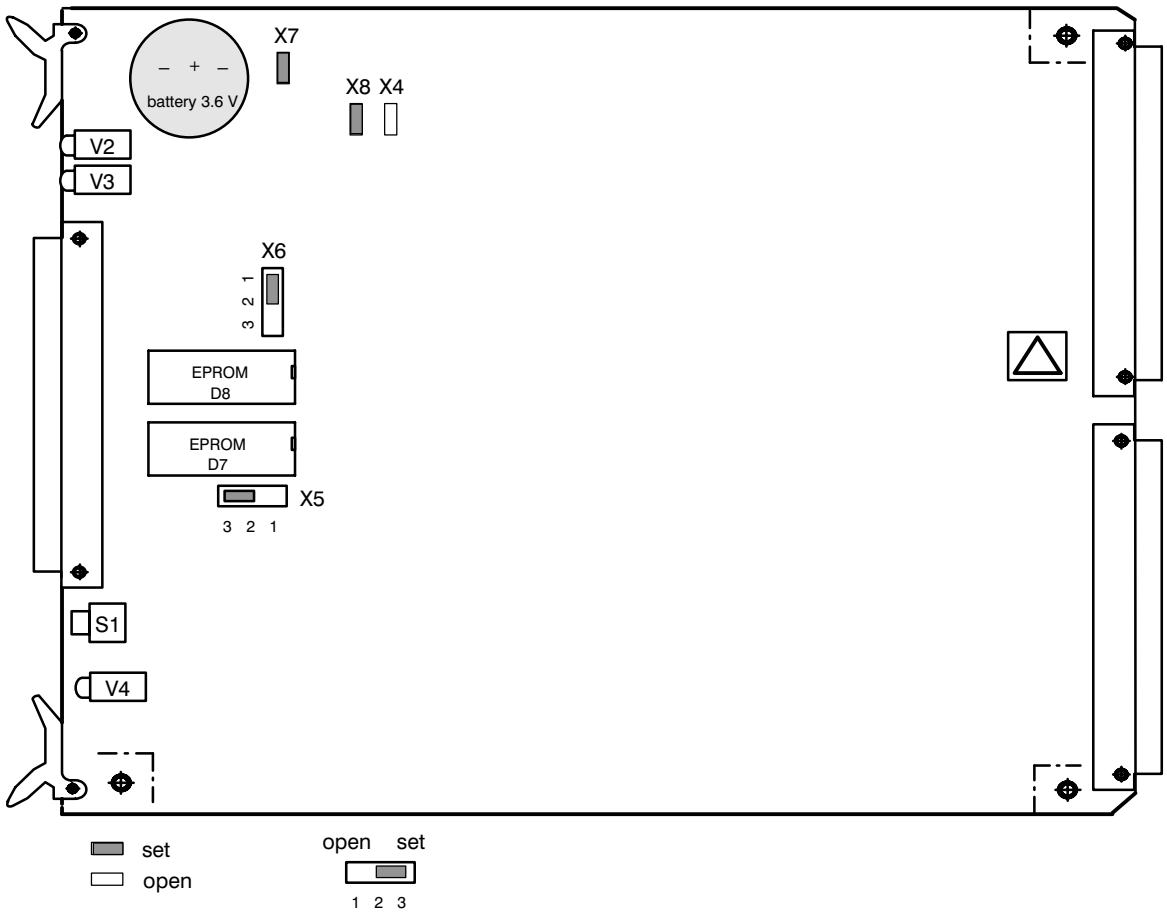
Overview of subassemblies containing DIP switches and jumpers:

No.	Subassembly	Short name	Reference number
1	Control and Selector Logic	CSL	83135 23100
2	Modulation Signal Generator Control	MSG−C	83135 27200
3a 3b	Monitor Signal Processor Monitor Signal Processor	MSP−CD MSP−CD	83135 22301 83135 22302
4a	Local Control Panel	LCP	83135 21001 / 21002
4b	Local Control Panel	LCP	83135 21003
4c	Local Control Panel	LCP	83135 21004
5	Voice Amplifier	VAM	83131 71701
6	Backpanel Transmitter	BP−T	58351 00210 / 00211
7	Processor board with Ethernet controller	EXT−CPU	84045 84300
8	Switched or dedicated line modem	LGM28.8	84045 83245
9	Dedicated or Party line modem	LGM1200D	84045 83233
10a 10b	Backpanel Control Backpanel Control	BP−C BP−C	58351 00112 58351 00113
11	Synthesizer CVOR	SYN−V	83135 28101

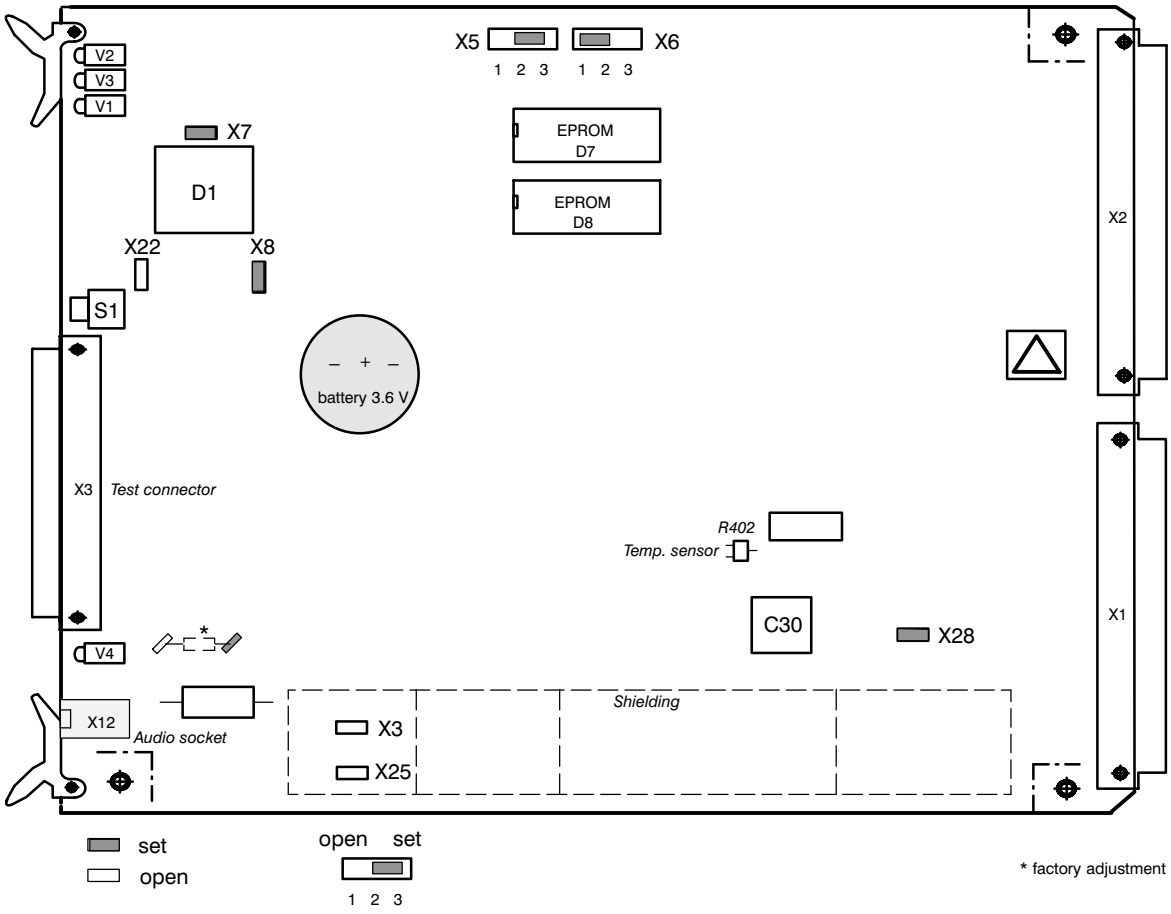


SWITCH	POSITION	DEFINITION	REMARKS
S1, S3	key	Manual switch off TX1 or TX2	
S2, S4	key	Manual switch on TX1 or TX2	
S5	lower upper	Independent, DME = Master (2−3, 5−6) Associated, AN400 = Master (1−3, 4−6)	Slide switch for DME/TACAN−identity interface, depends on installation
S6	0...F	Test signal select	
JUMPER	**POSITION**	**DEFINITION**	**REMARKS**
X7,X8,X11		Signal definition and drive select	Morse code signal for DME
X7, X8	1−2 2−3	positive logic: device on = current flow negative logic: device on = no current flow	Normal operation −
X5,X6,X12		Signal definition and drive select	to DME: Station Operational
X5, X6	1−2 2−3	positive logic: device on = current flow negative logic: device on = no current flow	Normal operation −
X9,X10			not existing
X11, X12	1−2 2−3	Drive using Darlington current source Drive using optocoupler only	Normal operation −

JUMPER	POSITION	DEFINITION	REMARKS
X13	set	Switch off line TX1 from LCP	default setting
	open	Interrupt Switch off line TX1 from LCP	–
X14	set	Switch off line TX2 from LCP	default setting
	open	Interrupt Switch off line TX2 from LCP	–
X15	set	Line OP_IN– from DME	default setting
	open	Interrupt line OP_IN– from DME	–
X16			not existing
X17	set	Test signal selection, ILS	default setting ILS
	open	Test signal selection, VOR/DVOR	default setting (D)VOR
X18	set	Enabling cutoff for over–discharge protection	Emergency battery operation
	open	without over–discharge protection	Operation without emergency battery or function disabled
X19,20,21		Selection of battery type/cell voltage	only one jumper set simultan.**!**
X19	set	battery switch off at 1,7 V/cell	alternate to X20, X21
	open		–
X20	set	battery switch off at 1,8 V/cell	default setting
	open		–
X21	set	battery switch off at 1,875 V/cell	alternate to X19, X20
	open		–
X22	set	enabling automatic restore (power management)	with PMM–5 and (D)VOR
	open	–	with PMM–5 and ILS
X23	set	no monitor fault monitoring MON2	–
	open	monitor fault monitoring MON2	default setting
X24	set	no monitor fault monitoring MON1	–
	open	monitor fault monitoring MON1	default setting
X25	1–2	DME–Status is transmitted via remote contr.	setting depends on DME–Interface
	2–3	DME–Status is transmitted via signalling line OP_IN+ and OP_IN–	
X26	set	On/off line to optocoupler interface of BCPS from LCP via CSL closed	Default setting (Power Management)
	open	On/off line to optocoupler interface of BCPS from LCP via CSL open, e.g. if no emergency battery exists	depends on installation
1 Control and Selector Logic (CSL)		**83135 23100**	**2 of 2**



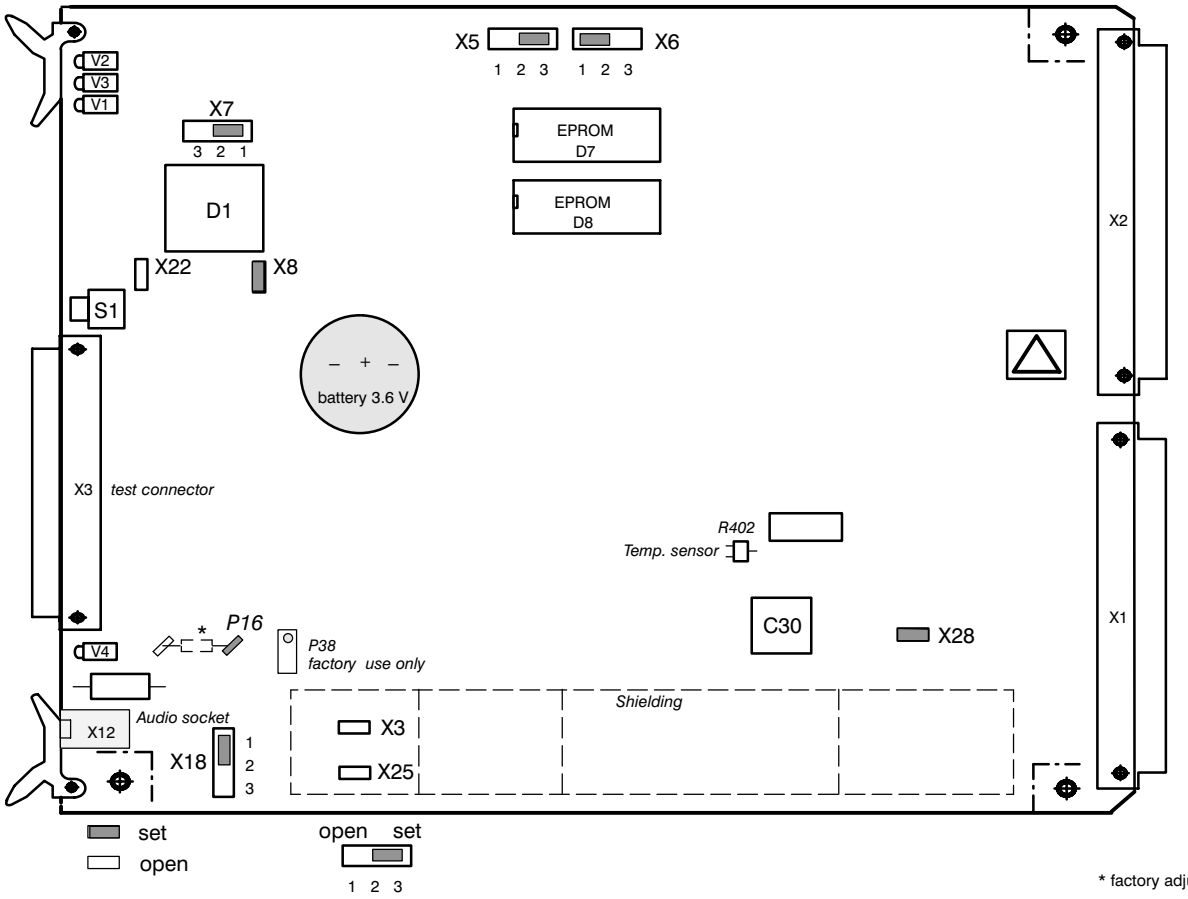
JUMPER	POSITION	DEFINITION	REMARKS
X4	set	watch–dog fault triggers NMI (Non Maskable Interrupt)	–
	open	NMI function disabled	default setting
X5	2–3	EPROM type 27C040	default setting
	1–2	EPROM type 27C020	–
X6	1–2	RAM type 628128	default setting
	2–3	RAM–Typ 628512	–
X7	set	backup battery switched on	default setting
	open	backup battery switched off	–
X8	set	multiple reset disabled, if watch dog fails	default setting
	open	multiple reset enabled	–
2 Modulation Signal Generator Control (MSG–C) 83135 27200			



JUMPER	POSITION	DEFINITION	REMARKS
X3		for factory adjustment only, a solder strip is inserted onto the soldering side after adjustment	
X5	1–2	EPROM type 27C020 or 27C040	–
	2–3	EPROM type 27C040 with complete decoding	default setting
X6	1–2	RAM type 628128	default setting
	2–3	RAM–Typ 628512	–
X7	set	the RAM is battery buffered, i.e. the system parameter, alarm storage and operating hours are maintained after system switch off	default setting
	open	RAM is not battery buffered, i.e. the above mentioned data will be lost after system switch off	–
X8	set	multiple reset disabled, if watch dog timer fails	default setting
	open	multiple reset enabled	–

JUMPER	POSITION	DEFINITION	REMARKS
X22	set	watch dog fault triggers NMI, i.e. when the processor has a fail function, the processor monitoring circuit leaves out one interrupt	
	open	NM function disabled	default setting
X25		feed in point for GND	
X28	set	connects the 30 Hz FM measurement path directly and via a low pass filter to test connector X3	default setting
	open	30 Hz FM signal not connected to X3	factory use
JUMPER	**CONNECT.**	**DEFINITION**	**REMARKS**
	X12	audio socket for listening to voice signals e.g. station identity, meteorological data (ATIS)	3.5 mm jack bush, 600 ohm
3a Monitor Signal Processor (MSP−CD)		**83135 22301**	**2 of 2**

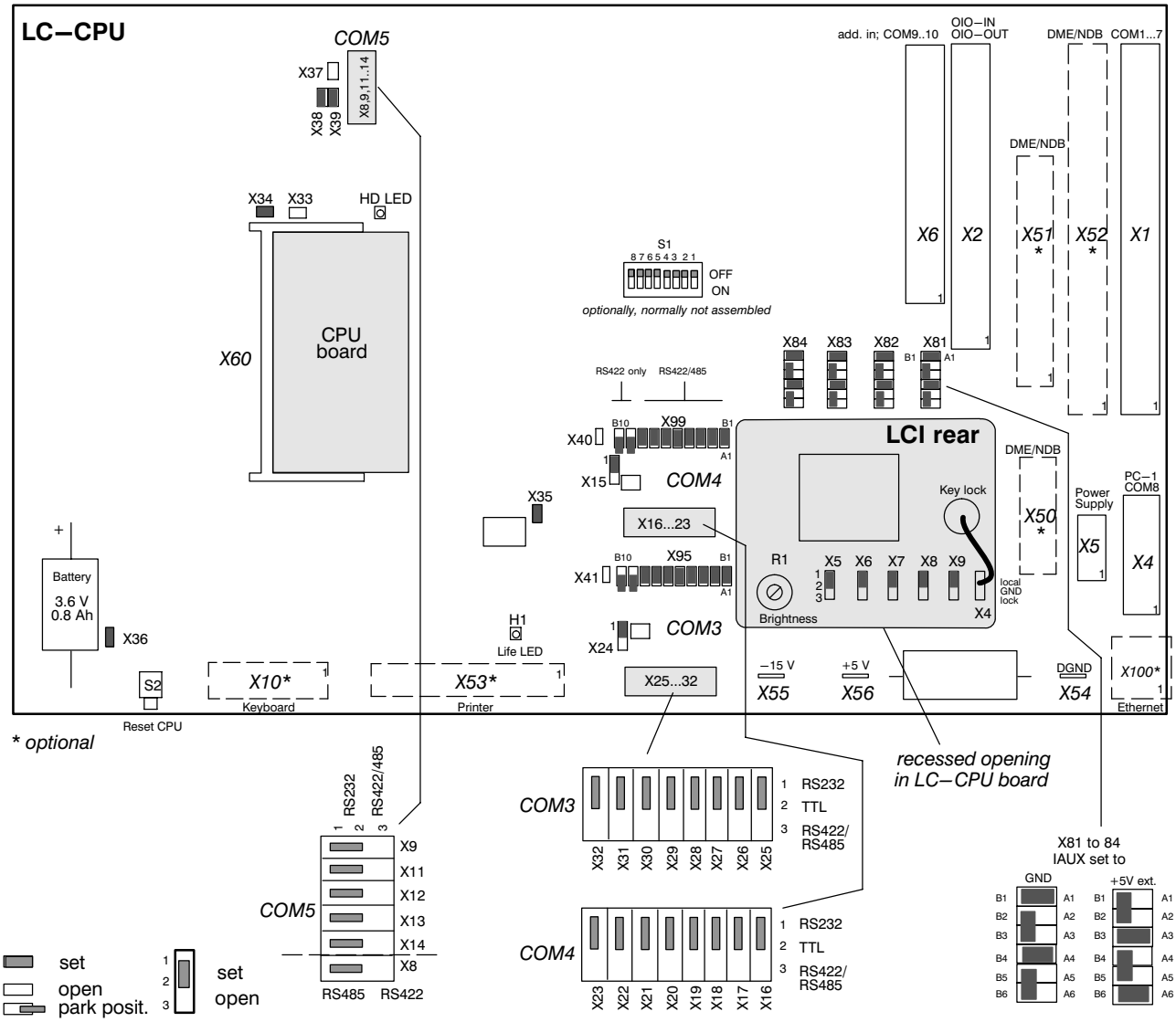
The MSP−CD, Ref. No. 83135 22301 replaces the MSP−VD, Ref. No. 83135 22300 and the MSP−V8, 83135 22600 (8PGC option only).



