Reference No. 83140 55625
PDM–Version E

SOAC

ILS 420

Instrument Landing System

Glide Path 422

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

PRELIMINARY REMARKS

The equipment manuals for ILS Glide Path 422 (1F and 2F versions) comprise:

PART	CONTENTS	CODE NO.
1	Equipment Description	83140 55625
2	Operation and Maintenance	
3	Antenna System Description	83140 55626

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

1 General Information
2 Installation
3 Operation
4 Alignment Procedure GP−1F
5 Alignment Procedure GP−2F (active)
6 Maintenance, Fault Location and Repair
7 Alignment Procedure GP−2F (standard)
Annex PC User Program−specific Procedures

The GP−1F specific alignment procedure is contained in Chapter 4, and the GP−2F specific alignment procedures are contained in Chapter 5 and Chapter 7. Installation guidelines concerning both GP−1F and GP−2F are contained in Chapter 2. All informations concerning the antenna systems are contained in Part 3 of the GP equipment manuals.

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 drawing numbers used in this description are no longer contained in the set of drawings supplied (GP−1F (2F), Volume A to B (C)), but rather than (to conform with the system) they have been replaced by new drawings with another number.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. Manual, Code No. 83140 55324, the one for use of **MCS** in the Tech. Manual, Code No. 83140 55325.

MARK SYMBOLS

To get the best out of the navigation systems 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.

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Basic edition: 01.04 / Revised: 05.11

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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**	**Code No.** *1)*	**Dimensions with packaging (mm)**	**Gross weight (kg)**
1	Shelter equipped with 1 GP cabinet (equipped): –1F, single/dual (0–Ref.) –1F, single/dual (SBR–Ref.*) –2F,dual act./stand. (CAT II/III) enclosed: Documentation GP	 098749/098751–0001 098752/098753–0001 098775/098754–0001 –	3000 x 2440 x 2440	approx. 1900

1) Standard version; customer specific versions may have different code numbers. * SBR–Ref.: Sideband Reference or B–Type

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

Package	**Contents**	**Code No.** *1)*	**Dimensions with packaging (mm)**	**Gross weight (kg)**
1	1 Cabinet GP (equipped): –1F, single/dual (0–Ref.) –1F, single/dual (SBR–Ref.) –2F,dual act./std (CAT II/III) enclosed: subassemb. MODPA	 098749/098751–0001 098752/098753–0001 098775/098754–0001 –	 1940 x 830 x 880* 1980 x 880 x 890** 1980 x 880 x 890** –	 approx. 244 approx. 260 approx. 303
2	Documentation GP			

* Corrugated paper container ** wooden crate

Fig. 1–2 GP 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.

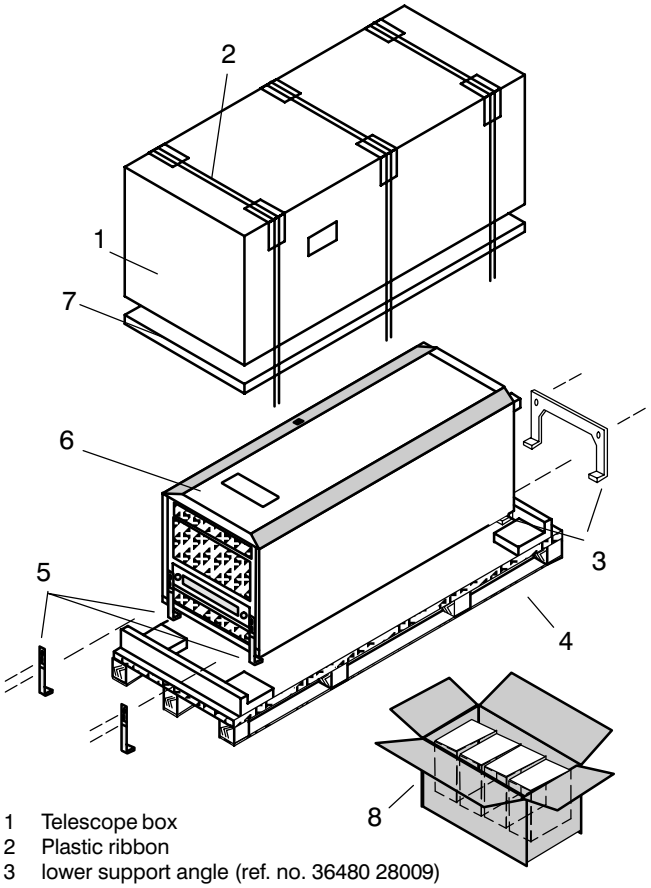
– Cut through the three plastic ribbons (Fig. 1–3/2) with scissors and remove. Lift off the telescope box (Fig. 1–3/1), 2 people required. Remove the foam panel (Fig. 1–3/8). Carefully lift the transmitter cabinet (Fig. 1–3/6), 2 people required, and install in a vertical position.

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.
– Take out enclosed subassemblies MODPA from packaging. Insert it according the marking in the subrack; take care for correct fitting to the guiding bars. Supporting with one hand, press subassembly carefully in the sockets on the backpanel. Take care for correct fitting of the RF connectors. Connect the premounted RF cables from Synthesizer and SOAC to the MODPA (refer to Fig. 1−3). Fix SMA connectors with a SMA−torque wrench.
– 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 enclosed subassemblies MODPA (up to 4)

Connecting RF cables to subassemblies MODPA

RF cables from Synthesizer front

TX1	J7 SYN1 to J1 MODPA 1/1 (CRS) J6 SYN1 to J1 MODPA 2/1 (CLR)
TX2	J7 SYN2 to J1 MODPA 1/2 (CRS) J6 SYN2 to J1 MODPA 2/2 (CLR)

RF cables from SOAC rear (2F):

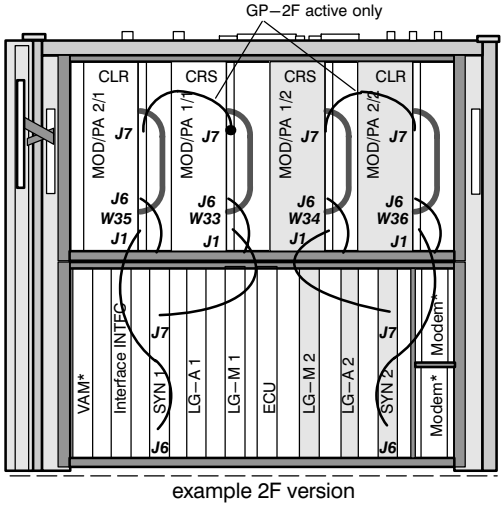
TX1	J13 SOAC (W33) to J6 MODPA 1/1 (CRS) J3 SOAC (W35) to J6 MODPA 2/1 (CLR)
TX2	J11 SOAC (W34) to J6 MODPA 1/2 (CRS) J1 SOAC (W36) to J6 MODPA 2/2 (CLR)

RF cable from MODPA to MODPA (2F, active only)

TX1	J7 MODPA 1/1 to J7 MODPA 2/1
TX2	J7 MODPA 1/2 to J7 MODPA 2/2

RF cables from Synthesizer front (1F):

TX1	J7 SYN1 to J1 MODPA 1/1 (CRS)
TX2	J7 SYN2 to J1 MODPA 1/2 (CRS)



example 2F version

Fig. 1−3 Packing for rail and road transport; mounting enclosed subassemblies MODPA

1.2 GENERAL INSTALLATION INFORMATION

1.2.1 Safety Precautions

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

1.2.1.1 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.
- 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.

1.2.1.2 Precautionary Measures against Damage caused by Animals

The complete installation should be checked with respect to remaining holes and slits following installation of the GP antenna. It is recommended to seal off appropriately holes through which small animals, such as mice or weasels, might penetrate using. The door of the shelter should be locked in the absence of the personnel.

1.2.1.3 Equipment 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 rack 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.

1.2.2 Personnel Requirements

Three persons are required to install the antenna and perform the related 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.

The installation time for the GP antennas depends on preparations; it will be approx. 3 days (calculation based on a working day of 8 hours). Additional times should be calculated for cabling and other precision work.

1.2.3 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 ILS 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 GP equipment and the GP antenna system:

1	crane truck, lifting capacity $\geq$1100 kg, min. jib reach 3 m, lifting height: $\geq$ 10 m (for B−Type installation), $\geq$ 12 m (for 0−Ref. installation), $\geq$ 15 m (for M−Type installation
1	motor truck
1	wire dispenser
1	crowbar
1	hammer 1000 g
2	ratchets with sets of sockets
1	three−square scraper
1	inch ruler
1	tape measure (surveyor's), if possible 150 m, otherwise 50 m
1	spirit level
2	ring/fork spanners, WAF 30 mm (for nuts of stone bolts)
1	impact drill, min power 600 W
1	theodolite
2	dip rods
1	set screwdrivers, blade width 3.5 mm to 8 mm
	light metal files (flat, 8...10", medium cut)
	various flat and round files
	various hard metal drills
	various twist drills for metal working

1.3 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 DETERMINING THE INSTALLATION SITE

The area in which a ILS Glide Path is to be installed is determined by the responsible Civil Aviation Authority according to the international air traffic regulations. The area is dependent on the necessary obstacle clearance and the runway configuration (e.g. overrun, clearway, stopway). The installation is determined by means of a site survey at which a surveyor must always be present. Thales ATM can provide an engineering consultant on site for this survey.

2.1.1 Antenna System

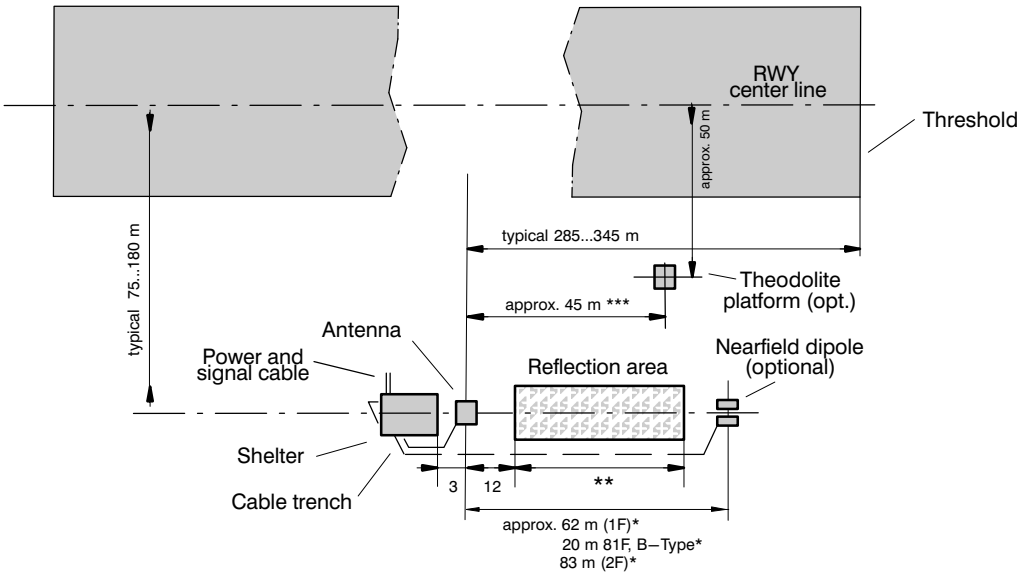
The Installation of the antenna system is described in Part 3 Antenna System Description.

2.1.2 Location of GP–Shelter/Building

See Fig. 2–1.

The typical location of the GP shelter or building referenced to the extended center line is shown in Fig. 2–1. It may be located left hand or right hand of the runway center line. The foundations for the standard shelter are shown in Fig. 2–2.

NOTE: The shelter or building must be located behind and beside the antenna base as shown. It shall be positioned in a way that the shelter door is situated in the opposite direction of view to the antenna but not to the weather side.



NOTE:
* defined after flight check
Shelter: either side of extended RWY center line
All distances in meters

** approx. 35 x 8 m (1F), 20 x 6 m (1F, B–Type), 65 x 8 m (2F)
*** 32 m (1F, B–Type)

Fig. 2–1 Typical installation site with site survey control points

2.2 SHELTER FOUNDATIONS

See Fig. 2−2

The following sections contain information to cable trenches, foundations. The production of the individual foundations and the excavation of cable trenches, are normally part of the civil works and not, therefore, the subject matter of this description. Site specific requirements must be taken from the project planning documents. The information on this subject herein, in consequence, only provided for information purposes.

Cable trenches are to be respectively excavated between the nearfield dipole foundation and the foundation for the antenna distribution unit (LLZ) or Shelter (GP) and between the cable man hole and the shelter. See Fig. 2−2 for a cross−section of a typical cable trench.

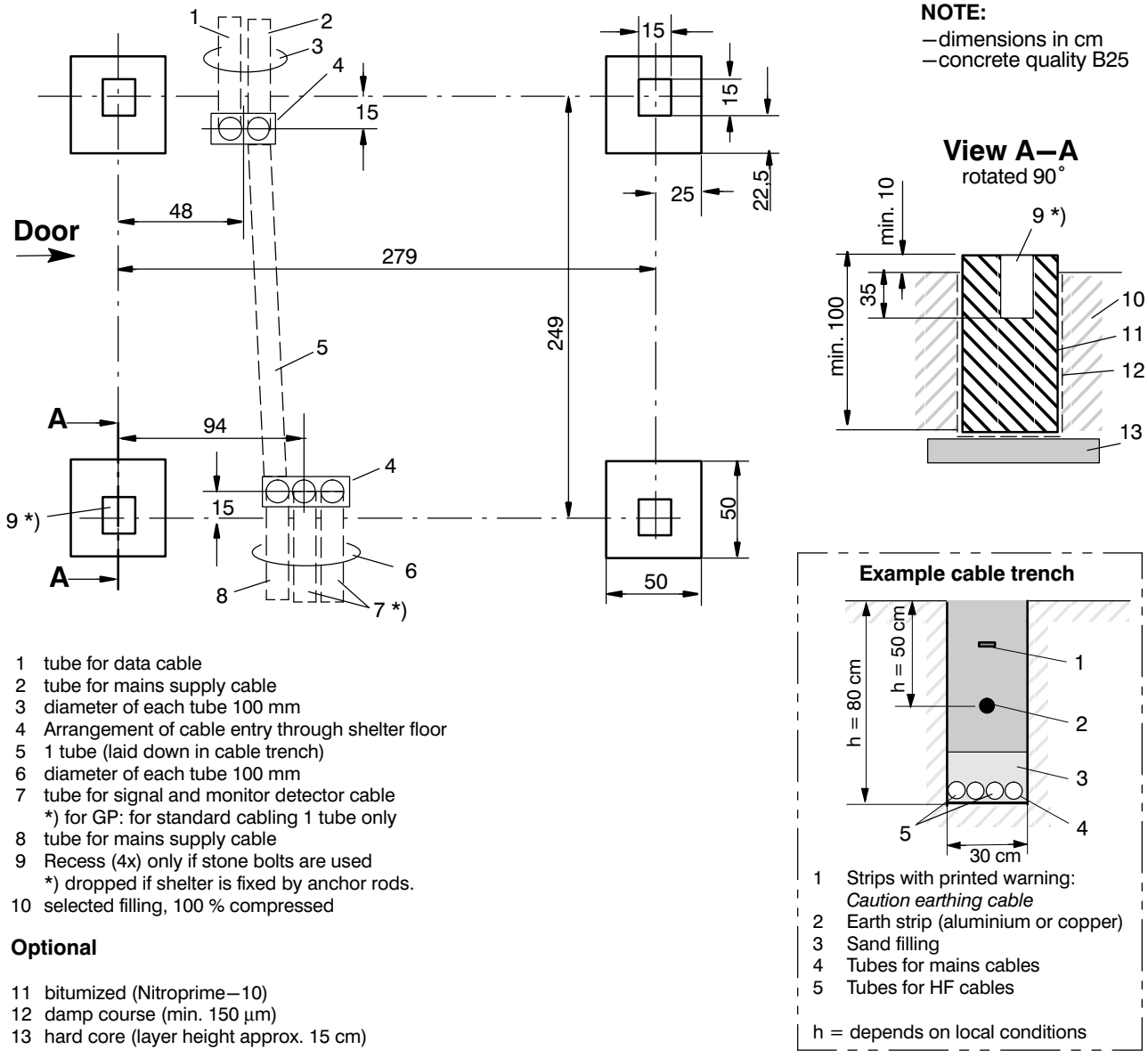


Fig. 2−2 Standard foundation for Shelter (10 ft) and cable trench example

2.3 ILS–GP HOUSING

2.3.1 General

A GP housing can be assembled by the customer as a solid construction (Thales ATM can provide the foundation drawings and construction drawings for this purpose) or can be delivered on request as a finished product, which takes the form of a container shelter.

– 10 ft GP container shelter Ref. No. 83134 60040

2.3.2 Container Shelter

See Figs. 2–3, 2–4, 2–5.

The Navaids 400 equipment can be supplied already installed in a 10 ft Standard Navaids Shelter (type 1D). 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 aluminium frame construction with eight ISO corners and walls made of sandwich panels in standardized container dimensions.
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 roof of the shelter can be walked on. The shelter itself is splash–proof, resistant against to a marine climate and insensitive to salt water, fungus and termites.

A complete electrical installation is already provided which can easily be adapted to specific project requirements. The battery box, which is hermetically sealed from the interior in its operating state, is accessible from the inside of the shelter and ventilated from the outside. Its shelf–type construction provides space for a block of batteries (48 V, 256 Ah max.) for the Navaids 400 installation as well as for collocated equipment. Ventilation is provided by one or two through–the–wall air conditioning units and thermostat. The air conditioning equipment is designed to fulfil the environmental conditions for all products installed in the container. One fire extinguisher is provided. The power supply (mains) and signal (RC, field monitor) feeder cables enter from below through openings in the shelter floor.

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).

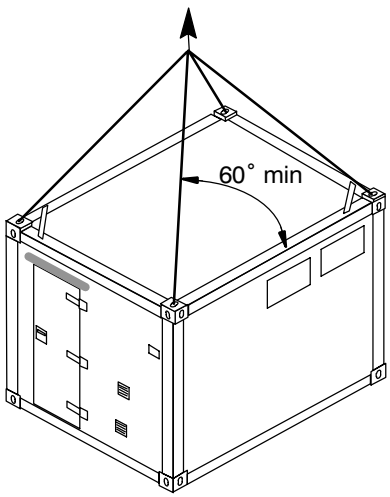


Fig. 2–3 Correct lifting with a lifting harness

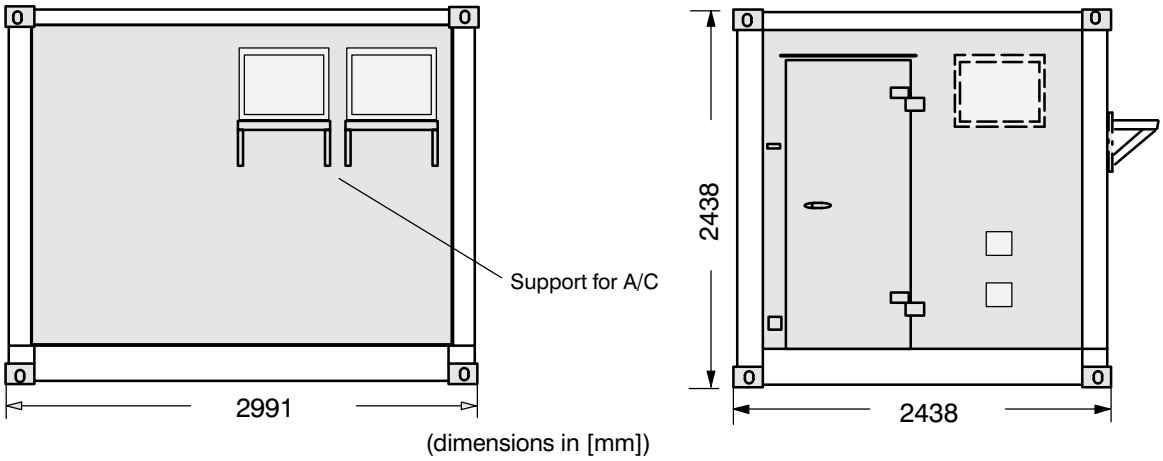
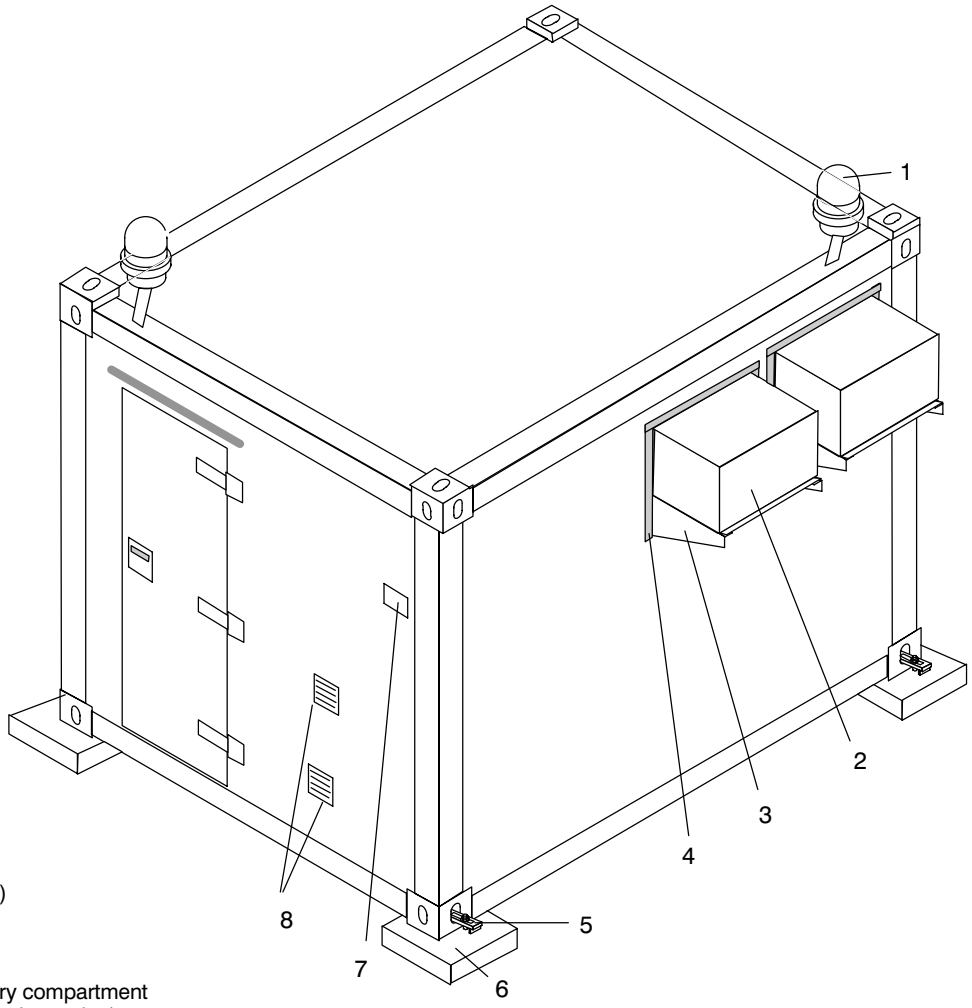
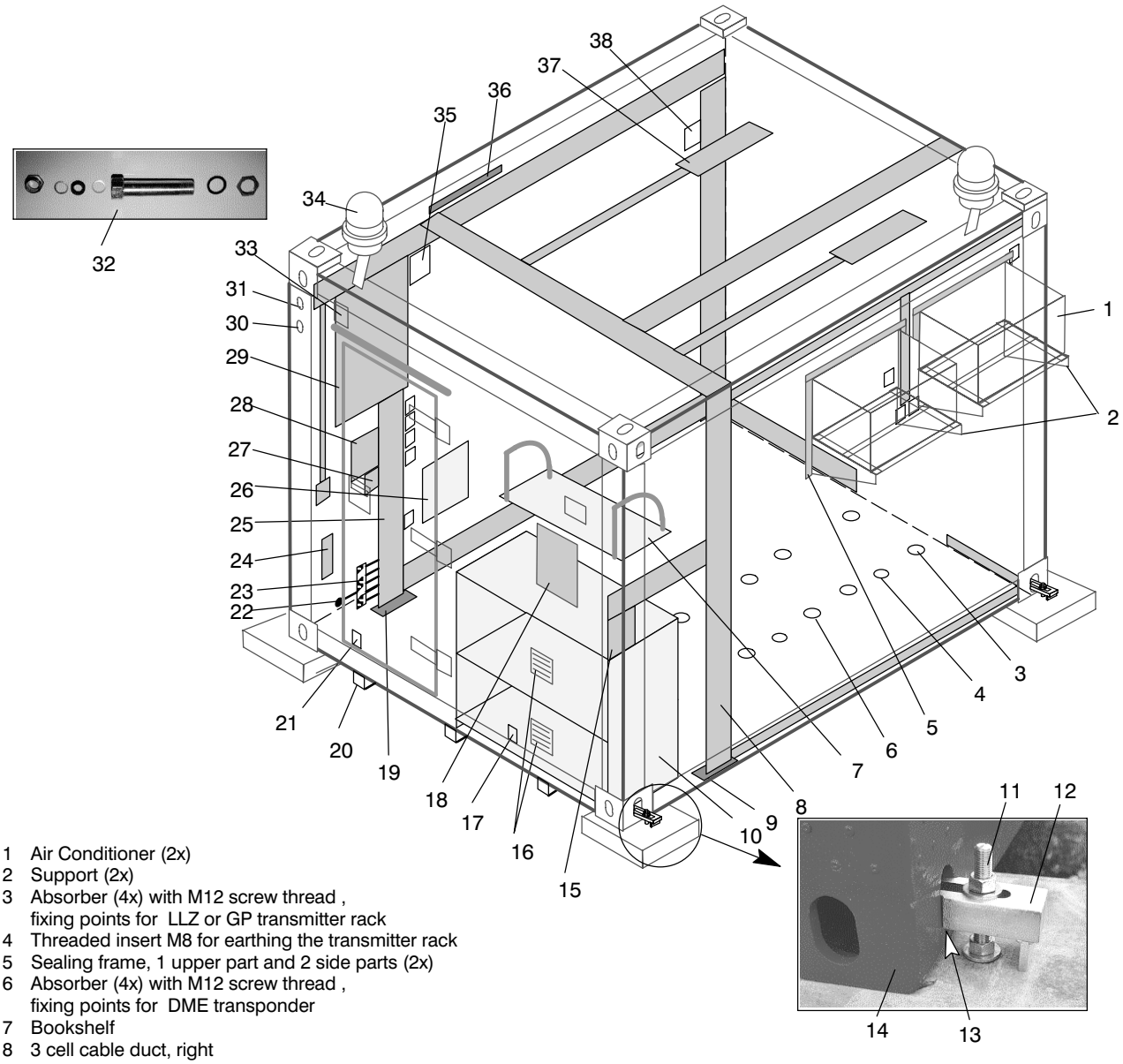


Fig. 2–4 10 ft container shelter, dimensions



1 Obstruction lights (2x)
2 air conditioner (2x)
3 Support (2x)
4 Sealing frame, complete (2x)
5 Shelter anchoring bolt
6 Concrete foundation
7 Type sign
8 Ventilation opening for battery compartment (covered by a weather protective gating)

Fig. 2–5 10 ft container shelter, outer details



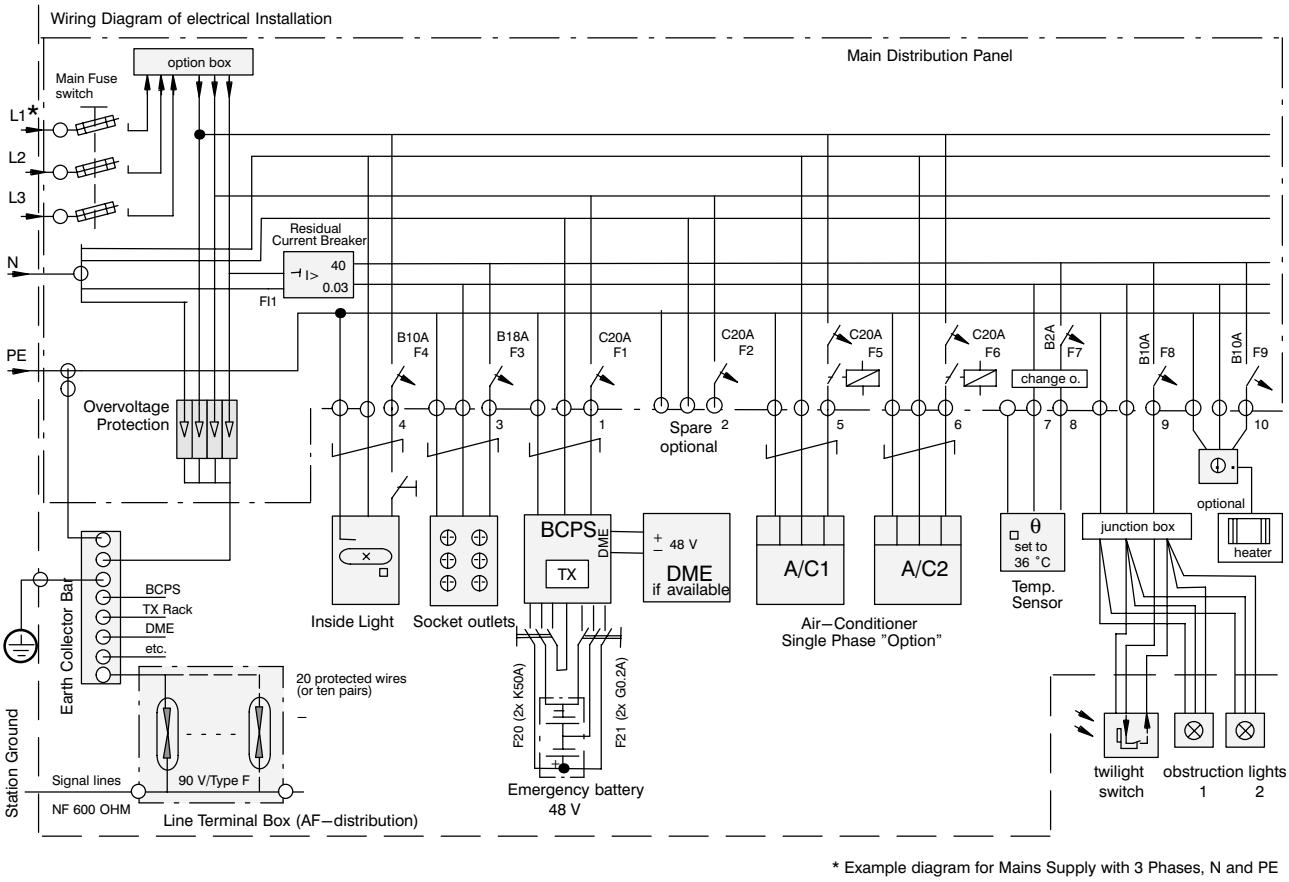
1 Air Conditioner (2x)
2 Support (2x)
3 Absorber (4x) with M12 screw thread , fixing points for LLZ or GP transmitter rack
4 Threaded insert M8 for earthing the transmitter rack
5 Sealing frame, 1 upper part and 2 side parts (2x)
6 Absorber (4x) with M12 screw thread , fixing points for DME transponder
7 Bookshelf
8 3 cell cable duct, right
9 Cover for cable through entry, right
10 Battery compartment
11 Anchor rod
12 Clamp strap
13 Insert to ISO corner (support part for clamp strap)
14 ISO−container corner
15 Battery fuse box
16 Battery compartment airing
17 Door lock, wall part
18 Wall mounted holding device for shelter documentation
19 Cover for cable through entry, left
20 Bottom surface profile (contains spare key for shelter door)
21 Door lock
22 Earthing main connector (at exterior wall side)
23 Potential equalisation bar
24 Fire extinguisher
25 3 cell cable duct, left
26 Heating (optional)
27 Phone connecting box
28 AF−distribution
29 Mains distribution
30 Cable through for twilight switch
31 Cable through for obstruction light
32 Cable through parts (PG 13,5)
33 Twilight switch
34 Obstruction light (2x)
35 Connecting box for obstruction lights and twilight switch
36 Spare fluorescent tube
37 Artificial lighting for interiors (2x)
38 Room thermostat for air conditioner

Fig. 2−6 10 ft container shelter, inner details

2.3.3 Electrical Installation

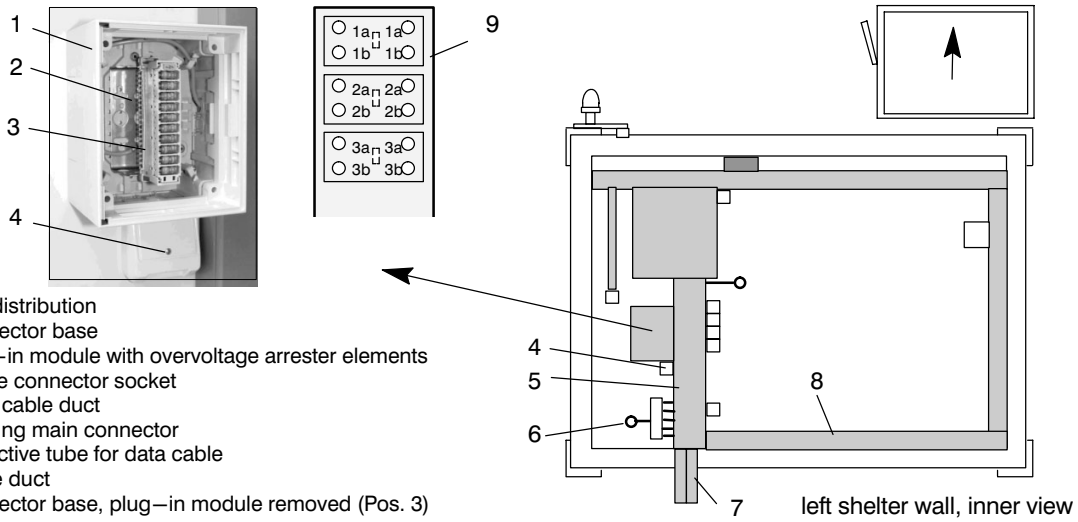
2.3.3.1 General

Fig. 2−7 shows an example wiring diagram of a standard electrical shelter installation (typical). The final installation depends on customer requirements.