JUMPER	POSITION	DEFINITION	REMARKS
X3		for factory adjustment only, a solder strip is inserted onto the soldering side after adjustment	
X5	1–2	EPROM type 27C020 or 27C040	–
	2–3	EPROM type 27C040 with complete decoding	default setting
X6	1–2	RAM type 628128	default setting
	2–3	RAM–Typ 628512	–
X7	1–2	RAM backup battery is not used: with NAV2K software, parameter are stored in the serial EEPROM. Requires NAV2K Monitor SW V3.x (DVOR) and V5.x (CVOR).	default setting
	2–3	RAM backup battery is used: it supports previous SN400 software or NAV2K 1st generation software, that stores parameter in the RAM. The RAM is battery buffered, i.e. the system parameter, alarm storage and operating hours are maintained after system switch off.	–
X8	set	multiple reset disabled, if watch dog timer fails	default setting
	open	multiple reset enabled	–
3b Monitor Signal Processor (MSP–CD)		**83135 22302**	**1 of 2**

JUMPER	POSITION	DEFINITION	REMARKS
X18	1–2	Ident signal from MSP RF detector. No support of DVOR 48SB advanced ident monitoring. Supported systems: – SN400 VOR and DVOR monitor software – NAV2K CVOR monitor software 1st gen. – NAV2K DVOR monitor software, 50SB HW – NAV2K DVOR monitor software 1st gen., 48SB HW and PMC–D p/n 83135 31200	default setting
	2–3	Ident signal from CSB forward detector on PMC–D (ID_COMP_MIX). Support of DVOR 48SB advanced ident monitoring for Nextfield option (NxF). Supported system: – NAV2K DVOR monitor software V4.x up, DVOR 48SB, PMC–D p/n 83135 31250	used for DVOR 48SB NxF option only
X22	set	watch dog fault triggers NMI, i.e. when the processor has a fail function, the processor monitoring circuit leaves out one interrupt	–
	open	NMI function disabled	default setting
X25		feed in point for GND	
X28	set	connects the 30 Hz FM measurement path directly and via a low pass filter to test connector X3	default setting
	open	30 Hz FM signal not connected to X3	factory use
JUMPER	**CONNECT.**	**DEFINITION**	**REMARKS**
–	X12	audio socket for listening to voice signals e.g. station identity, meteorological data (ATIS)	3.5 mm jack bush, 600 ohm
3b Monitor Signal Processor (MSP–CD)		**83135 22302**	**2 of 2**

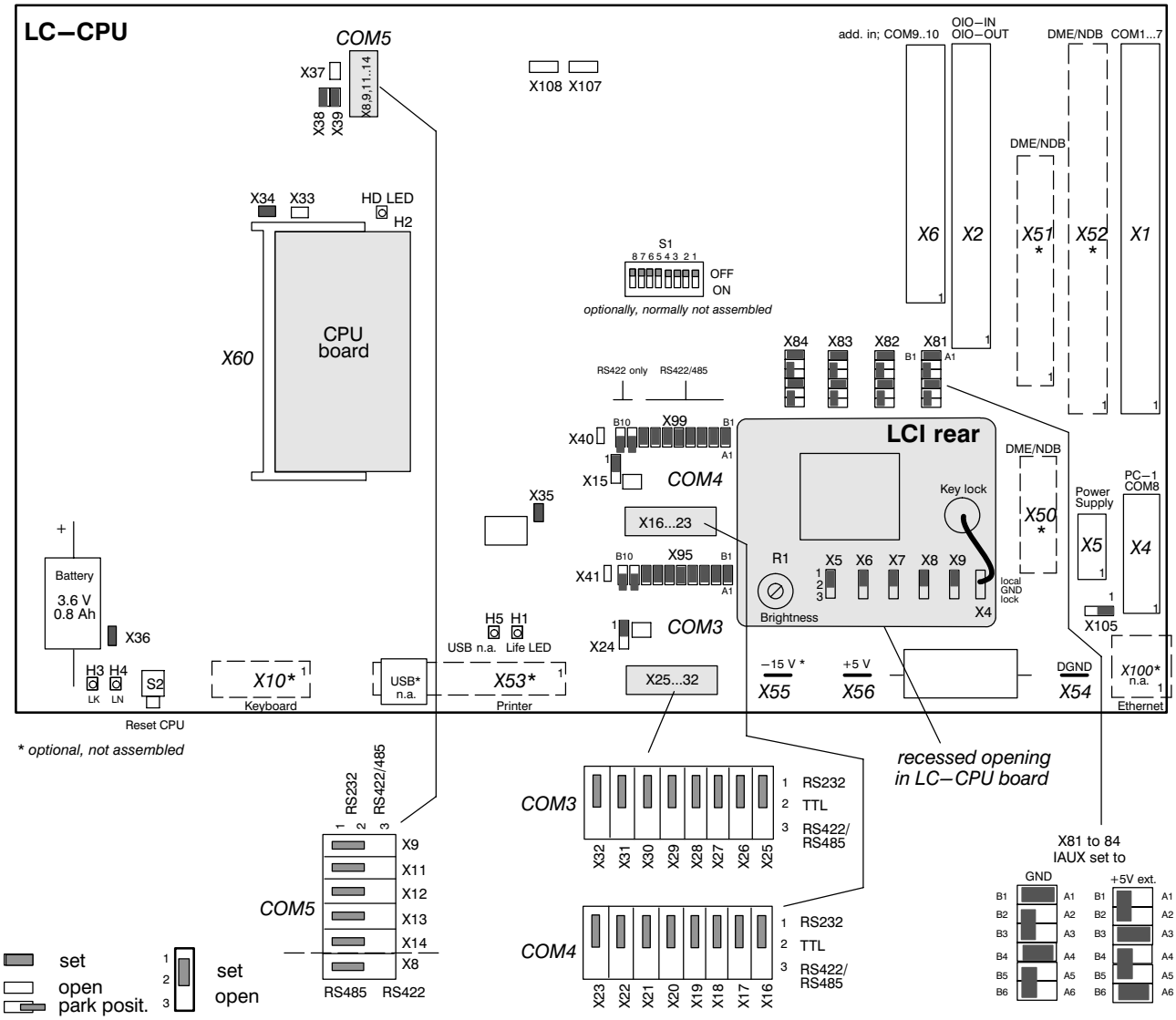
The MSP–CD, Ref. No. 83135 22302 replaces the MSP–CD, Ref. No. 83135 22301. It is downward compatible for previous systems.



JUMPER	POSITION	DEFINITION	REMARKS
bank X81	A1–B1/B2–B3 B1–B2/A3–B3 A4–B4/B5–B6 B4–B5/A6–B6	IAUX14 active low IAUX14 active high IAUX15 active low IAUX15 active high	default setting – default setting –
bank X82	A1–B1/B2–B3 B1–B2/A3–B3 A4–B4/B5–B6 B4–B5/A6–B6	IAUX12 active low IAUX12 active high IAUX13 active low IAUX13 active high	default setting – default setting –
bank X83	A1–B1/B2–B3 B1–B2/A3–B3 A4–B4/B5–B6 B4–B5/A6–B6	IAUX11 active low IAUX11 active high IAUX10 active low IAUX10 active high	default setting – default setting –
4a Local Control Panel (LCP: LC–CPU/LCI)		**83135 21402 / 83135 21301**	**1 of 3**

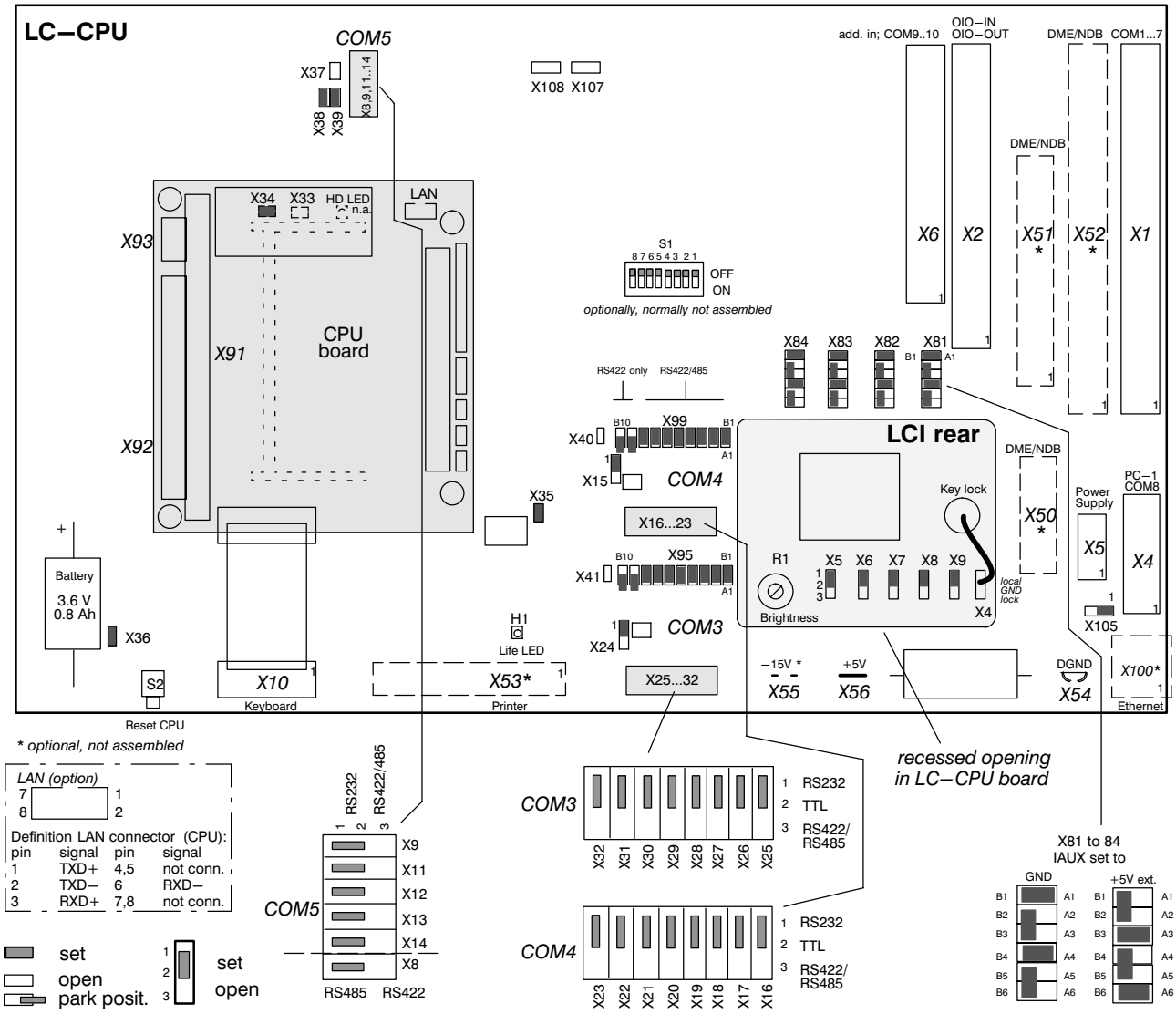
JUMPER	POSITION	DEFINITION	REMARKS
bank X84	A1−B1/B2−B3 B1−B2/A3−B3 A4−B4/B5−B6 B4−B5/A6−B6	IAUX9 active low IAUX9 active high IAUX8 active low IAUX8 active high	default setting − default setting −
X95 X25...X32 X24, X41	A1−B1, ... , A8−B8 1−2 not used	serial port3 set to RS232 −	**Port 3** (COM3) −
X95 X25/26 X27/28 X29/30 X31/32 X24, X41	B1−B2, B3−B4 ,B5−B6, B7−B8 2−2 2−2 2−2 2−2 not used	serial port3 set to TTL −	− −
X95 X25...X32 X24 X41	A1−B1, ... , A8−B8 2−3 2−3 open	serial port3 set to RS422 full duplex −	− default setting −
X95 X25...32 X24 X41	A1−B1, ... , A10−B10 2−3 1−2 set	serial port3 set to RS485 half duplex adds 100 ohm termination	− default; signal RTS controls TX enable in UART mode −
X99 X16...23 X15, X40	A1−B1, ... , A8−B8 1−2 not used	serial port4 set to RS232 −	**Port 4** (COM4) −
X99 X16/17 X18/19 X20/21 X22/23 X15, X40	B1−B2, B3−B4 ,B5−B6, B7−B8 2−2 2−2 2−2 2−2 not used	serial port4 set to TTL −	− −
X99 X16...23 X15 X40	A1−B1, ... , A8−B8 2−3 2−3 open	serial port4 set to RS422 full duplex −	− default setting −
X99 X16...23 X15 X40	A1−B1, ... , A10−B10 2−3 1−2 set	serial port4 set to RS485 half duplex adds 100 ohm termination	− default; signal RTS controls TX enable in UART mode −
4a Local Control Panel (LCP: LC−CPU/LCI)		**83135 21402 / 83135 21301**	**2 of 3**

JUMPER	POSITION	DEFINITION	REMARKS
X38,39 X9,11...14 X8/X37	open 1–2 not used	serial port5 set to RS232 –	**Port 5** (COM5), *used with ETX–CPU option* –
X38,39 X9,11...14 X8 X37	open 2–3 2–3 open	serial port5 set to RS422 full duplex –	– default setting –
X38,39 X9,11...14 X8 X37	set 2–3 1–2 set	serial port5 set to RS485 half duplex adds 100 ohm termination	– default; signal RTS controls TX enable in UART mode –
X33 X34 	open set set open	serial port1 set to RS232, interrupt path not used serial port5 set to RS232, RS422/485, interrupt path for ext. device test	IRQ14 pathed to CPU – IRQ6 pathed to CPU –
X35	set open	watch dog on watch dog off	if enabled by software –
X36	set open	battery backup enabled battery backup disabled	used for RTC on CPU RTC not buffered
S1 S1/8 S1/7 S1/6 S1/5 S1/1 to 4	 on off on off on off on off off	input register 6 Bit 4...7: Bit 4 to GND – Bit 5 to GND – Bit 6 to GND – Bit 7 to GND – IN0...IN3	(optional assembly) Bypass not auto–disabled default setting not used default setting not used TX1 ON, Status not used TX2 ON, Status always off, on not allowed
LCI rear			
X5 X6 X7 X8 X9	1–2 2–3 1–2 2–3 1–2 2–3 1–2 2–3 1–2 2–3	Font select: 40 characters Font select: 30 characters Font select: per HW (X5) Font select: per SW Display allways on Display off/on per SW spare not used Buzzer on Buzzer off	default setting – default setting – default setting – default setting – default setting –
4a Local Control Panel (LCP: LC–CPU/LCI)		**83135 21402 / 83135 21301**	**3 of 3**



NOTE: Compared with the LC–CPU 83135 21402 (see 4a), the LC–CPU 83135 21403 contains three additional jumper (X105, 107, 108). X107 and 108 are used for special setting in ILS systems. All other settings are the same as described for LC–CPU 83135 21402 (refer to 4a). Connectors USB and X100 are not applicable or assembled.

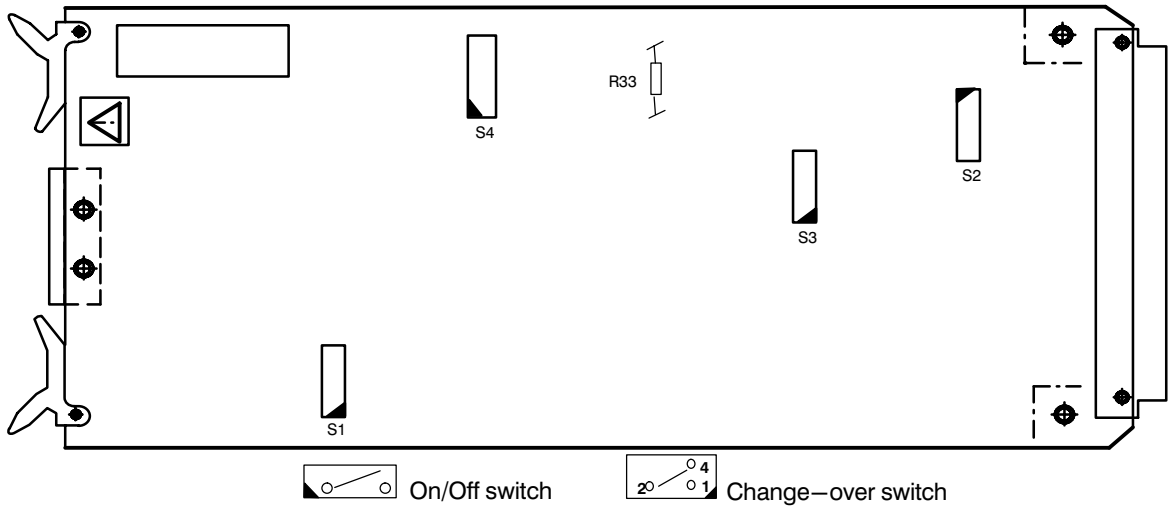
JUMPER	POSITION	DEFINITION	REMARKS
X105	1–2 2–3	–15 V from external –15 V from internal	default setting not applicable
X107	set open	Maint. ILS, LCD control –	special setting ILS FAA default setting ILS, (D)VOR
X108	set open	Local ILS, LCD control –	special setting ILS FAA default setting ILS, (D)VOR
4b Local Control Panel (LCP: LC–CPU/LCI)		**83135 21403 / 83135 21301**	**1 of 1**



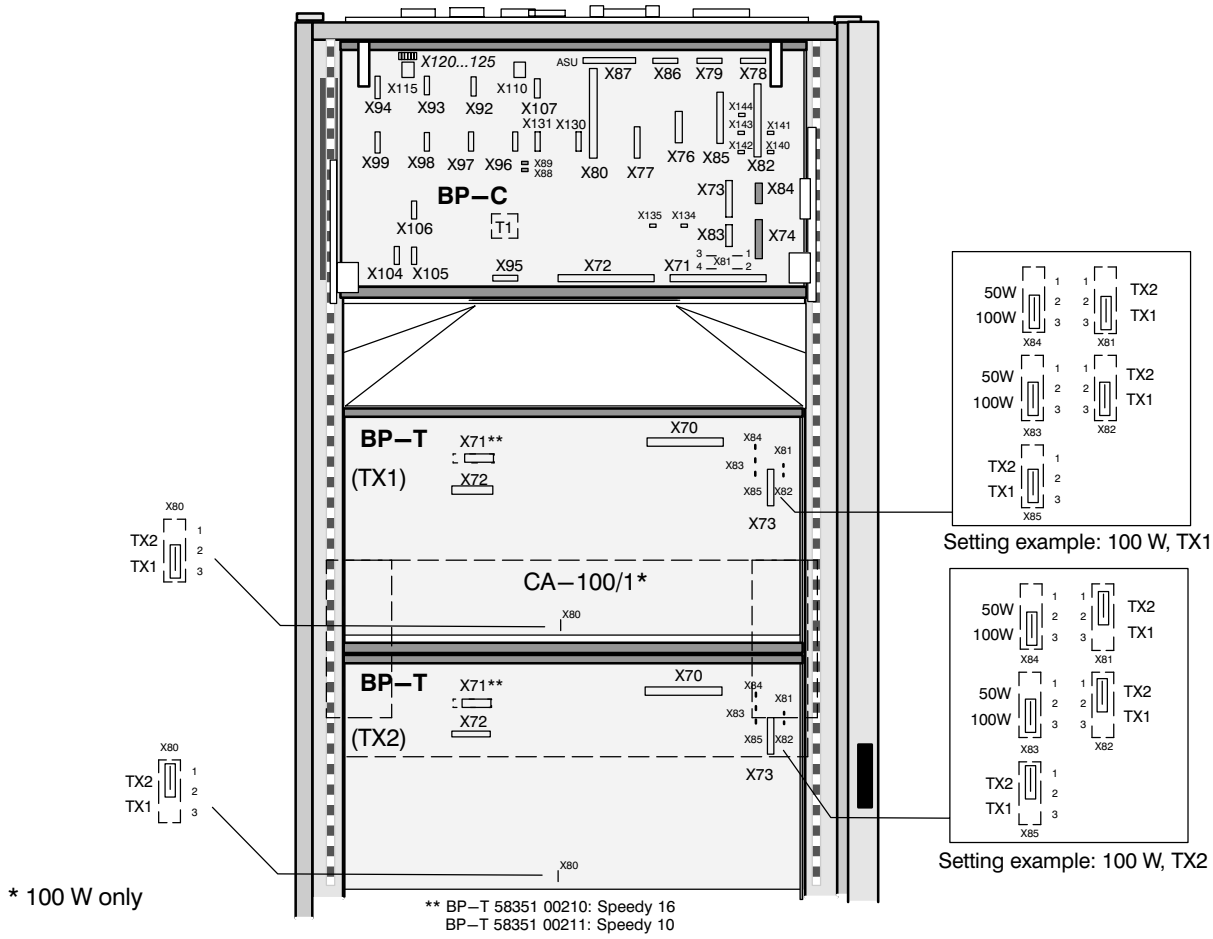
NOTE: Compared with the LC–CPU 83135 21402 and the LC–CPU 83135 21403, the LC–CPU 83135 21404 has a redesign due to replacement of the previously used DIMM–CPU which becomes obsolete. As with LC–CPU 83135 21403, the LC–CPU 83135 21404 contains three additional jumper (X105, 107, 108). X107 and 108 are used for special setting in ILS systems. All other settings are the same as described for LC–CPU 83135 21402 (refer to 4a).

Connectors USB and X100 are not applicable or assembled. Connector X55 is also not assembled any more.

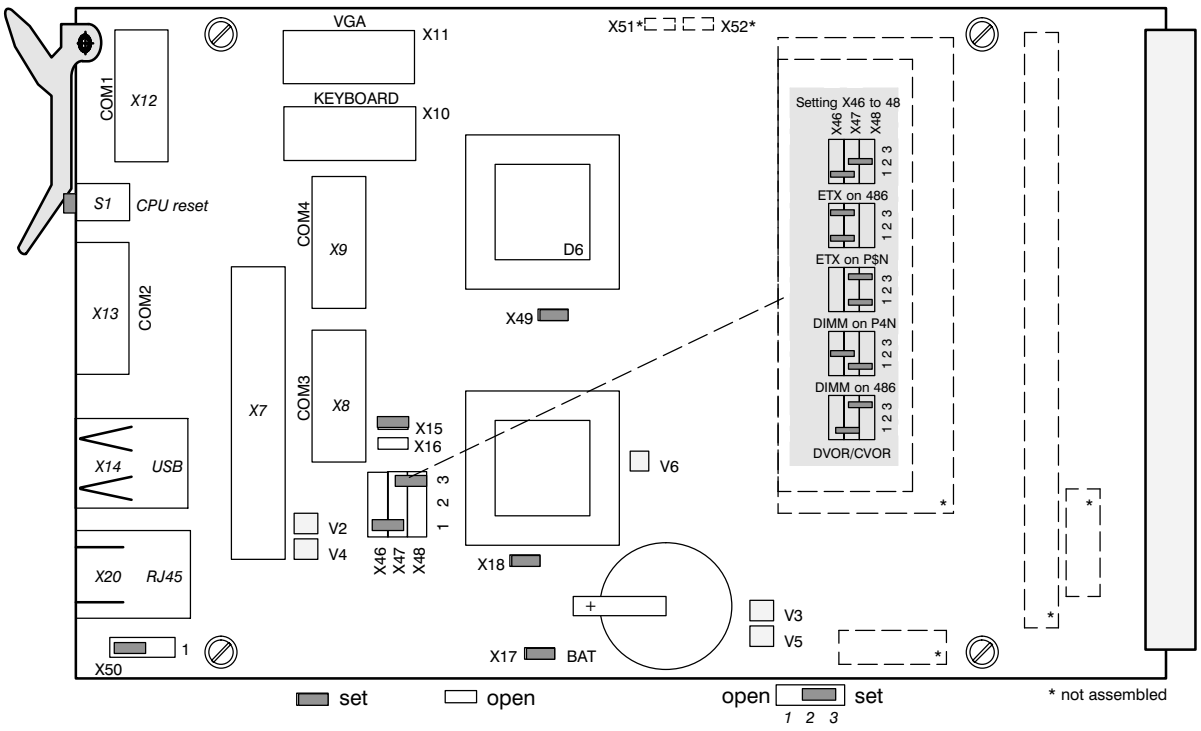
JUMPER	POSITION	DEFINITION	REMARKS
X105	1–2 2–3	–15 V from external –15 V from internal	default setting not applicable
X107	set open	Maint. ILS, LCD control –	special setting ILS FAA default setting ILS, (D)VOR
X108	set open	Local ILS, LCD control –	special setting ILS FAA default setting ILS, (D)VOR
4c Local Control Panel (LCP: LC–CPU/LCI)		**83135 21404 / 83135 21301**	**1 of 1**



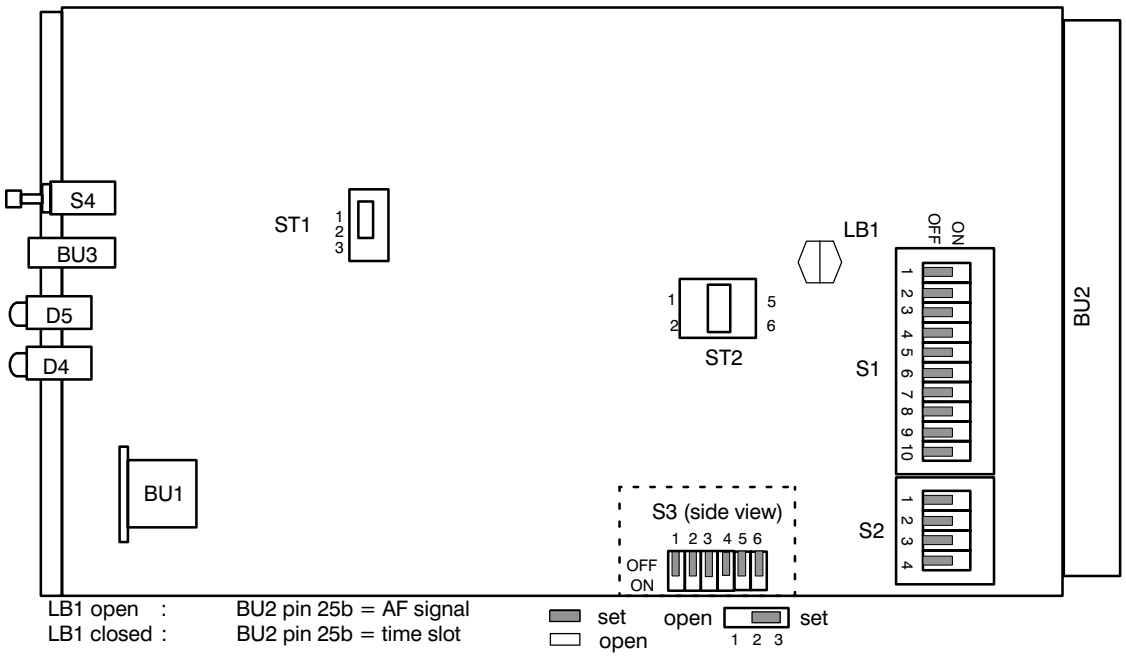
DIP–FIX SWITCH	POSITION	DEFINITION	REMARKS
S1, S2, S3	on	signal path closed	normal operation
	off	signal path open between filters for measurement	factory adjustment
S4	2 – 1	signal path closed	normal operation
	2 – 4	signal path opened for comparator test	factory adjustment
5 Voice Amplifier (VAM), option		**83131 71701**	**1 of 1**



Jumper	POSITION	DEFINITION	REMARKS
X80	1–2 2–3	TX2 TX1	Definition of TX1 or TX2 –
X84, X83 X85 X81 X82	1–2 2–3 2–3 2–3	50W TX1 TX1 TX1	Settings for 50 W, TX1 – – –
X84, X83 X85 X81 X82	2–3 2–3 2–3 2–3	100W TX1 TX1 TX1	Settings for 100 W, TX1 – – –
X84, X83 X85 X81 X82	1–2 1–2 1–2 1–2	50W TX2 TX2 TX2	Settings for 50 W, TX2 – – –
X84,X83 X85 X81 X82	2–3 1–2 1–2 1–2	100W TX2 TX2 TX2	Settings for 100 W, TX2 – – –
6 Backpanel Transmitter (BP–T)		**58351 00210 / 58351 00211**	**1 of 1**



JUMPER	POSITION	DEFINITION	REMARKS
X15	closed	SIB interface disabled / USART enabled	Default setting
X16	open	SIB interface enabled, but not used	Default setting
X17	set open	Normal operation mode of battery 'Parking' mode of battery	battery connected battery disconnected
X18	set	Watchdog enabled	Default setting
X46,X47,X48		defines board use; depends on type of remote control equipment and PAL	
X46/1–X47/1	set	Default setting DVOR/CVOR	–
X46/1–X47/1	set	Default setting DVOR/CVOR	–
X49	set	USART (D6) enabled	Default setting
X50	2–3 2–1	Ethernet interface enabled Ethernet interface disabled	Default setting –
7 Processor board with Ethernet controller (ETX–CPU)		**84045 84300**	**1 of 1**



DEFINITION	JUMP./POSITION

Dialing mode: automatic recognition of type of modulation, V.25bis, auto reliable mode, flow control with RTS/CTS (S2/M2), autobaud (AT), pulse dial mode

S1.1	S1.2	S1.3	S1.4	S1.5	S1.6	S1.7	S1.8	S1.9	S1.10
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

S2.1	S2.2	S2.3	S2.4	S3.1	S3.2	S3.3	S3.4	S3.5	S3.6
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

Dedicated line mode: V.32 (9600 bit/s), error correction with direct mode 10 bit/sign, flow control with RTS/CTS (S2/M2), autobaud (AT), 2−wired dedicated line

S1.1	S1.2	S1.3	S1.4	S1.5	S1.6	S1.7	S1.8	S1.9	S1.10	
ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	OFF	for RCSE/RMC
ON	ON	OFF	ON	ON	ON	OFF	ON	ON	OFF	for NAV−LCU

S2.1	S2.2	S2.3	S2.4	S3.1	S3.2	S3.3	S3.4	S3.5	S3.6
OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON

ST1 Receive level range:

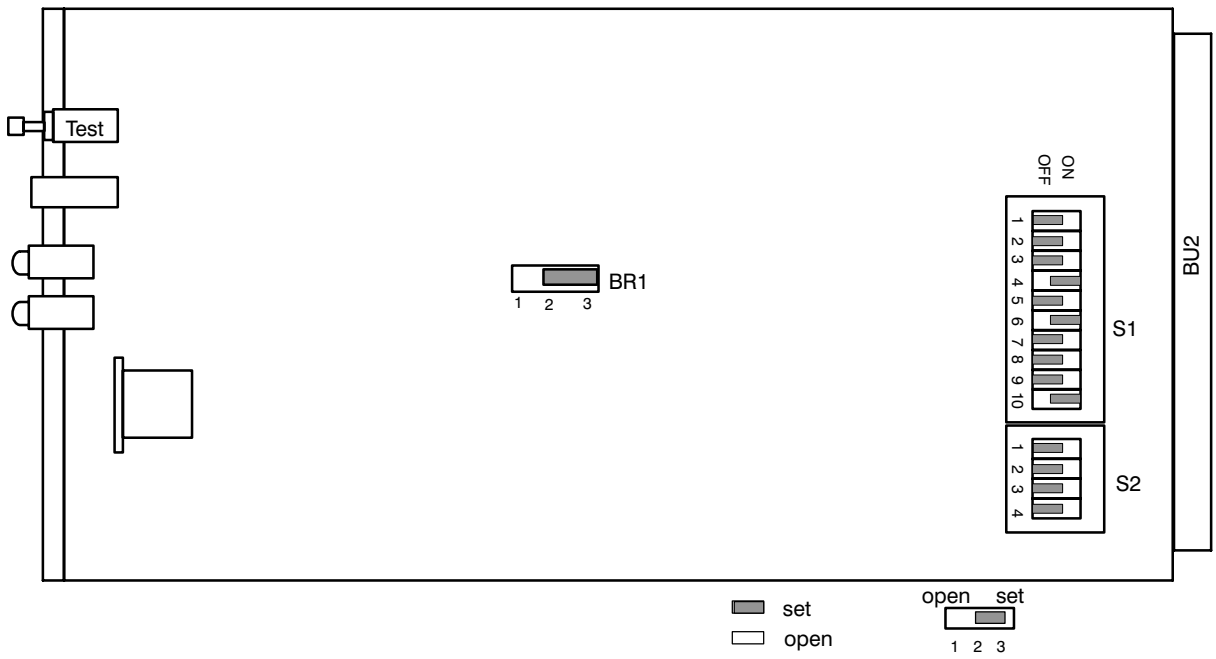
Level at Z	ST1
−43 dBm	1−2 (delivery setting)
−33 dBm	2−3

ST2 Transmit level range:

Switched line at Z	ST2	Dedicated line (600 Ω)	ST2
−4.5 dBm	3−5	−6 dBm	3−5
−6.5 dBm	5−6	−8 dBm	5−6
−8.5 dBm	3−4 (default setting)	−10 dBm	3−4
−10.5 dBm	1−2	−12 dBm	1−2

NOTE: Some telephone networks may prohibit alteration of the transmit level.

8 Switched or Dedicated line Modem (LGM28.8)	84045 83245	1 of 1

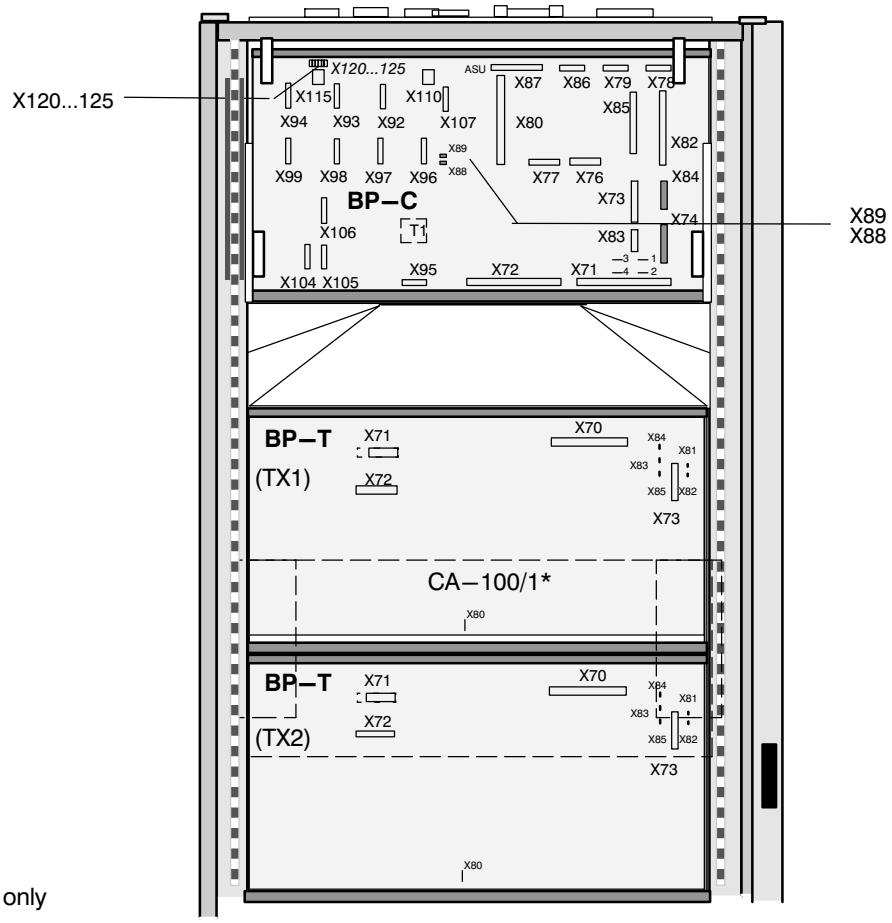


DEFINITION	JUMP./POSITION		REMARKS
Permanent transmission control	**S2.1**		
on	OFF		default setting
off	ON		–
Operation 1200/600 bit/s	**S2.2**		
1200 bit/s	OFF		default setting
600 bit/s	ON		–
Transmit level	**S1.9**	**S1.10**	
±0 dBm	OFF	OFF	–
–3 dBm	ON	OFF	–
–6 dBm	OFF	ON	default setting
–9 dBm	ON	ON	–

NOTE: Some telephone networks may prohibit alteration of the transmit level.

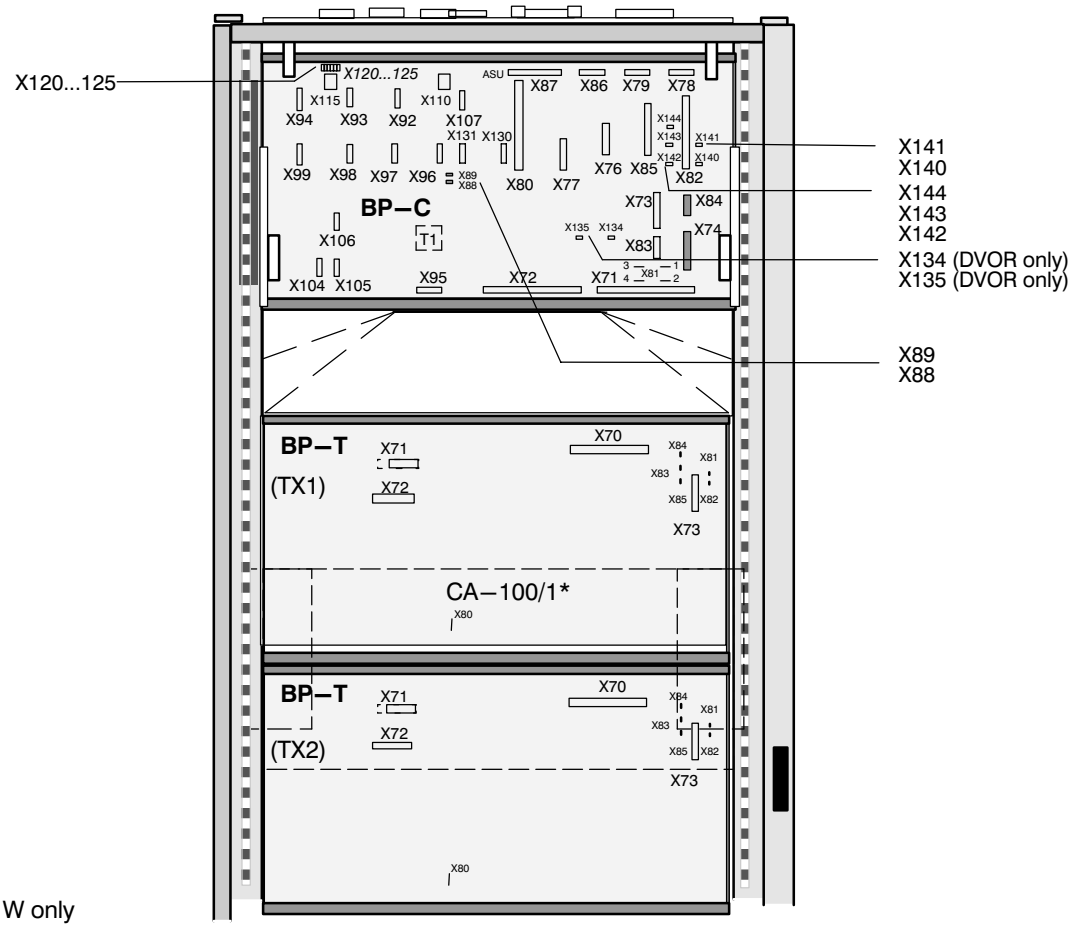
Impedance during transmission	**S1.8**	
300 ohms	OFF	for remote side (e.g. RCSE)
600 ohms	ON	for station side
Receive level (min.)	**S1.7**	
–43 dBm	OFF	default setting
–33 dBm	ON	–
Carrier lag time	**S1.6**	
13 ms	OFF	–
3 ms	ON	default setting
S2–M2 lead time	**S1.5**	
30 ms	OFF	default setting
200 ms	ON	–

DEFINITION	JUMP./POSITION			REMARKS
Additional equalizer	**S1.4**			
Equalizer switched on	OFF			–
Equalizer switched off	ON			default setting
Switching on mode	**S1.3**			
Fixed switching on (M1+) operation	OFF			default setting
Switching on with S1.1	ON			–
Operation mode	**S1.1**	**S1.2**	**S2.2**	
0...1200 bit/s, hx, asyn. (1300/2100 Hz)	OFF	OFF	OFF	default setting
0...1200 bit/s, hx, syn. with 1:1 change	ON	OFF	OFF	–
0...1200 bit/s, hx, syn. without change	OFF	ON	OFF	–
not used	ON	ON	OFF	–
0...600 bit/s, hx, asyn. (1300/1700 Hz)	OFF	OFF	ON	–
Sensitivity increase (–53 dBm)	**BR1**			
Sensitivity higher + add. equalizer	1–2			–
Sensitivity normal	2–3			default setting



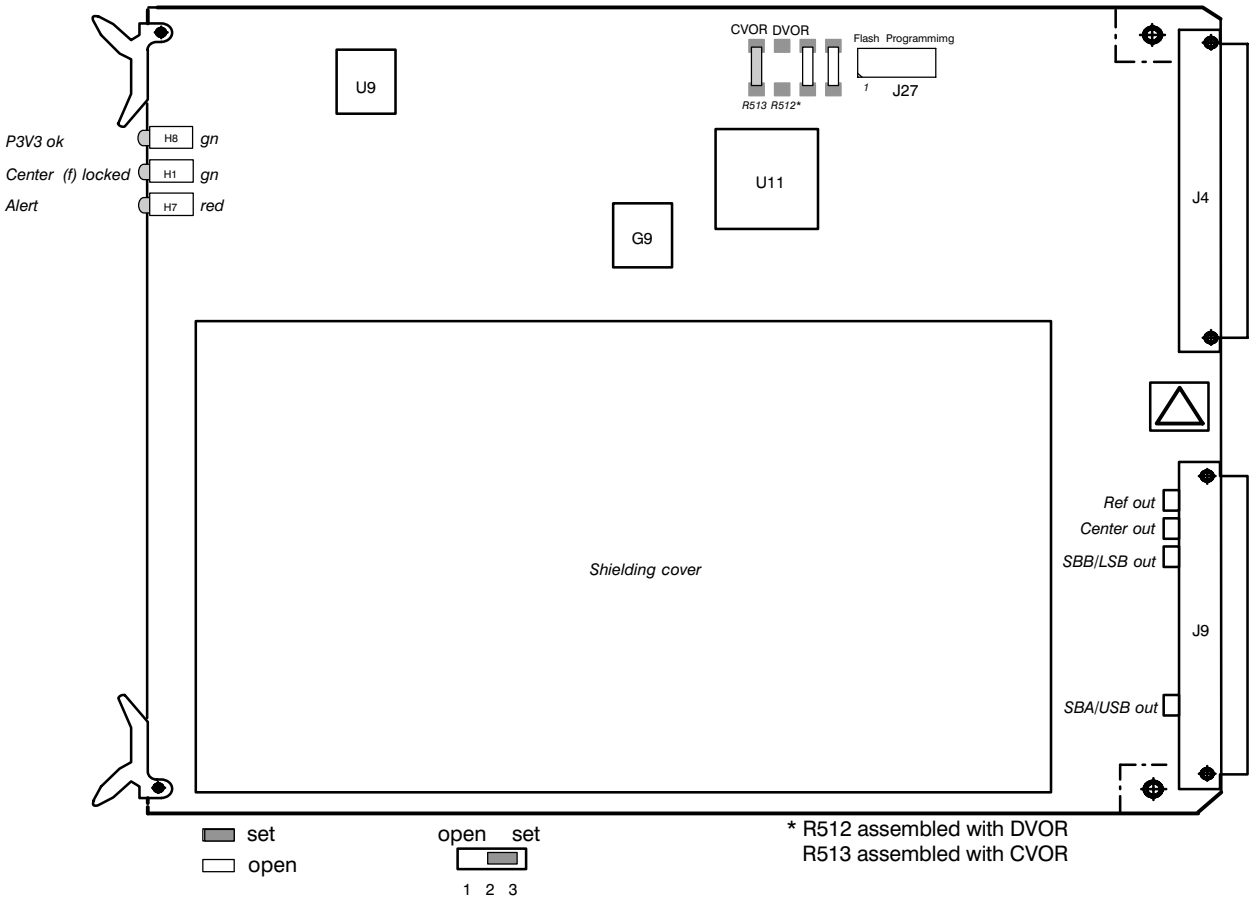
* 100 W only

JUMPER	POSITION	DEFINITION	REMARKS
X120...125		Allocation of X115 PTT line to LGM1..3, La/Lb	Set only one allocation
X120, 121 X122, 123 X124, 125	set set set	Allocation of X115 PTT line to LGM1 (La/Lb) Allocation of X115 PTT line to LGM2 (La/Lb) Allocation of X115 PTT line to LGM3 (La/Lb)	– – –
X88	set	–12V connected (used for LGM connectors)	Default setting
X89	set	+12V connected (used for LGM connectors)	Default setting
10a Motherboard Backpanel C (BP–C)		**58351 00112**	**1 of 1**



* 100 W only

JUMPER	POSITION	DEFINITION	REMARKS
X120...125		Allocation of X115 PTT line to LGM1..3, La/Lb	Set only one allocation
X120, 121 X122, 123 X124, 125	set set set	Allocation of X115 PTT line to LGM1 (La/Lb) Allocation of X115 PTT line to LGM2 (La/Lb) Allocation of X115 PTT line to LGM3 (La/Lb)	– – –
X88	set	–12V connected (used for LGM connectors)	Default setting
X89	set	+12V connected (used for LGM connectors)	Default setting
X134 X135	set open set open	enables advanced ident monitoring for Mon1 advanced ident function not available enables advanced ident monitoring for Mon2 advanced ident function not available	MSP supports the function MSP does not support it MSP supports the function MSP does not support it
X140 X141 X142 X143 X144	open set open set open set open set open set	IAUX11 is a free configurable LCP input IAUX11 connected to VARP MICRO_STATUS IAUX13 is a free configurable LCP input IAUX13 connected to VARP_INSTALLED IAUX10 is a free configurable LCP input IAUX10 connected to VARP_EMERGENCY IAUX12 is a free configurable LCP input IAUX12 connected to DME_TRIGGER IAUX14 is a free configurable LCP input IAUX14 connected to DME_TRIGGER_6_5	X140 to 144 are dedicated to optional VARP function; the jumpers connect LCP inputs to the VARP function.
10b Motherboard Backpanel Control (BP–C) 58351 00113			**1 of 1**



JUMPER	CONNECT.	DEFINITION	REMARKS
–	J27	Connector for Flash programming	
11 Synthesizer CVOR (SYN–V)		**83135 28101**	**1 of 1**

Annex

PC User Program—specific Procedures

Used in Navaids

Alignment Procedure

ANNEX
TABLE OF CONTENTS

ANNEX
PC USER PROGRAM–SPECIFIC PROCEDURES

The following sections give the detailed description of procedures used for the alignment of Navaids equipment. Because two different PC user programs (ADRACS and MCS) are available, all procedures are described here for both user programs.