* Example diagram for Mains Supply with 3 Phases, N and PE

Fig. 2−7 Standard shelter, electrical installation GP (example)



1 AF−distribution
2 Connector base
3 Plug−in module with overvoltage arrester elements
4 Phone connector socket
5 3 cell cable duct
6 Earthing main connector
7 Protective tube for data cable
8 Cable duct
9 Connector base, plug−in module removed (Pos. 3)

Fig. 2−8 AF−distribution box

2.3.3.2 Mains Power Supply for Shelter

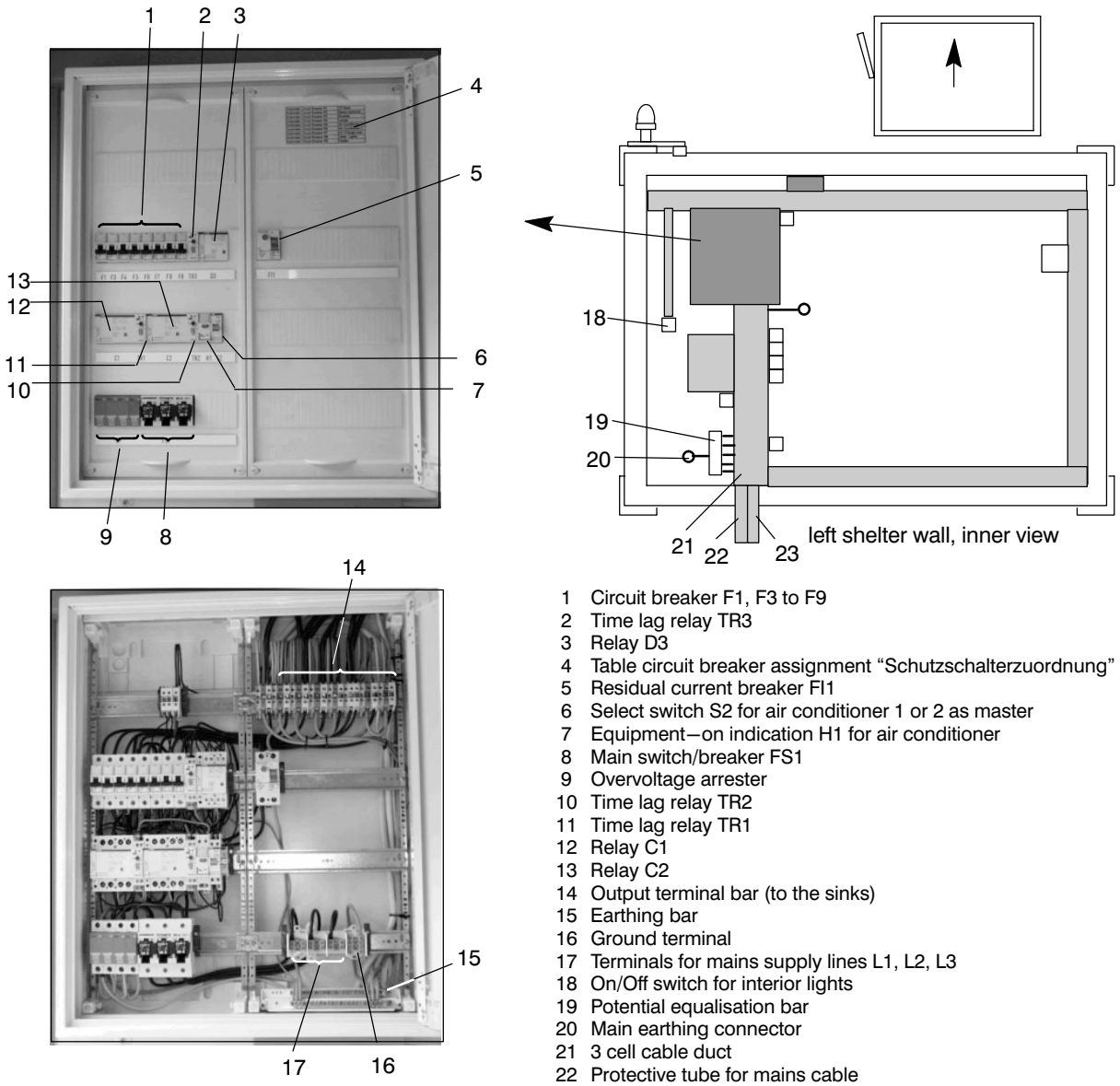
Before any mains installation is performed the mains supply to the shelter has to be interrupted.

WARNING

Works on electrical installations of up to 230 VAC must be performed by skilled and legitimate personnel only. Danger of electric injury or hazards.

– Check that the mains power supply feeder cable to the shelter is dead. Otherwise switch off mains on the corresponding power supply distribution of the airport.

– Connect mains power supply feeder cable to the mains distribution box in the shelter: Connect lines L1, L2, L3 and N to the correspondent terminals (Fig. 2–9/17,16).



1 Circuit breaker F1, F3 to F9
2 Time lag relay TR3
3 Relay D3
4 Table circuit breaker assignment “Schutzschalterzuordnung”
5 Residual current breaker FI1
6 Select switch S2 for air conditioner 1 or 2 as master
7 Equipment–on indication H1 for air conditioner
8 Main switch/breaker FS1
9 Overvoltage arrester
10 Time lag relay TR2
11 Time lag relay TR1
12 Relay C1
13 Relay C2
14 Output terminal bar (to the sinks)
15 Earthing bar
16 Ground terminal
17 Terminals for mains supply lines L1, L2, L3
18 On/Off switch for interior lights
19 Potential equalisation bar
20 Main earthing connector
21 3 cell cable duct
22 Protective tube for mains cable
23 Protective tube for data cable

Fig. 2–9 Mains distribution box in the shelter

2.3.3.3 Installing sulphuric Acid Batteries for Emergency Power Supply

NOTE: Take out block batteries from the transport case just before the first setup activities have to be performed.

– Switch off battery circuit breaker F20 and F21 (down position, 2–10/2,1).

– Put the battery set G1 to G*n* in the battery compartment (2–6/10) and connect depending on type of battery set as shown in Fig. 2–11.

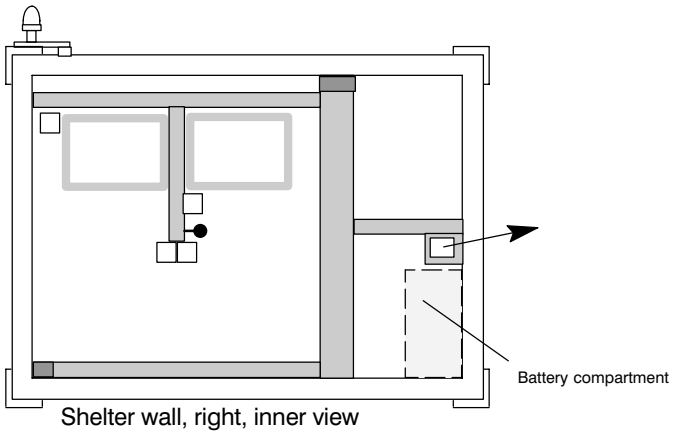
– Connect all block connections (2–11/4).

– Connect cable terminal of the positive line (16 mm^2, red, 2–11/1) to the positive pole of the battery.

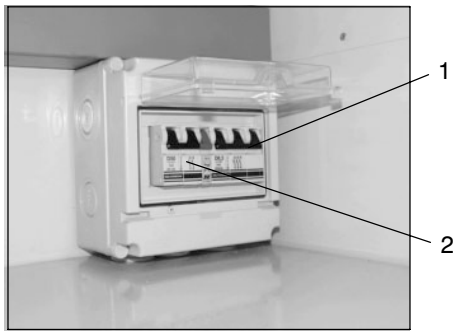
– Connect cable terminal of the negative line (16 mm^2, blue, 2–11/2) to the negative pole of the battery.

– Connect 3 monitoring and measurement lines (1,5 mm^2) to battery "+" , "–", and half voltage point (middle of battery set).

– Fasten all screws of the battery terminals (torque moment 15 Nm).

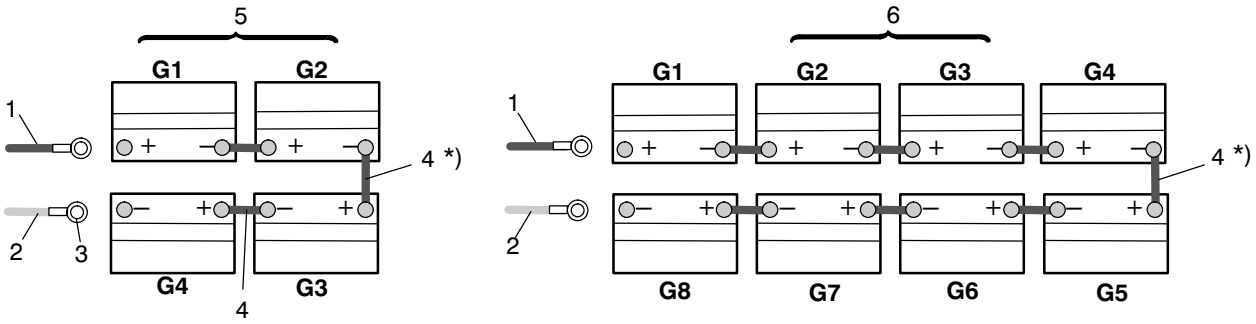


Shelter wall, right, inner view



1 Battery circuit breaker fuse F21
2 Battery circuit breaker fuse F20

Fig. 2–10 Battery fuse box



*) half voltage

1 Positive line (red)
2 Negative line (blue)
3 Cable terminal
4 Block connection
5 Emergency battery 48 V(4x 12 V); capacity depends on type: 54, 72, 90 or 108 Ah
6 Emergency battery 48 V(8x 6 V); capacity depends on type: 128 or 192 Ah

Fig. 2–11 Emergency battery set

2.4 INSTALLATION AT THE TRANSMITTER RACK IN THE SHELTER

2.4.1 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 pre−installed. 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. 2−7.
For a mains voltage of 115 VAC the standard mains wiring concept allows up to 3 ACC54 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.

2.4.2 Power Supply

2.4.2.1 Power Connections

See Fig. 2−13, 2−14 and 2−22.

The terminal blocks for electrical and signal connections as listed below are installed on the backpanel BP−PS and the C−bar, which are located at the lower back side of the transmitter cabinet, or on the cabinet bottom plate.

Backpanel BP−PS:
− 6 mains terminals N, L1, L2, L3, PE (Protective Earth) and FPE (Functional Protective Earth)
− 1 Speedy connector 10−pin and 26−pin for control signals to/from the BCPS from TX
− 2 single terminal blocks for battery (+ and −), 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
− 2 single terminal blocks (+N,−N; +A,−A) for internal connection, factory wired if need be

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:

- 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 (0). Remove the units.
– Open the rear panel. Check tight fitting of all internal cable connections to the terminal blocks.
– 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. The further wiring to the backpanel BP–PS connection plate is factory wired. It may be fed via a mains filter installed on the bottom plate (European version only). 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. 2–13, 2–22) to the ground points and/or the potential equalization bus of the shelter.

2.4.2.2 Connection of Battery Set

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. 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 (50 A DC) 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

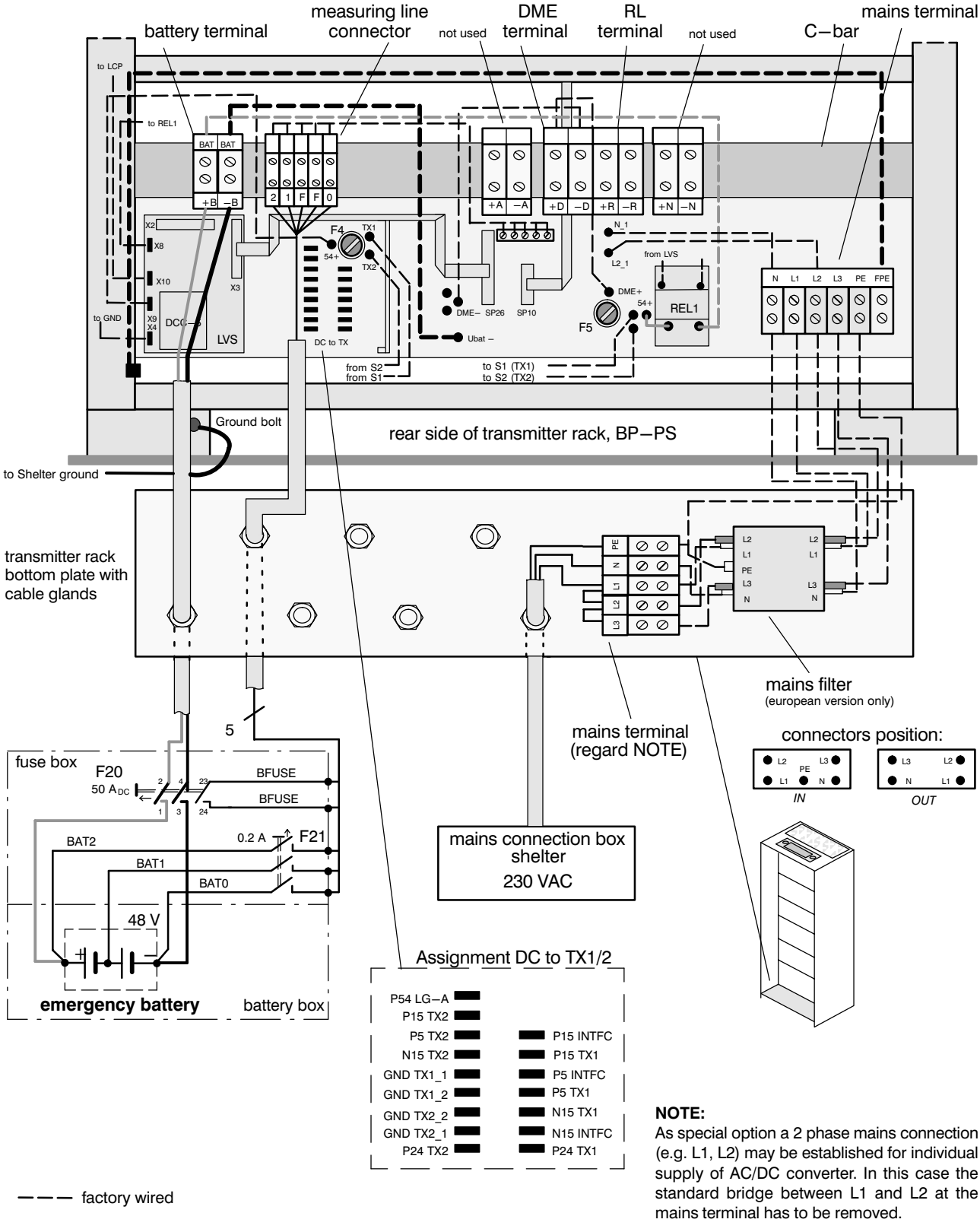
2.4.2.3 Connecting Installations

See Fig. 2–12.

Wire connections should be made between the terminals shown in the table below when the system is collocated with DME and Radio Link (RL) equipment.

Device	**TX rack C–bar**	**Cabinet**
DME	DME+ and DME–	Ground ⏚
Radio Link	RL+ and RL–	Ground ⏚

Fig. 2–12 Cable connections with collocated DME and RL equipment



NOTE:
As special option a 2 phase mains connection (e.g. L1, L2) may be established for individual supply of AC/DC converter. In this case the standard bridge between L1 and L2 at the mains terminal has to be removed.

Fig. 2–13 Connections at the BCPS connection plate, C–bar and bottom plate

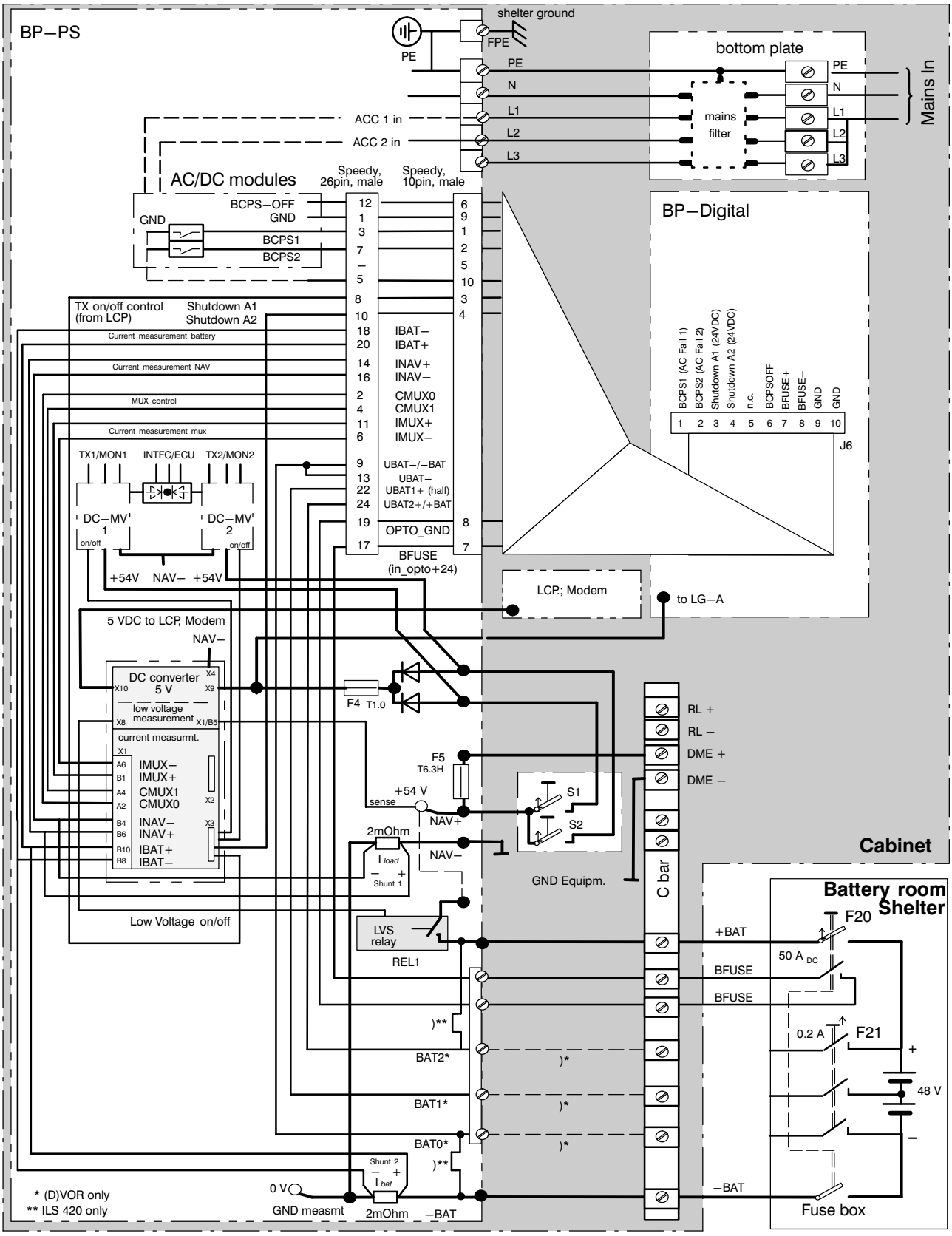


Fig. 2–14 Cabling, BCPS connection plate, C–bar and bottom plate

2.4.3 RF/AF—Connections at Transmitter Rack

See Figs. 2—15 to 2—17, 2—21, 2—25 to 2—27.