A.1 START USER PROGRAM, PERFORM LOGIN AND SELECT STATION

A.1.1 ADRACS user program

– Click 'Start' button, select 'Programs', program group 'Adracs Remote Controlling', program 'Adracs Remote Controlling Software'. The 'Adracs – Select configuration' window appears on the screen (see Fig. A–1).

– Select the configuration type 'STANDARD' for starting ADRACS. Click on button 'OK' to confirm this selection.
NOTE: The configuration 'STANDARD' is defined in the initialization file *Adracs.ini*, and is similar to <default values> at state of delivery.

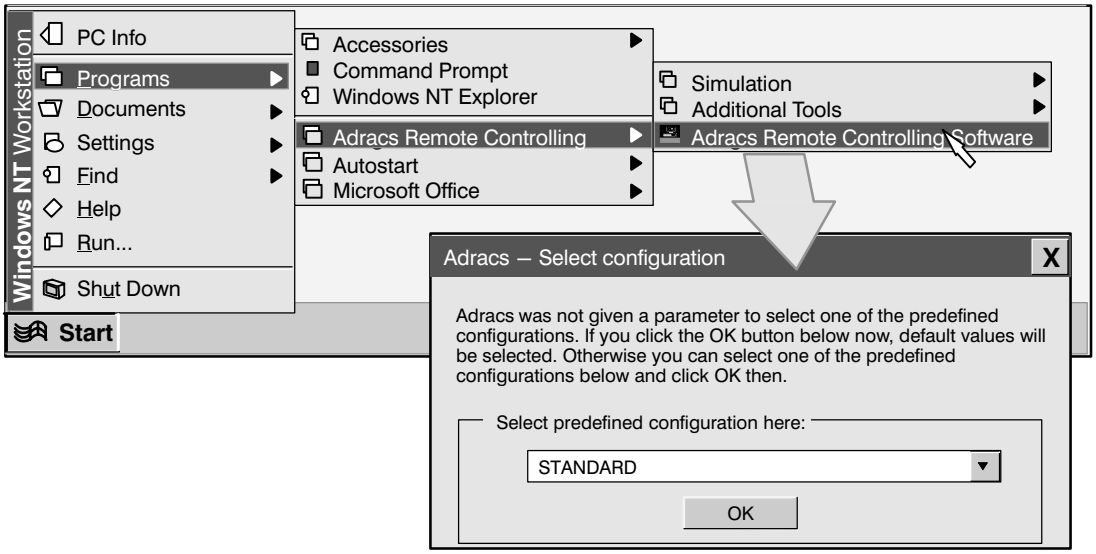


Fig. A–1 Starting 'Adracs Remote Controlling Software' on PC (example)

– The Main Status window of ADRACS is generated (see Fig. A–2).

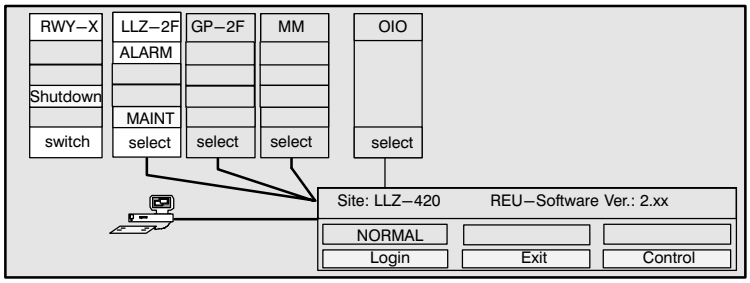


Fig. A–2 ADRACS Main Status window (example)

– Perform login procedure at the PC. Click on button 'Login' in the Main Status window (see Fig. A–2). The dialog 'Enter Password' appears (see Fig. A–3) .
Acknowledge the selection 'User 1' and Level 5 with button 'OK'.

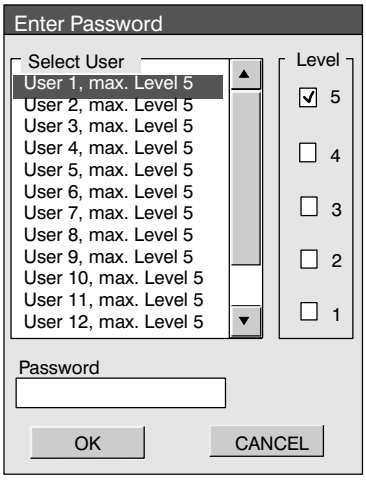


Fig. A–3 ADRACS login function using 'Enter Password' window (example)

– Click on screen button 'select' in the station (e.g. LLZ) status field of the Main Status window (see Fig. A–2). The Detailed Status window of the Navaids station appears (see Fig. A–4).

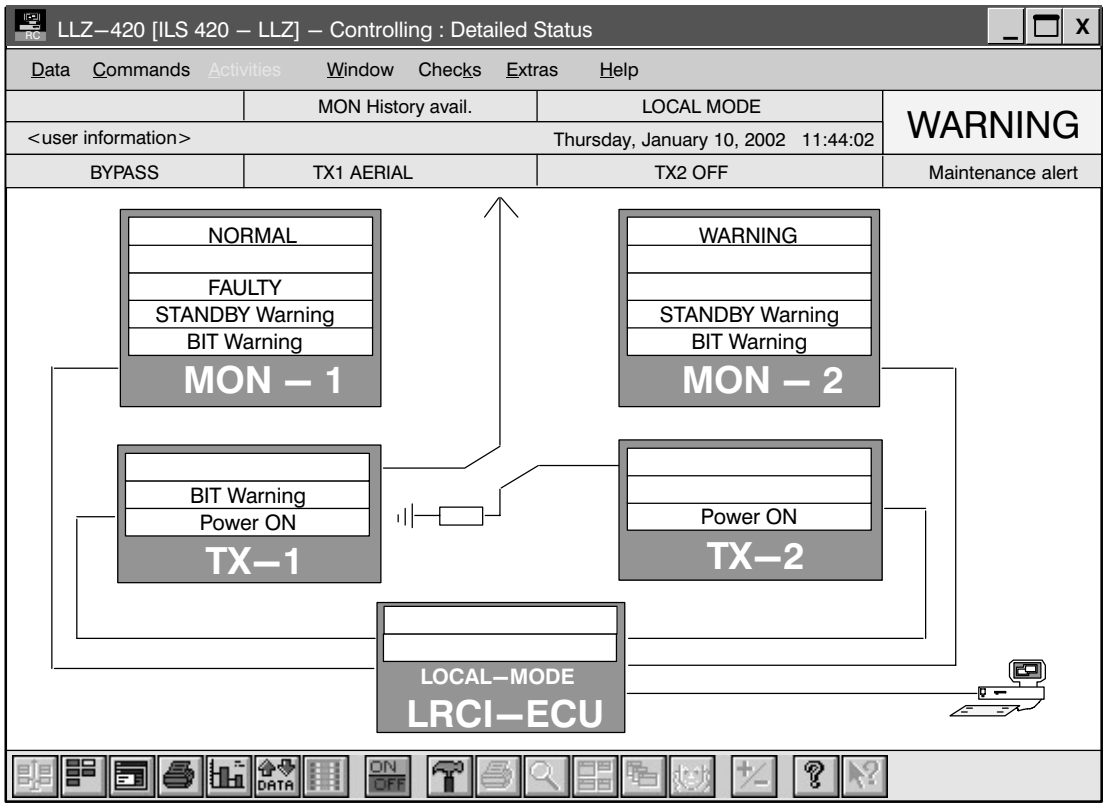


Fig. A–4 ADRACS Detailed Status window of the Navaids equipment (example)

A.1.2 MCS user program

In the standard application the local PC/Laptop is used as MCWP, i.e. the MCS application GUI, the SNMP Proxy agents and the Direct Connect option are installed to the PC/Laptop. The Laptop is connected to the connector Local PC (serial interface) on top of the cabinet.

In an optional application (currently only avialable for DVOR/CVOR systems) the local PC/Laptop is used as CWP, i.e. the MCS application GUI is installed to the PC/Laptop and the SNMP Proxy agents are installed to a built−in intelligent board, the optional ETX−CPU board. The Laptop is connected to the connector ETHERNET on top of the cabinet which is fed to the ETX−CPU board.

A.1.2.1 Start Standard Application (Direct Connection via Serial Interface)

Only an MCWP (with SNMP proxy agents installed) running under a Linux operating system can be directly connected via a serial cable (RS232) to a Navaids cabinet (see Fig. A−5).

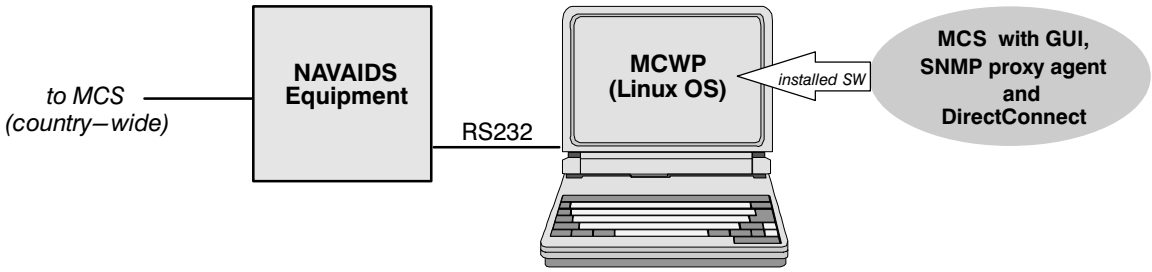


Fig. A−5 Direct connection to a Navaids equipment via serial interface

The tool 'MCS direct connect' has to be is used for the standard application. For details see Technical Manual MCS, section 1.8.1. To start the MCS Direct Connect application on the connected PC/Laptop perform the steps:

– Click start button of Linux desktop ('red hat'), select 'System Tools', select 'More System Tools', select 'MCS direct connect' (see Fig. A−6).

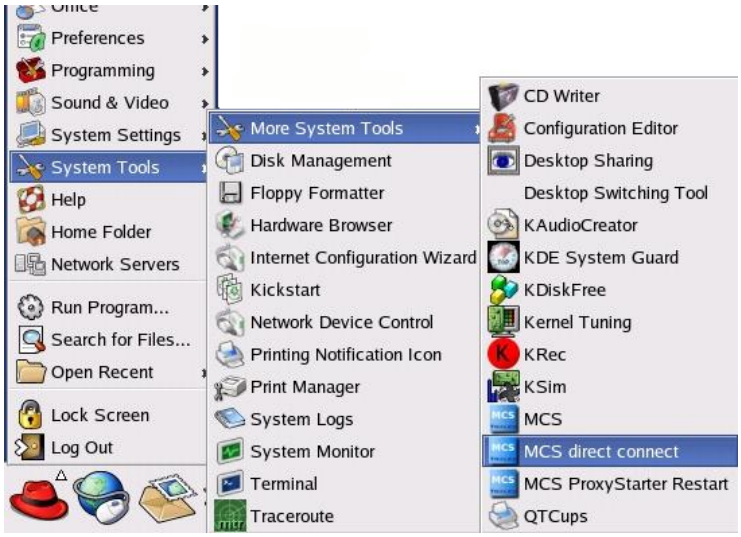


Fig. A−6 Linux desktop start menu with 'MCS direct connect' tool (example)

– The 'MCS direct connection' start window appears (see Fig. A–7). Select the parameters for the connected Navaids station in the following dialog windows and confirm each setting with button 'OK'.

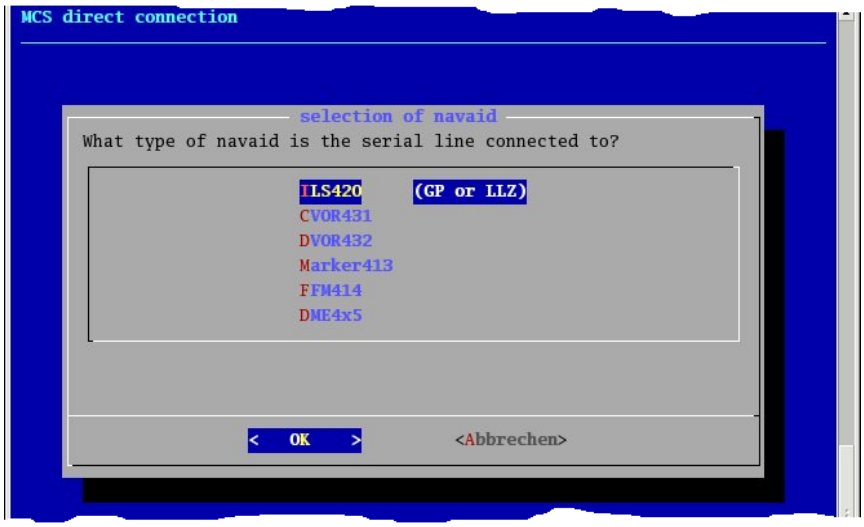


Fig. A–7 Start window of 'MCS direct connection' tool (example)

– If the MCS direct connection set up is finished, the MCS Main window, presenting the defined Navaids station as equipment level in the Navigation Tree panel, and as an equipment icon in the Map View panel (see Fig. A–8).

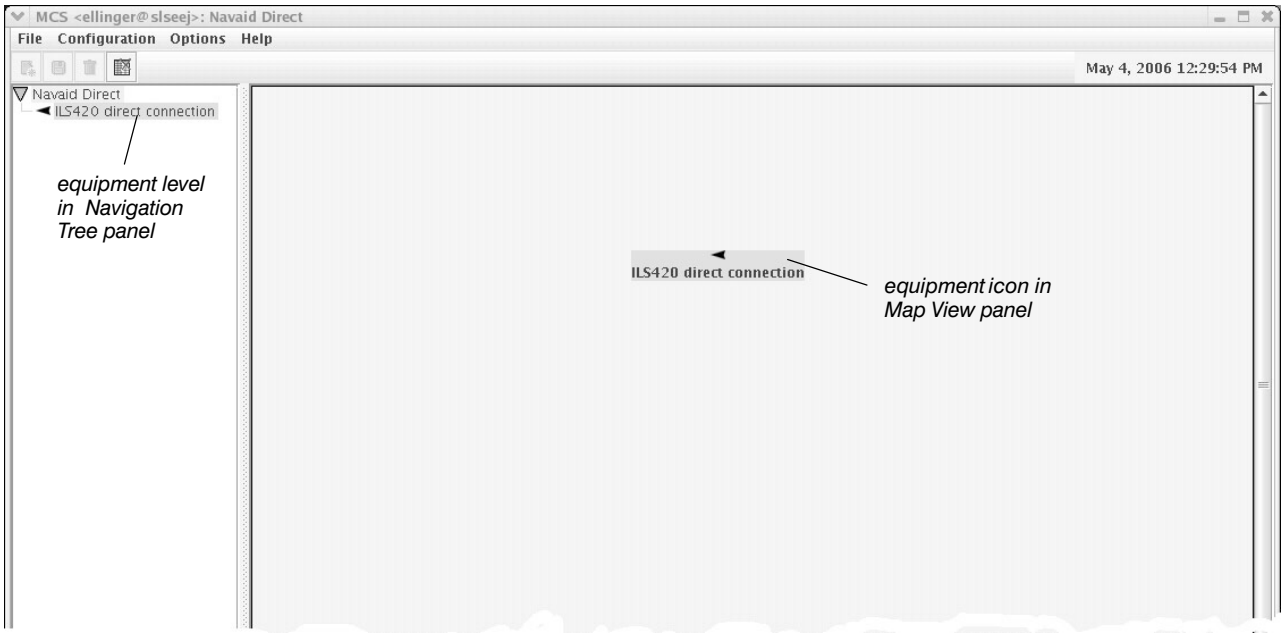


Fig. A–8 MCS Main window after setting up the direct connection to the station (example)

A.1.2.2 Start Optional Application (Ethernet Connection and ETX–CPU Board)

A CWP (running under Linux or MS Windows OS) with an MCS GUI can be connected via an Ethernet interface (TCP/IP) only to a Navaids equipment equipped with the ETX–CPU board (see Fig. A–9). The SNMP proxy agent of the Navaids equipment is installed on the ETX–CPU board. For details see Technical Manual MCS, Part 1, section 'Ethernet (TCP/IP) Connection'.

The common MCS application has to be used for the optional application.

The network interface of the CWP laptop has to be configured as 'DHCP Client', i.e. the laptop gets its LAN interface configuration (IP address, ...) from the ETX–CPU board.

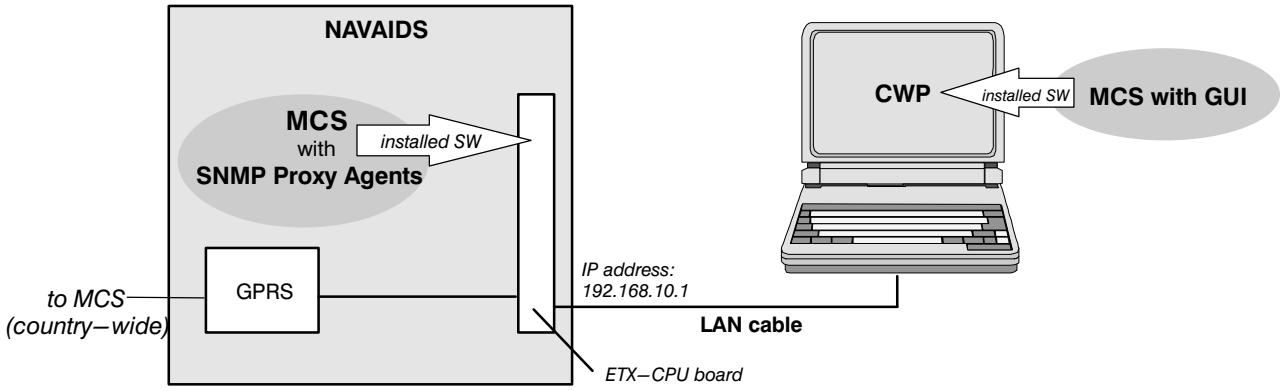


Fig. A–9 Direct connection to a Navaids equipment via Ethernet interface (example)

Start the MCS GUI on the CWP laptop via the corresponding menu entry in the desktop start menu. The MCS Main window appears (see Fig. A–10).

Fig. A–10 MCS Main window after starting GUI on CWP (example: no root structure defined)

If the Navigation Tree panel is empty (i.e. no root structure is defined), create a new structure by clikking on main menu 'Configuration', select submenu 'Position', select function 'Create New Root Structure'. Select a local level ('Airport' or 'En Route Site') in the 'Create New Root Structure' dialog, see Fig. A–11).

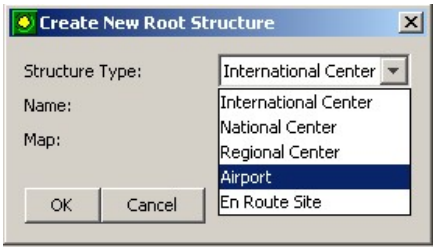


Fig. A–11 Create New Root Structure in the MCS Main window (example)

Now the user has to add a new Navaid equipment, i.e. a new sublevel (Navaid) within the root structure. After a right mouse−click on the (now) existing local level, a menu provides the submenu 'New', select function 'Navaid' (see Fig. A−12).

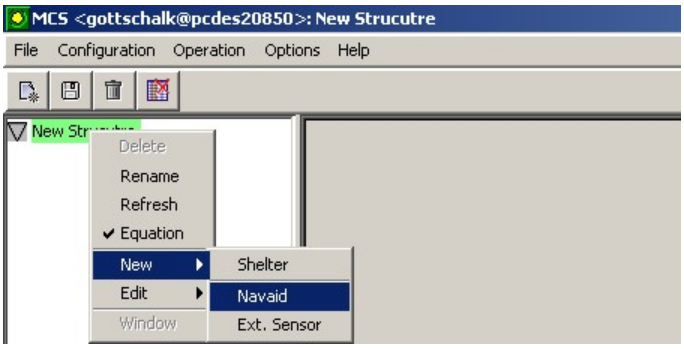


Fig. A−12 Start procedure to create a new Navaid equipment level (example)

The 'Create New Navaid' dialog window appears (see Fig. A−13). Select the corresponding 'Device Type', define a 'Name', set the 'Proxy Host' parameter to IP address '192.168.10.1' and use the given 'Proxy Port' (or set the parameter to a defined value). Click first button 'Test' and then button 'OK'.

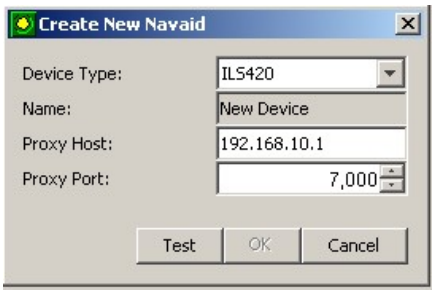


Fig. A−13 Dialog 'Create New Navaid' (example)

The MCS Main window is presenting now the defined Navaids station as equipment level in the Navigation Tree panel, and as an equipment icon in the Map View panel (see Fig. A−14).

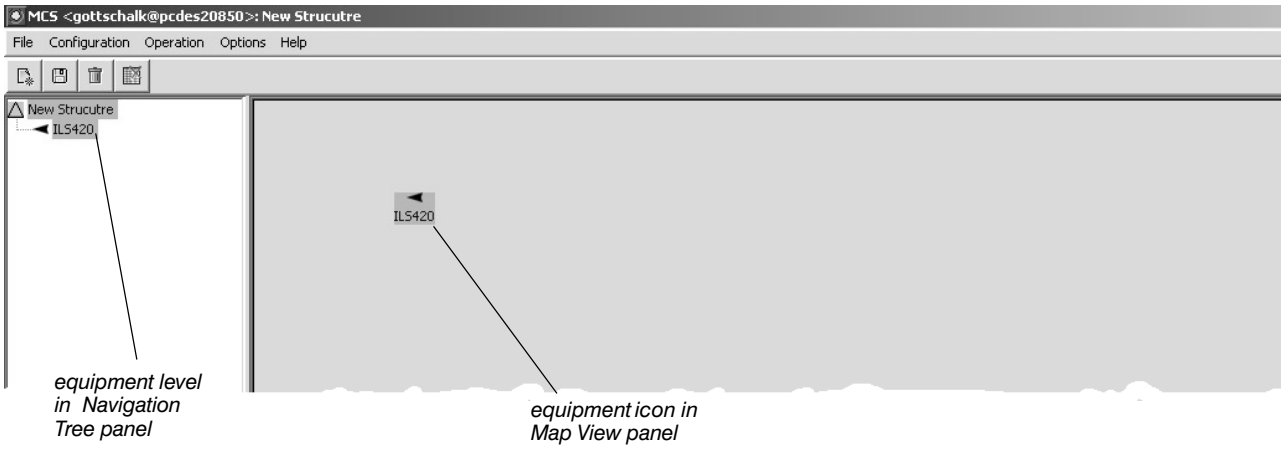


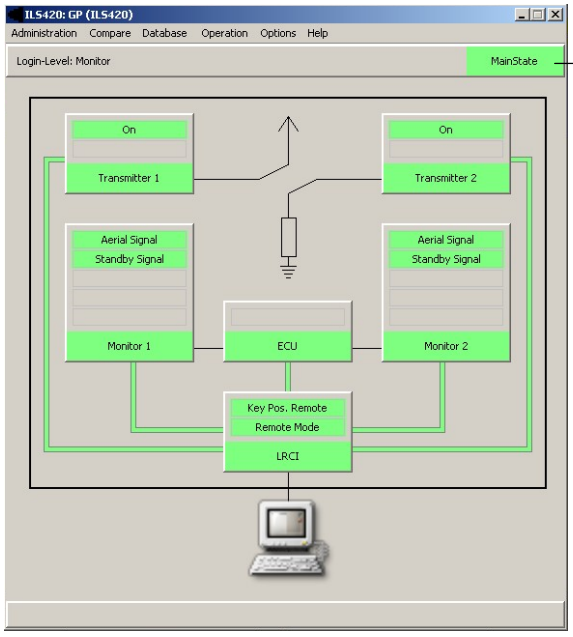
Fig. A−14 MCS Main window after creating a Navaid station in the root structure (example)

A.1.2.3 Perform Login and Select Station

– Open the 1st Equipment Level window of the Navaids station by left mouse–click on the equipment level in the Navigation Tree panel or by double left mouse–click on the equipment icon in the Map View panel of the MCS Main window (see Fig. A–8 resp. A–14).

– The 1st Equipment Level window with login level 'Monitor' appears (see Fig. A–15a). Login as 'maintenance' user via pull–down menu 'Administration', submenu 'Login' in the 1st Equipment Level window. The default password is 'MCS. The login level 'Maintenance' is shown in the status bar of the window (see Fig. A–15b). The Maintenance user has now access to all maintenance functions.

a) login level 'Monitor'



Status bar with login level

b) login level 'Maintenance'

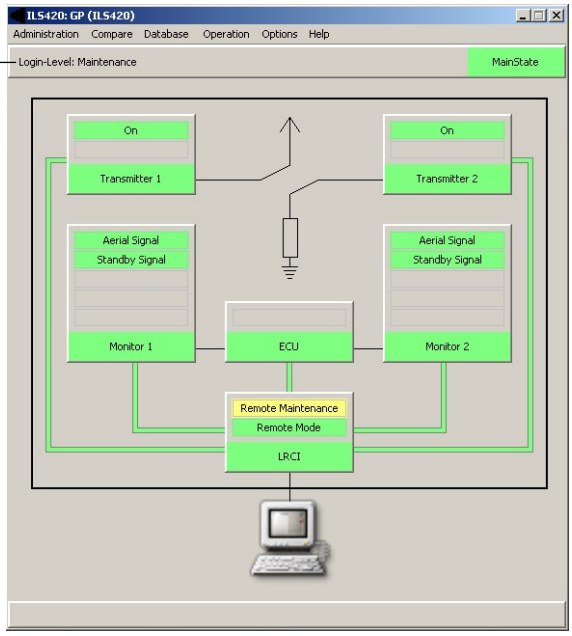


Fig. A–15 MCS 1st Equipment Level window of the Navaids station (examples a and b)

A.2 SWITCH BOTH TX ON (OFF)

A.2.1 ADRACS user program

– Open the menu 'Commands' in the ADRACS 'Detailed Status' window (see Fig. A–16).
– Click on command 'Switch both TX ON' (resp. 'Switch both TX OFF').

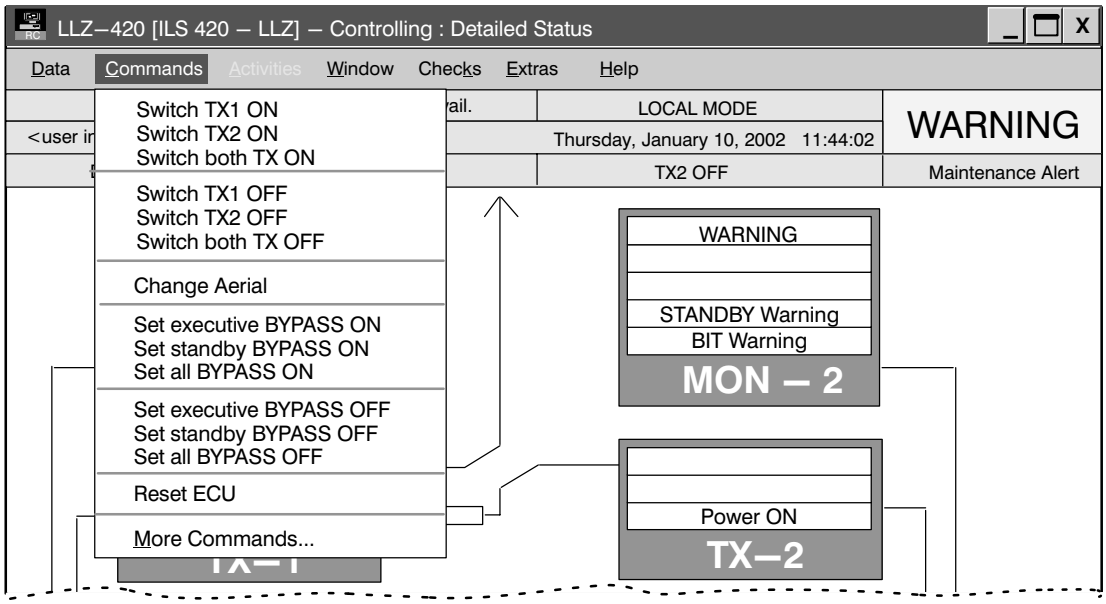


Fig. A–16 ADRACS Detailed Status window with pulldown menu 'Commands' (example)

A.2.2 MCS user program

– Open the pull–down menu with the commands for the subsystem 'Transmitter 1' (or 'Transmitter 2') via right mouse–click on the subsystem label 'Transmitter 1' (resp. 'Transmitter 2') in the MCS 1st Equipment Level window (see Fig. A–17).

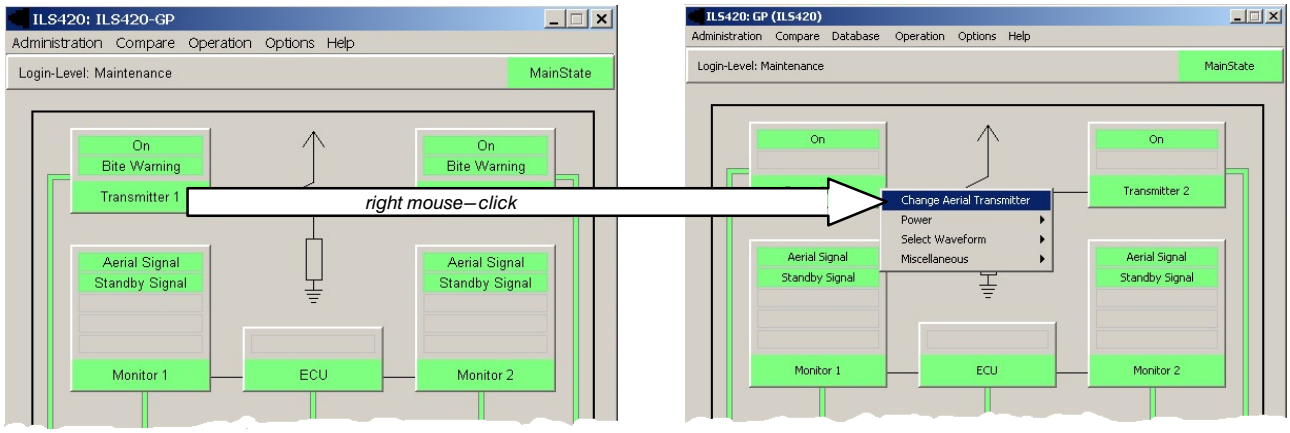


Fig. A–17 MCS 1st Equipment Level window with pull–down menu of transmitter commands (example)

– Open the commands submenu 'Power' by moving the cursor onto the submenu item 'Power' (see Fig. A–18).

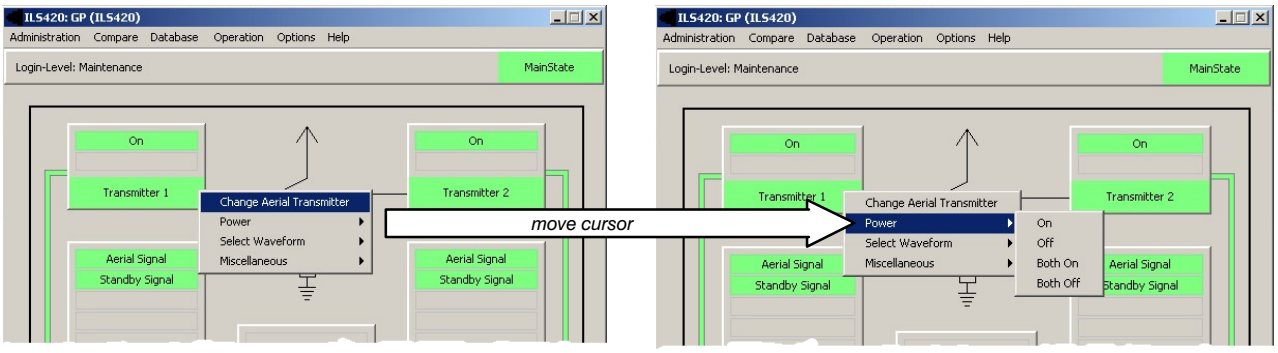


Fig. A–18 Open transmitter commands submenu 'Power' (example)

– Select the command 'Both On' (resp. 'Both Off') by moving the cursor onto the corresponding menu item. Send the selected command to the equipment by left mouse–click on the selected item 'Both On' (resp. 'Both Off', see Fig. A–19).

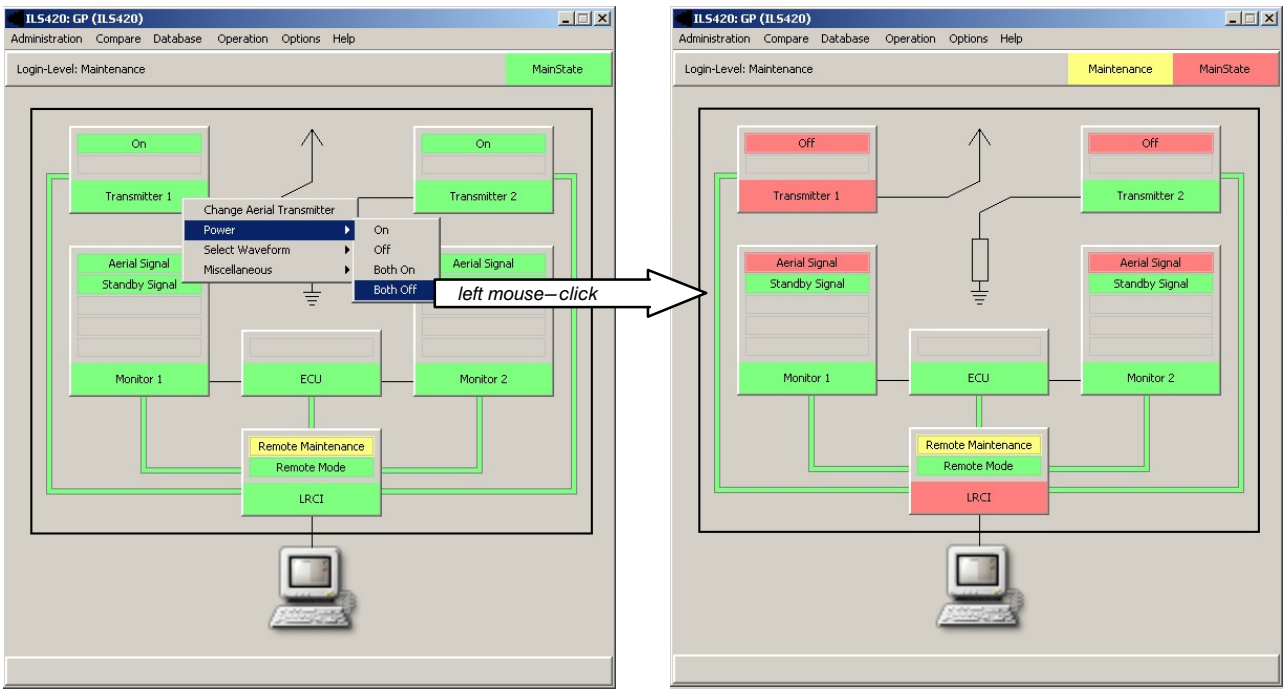


Fig. A–19 Send command 'Power, Both off' to the equipment, state indication is actualized (example)

A.3 SWITCH TX1 (2) ON (OFF)

A.3.1 ADRACS user program

– Open the menu 'Commands' in the ADRACS 'Detailed Status' window (see Fig. A–20).
– Click on command 'Switch TX1 (2) ON' resp. 'Switch TX1 (2) OFF'.

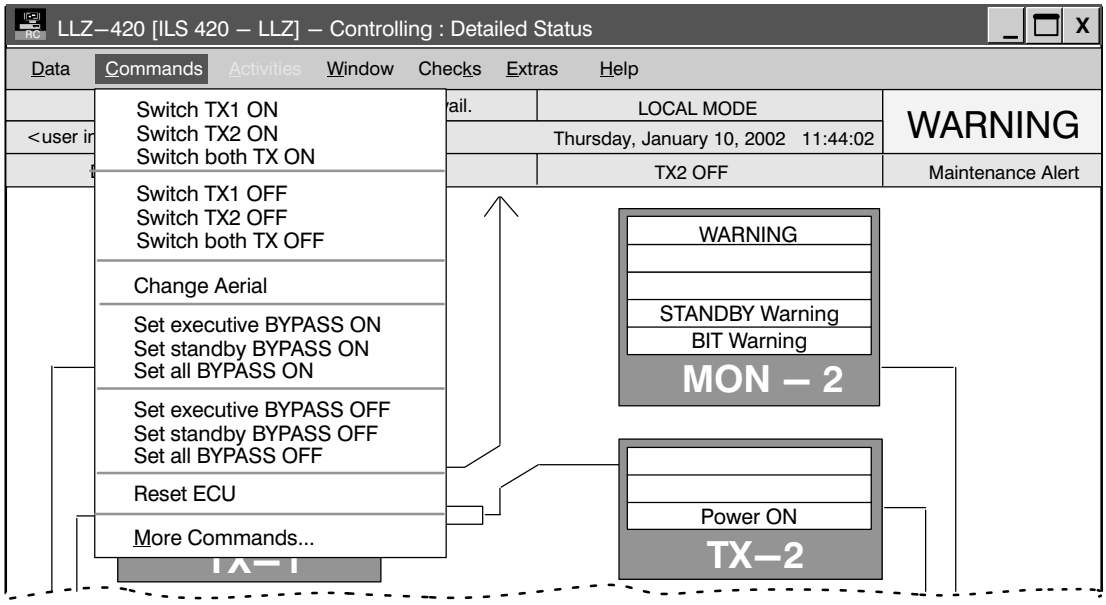


Fig. A–20 ADRACS Detailed Status window with pulldown menu 'Commands' (example)

A.3.2 MCS user program

– Open the pull–down menu with the commands for the subsystem 'Transmitter 1' (resp. 'Transmitter 2') via right mouse–click on the subsystem label 'Transmitter 1' (resp. 'Transmitter 2') in the MCS 1st Equipment Level window (see Fig. A–21).

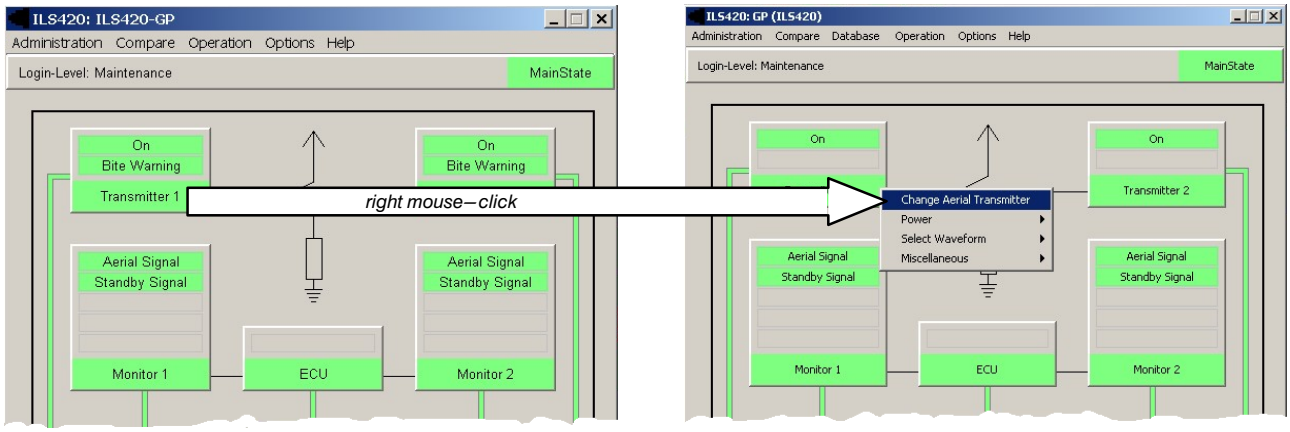


Fig. A–21 MCS 1st Equipment Level window with pull–down menu of transmitter commands (example)

– Open the commands submenu 'Power' by moving the cursor onto the submenu item 'Power' (see Fig. A–22).

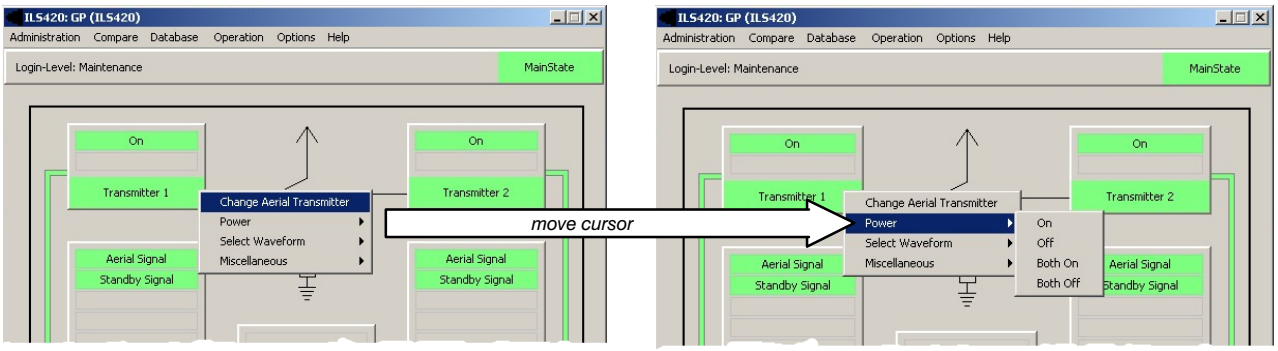


Fig. A–22 Open transmitter commands submenu 'Power' (example)

– Select the command 'On' (resp. 'Off') by moving the cursor onto the corresponding menu item. Send the selected command to the equipment by left mouse–click on the selected item 'On' (resp. 'Off'), see Fig. A–23.

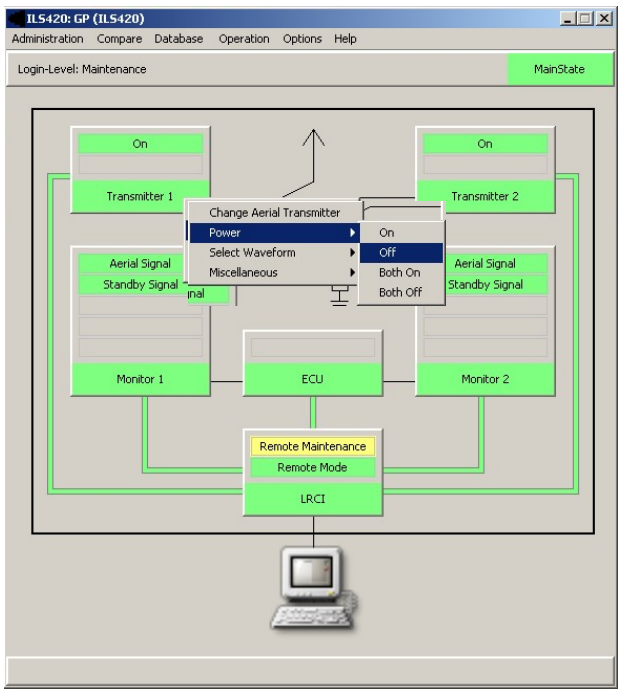


Fig. A–23 Send command 'Power, Off' to the station (example)

A.4 SET TX 1 (2) ON AERIAL

NOTE: This procedure is only necessary if transmitter 1 (2) is not yet set to the aerial transmitter.