Make the following cable connections (from/to):

Transmitter Rack	**Cable (1F)**	**Shelter to/from Antenna**	
J8, CRS CSB (A1)	W2	X2+W13	*A1*
J1, CRS SBO (A2)	W1	X1+W11	*A2*
J25, A1/Path	W6	W14	(*A1*)
J26, A2	W5	W12	(*A2*)
J28, NFM1	W3	W15	*Nearf. dipole*

Transmitter Rack	**Cable (2F)**	**Shelter to/from Antenna**	
J8, CRS CSB (A1)	W2	X3+W13	(*A1*)
J1, CRS SBO (A2)	W7	X2+W11	(*A2*)
J2, CLR SBO (A3)	W1	X1+W9	(*A3*)
J25, A1/CRS Path/CSB	W6	W14	(*A1*)
J26, A2	W5	W12	(*A2*)
J27, A3/CRS Width/SBO	W4	W10	(*A3*)
J28, NFM1	W3	W15	*Nearf. dipole*

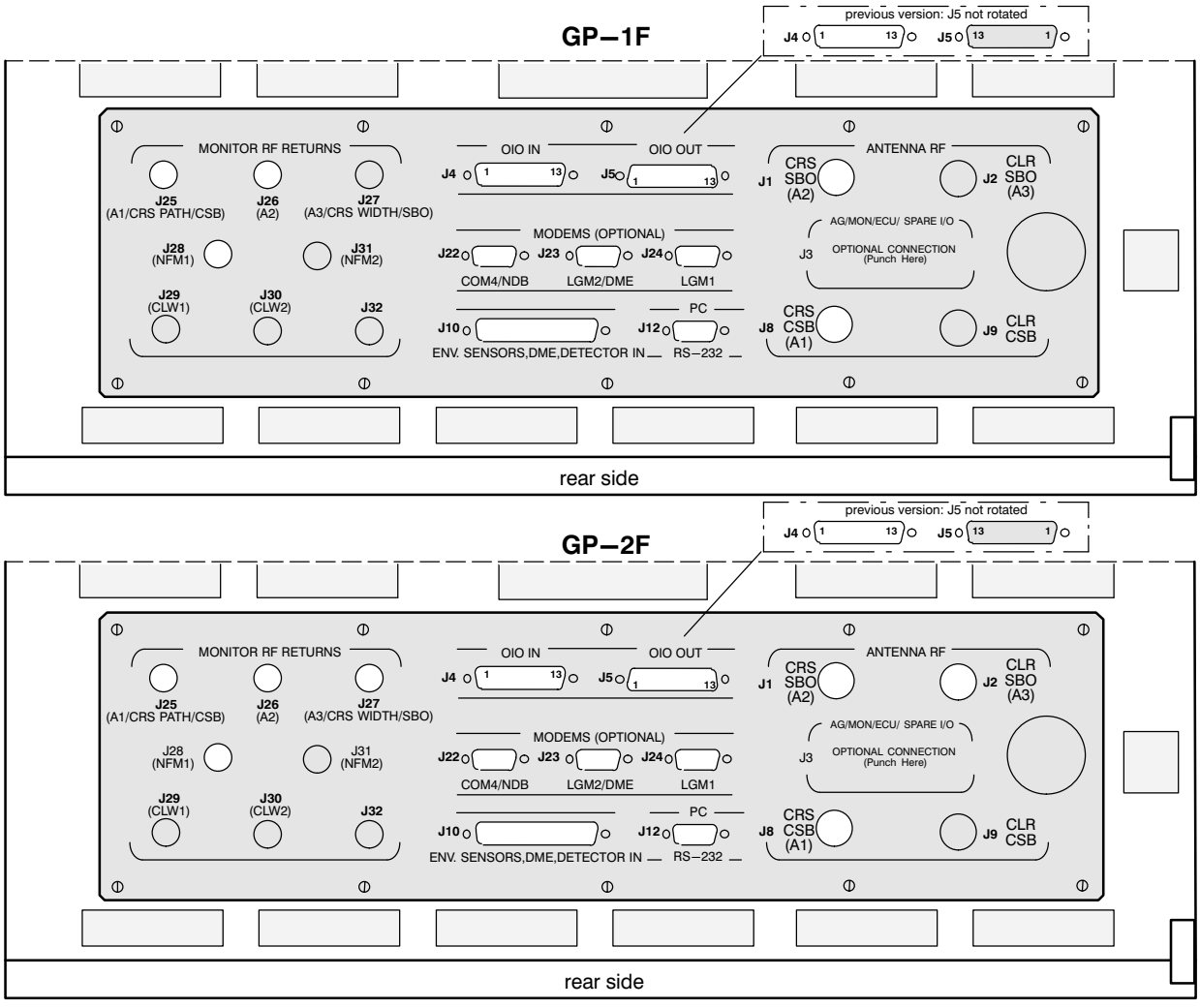


Fig. 2—15 GP transmitter rack, top view, connectors

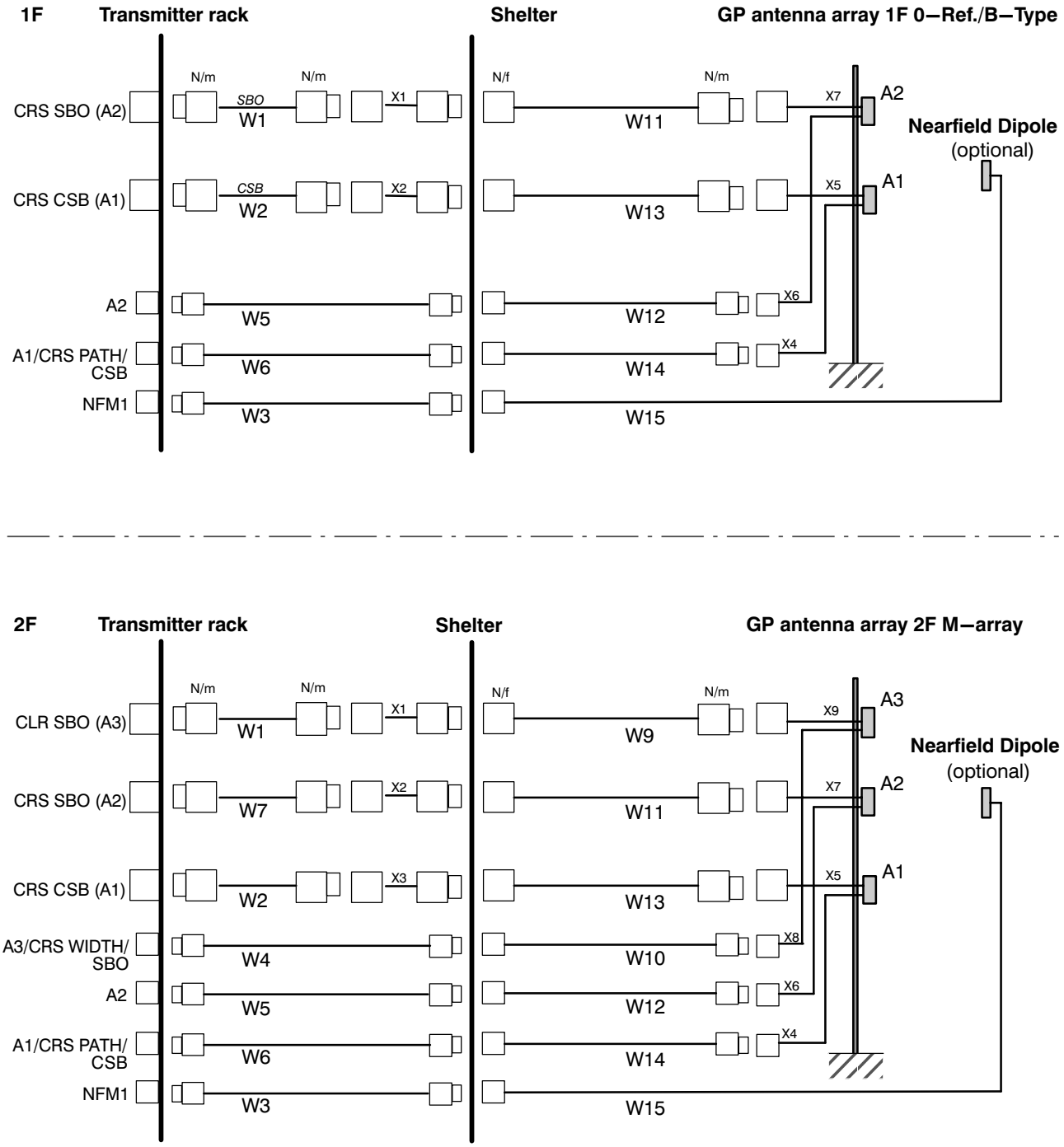
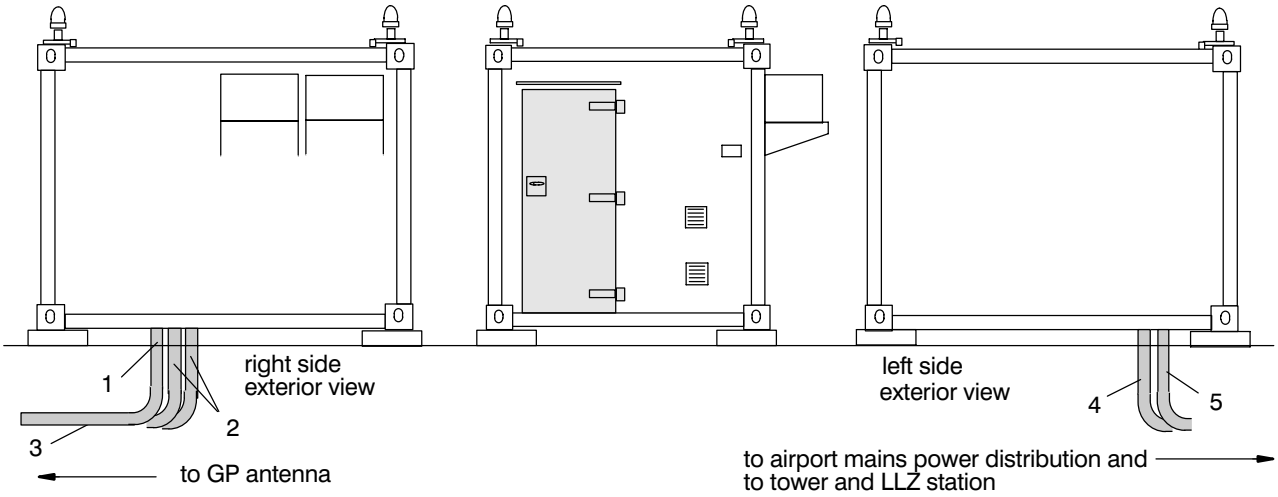
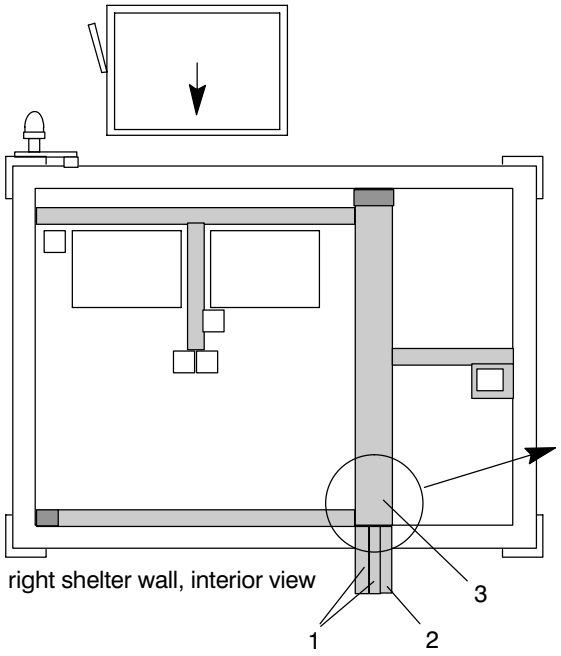
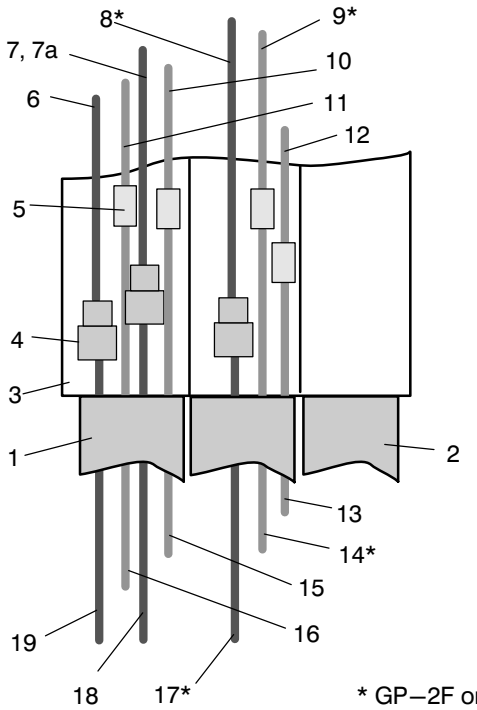


Fig. 2—16 RF/AF cabling GP—1F/2F



1 Protective tube for mains supply cable (opstruction lights of GP antenna and monitor mast)
2 Protective tubes for RF cables (if need be two)
3 Tubes to GP antenna
4 Protective tube for data cable
5 Protective tube for mains supply cable (Shelter or system supply)





1 Protective tube for RF cable (if need be 2 tubes)
2 Protective tube for mains supply cable
(Obstruction lights GP antenna and monitor antenna mast)
3 3 cell cable duct
4 Coax connection external to shelter internal RF cable
5 Coax connection external to shelter internal monitor cable
6 W2, signal cable from transmitter to antenna A1 (intern.)
7 W7, signal cable from transmitter to antenna A2 (intern., 2F)
7a W1, signal cable from transmitter to antenna A2 (intern., 1F)
8 W1, signal cable from transmitter to antenna A3 (intern., 2F)
9 W4, monitor cable to transmitter from antenna A3 (intern., 2F)
10 W5, monitor cable to transmitter from antenna A2 (intern.)
11 W6, monitor cable to transmitter from antenna A1 (intern.)
12 W3, signal cable to transmitter from nearf. dipole (intern.)
13 W15, signal cable to transmitter from nearf. dipole (extern.)
14 W10, monitor cable to transmitter from A3 to shelter (extern., 2F)
15 W12, monitor cable to transmitter from A2 to shelter (extern.)
16 W14, monitor cable to transmitter from A1 to shelter (extern.)
17 W9, signal cable from transmitter to A3 (extern., 2F)
18 W11, signal cable from transmitter to A2 (external)
19 W13, signal cable from transmitter to A1 (external)

Fig. 2−17 RF/AF cabling GP−1F/2F

2.4.4 External Interface Connection

See Fig. 2−15, 2−22 to 2−27.

The following connectors are available on top and rear side of the cabinet:

– PC/RS−232	local operation with the PC user program or RS−232 port
– LGM1	PSTN connection (intern. Euro modem) or serial communication interface or dedicated line (to RMMC) with use of LGM 1200MD
– LGM2/DME	PSTN connection (intern. Euro modem) or serial communication interface to DME
– COM4/NDB	spare serial input/output or serial communication interface to NDB
– ENV. SENSORS, DME, DETECTOR IN	environmental sensors connection (e.g. smoke etc.), analog DME interface, and AF input signals of monitor detector unit at antenna
– OIO LCP IN	spare in, optocoupler isolated
– OIO LCP OUT	spare out, optocoupler isolated
– AG/MON/ECU SPARE I/O	spare input/output to/from Audio Generator, Monitor, ECU
– PHONE1 (rear)	optional RJ11 phone input, e.g. from external US modem
– PHONE2 (rear)	optional RJ11 phone input, e.g. from external US modem

2.4.4.1 PC/RS−232 (J12)

SubD, 9pin, male, from connector X4 LCP

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

2.4.4.2 LGM1 (J24)

SubD, 9pin, male, from connector J4 or J2 BP−Digital

J4 = 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		

J2 = TTL (direct)

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

2.4.4.3 LGM2/DME (J23)

SubD,9pin, male, from connector J3 or J1 BP−Digital

J3 = Modem output

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

J1 = TTL/RS232 (direct)

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

J1 = 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		

2.4.4.4 COM4/NDB (J22)

SubD, 9pin, female, from connector J14 BP−Digital

J14 = TTL/RS232 (direct)

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

J14 = 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		

2.4.4.5 ENV. SENSORS, DME, DETECTOR IN (J10)

SubD, 37pin, female, from connector J19 BP−Digital. Refer also to section 2.6 for DME collocation.

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	MODEM1 TIP	20	MODEM1 RING
2	MODEM2 TIP	21	MODEM2 RING
3	+24V#1	22	+24V#1
4	GND	23	GND
5	+24V#2	24	+24V#2
6	GND	25	GND
7	TEMP SUPPLY (−15 V)	26	INSIDE TEMP
8	OUTSIDE TEMP	27	OB LIGHT SN
9	VOICE EXT TX 1	28	VOICE EXT TX 2
10	CABLE FLT A	29	CABLE FLT B
11	DET5A FF1	30	DET5B FF1
12	DET6A FF2	31	DET6B FF2
13	DET12−A Spare	32	DME INTERLOCK A
14	DME INTERLOCK B	33	DME KEY A
15	DME KEY B	34	LCP DOUT1
16	LCP DOUT2	35	ALARM RST SMOKE
17	ALARM SMOKE	36	ALARM INTRUSION
18	LCP DIN2	37	LCP DIN1
19	not used		

2.4.4.6 AG/MON/ECU SPARE I/O (J3), Spare

SubD, 37pin, female, from connector J12 BP−Digital.

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	Spare AG1ANL 01	20	Spare AG2ANL 01
2	Spare AG1ANL 02	21	Spare AG2ANL 02
3	Spare AG1ANL 03	22	Spare AG2ANL 03
4	Spare MON1ANL+24	23	Spare MON2ANL+24
5	Spare MON1ANL+48	24	Spare MON2ANL+48
6	Spare MON1ANL 01	25	Spare MON2ANL 01
7	Spare MON1ANL 02	26	Spare MON2ANL 02
8	Spare MON1ANL 03	27	Spare MON2ANL 03
9	MON1 ANL CUR SENS	28	MON2 ANL CUR SENS
10	MON1 ANALOG GND	29	MON2 ANALOG GND
11	Spare ECU DIGIN1	30	Spare ECU DIGIN2
12	Spare ECU DIGIN3	31	not used
13	Spare ECU DOUT1	32	not used
14	Spare 1 Tip	33	Spare 1 Ring
15	Spare 2 Tip	34	Spare 2 Ring
16	GND	35	GND
17	GND	36	GND
18	not used	37	not used
19	not used		

Not assembled, knockout option.

2.4.4.7 OIO LCP IN (J4)

SubD, 25pin, male, from connector X2 LCP

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				

2.4.4.8 OIO LCP OUT (J5)

SubD, 25 pin, female, from connector X2 LCP *(assignment for J5 with rotated and not rotated connection)*

PIN	ASSIGNMENT *(refer to Fig. 2–15)*	
	J5 rotated	***J5 not rotated** (previously)*
1	COM3	GND
2	TTLOUT2 (internal)	TTLOUT1 (internal)
3	OAUX1	COM2 (common 2)
4	OAUX3	OAUX14
5	OAUX5	OAUX12
6	OAUX7	OAUX10
7	OAUX8	OAUX8
8	OAUX10	OAUX7
9	OAUX12	OAUX5
10	OAUX14	OAUX3
11	COM2 (common 2)	OAUX1
12	TTLOUT1 (internal)	TTLOUT2 (intern.)
13	GND	COM3 (common 3)

PIN	ASSIGNMENT *(refer to Fig. 2–15)*	
	J5 rotated	***J5 not rotated** (previously)*
14	COM4 (common 4)	VCC (+5 V)
15	OAUX0	TTLOUT0 (internal)
16	OAUX2	OAUX15
17	OAUX4	OAUX13
18	OAUX6	OAUX11
19	COM1 (common 1)	OAUX9
20	OAUX9	COM1 (common 1)
21	OAUX11	OAUX6
22	OAUX13	OAUX4
23	OAUX15	OAUX2
24	TTLOUT0 (internal)	OAUX0
25	VCC (+5 V)	COM4 (common 4)

2.4.4.9 PHONE 1 (J7, rear of cabinet)

RJ11/6, at BP, wired via XA12 (Jumper 1)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	n.c.	4	MODEM1 RING (Lb)
2	n.c.	5	n.c.
3	MODEM1 TIP (La)	6	n.c.

2.4.4.10 PHONE 2 (J10, rear of cabinet)

RJ11/6, at BP, wired via XA12 (Jumper 1)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	n.c.	4	MODEM2 RING (Lb)
2	n.c.	5	n.c.
3	MODEM2 TIP (La)	6	n.c.

2.4.5 External Interfaces, Connections to peripheral Equipment

2.4.5.1 Connecting Remote Control RMMC

– Dedicated line modem LGM1200MD (Euro Modem): Connect a two wire line from RMMC to pins 1 and 2 of a SubD, 9pin, female connector and connect it 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 LGM28.8 (Euro Modem): Connect a two wire line from PTT/RMMC to pins 1 and 2 of a SubD, 9pin female connector and connect it to connector LGM1 (or LGM2, if modem assembled) on top of the cabinet.

The two wire line from/to RMMC or PSTN is fed via the AF distribution box (see Fig. 2–21).

2.4.5.2 Connection of Local Personal Computer

Connect V.24 cable (zero modem cable) with SubD, 9pin female plug from the PC to J12 PC/RS–232 on top of the cabinet.

2.4.5.3 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 capability of the OIO connections is shown in Fig. 2–18. AF or DC signals from outside the shelter have to be fed via the AF distribution box or equivalent if no further terminals available.

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

IAUX 8...15 when active high
(selectable with jumper bank X81...84, refer to 6.2.4.1)

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)

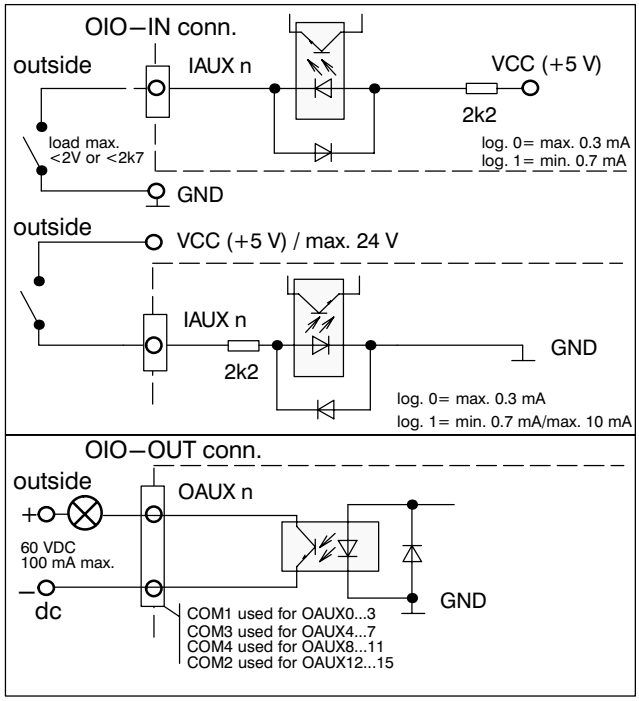


Fig. 2–18 External wiring of auxiliary OIO connections of LCP

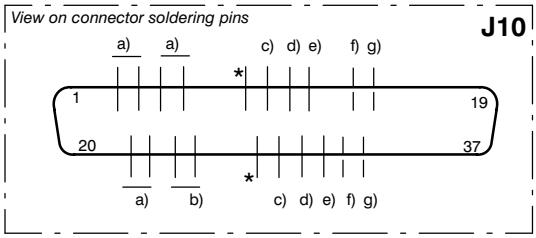
2.4.5.4 Connection of Detector Feedback Signals from Distribution Unit (opt.) (GP−1F only)

See Fig. 2−19, 2−20, 2−21.

Connector J10 is used to interconnect optionally sensor signals (e.g. Farfield Monitor, LLZ only) which are located outside the cabinet. A multi conductor cable (e.g. 10 pairs) supplies the detector signals first to the AF distribution box (Abb. 2−20) in the shelter. The recommended assignment of terminals is shown in Fig. 2−21. From the AF distribution box the multi conductor cable is fed to the transmitter rack. Connect the cable to a SubD connector 37pin, male. Plug the connector to connector J10 (ENV. SENSORS, DME, DETECTOR IN) on top of the cabinet. Fig. 2−19 shows the pin assignment.

J10: Detector signals (FFM1,2; cable fault signal A, B)

	PIN	SIGNAL
a)	3,22	+24V1
	4,23	GND
b)	5,24	+24V2
	6,25	GND
c)	10	CABLE FAULT A (spare)
	29	CABLE FAULT B (spare)
d)	11	DET5A FF1
	30	DET5B FF1
e)	12	DET6A FF2
	31	DET6B FF2



f)	32	DME INTERLOCK A
	14	DME INTERLOCK B
g)	33	DME KEY A
	15	DME KEY B
*)	9,28	optional ext. voice input

NOTE: The NF signal level at input 11,30 and 12,31 of J10, DET5A,5B and DET6A,6B should be approx. 1.8 V (max. < 2 V).

Fig. 2−19 Assignment of connecting detector signals at J10 on top

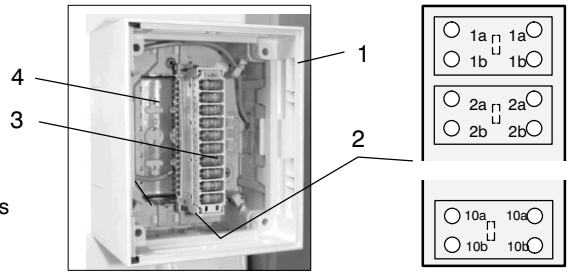
2.4.5.5 AF Distribution Box

See Figs. 2−20, 2−21.

The AF distribution box is the entry point for AF signal lines, which are fed from external to the shelter. The recommended assignment of the 20 connection terminals (10 pairs) is shown in Fig. 2−21. Each line is protected by overvoltage arrester elements. As an option a second terminal bar can be assembled.

- Remove the plug−in module with arrester elements.
- Connect the skinned wire of the signal cable to the respective terminal of the terminal bar (use special tool of manufacturer Krone).
- Finally insert the plug−in module with arrester elements.

NOTE: Connect the screening of the data or AF signal cable one sided to ground: either on the AF distribution box or on the airport side. Use the recommended assignment of terminals.



1 AF−distribution
2 Terminal bar below plug−in modules
3 Plug−in module with overvoltage arrester elements
4 Terminal base (reserve)

Fig. 2−20 Standard shelter, AF distribution box inside

Terminal bar 1		*Terminal bar 2 (optional, normally not assembled)*	
1a	RMMC La	1a	DET5A FF1*
1b	RMMC Lb	1b	DET5B FF1*
2a	DME INTERLOCK A **	2a	DET6A FF2*
2b	DME INTERLOCK B **	2b	DET6B FF2*
3a	DME KEY A **	3a	CABLE FLT A
3b	DME KEY B **	3b	CABLE FLT B
4a	Reserve DME **	4a	
4b	Reserve DME **	4b	
5a	Voice in LV1 (opt.)*	5a	
5b	Voice in LV2 (opt.)*	5b	
6a		6a	
6b		6b	
7a		7a	+24V1 *
7b		7b	+24V1 *
8a		8a	+24V2 *
8b		8b	+24V2 *
9a		9a	GND *
9b		9b	GND *
10a		10a	GND *
10b		10b	GND *

* Terminal bar 2 optional ** collocation DME to LLZ

Fig. 2−21 Recommended assignment of terminals in AF distribution box

2.4.5.6 Connecting Environmental Sensors (option)

See Fig. 2−22.

Environmental sensors e.g. for temperature, intrusion or smoke are optionally used. The used sensors depend on local facilities and are defined during the engineering period on site. The inputs are available at connector J10 on top of the cabinet. For temperature measurement inputs of connector J10 (outside/inside) it is recommended to use the sensor AD590 (0 V = 10 °C) which is supplied with −15 V by J10/pin 7. This sensor is supported by the internal measurement circuit. Other sensors have to be adapted. Inputs for alarm intrusion and smoke detector are recommended to switch to ground: open switch means high level (5 V) to the LCP input, closed means low level (0 V).

2.4.5.7 Connecting Signals from/to AG/MON/ECU SPARE I/O (option)

This connector option is normally not used.

2.4.5.8 Connection Voice Signal for VAM (option)

Not applicable for GP installation.

2.4.5.9 Connecting to serial Interface COM4/NDB (option)

This connector allows to achieve a serial data connection to an associated equipment. Connect the RS232 cable with SubD, 9pin male connector from associated equipment to connector J22 on top of the cabinet.