A.4.1 ADRACS user program

– Open the menu 'Commands' in the ADRACS 'Detailed Status' window, select function 'Change aerial' (see Fig. A–24).

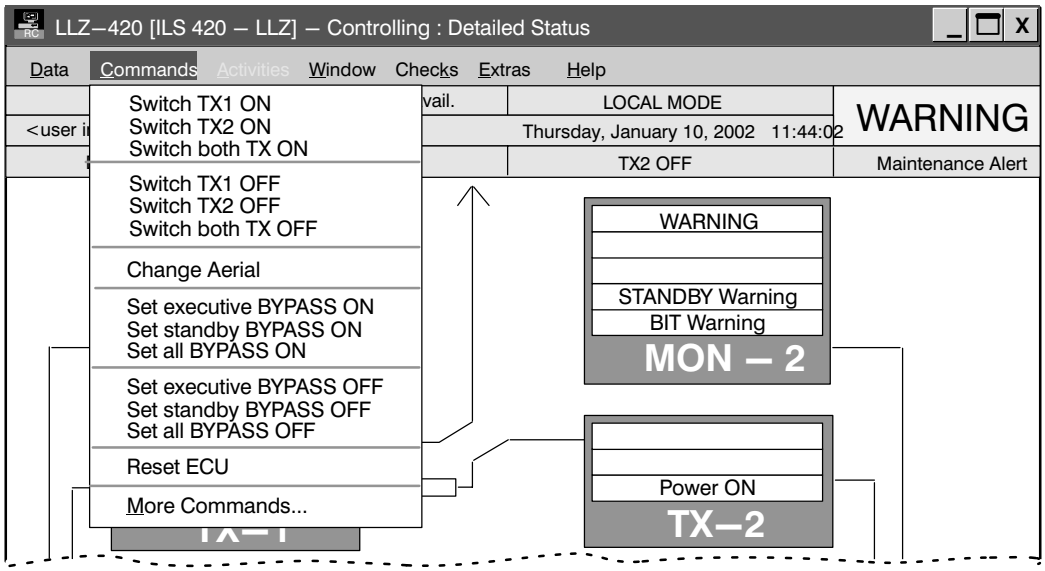


Fig. A–24 ADRACS Detailed Status window; menu 'Commands' (example)

A.4.2 MCS user program

– Open the pull–down menu with the commands for the subsystem 'Transmitter 1' (resp. 'Transmitter 2') via right mouse–click on the subsystem label 'Transmitter 1' (resp. 'Transmitter 2') in the MCS 1st Equipment Level window.

– Send the selected command 'Change Aerial Transmitter' to the equipment by left mouse–click on the selected item (see Fig. A–25).

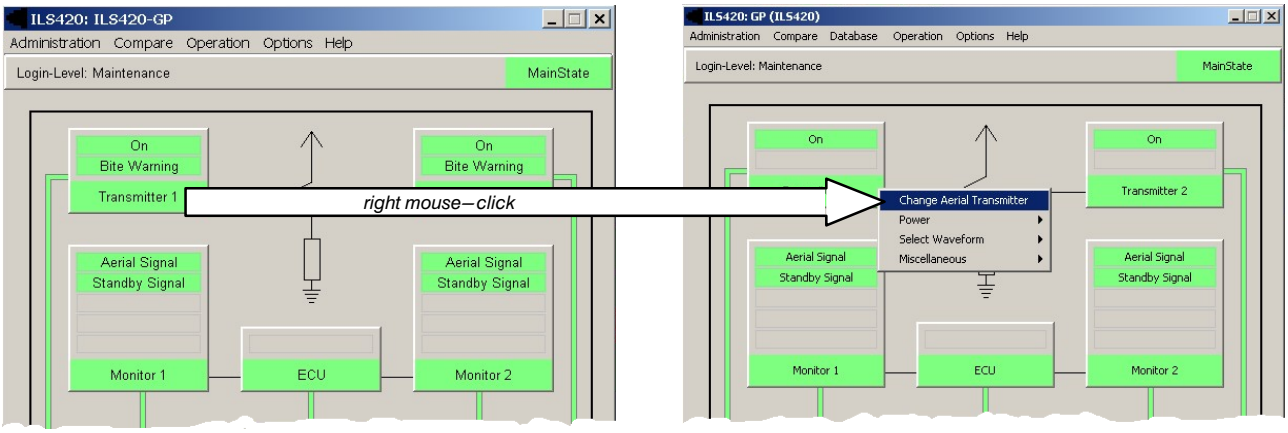


Fig. A–25 MCS 1st Equipment Level window with transmitter command 'Change Aerial' (example)

A.5 SET ALL MONITOR BYPASS ON (OFF)

A.5.1 ADRACS user program

– Open the menu 'Commands' in the ADRACS 'Detailed Status' window (see Fig. A–26). Click on command 'Set all BYPASS ON' ('Set all BYPASS OFF').

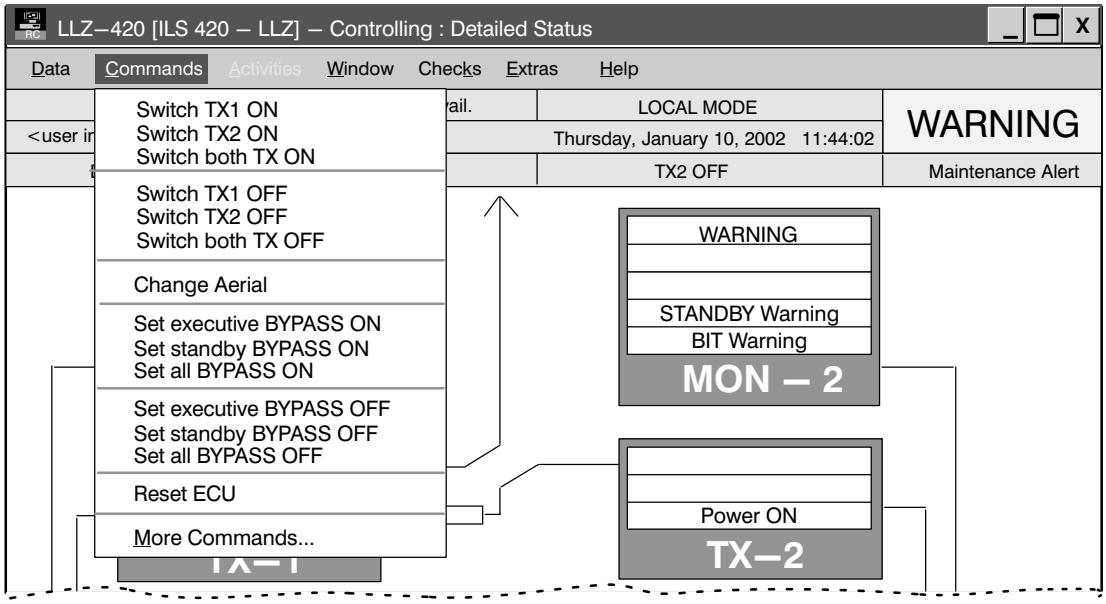


Fig. A–26 ADRACS Detailed Status window; menu 'Commands' (example)

A.5.2 MCS user program

– Open the pull–down menu with the commands for the subsystem 'Monitor 1' (or Monitor 2') via right mouse–click on the subsystem label 'Monitor 1' (or 'Monitor 2') in the MCS 1st Equipment Level window.

– Open the submenu 'Bypass', open submenu 'All Bypass' (see Fig. A–27) and select command 'On' ('Off'). Send command to the equipment by left mouse–click on the selected item.

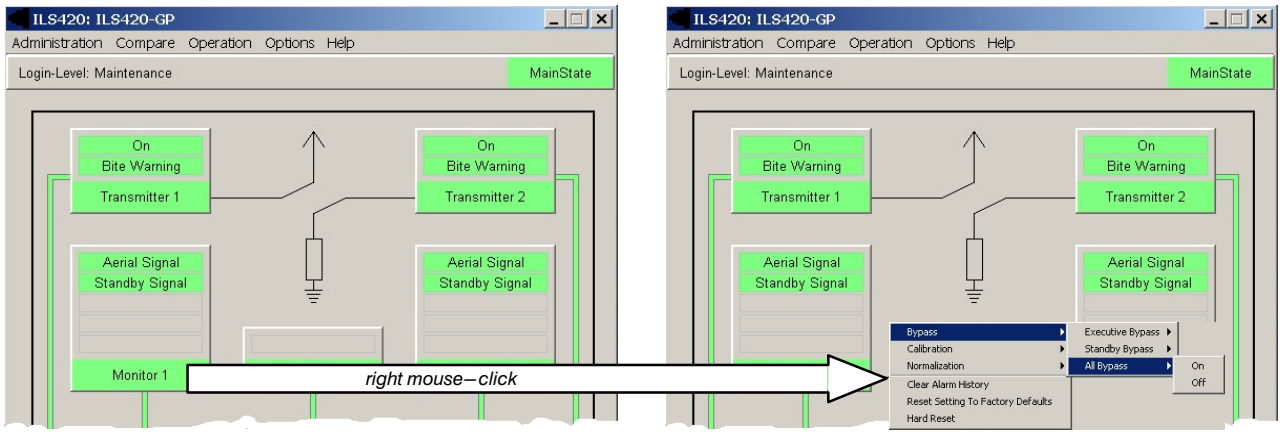


Fig. A–27 MCS 1st Equipment Level window with monitor bypass commands (example)

A.6 OPEN THE STATION CONFIGURATION DIALOG

A.6.1 ADRACS user program

– Select menu ’Data’, submenu ’MON–TX–LRCI Data’ in the ADRACS ’Detailed Status’ window, or click on corresponding functional key at the bottom of the window (see Fig. A–28).
The ’General Data window appears.

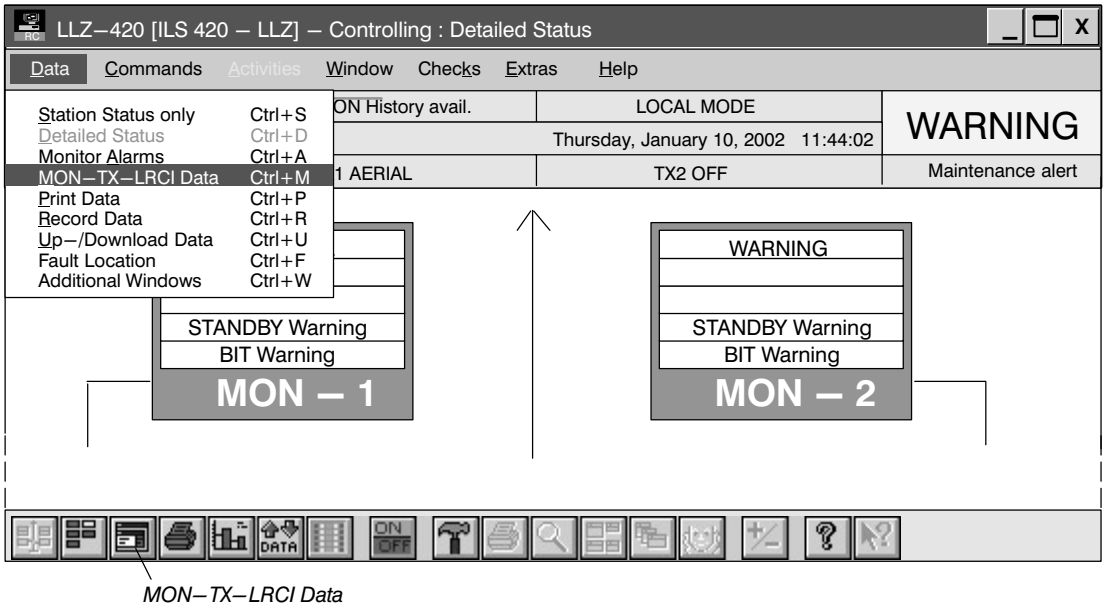


Fig. A–28 ADRACS Detailed Status window; menu ’Data’ (example)

– Select menu ’Window’, function ’Adjust Windows’ in the General Data window or click on corresponding functional key at the bottom of the window (see Fig. A–29).

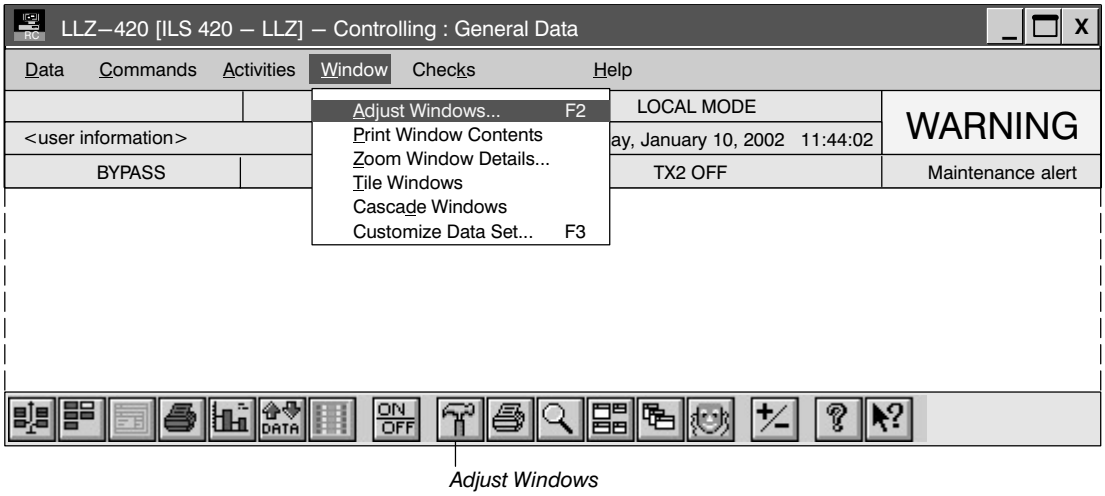


Fig. A–29 ADRACS General Data window; menu ’Window’ (example)

– The 'ADJUST WINDOWS' dialog appears (see Fig. A–30).

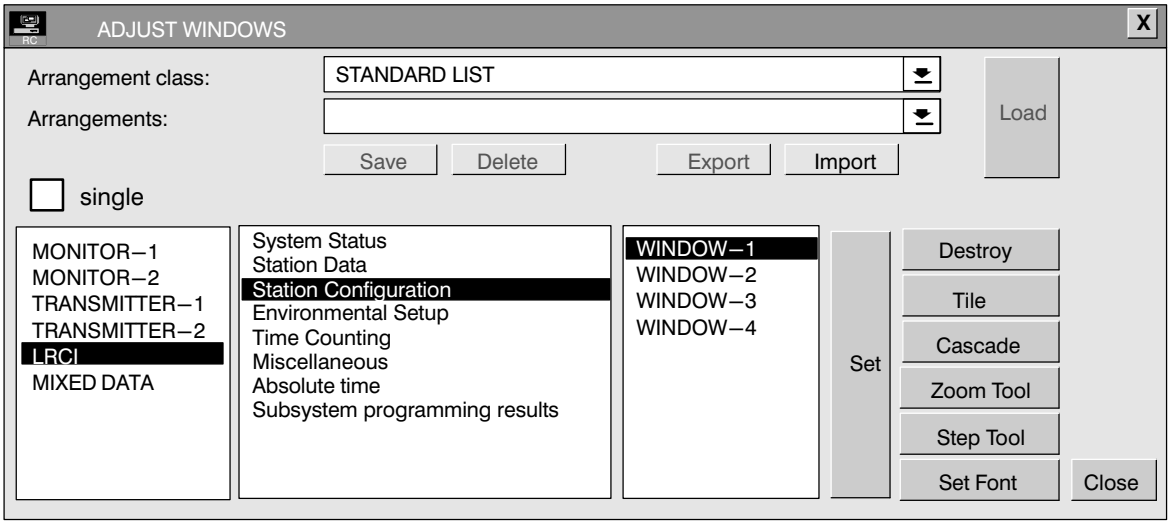


Fig. A–30 ADRACS dialog 'ADJUST WINDOWS' (example)

– Select subsystem 'LRCI', data set 'LRCI Station Configuration'. Select a presentation window (WINDOW–1 to 4). Confirm with button 'Set'.

– The 'LRCI Station Configuration' dialog appears (see Fig. A–31). Verify and set the required parameter.

– After parameter setting, select "Click here to accept" to confirm the settings.

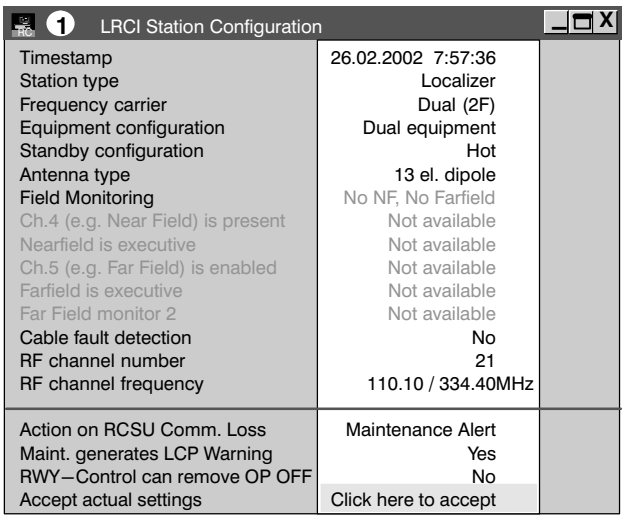


Fig. A–31 ADRACS 'LRCI Station Configuration' window for parameter setting (example)

A.6.2 MCS user program

– Open the pull–down menu 'Operation' via left mouse–click on the menu item 'Operation' in the menu bar of the MCS 1st Equipment Level window. The submenu 'Station Configuration' appears (see Fig. A–32)

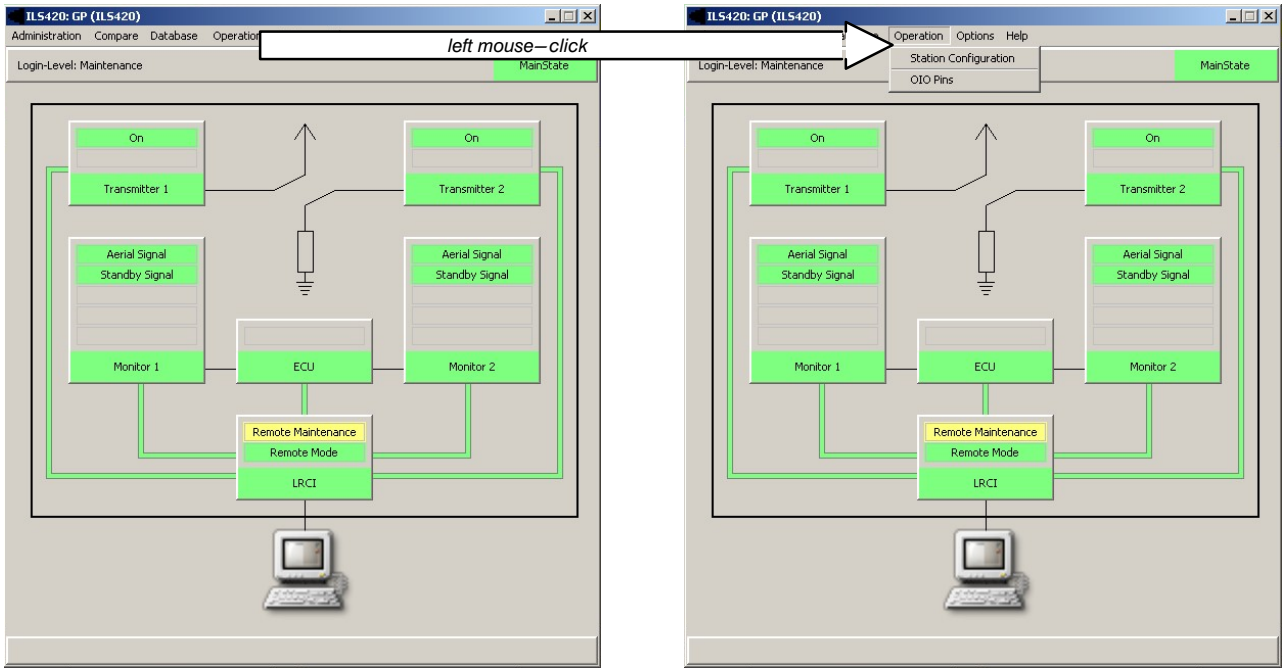


Fig. A–32 MCS 1st Equipment Level window with submenu 'Station Configuration' (example)

– Select the 'Operation' submenu 'Station Configuration' via left mouse–click on the corresponding submenu item (see Fig. A–33). The '<equipment> Station Configuration ' dialog is superimposed on the 1st Equipment Level window.