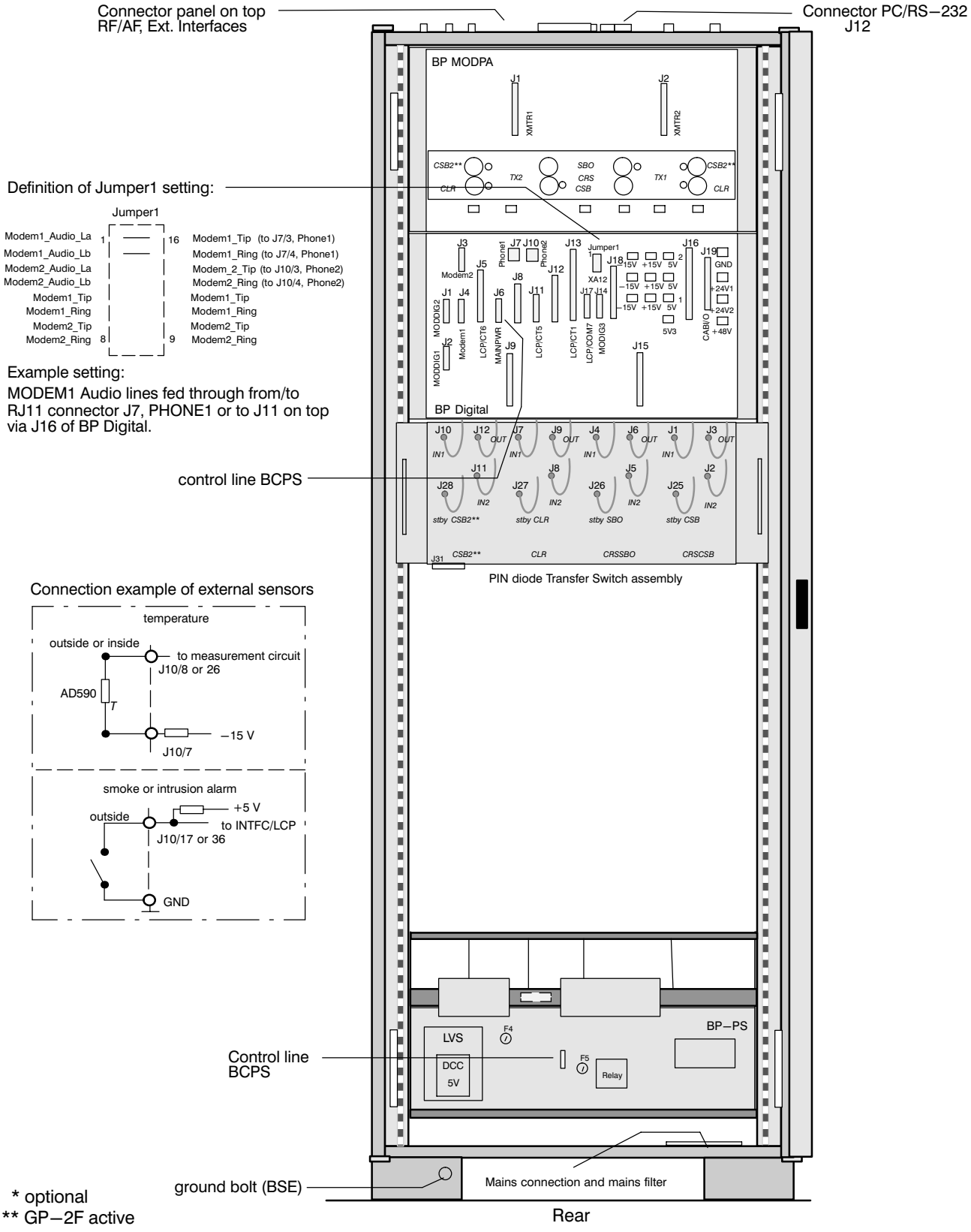


Fig. 2−22 Interface connections and back panel connector locations

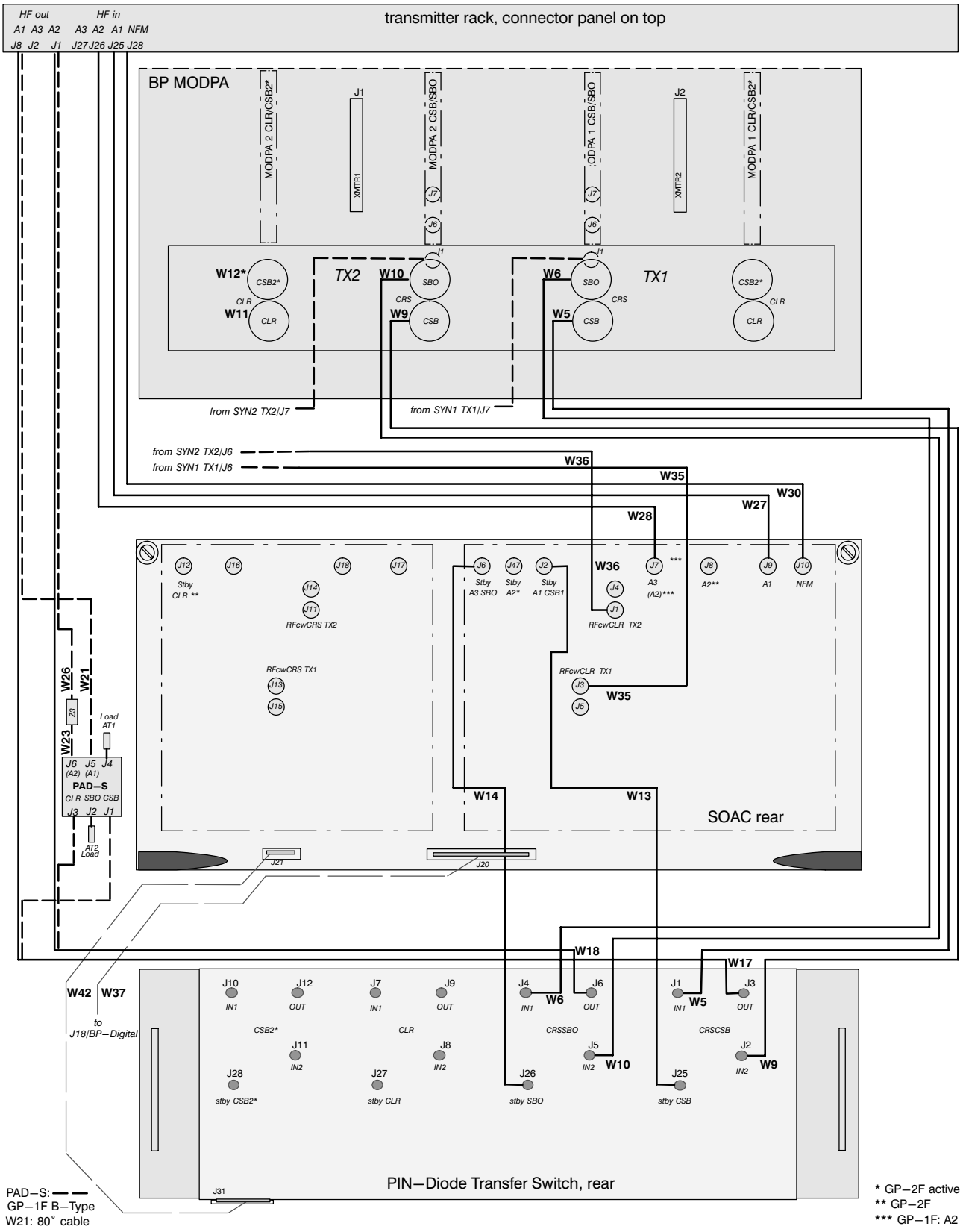


Fig. 2–23 RF–cabling transmitter rack (example GP–1F), with SYN RF cabling

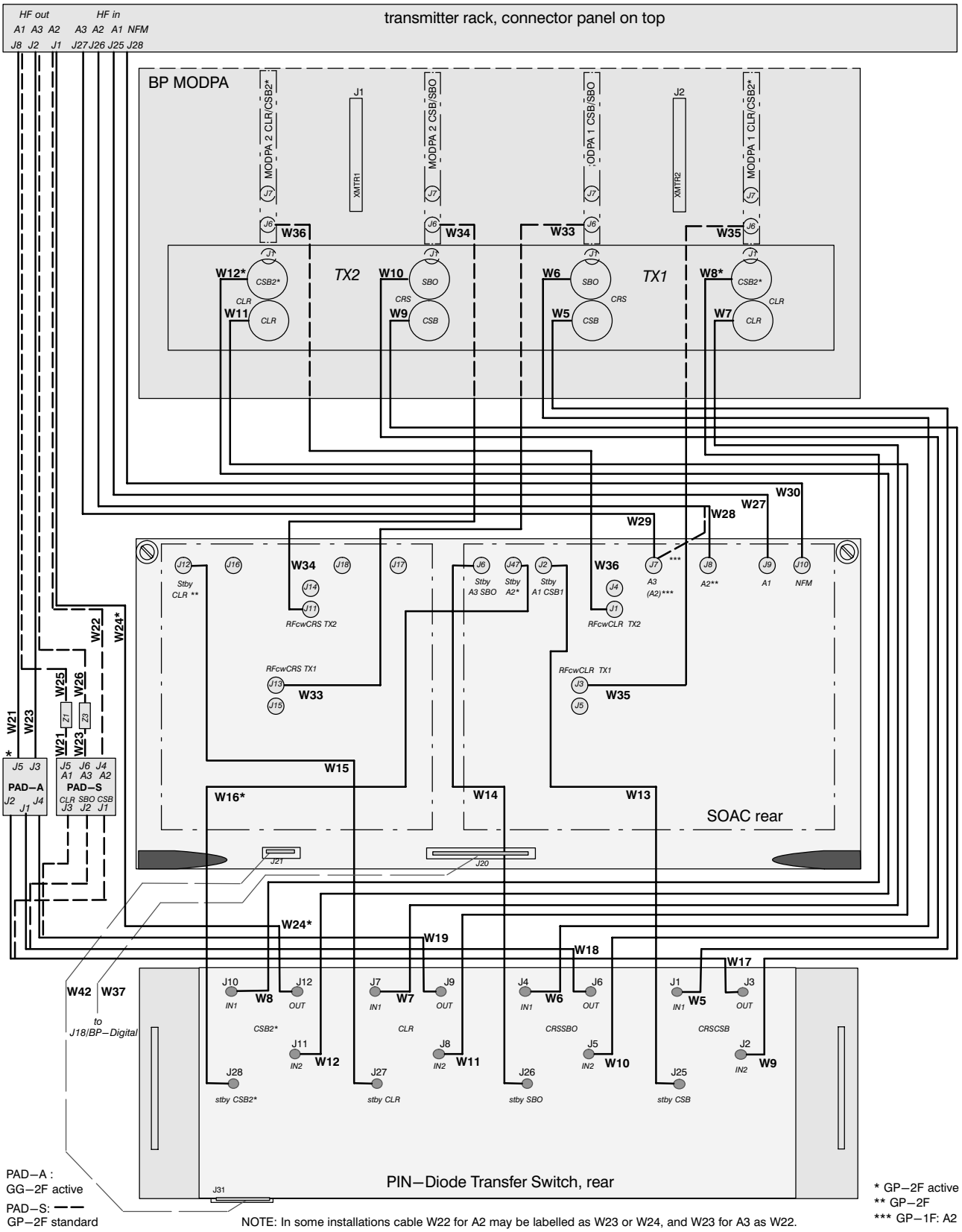
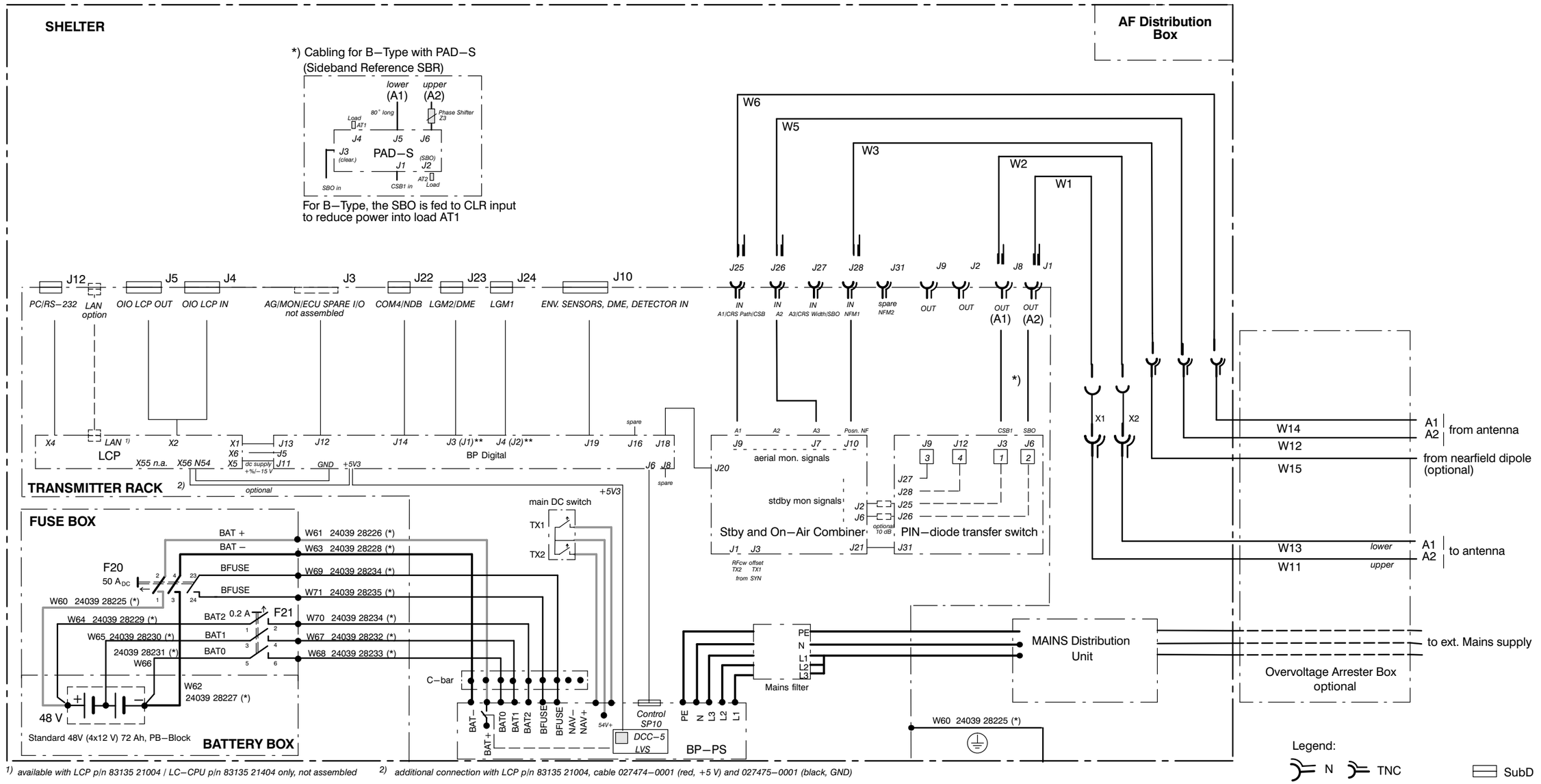


Fig. 2–24 RF–cabling transmitter rack (example GP–2F), without SYN RF cabling

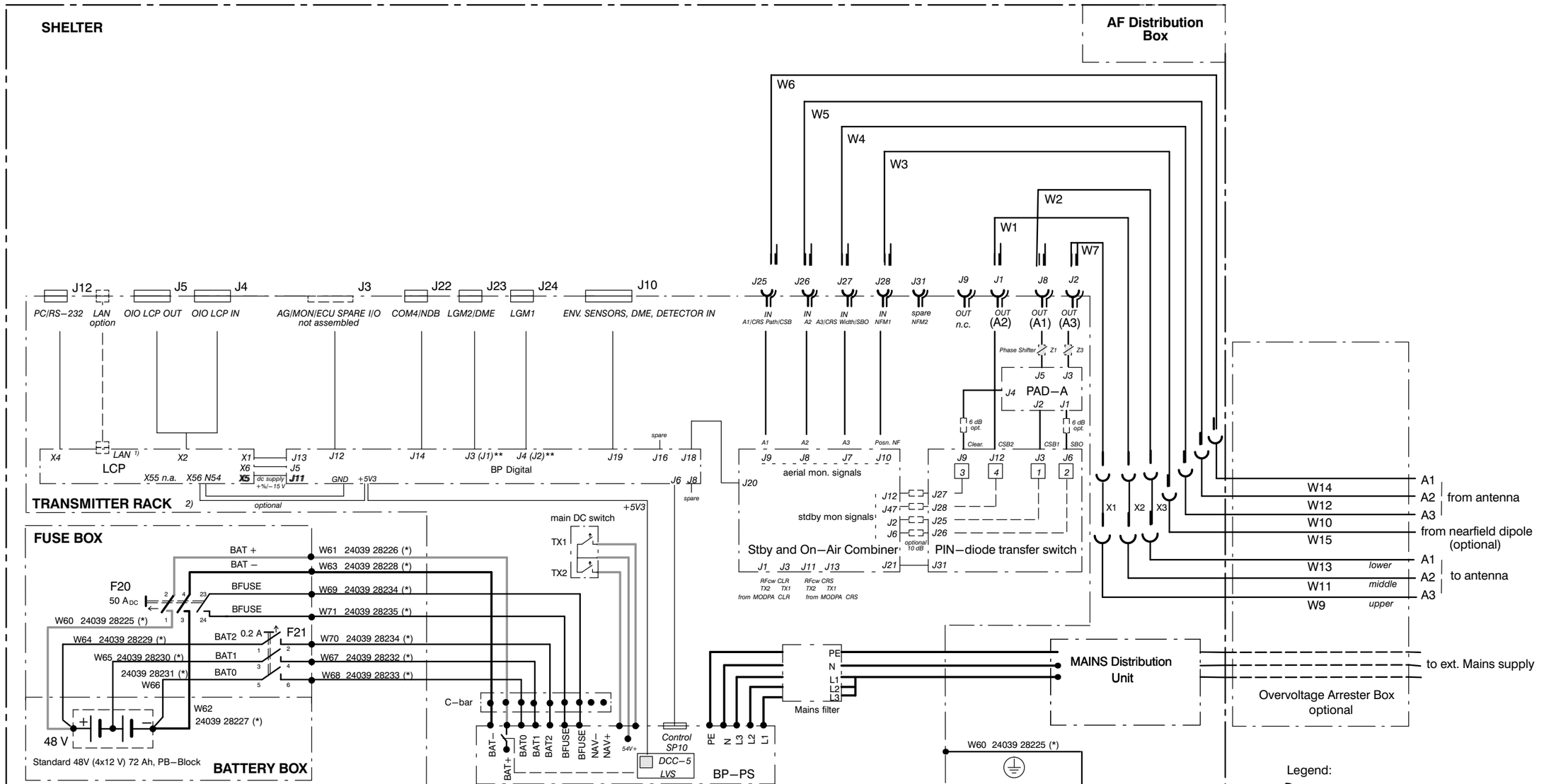


1) *available with LCP p/n 83135 21004 / LC–CPU p/n 83135 21404 only, not assembled*

2) *additional connection with LCP p/n 83135 21004, cable 027474–0001 (red, +5 V) and 027475–0001 (black, GND)*

Note:
(*) PVC–covered power lines are contained in the battery cable set 58341 00030.
** Used if digital serial interface instead of modem audio out shall be available
Optional: Attenuators (10 dB) in connection Transfer Switch – SOAC for Stby

Fig. 2–25 System cabling GP–1F



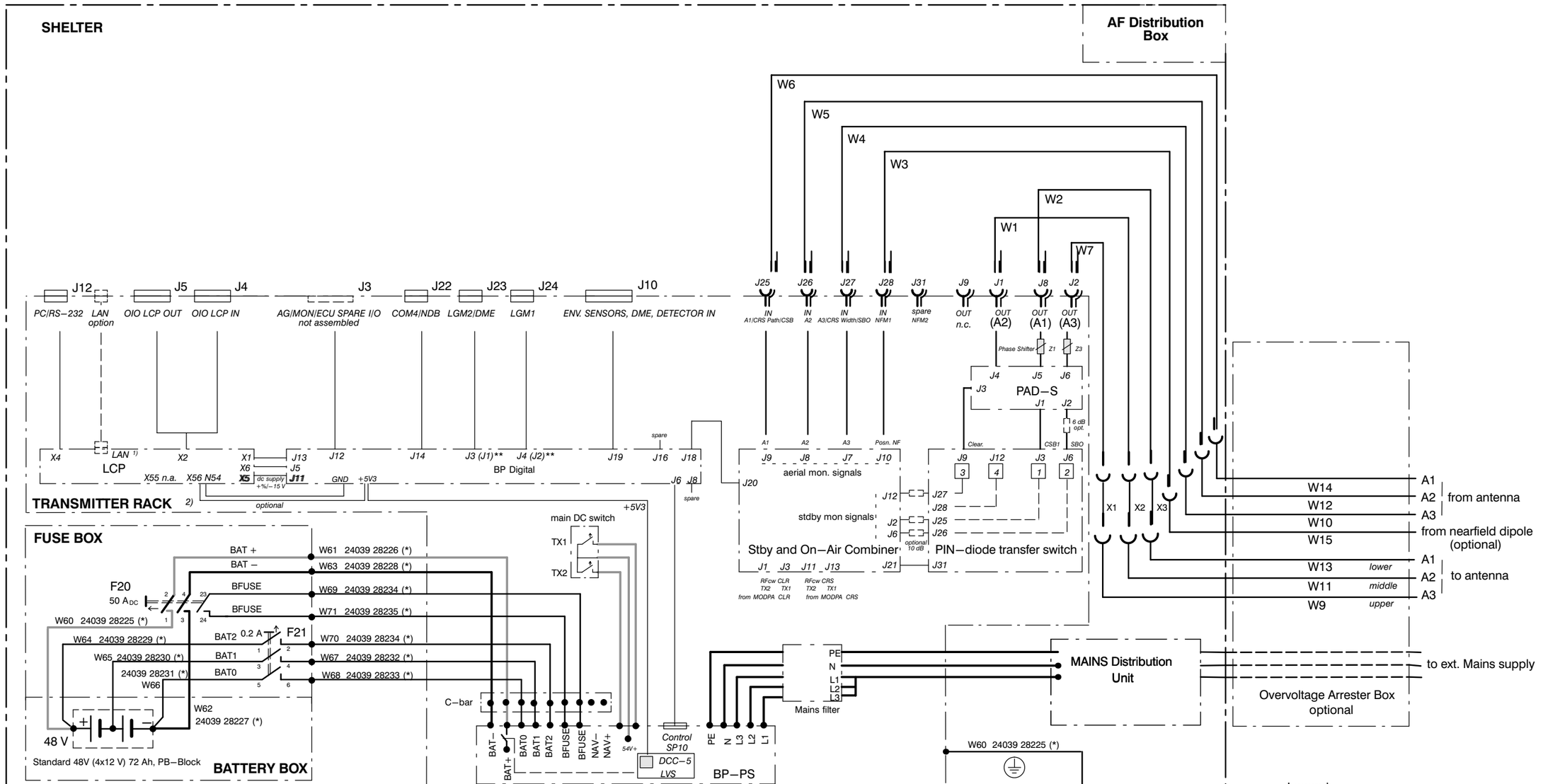
1) *available with LCP p/n 83135 21004 / LC–CPU p/n 83135 21404 only, not assembled*

2) *additional connection with LCP p/n 83135 21004, cable 027474–0001 (red, +5 V) and 027475–0001 (black, GND)*

Legend: N TNC SubD

Note:
(*) PVC–covered power lines are contained in the battery cable set 58341 00030.
** Used if digital serial interface instead of modem audio out shall be available
Optional: Attenuators (10 dB) in connection Transfer Switch – SOAC for Stby
Phase Shifters Z1 and Z3 at J5, J3 of PAD–A

Fig. 2–26 System cabling GP–2F active



1) *available with LCP p/n 83135 21004 / LC−CPU p/n 83135 21404 only, not assembled*

2) *additional connection with LCP p/n 83135 21004, cable 027474−0001 (red, +5 V) and 027475−0001 (black, GND)*

Legend:
N TNC SubD

Note:
(*) PVC−covered power lines are contained in the battery cable set 58341 00030.
** Used if digital serial interface instead of modem audio out shall be available
Optional: Attenuators (10 dB) in connection Transfer Switch − SOAC for Stby

Fig. 2−27 System cabling GP−2F standard

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.

NOTE: All connections in the ground must be welded and protected against corrosion.

The ground resistance required for a navigation installation can be given as $\leq$5 ohms. 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 ohms 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 shown in Fig. 2−28.

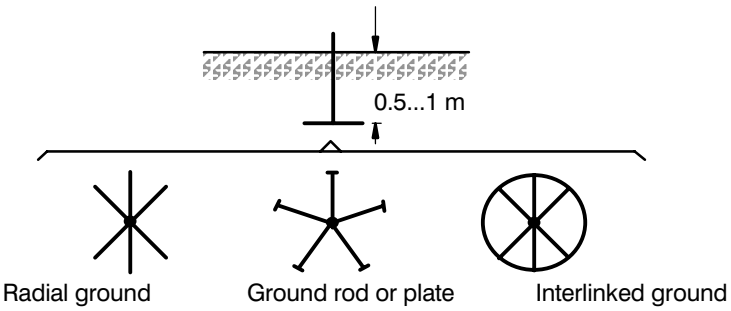


Fig. 2−28 Different types of ground conductor configuration

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...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 LLZ or GP 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 ohms
50 m	5 ohms
100 m	3 ohms

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 ohms	
		Length 2 m = approx. 40 ohms	

2.5.4 Ground Plates

Ground plates are solid perforated sheet metal plates with dimensions of approx. 0.5 x 1 m or 1 x 1 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. The grounding resistance of a plate 1 m^2 is approx. 30 ohms. The data for the connecting conductors is specified in the tables in Section 2.5.2.

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

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 ground resistance should then be calculated as follows: $1/R_{res} = 1/R_1 + 1/R_2 + 1/R_3 + ... + 1/R_n$.

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 ohms. If the value calculated is 5 ohms or more, we recommend measuring the ground resistance.

2.5.6 Measuring the Ground Resistance

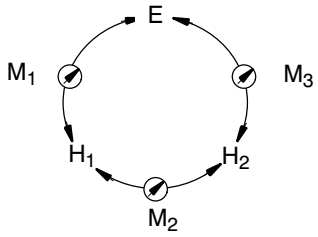
See Fig. 2−29.

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. An example of a GP strip conductor ground is shown in the following figure. The drawing is not to scale.

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

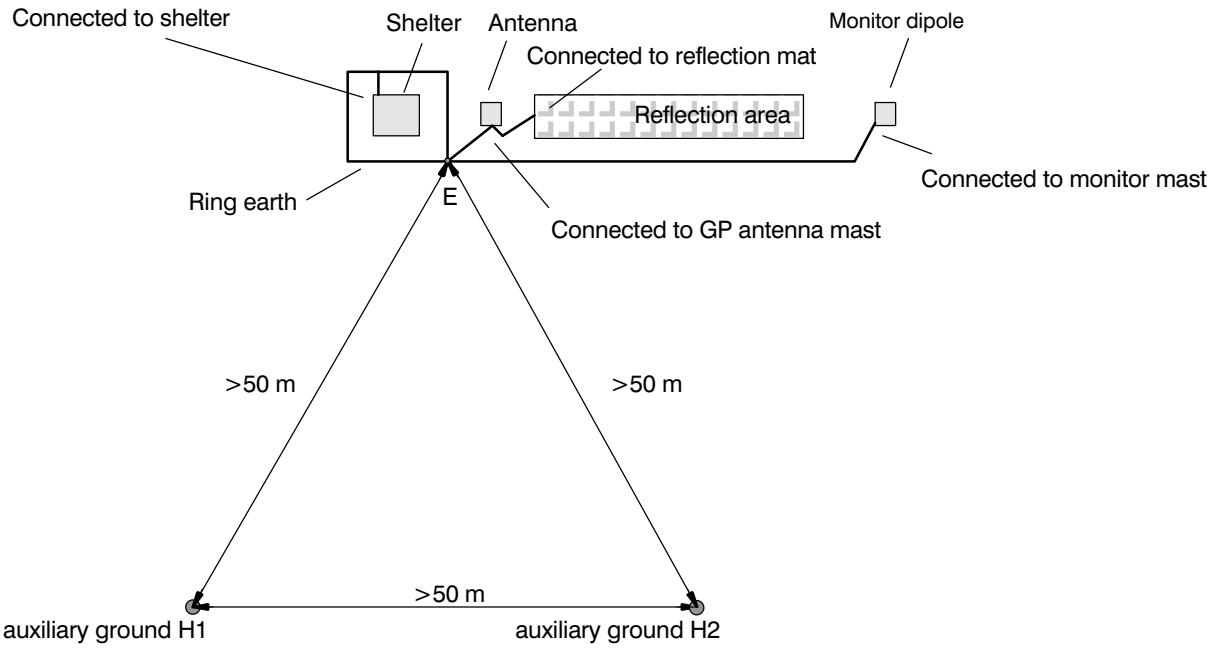


Measured value 1: Resistance between installation ground and auxiliary ground 1
Measured value 2: Resistance between auxiliary ground 1 and auxiliary ground 2
Measured value 3: Resistance between installation ground and auxiliary ground 2

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 ohms. This resistance should therefore be measured and deducted from measured values M1, 2 and 3. The measured values corrected in this manner are entered into the above formula.



An auxiliary ground is required to measure the ground resistance of the antenna ground and the installation ground.

Fig. 2−29 Example of ground of a Glide Path installation

2.5.7 Earthing System LLZ or GP

See Fig. 2−30.

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.

The LLZ or GP grounding system consists of ground strips (usually made of aluminium, copper, galvanized iron or stainless stee, round (10 mm ∅) or flat (30 x 3,5 mm) material. The grounding is laid down in the earth to and along the LLZ antenna foundation or to the GP antenna foundation, and in the form of a ring ground around the shelter foundation in the defined depth. The ring ground is grounded at the corners with additional ground rods

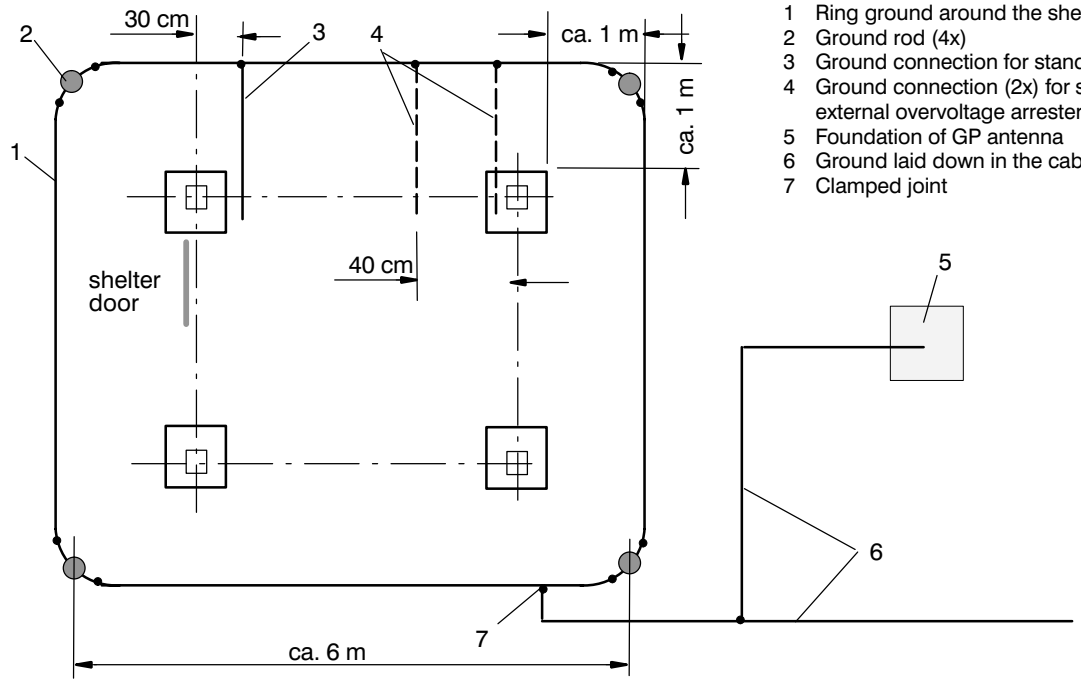


Fig. 2−30 Ring earth and earth connection of shelter (example GP)

2.6 COLLOCATION WITH DME

2.6.1 Overview

This description concerns to the collocation of DME 415/435 with ILS 420, LLZ/GP. The DME equipment is normally located in the GP shelter and the DME antenna is mounted on the GP mast. To synchronize the identification, the collocated DME uses an interface with the LLZ system. To transfer optionally ”Maintenance” and ”Status” of the DME a RS 232−cable connection is established between GP and DME if the DME is not connected with an individual modem (internal or external) to the Tower resp. to a Remote Unit (e.g. RCSE 443 or MCS) via a 2 wire lines connection.

2.6.2 Connection of DME 415/435 to ILS 420 LLZ/GP

2.6.2.1 Ident Connection

See Figs. 2−21, 2−31, 2−32, 2−33, 2−34.

– Connect the airport−side data cable already laid between LLZ and GP shelter (Fig. 2−33) to the AF−distribution box in each shelter.

– Lay the ID−cable (Ref. No. 24009 xxxxx) in the GP shelter cable duct. Connect it to the connector SK4/AF1 on top of the DME cabinet and the open end to the AF−distribution box of the GP shelter: sequence of connection see Fig. 2−34, terminal points in the AF−distribution box see Fig. 2−21 and 2−32.

– Lay the ID−cable (Ref. No. 24009 xxxxx) in the LLZ shelter cable duct. Connect it to connector J10 (ENV. SENSORS, DME, DETECTOR IN) on top of the cabinet and the open end to the AF−distribution box of the LLZ shelter: sequence of connection see Fig. 2−34, recommended terminal points in the AF−distribution box see Fig. 2−21 and 2−32.

NOTE: The ground connection between LLZ and DME remains open. Connect shielding of cable between LLZ and GP shelter one−sided only.

2.6.2.2 RS232 Connection

See Figs. 2−33, 2−35.

– As standard, the DME is located in the GP−Shelter. To establish the RS 232 connection plug adapter Ref.No. 97243 28211 (Fig. 2−33 and 2−35) to connector PL1/Port 3 on top of the DME cabinet.

– Place the RS 232−cable (Ref.No. 97240 28166) in the GP shelter cable duct. Connect it to the adapter (on top of DME cabinet) and to connector J23 LGM2/DME on top of the GP cabinet.

– Sequence of connection on GP and DME see Fig. 2−35.

– Check that connection to connector J23 LGM2/DME is fed from J2 on the BP−Digital rear.

NOTE: The adapter 92243 28211 can be ommitted if a RS 232 cable is used with 1:1 through connection (not crossed).

2.6.2.3 Configuration of ILS 420 LLZ/GP and DME 415/435

The configuration is set both with hardware and software settings at the LLZ 421 and DME 415/435. Ident collocation software setting concerns localizer only. Check or/and perform following settings:

LLZ 421 hardware (refer to section 6.6.5):

ECU:	SW1 /2	*open*
	J6	*1−2*
	J7	*2−3*

LLZ 421 software, enter with PC user program (see Annex 'PC User Program–specific Procedures', in Register 8 of this manual):

– Open dialog 'TX1: Waveform Data' and open dialog 'TX2: Waveform Data'.

– Enter:

DME/Ident Interleave	*3:1 DME*
ILS Ident keying	*Keyed*
DME Ident keying	*Keyed*

DME 415/435: Refer to Technical Manual, Volume 1, Ref. No. 955 900 031C, Vers. D, Sep. 2005, or Ref. No. 2459824, Dec. 2002, Vers. B, or Ref. No. 8BR 02012 1000 DEGFA, Dec. 1998:

– HW configuration of AFI: Regard that path M5, M2, M3 is set to "Internal Source" (delivery position)

– Enter with PC user program (ADRACS/WINDME or MCS–Operation–Settings–AFI Configuration):

AF Status	*Low*	Morse Code	*Slave Trigger* / *Slave Code*
ID Code/trigger from AF	*Low*	Ident Recovery	*On Sensing*
DME Status	*Low*	Associated Equipment	*No*

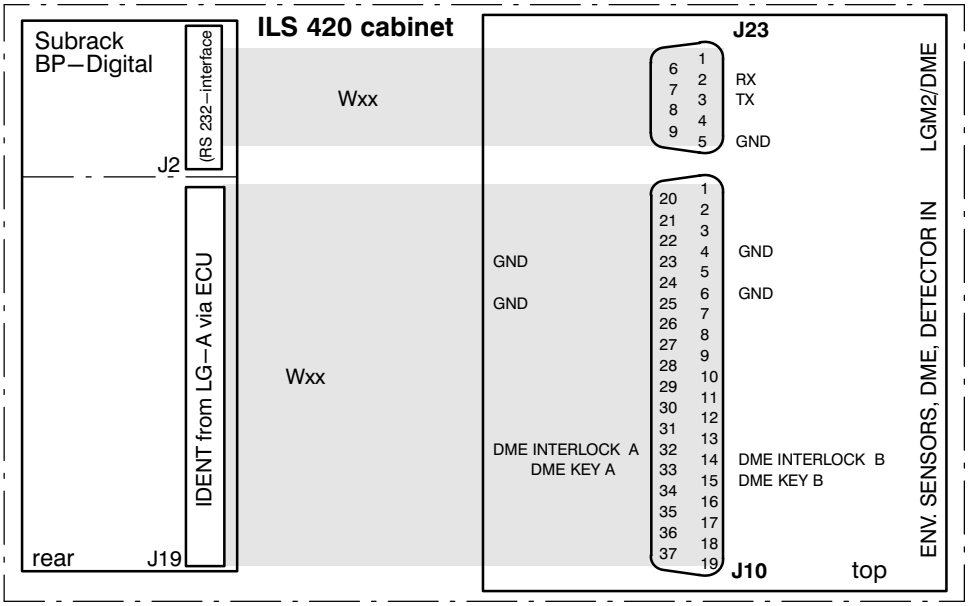


Fig. 2–31 Interface Assignment of LGM2/DME and ENV. SENSORS+DME ID in ILS 420

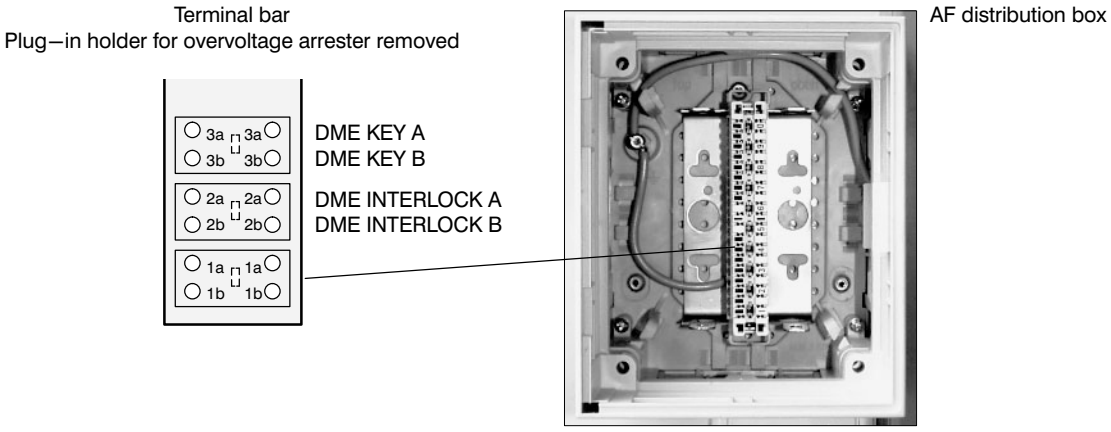


Fig. 2–32 AF–distribution box, recommended assignment of terminals (example)