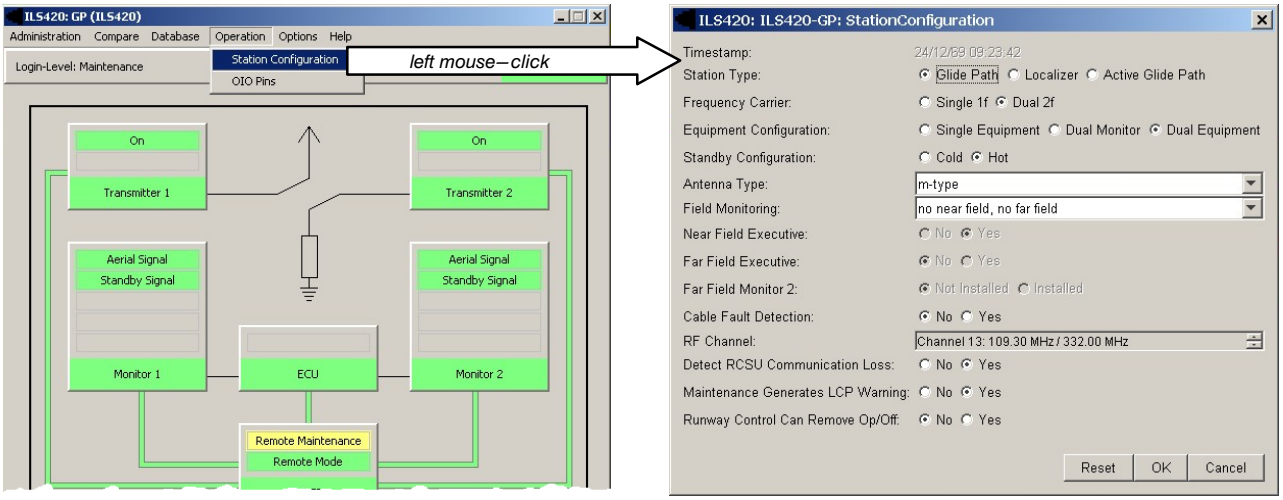


Fig. A–33 Select MCS 'Operation' submenu 'Station Configuration' (example)

– After parameter setting, send the new configuration data to the station (LRCI) via left mouse–click on button 'OK'. The '<equipment> StationConfiguration' dialog is closed, the 1st Equipment Level window is visible again (see Fig. A–34).

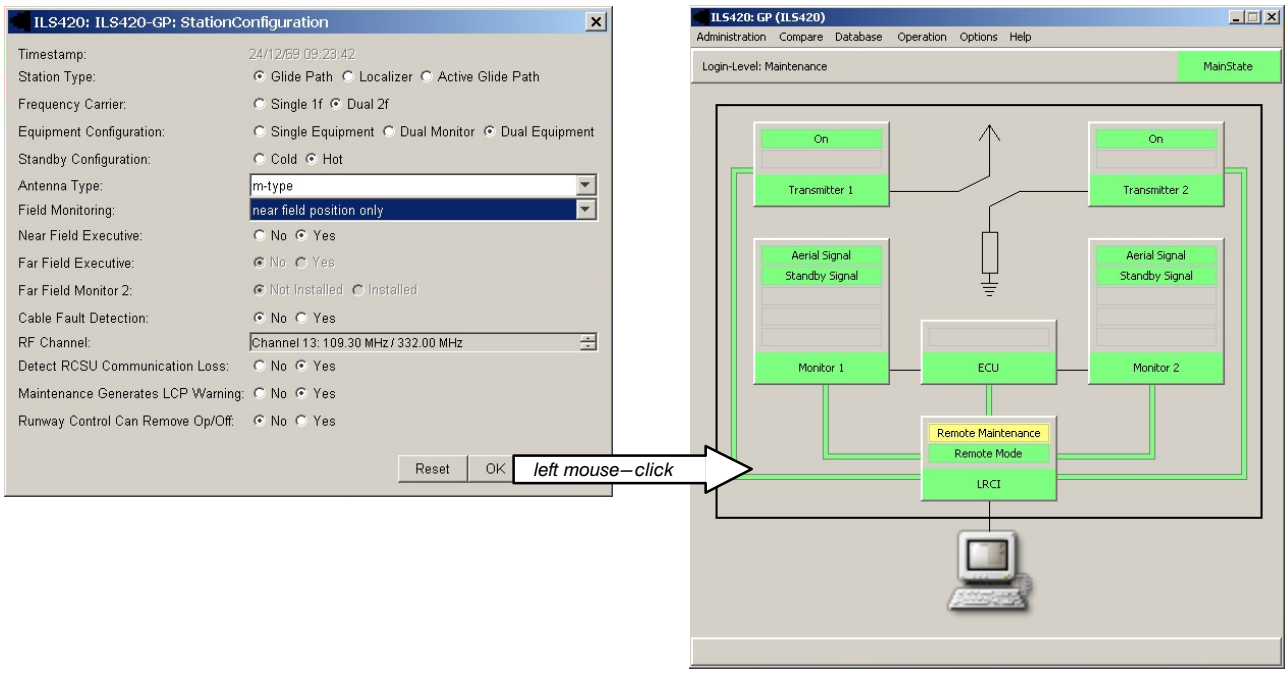


Fig. A–34 Parameter setting in the MCS '<equipment> Station Configuration' dialog (example)

A.7 OPEN DIALOG '<SUBSYSTEM>–<DATA SET>'

A.7.1 ADRACS user program

– Select menu 'Data', submenu 'MON–TX–LRCI Data' in the 'Detailed Status' window, or click on corresponding functional key at the bottom of the window (see Fig. A–35).
The 'General Data window appears.

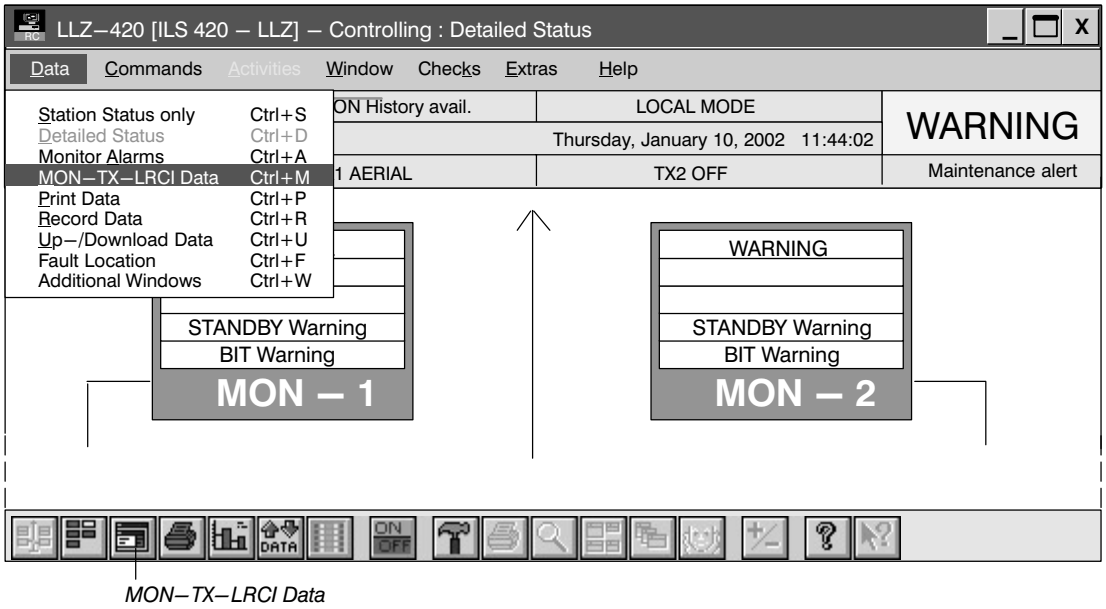


Fig. A–35 ADRACS Detailed Status window; menu 'Data' (example)

– Select menu 'Window', function 'Adjust Windows' in the General Data window or click on corresponding functional key at the bottom of the window (see Fig. A–36).

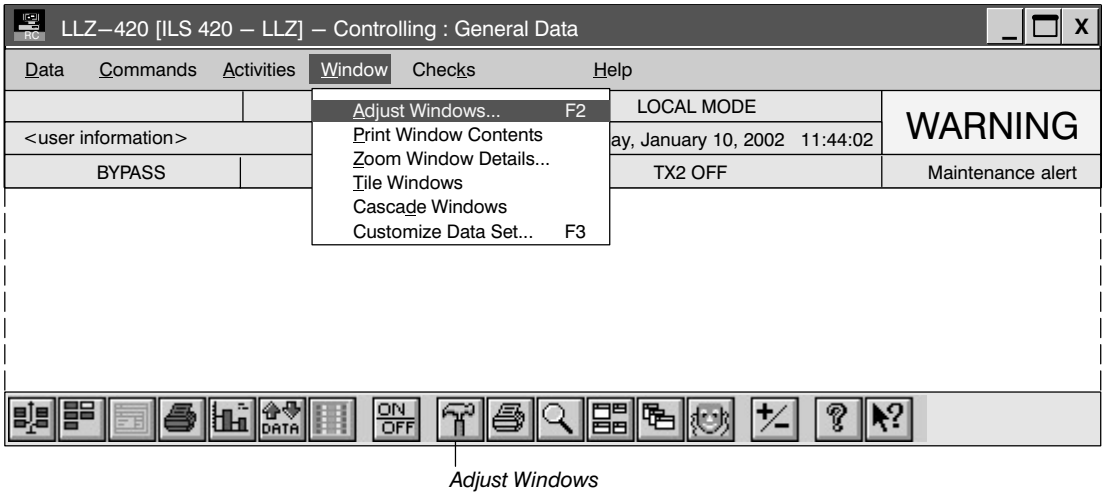


Fig. A–36 ADRACS General Data window; menu 'Window' (example)

– The 'ADJUST WINDOWS' dialog appears (see Fig. A–37).

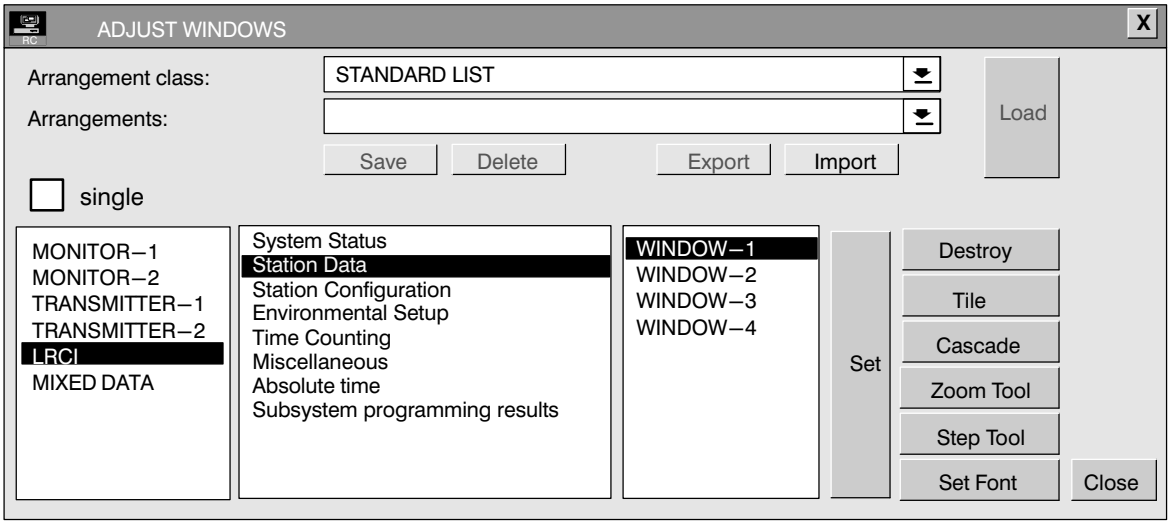


Fig. A–37 ADRACS dialog 'ADJUST WINDOWS', selection of <subsystem> and <data set> (example)

– Select the <subsystem> (e.g. 'MONITOR–1', 'LRCI') and the <data set> (e.g. 'Station Data'), and select the window number. Confirm the selections with button 'Set'.
The corresponding data window appears (see Fig. A–38).

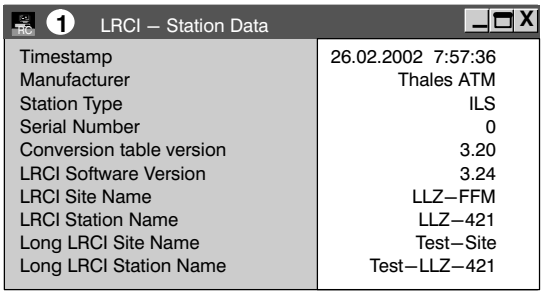


Fig. A–38 ADRACS data window with <data set> for parameter setting (example)

If more than one data window is necessary for parameter setting, start this procedure from the beginning and select another window number within the ADJUST WINDOWS dialog (see Fig. A–37).

NOTE: The 'Window' functions 'Tile Windows' and 'Cascade Windows' support the operator to get a better view on the number of data windows.

A.7.2 MCS user program

– Open the MCS 2nd Equipment Level window of the <subsystem> via double left mouse–click on the corresponding subsystem label in the MCS 1st equipment Level window (see Fig. A–39).

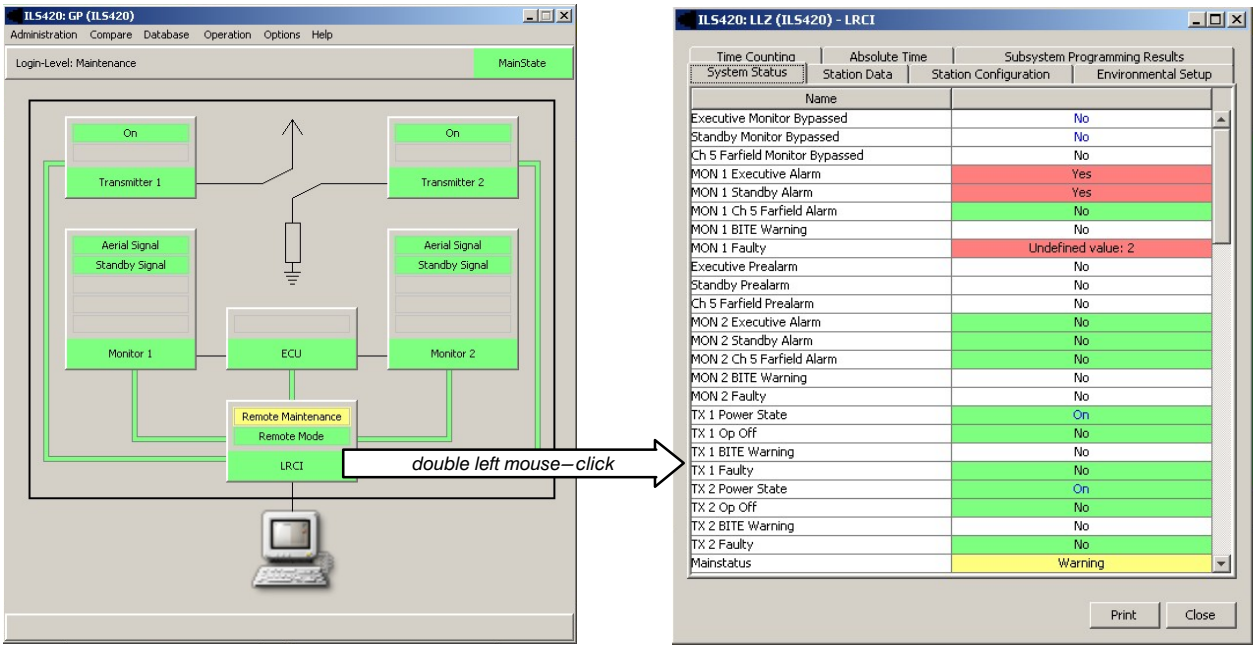


Fig. A–39 MCS <subsystem> 2nd Equipment Level window for parameter setting (example)

– Select the parameter list of the <data set> via left mouse–click on the corresponding file tab (see Fig. A–40).

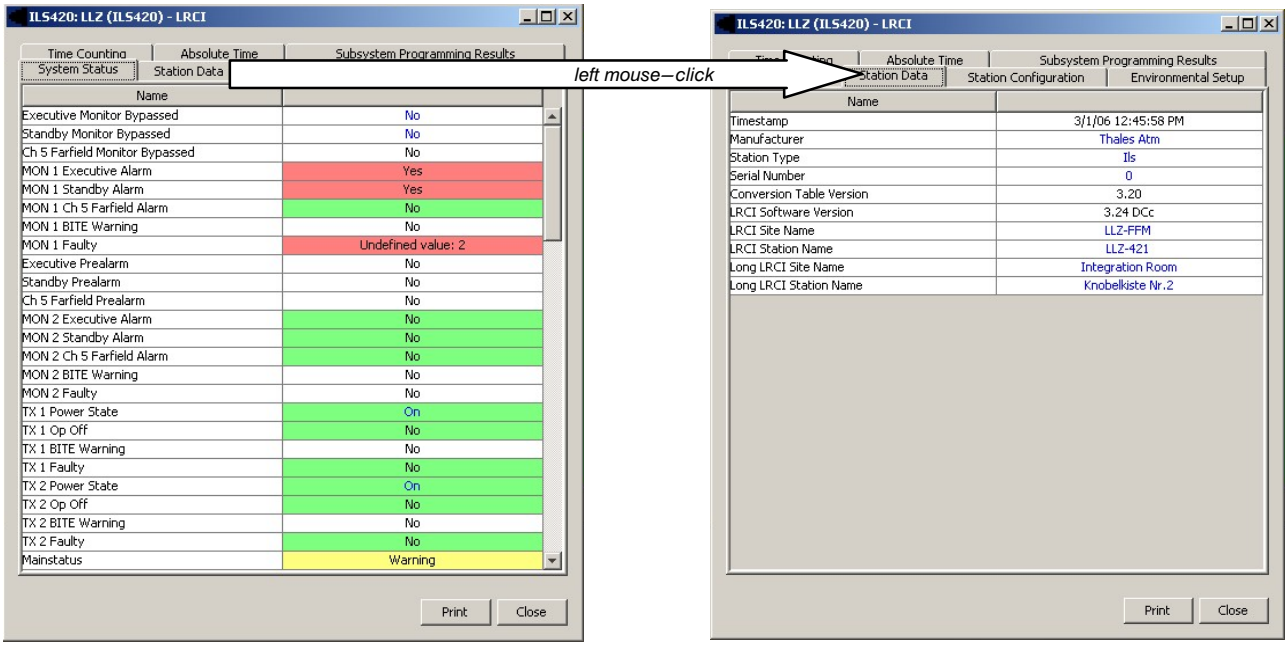


Fig. A–40 Select the <data set> for parameter setting (example)

– A double left mouse–click on a parameter value with 'write access' (written in blue characters) opens the 'Edit Value' dialog (see Fig. A–41) to change the value. Confirm with button 'OK'.

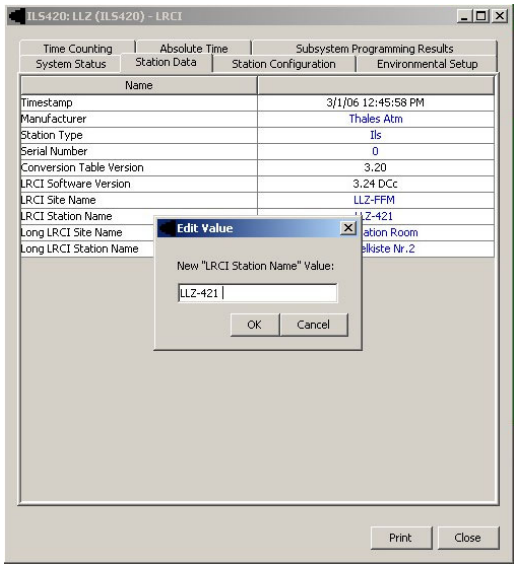


Fig. A–41 'Edit Value' dialog for modifying parameter value (example)

For a number of parameter lists some 'sub–sets' exist, which are accessible via file tabs in the upper line of the 2nd Equipment window (see Fig. A–42).
Within the alignment of Navaids equipment, the procedure to open the dialog of such a parameter sub–set is given as
"Open dialog '<subsystem>–<data set>: <sub–set>' for parameter setting".
In the example of Fig. A–42 the used procedure would be
"Open dialog 'Monitor1–Measurements/Limits: Current Executive Data' for parameter setting".

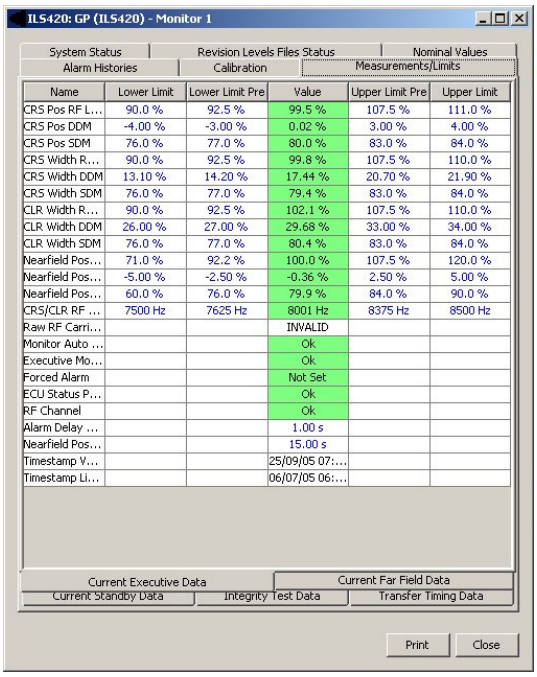


Fig. A–42 2nd Equipment Level window with a <sub–set> of a parameter <data set> (example)

If more than one data window is necessary for parameter setting, start this procedure from the beginning. If two data windows of the same subsystem are required, the dialog window 'Duplicate Windows' appears after double left mouse−click on the subsystem label (see Fig. A−43). Confirm with button 'Open new window' to get a further window of the same subsystem (in our example 'Monitor1').

Fig. A−43 Dialog 'Duplicate Window' to open a second subsystem data set window (example)

NOTE: To get a better view on the data windows, use the common Windows function to arrange the data windows on the screen.

If the same data sets of both monitors or both transmitters are required for parameter setting (e.g. 'Measurements/Limits' of Monitor 1 and Monitor 2), the functions of the pull−down menu 'Compare' in the MCS 1st Equipment Level window can be used (for details see Technical Manual MCS).

A window appears after selecting the corresponding function ('Compare Monitors' resp. 'Compare Transmitters'), see example in Fig. A−44, providing the parameters of both subsystems in parallel columns. Select the required parameter (set) via left mouse click in the left column, click again and-hold the left mouse button, then draw the cursor into the left blank area. The parameter list appears there.

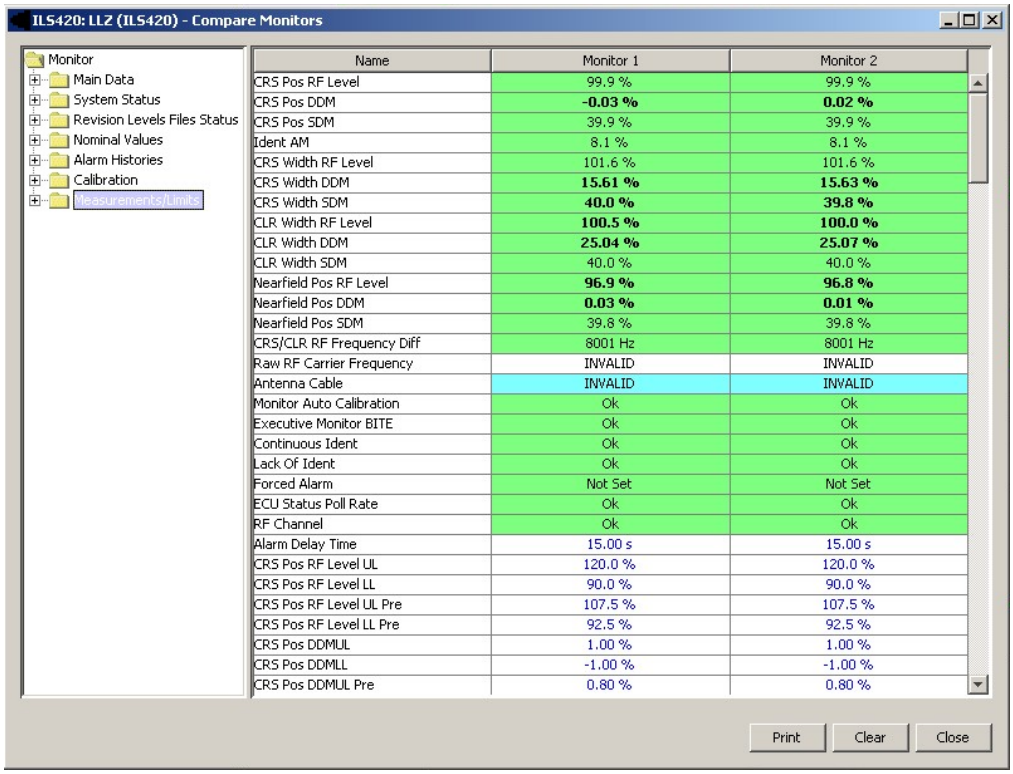


Fig. A−44 'Compare' function in the 1st Equipment Level window (example)

A.8 SEND TO <SUBSYSTEM1/2> THE COMMAND '<LIST, COMMAND>'

A.8.1 ADRACS user program

– Click on functional key 'ON/OFF' at the bottom of the 'Detailed Status' window (see Fig. A–45). The 'Commands' window appears (see Fig. A–46).

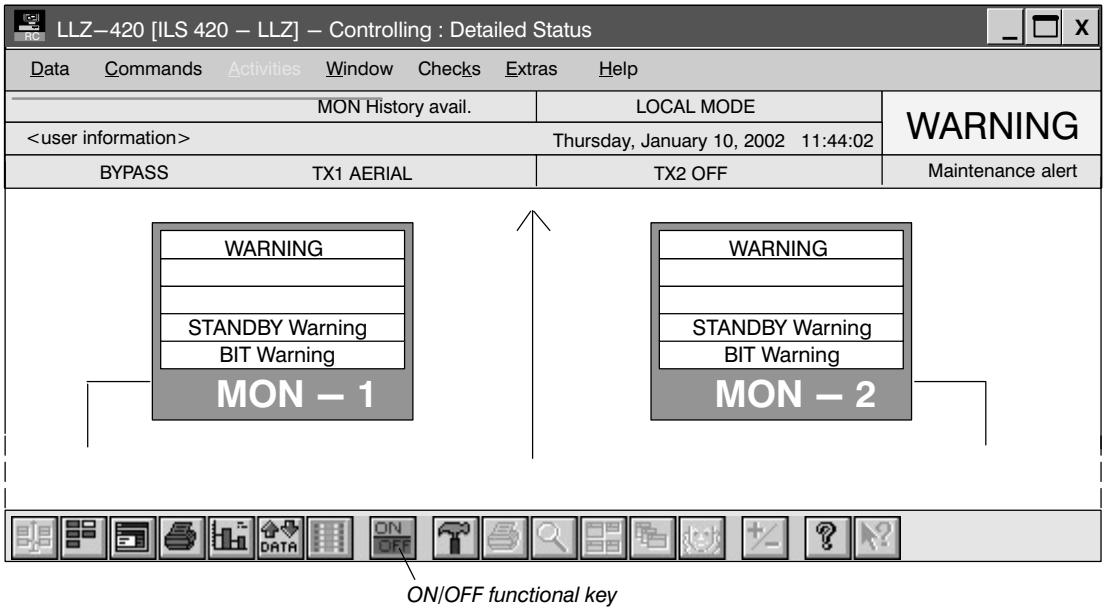


Fig. A–45 ADRACS functional key 'ON/OFF' (example)

– Click on <subsystems> pull–down menu (see Fig. A–46). The <subsystems> command lists appear. Select <list> and <command>. Confirm with button 'program <subsystem(s)>'. The 'Commands' window is closed. The command is then sent to the equipment.

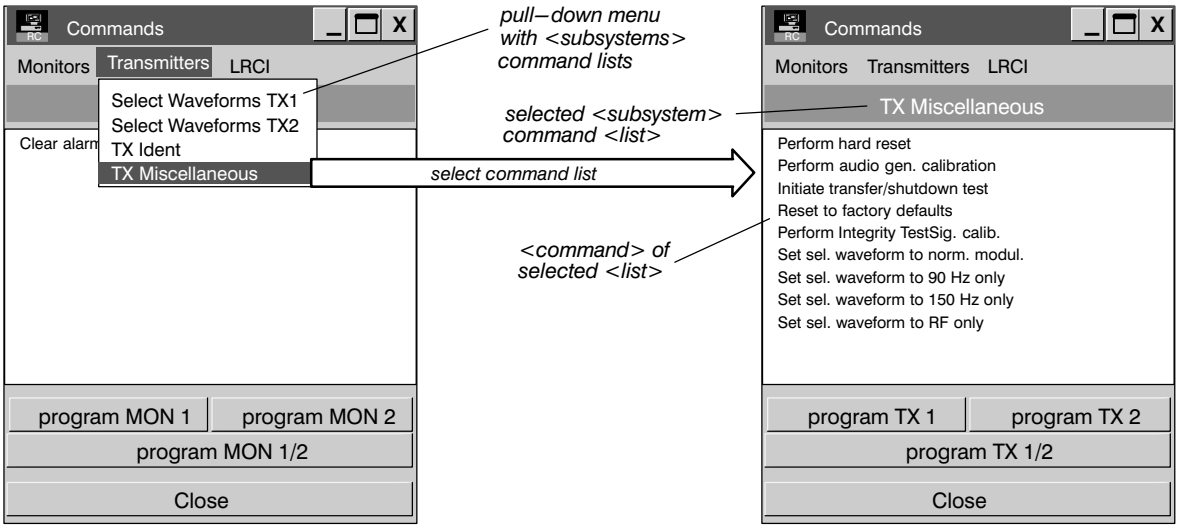


Fig. A–46 ADRACS 'Commands' window after opening the window (example)

A.8.2 MCS user program

– Open the pull–down menu with the commands for the <subsystem 1> via right mouse–click on the <subsystem 1> label in the MCS 1st Equipment Level window (see Fig. A–47).

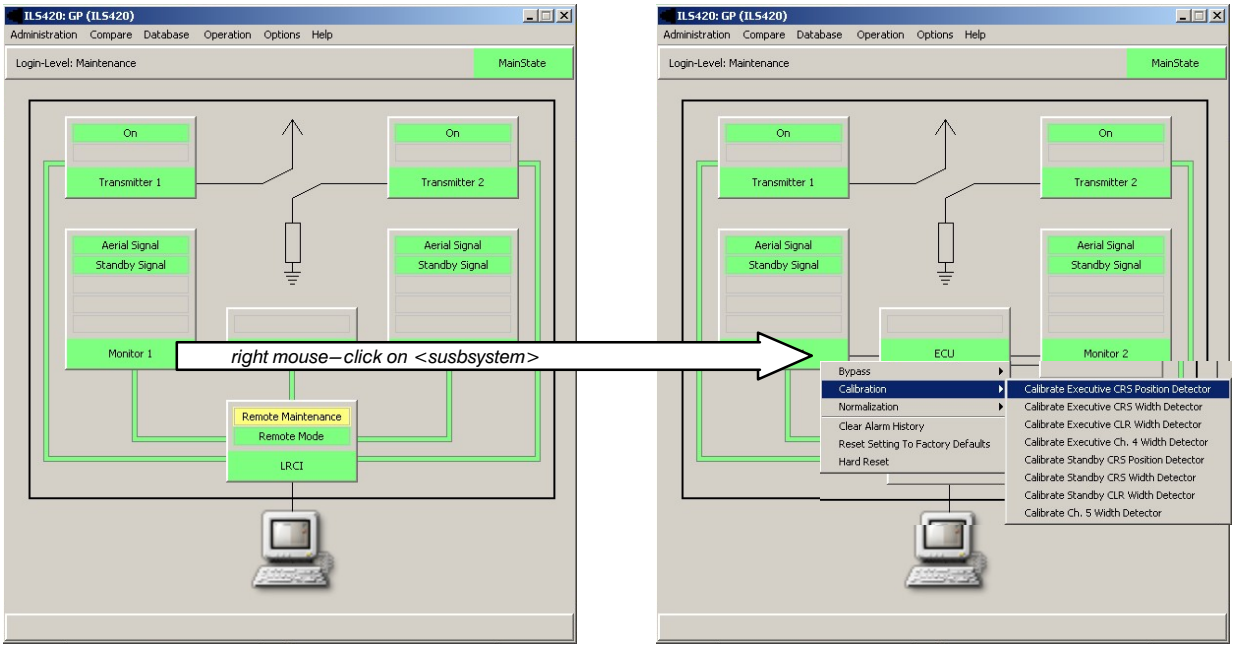


Fig. A–47 MCS 1st Equipment Level window with <subsystem> commands (example)

– Select submenu <list>, then select <command> (see Fig. A–47), send command to the equipment by left mouse–click on the selected item.

– Repeat the same procedure for the <subsystem 2>.

AMMENDMENT
LABEL CONVERSION SUMMARY DVOR/CVOR

From ADRACS software version 3.8 and MCS software V1.8, the user interface implements changes for CVOR and DVOR application handling, which shall clearify some labels and introduce some dialog window instead of data window to improve handling. A summary of the changed labels and the new dialog windows is given in the following table.

ADRACS up to 3.6 / MCS	ADRACS from 3.8	MCS from 1.8	differs
DVOR			
Data window Transmitter 1 — Adjustments	**Dialog window 'TX1— Adjustments'**	**DVOR (N1..N4)—Transmitter 1: Setup: Adjustments**	
USB Power level	USB Level	USB Level	x
LSB Power level	LSB Level	LSB Level	x
USB LSB Power Level *MCS: Alignment USB LSB Power Level*	SB Level Multiplier	SB Level Multiplier	x
USB RF phase	USB Phase	USB Phase	x
Mod. Depth 30 Hz AM	30 Hz AM Depth	30 Hz AM Depth	x
Azimuth Alignment	Azimuth Alignment	Azimuth Alignment	
Mod. Depth Identity AM	1020 Hz AM Depth	1020 Hz AM Depth	x
Mod. Depth Voice AM	Voice AM Depth	Voice Modulation Depth	x
Carrier Power	Carrier Power	Carrier Power	
Data window Transmitter 1 – Adjustments ASU	*‚TX1 ASU' is now integrated in window ‚TX1— Adjustments'*	**DVOR (N1..N4)—Transmitter 1: Setup: ASU Adjustments**	
Alignment All Blending Levels	Blending Levels Adjustment	Blending Levels Multiplier	x
USB Sine Blending	USB Sine Amplitude Adjust	USB Sine Blending	x
USB Cos Blending	USB Cosine Amplitude Adjust	USB Cosine Blending	x
LSB Sine Blending	LSB Sine Amplitude Adjust	LSB Sine Blending	x
LSB Cos Blending	LSB Cosine Amplitude Adjust	LSB Cosine Blending	x
Start Antenna Normal Operation	Start Antenna Normal Operation	Start Antenna Normal Operation	
Start Antenna Single Step	Set Antenna for Single Step	Start Antenna Single Step	x
RF Phase Upper Limit	CSB/SB Phase (UL)	CSB/SB Phase UL	x
RF Phase Lower Limit	CSB/SB Phase (LL)	CSB/SB Phase LL	x
ASU Blending Waveform *(50SB version has solution with jumpers)*	ASU Blending Waveform	ASU Blending Waveform	
CVOR			
Data window Transmitter 1 — Adjustments	**Dialog window 'TX1— Adjustments'**	**CVOR (8PGC)—Transmitter 1: Setup: Adjustments**	
SBA Power Level	SBA Level	SBA Level	x
SBB Power Level	SBB Level	SBB Level	x
SBA Phase Adjustment	SBA Phase	SBA Phase	x
SBA/SBB Power Level	SB Level Multiplier	SB Level Multiplier	x
FM Deviation	Modulation Index	FM Index	x
DVOR			
Data window 'Transmitter 1 — Measurements'	**Data window 'TX1— Measurements'**	**DVOR (N1..N4)—Transmitter 1: Measurements**	
RF Phase *MCS : RF Phase Measurement*	CSB/SB Radiated Phase	CSB/SB Phase	x

ADRACS up to 3.6 / MCS *cont.*	**ADRACS from 3.8**	**MCS from 1.8**	**differs**
DVOR *cont.*			
Data window 'Monitor – Alarm Limits'	**Dialog window 'Monitor – Alarm Limits'**	**DVOR (N1..N4)—Monitor 1: Measurements/Limits**	
Upper Limit MCS: Azimuth Upper Limit	Nearfield Azimuth … (UL)	Azimuth UL	x
Lower Limit *MCS: Azimuth Lower Limit*	Nearfield Azimuth … (LL)	Azimuth LL	x
Distortion 30 Hz FM	30 Hz FM Distortion	Distortion 30 Hz FM	x
Distortion USB – LSB	USB – LSB Distortion	Distortion USB/LSB	x
RF Phase Upper Limit/Lower Limit	RF Level	RF Level	
Data window 'Monitor – Measurements'	**Data window 'Monitor – Measurements'**	**DVOR (N1..N4)—Monitor 1: Measurements/Limits**	
Azimuth	Azimuth	Azimuth	
RF Level	RF–Level	RF Level	x
Mod. Depth 30 Hz AM	30 Hz AM Depth	30 Hz AM Depth	x
Mod. Depth 9960 Hz AM	9960 Hz AM Depth	9960 Hz AM Depth	x
Mod. Index 30 Hz FM	FM Index	FM Index	x
Distortion 30 Hz FM	Distortion 30 Hz FM	Distortion 30 Hz FM	
Distortion on 9960 Hz AM	Distortion 9960 Hz AM	Distortion 9960 Hz AM	x
60 Hz Component on 30 Hz AM	60 Hz Modulation	Modulation 60 Hz	x
Distortion LSB *MCS: Distortion on det. LSB*	USB Distortion Received CSB	Distortion USB	x
Distortion USB–LSB *MCS: Distortion on det. USB–LSB*	Distortion USB–LSB	Distortion USB/LSB	x
Carrier Frequency	Carrier Frequency	Carrier Frequency	
Upper Sideband Frequency, USB	USB Frequency	USB Frequency	x
Lower Sideband Frequency, USB	LSB Frequency	LSB Frequency	x
Lower Sideband Frequency, LSB	Internal CSB RF – Level	Internal CSB RF Level	x
CVOR			
Data window 'Monitor – Measurements'	**Data window 'Monitor – Measurements Main'**	**CVOR (8PGC)—Monitor 1: Measurements/Limits**	
Mod. Depth Identity AM	1020 Hz AM Depth	1020 Hz AM Depth	x
DVOR			
Data window 'Monitor – Measurements TSG'	**Data window 'Monitor – Measurements TSG'**	**DVOR (N1..N4)—Monitor 1: Self–Check: Tsg Data/Limits**	
TSG Level	TSG Level	Signal Level	x
TSG Mod. Depth 30 Hz AM	TSG 30 Hz AM Depth	30 Hz AM Depth	x
TSG Mod. Depth 9960 Hz AM	TSG 9960 Hz AM Depth	9960 Hz AM Depth	x
TSG Mod. Index 30 Hz FM	TSG FM Index	FM Index	x
TSG Azimuth	TSG Azimuth	Azimuth	x
Data window 'Monitor – Miscelleanous'	**Data window 'Monitor – Configuration'**	**DVOR (N1..N4)—Monitor 1: Setup: Configuration**	
Single Channel	Single Channel Mode	Single Channel Mode	x
Identity	Identification Morse Code	Identification Morse Code	x

ADRACS up to 3.6 / MCS *cont.*	**ADRACS from 3.8**	**MCS from 1.8**	**differs**
DVOR *cont.*			
Data window 'LRCI — Measurements'	**Dialog window 'Monitor – Environmental Setup'**	**DVOR (N1..N4)—LRCI: Environmental Setup**	
Installed Batt. Capacity	Installed Battery Capacity	Installed Battery Rated Capacity	x
Data window 'LRCI — Miscelleanous'	**Dialog window 'LRCI – BCPS'**	**DVOR (N1/N2)—LRCI: Measurements/Limits**	
Actual Charge Level	Set Actual Capacity	Actual Charge Level	x
Data window 'Monitor – Calibration'	**Dialog window 'Monitor – Calibration Nearfield'**	**DVOR (N1..N4)—Monitor 1: Setup: Calibration**	
Digital Ctrl. Attenuation	Digital Attenuation	Digitally Controlled Attenuation	x
AGC Adjustments	AGC Adjust	Calibration AGC Adjustment	x
Calibrate Mod. Depth Ident	Cal 1020 Hz AM Depth	Calibration 1020 Hz AM Depth	x
Calibrate Mod. Depth 9960 Hz AM	Cal 9960 Hz AM Depth	Calibration 9960 Hz AM Depth	x
Calibrate Mod. Depth 30 Hz AM	Cal 30 Hz AM Depth	Calibration 30 Hz AM Depth	x
Calibrate Mod. Index 30Hz FM	Cal FM Index	Calibration FM Index	x
CVOR			
Data window 'Monitor – Calibration'	**Dialog window 'Monitor – Calibration Nearfield'**	**CVOR (8PGC)—Monitor 1: Setup: Calibration Misc**	
Calibrate Azimuth	Calibrate Azimuth	Calibration Azimuth	
DVOR NEXTFIELD OPTION			
Data window ‚Monitor – Miscelleanous'	**Dialog window 'LRCI – Station Configuration'**	**DVOR (N1..N4)—LRCI: Station Configuration**	
Station Type	Field Monitoring	Field Monitoring Mode	x
Data window 'Monitor – Measurements'	**Data window 'Monitor – Measurements'**	**DVOR N2—Monitor 1: Measurements/Limits:**	
MCS: AGC Level 9960Hz AM	Integral 9960Hz AM Depth	Mod Depth 9960 Hz AM Nextfield	x
Data window 'Monitor – Measurements'	**Data window 'Monitor – BITE Measurements'**	**DVOR N2—Monitor 1: Measurements/Limits**	
30Hz FM LSB Level (Dipole—1) *MCS: AGC Level 30Hz FM LSB*	Dipole 1 LSB 30Hz FM Level	LSB 30 Hz FM Level Counterpoise Dipole 1	x
30Hz FM USB Level (Dipole—1) *MCS: AGC Level 30Hz FM USB*	Dipole 1 USB 30Hz FM Level	USB 30 Hz FM Level Counterpoise Dipole 1	x
Data window 'Monitor – Calibration'	**Dialog window 'Monitor – Calibration Dipole'**	**DVOR N2—Monitor 1: Nextfield 2 Cal**	
Calibration Mod. Index 30Hz FM Nextfield *MCS: Calibrate Mod. Index 30Hz FM*	Mod Index Cal Factor	Calibration FM Index All Counterpoise Dipoles	x
Analog AGC RF Level CSB Internal Adjustment Nextfield	Internal CSB RF Level AGC	AGC RF Level CSB Internal Adjustment Nextfield	x
Digital AGC RF Level CSB Internal Adjustment Nextfield	Internal CSB RF Level Dig	AGC RF Level Atten uation Nextfield	x
AGC 9960 Hz AM Level Adjustment Nextfield	Integral 9960Hz AGC Adjust	AGC 9960 Hz AM Level Adjustment Nextfield	x

ADRACS up to 3.6 / MCS *cont.*	**ADRACS from 3.8**	**MCS from 1.8**	**differs**
DVOR NEXTFIELD OPTION *cont.*			
AGC 30Hz FM Level LSB Adjustment Nextfield	LSB Level AGC Adjust	Counterpoise Dipole 1 Analog Analog AGC Adj FM Level LSB	x
LSB Level Digital AGC Adjust	LSB Level Digital AGC Adjust	Counterpoise Dipole 1 Digital AGC Adj FM Level LSB	x
AGC 30Hz FM Level USB Adjustment Nextfield	USB Level AGC Adjust	Counterpoise Dipole 1 Analog AGC Adj FM Level USB	x
USB Level Digital AGC Adjust	USB Level Digital AGC Adjust	Counterpoise Dipole 1 Digital AGC Adj FM Level USB	x
AGC RF Level Attenuation Nextfield	RF Level AGC Adjust	Counterpoise Dipole 1 Analog AGC Adj RF Level	x
RF Level Digital AGC Adjust	RF Level Digital AGC Adjust	Counterpoise Dipole 1 Digital AGC Adj RF Level	x
Calibrate Mod. Depth 30Hz AM CSB internal *MCS: Calibrate Mod. Depth 30Hz AM CSB internal*	Internal 30 Hz AM Depth	Calibrate Mod. Depth 30Hz AM CSB internal	x