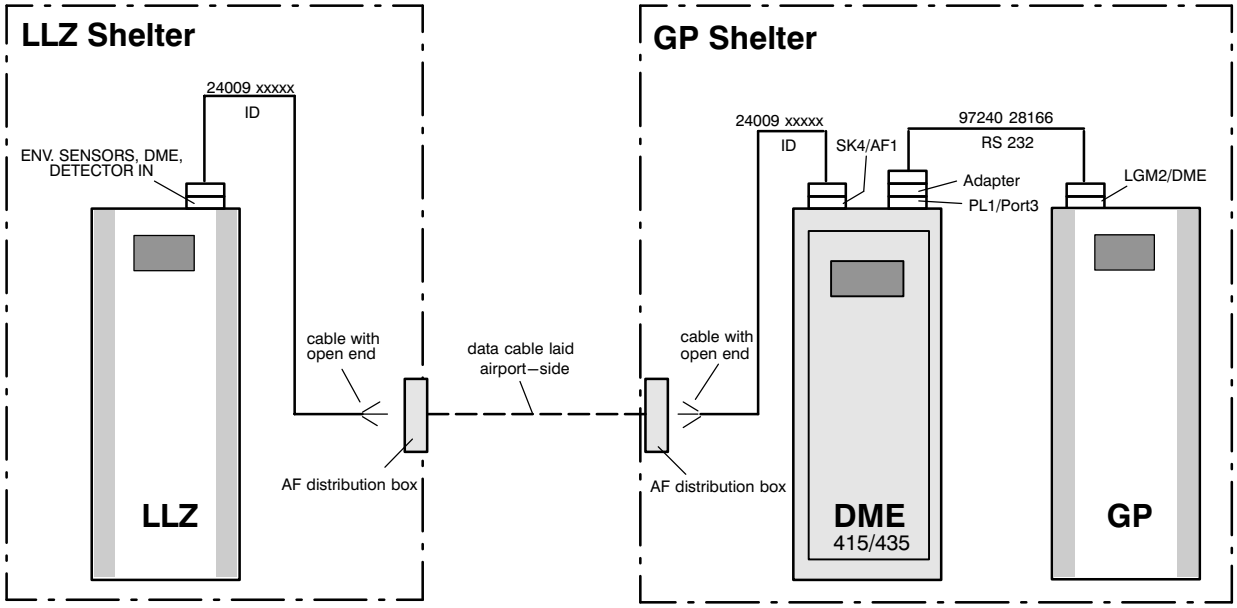
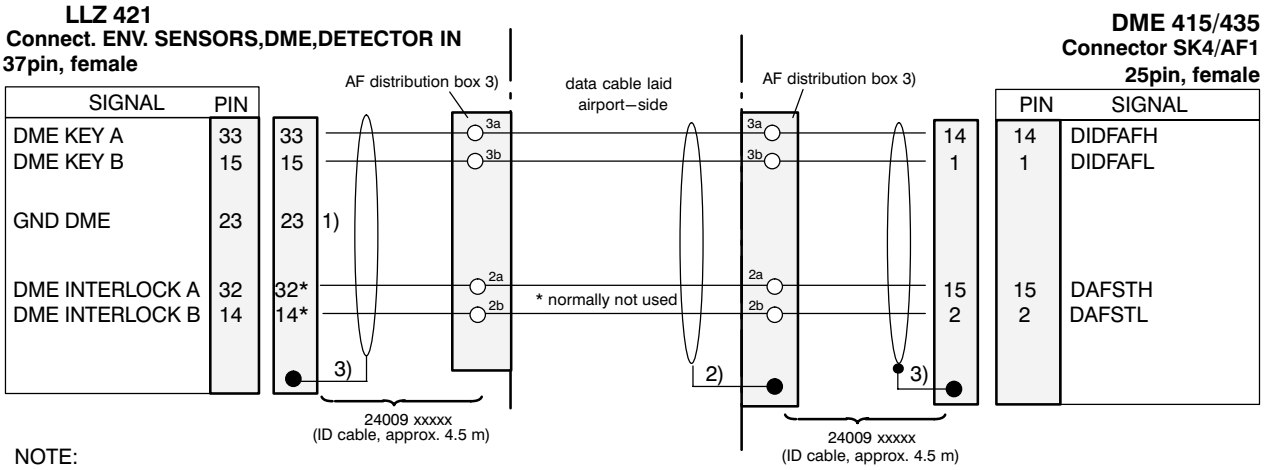
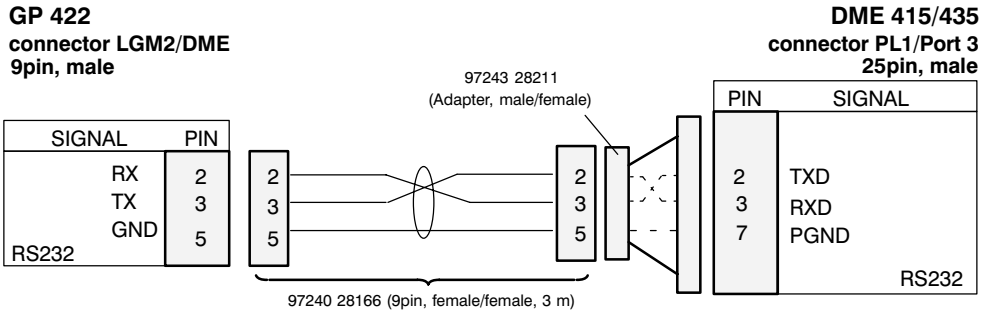


Fig. 2−33 Collocation ILS 420 LLZ/GP with DME 415/435, overview



NOTE:
1) Ground not connected between LLZ (pin 23, or alternatively 4,6,25) and DME
2) Shielding of data cable (placed at disposal airport side) connected one−sided to ground
3) Shielding of ID cable connected one−sided to ground on connector shell

Fig. 2−34 Ident connection LLZ 421 to DME 415/435



NOTE:
The adapter can be ommitted, if a RS232 cable is used with 1:1 through connection (not crossed)

Fig. 2−35 RS 232 connection GP 422 to DME 415/435

CHAPTER 3
OPERATION

3.1 GENERAL

Standard operation is normally carried out via a remote control interface (Modem) with the user program ADRACS installed on a PC. For local operation basic operation is available at the local control panel (LCP). It provides access to 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 which is connected to connector Local PC on top of the cabinet.

3.2 LOCAL CONTROL PANEL (LCP)

See Fig. 3−1.

The LCP located in the front door of the cabinet provides following indications and controls:

- three indication lamps for the main status of the system (ALARM, WARNING, NORMAL)
- a menu driven liquid crystal display (LCD) 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 (S1 to S4) to perform simple activities in the control menu like change−over or disconnect the transmitter(s); the function of buttons is defined by software and assigned in the LCD screen.
- a key−lock switch to select three operational modes of the station REMOTE, LOCAL, MAINTENANCE, which define operation from remote site or local at the cabinet or operation in maintenance mode; the actual mode is presented on the LCD screen in window ”Show Alerts”.

A test of the three indication lamps on the LCP is provided by pressing buttons S2 and S3 simultaneously. The meaning of the indications, buttons and the key−lock switch on the LCP is described in the following sections.

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

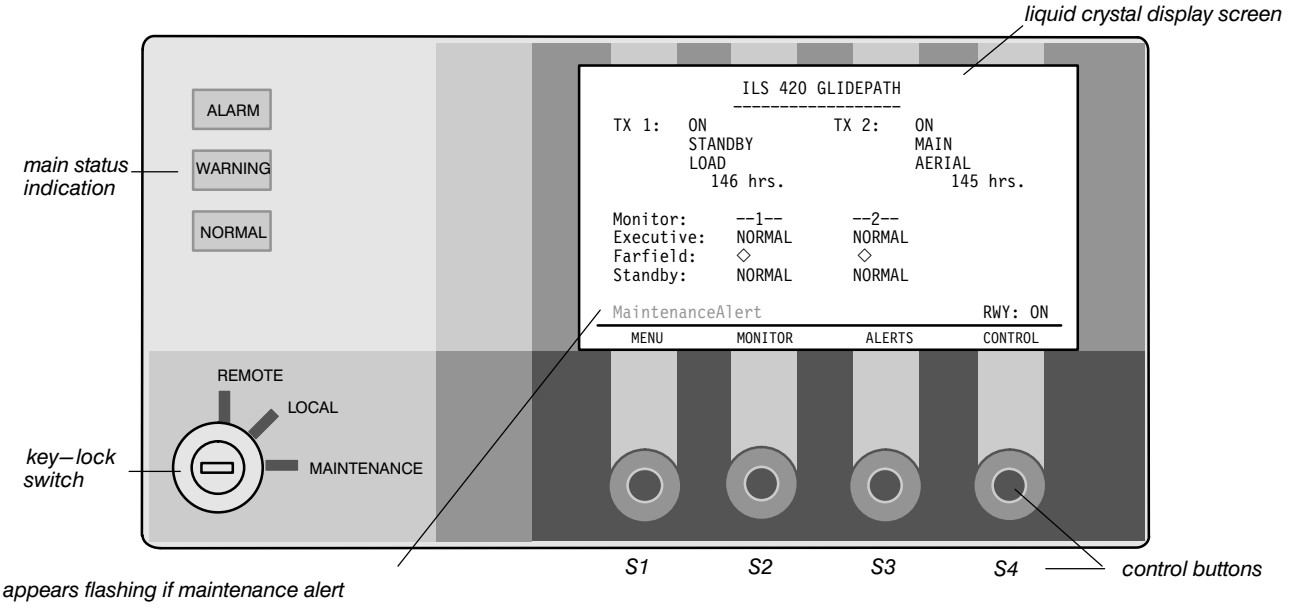


Fig. 3−1 Local Control Panel, example

3.2.1 Indicators and Controls on LCP Front

Indicator	Color	Function if indicator lights	Remarks
ALARM	red	Monitor 1 and 2 are in ALARM state (i.e. relevant signals are out of tolerance): Alarm is set if the monitors being in executive mode detect that the signal is radiated with defects caused by faults in the aerial transmitter (or antenna); the faulty transmitter is shut down and if available the standby transmitter is changed to aerial. If the radiated signal remains faulty the system is shut down *or* ECU fault *or* Monitor 1 and 2 are in Bypass/Maintenance Mode.	executive bypass
WARNING	yellow	The station is supplied by battery *or* has a BITE warning *or* Monitor 1 and 2 are in Bypass/Maintenance Mode.	standby bypass
NORMAL	green	All transmitter and monitor equipment is switched on, initialized and serviceable for the intended category of operations (no WARNING and no ALARM).	

Control	Position	Function	Remarks
Key–Lock Switch	REMOTE	Station enabled for remote control, local control commands at LCP disabled	Station is operable. Local read out of values possible
	LOCAL	Station enabled for local operation, control commands from remote disabled	Station is not operable. Remote read out of values possible
	MAINTENANCE	System set to maintenance mode: 'Monitor Bypass' is set, ALARM indication is lit.	Station is not operable.
Push button	S1,S2,S3,S4	Function keys meaning defined per SW menu	
	S2+S3 simult.	Lamp test and audible alarm 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 INDICATORS ON THE SUBASSEMBLIES

See Fig. 3−2.

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

Board	Indicator	Color	Control	Function of control or indicator (lit or flashing)
LG−A	CPU_NORM	green		flashing slowly (1 Hz) board ok off board faulty or TX shutdown
	Audio_On	green		lit TX on, generating nav. signals flashing slowly TX off, not generating signals flashing fast program state faulty off TX shutdown
			Reset	performs a reset of the processor board
			Load/Boot	Used with Reset, to prepare the board for software load procedure, both LED are lit. During load procedure both LED are flashing.
LG−M	CPU_NORM	green		lit monitor program stopped flashing slowly (1 Hz) board ok, monitor runs off board faulty or TX shutdown
	Audio_On	green		lit TX on flashing normal operation, indic. measurement chain repetition rate flashing fast program state faulty off monitor is not operating or TX shutdown
			Reset	performs a reset of the processor board
			Load/Boot	Used with Reset, to prepare the board for software load procedure, both LED are lit. During load procedure both LED are flashing.
ECU	LED indicators top down	green yellow red red		Lit if: Executive TX on Executive Monitor bypass on Executive Alarm Monitor 1 Executive Alarm Monitor 2
		green yellow red red		Standby TX on Standby Monitor bypass on Standby Alarm Monitor 1 Standby Alarm Monitor 2
		yellow red red		Field monitor bypass on Field Alarm Monitor 1 Field Alarm Monitor 2
		green red red red		Equipment 1 Executive 3rd redundant detection path off; safety shutd. Integrity fail:integritytest of monitors has failed Switch fail: switching action failed (flashing: missing subassemblies/HW)

Board	Indicator	Color	Control	Function of control or indicator (lit or flashing)
ECU cont.			Board reset Lamp test DipFix Switch SW4 *(SW1)*	press to reset ECU board, if e.g. SW4 *(SW1)* settings changed Press to test all indication LED's. Hardware setting of system configuration, see 6.6.5. **Remark:** If this setting is changed, the 'Board reset' key has to be executed to achieve settings. Settings of SW4 *(SW1)* must correspond to the Software Configuration settings (with PC user program).
SYN	LED, VCO	red		Normaly off; indicates VCO's off
LCP	LED HD LED	green red	 Reset key R1	Indicates LC−CPU is alive HD−r/w operation (RAM), flashes if access (not with LC−CPU 83135 21404) Restarts the LCP processor and software Controls brightness of the LCD screen
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 adjustment of battery charging voltage
DC supply BP−PS, rear			TX1 TX2 Fuses: F4 F5	main switch for power on of transmitter 1 main switch for power on of transmitter 2 T1.0H, 250 V, protects 48 V to LG−A 1/2 and to DCC−5 converter T6.3H, protects DC supply line to collocated equipment (e.g. DME)
INTFC SNR: 120628	LED (dual)	green red	 Hex switch	indicates ident key tone (not with GP) not supported Factory use (manual test detector input select)

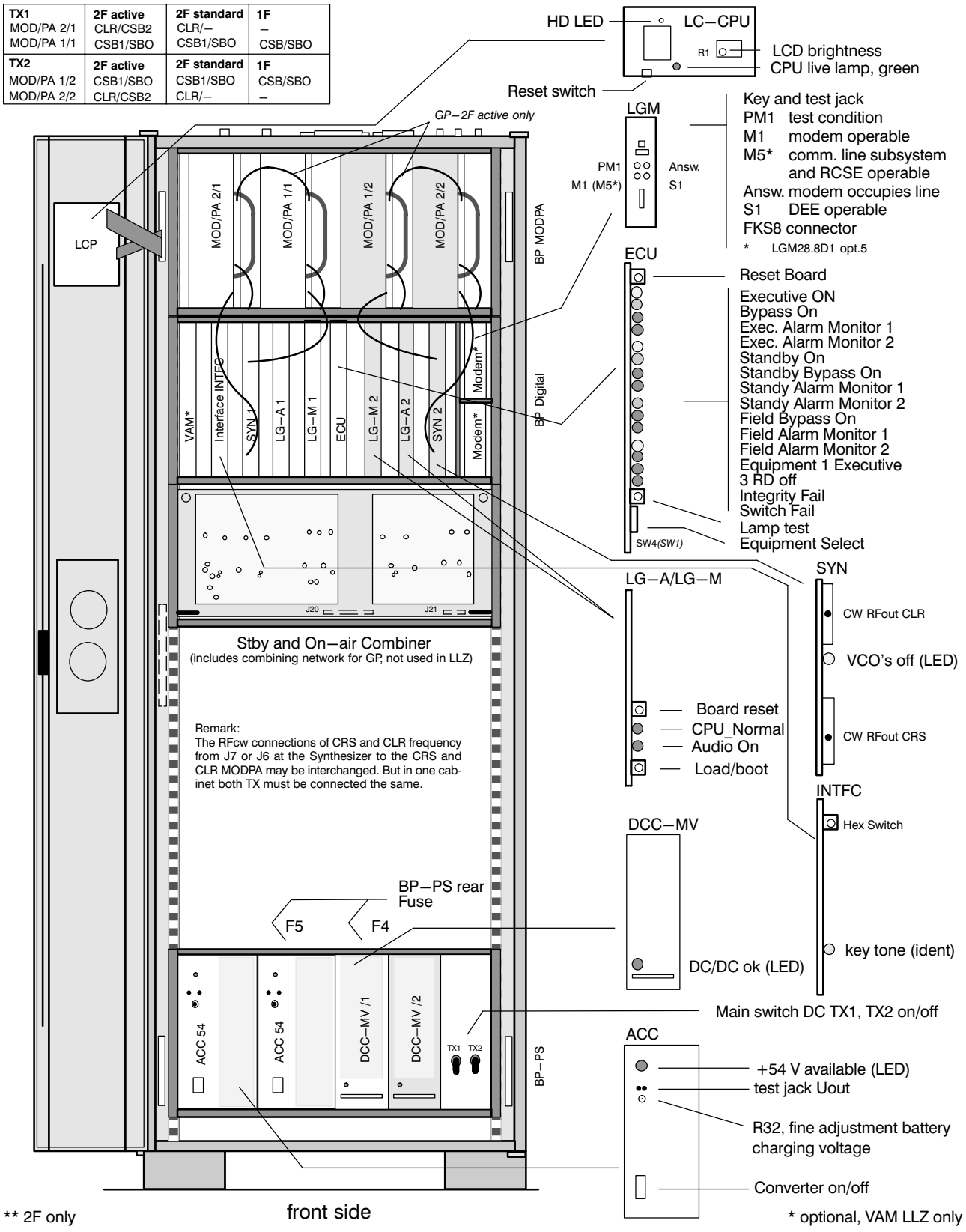
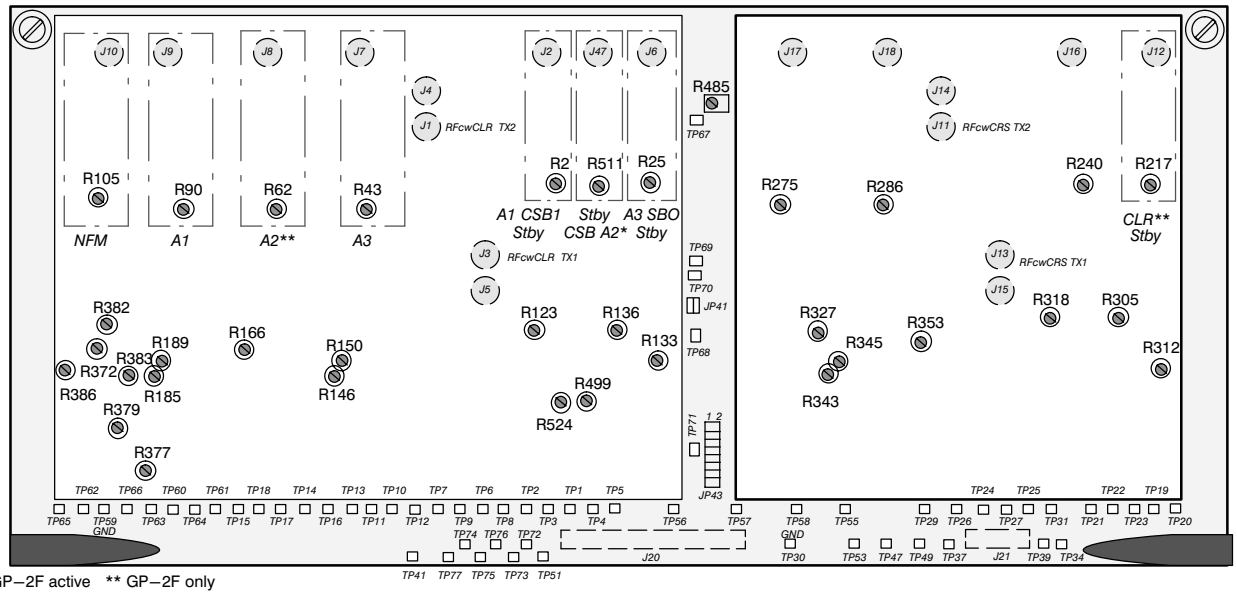


Fig. 3–2 Push buttons and indications on the subassemblies inside the rack

3.3.1 Controls and Test Points at the Stby and On−Air Combiner (SOAC)

The following table lists the control elements (potentiometer) and test points used for first setup.

Control	Test point	Function	Remarks
aerial RF in		*Gain adjustment input*	
R105	TP18,TP41	IF gain adjust of nearfield monitor input signal (NFM)	–
R90	TP16	IF gain adjust of GP: A1 input	–
R62	TP12	**GP−2F only:** IF gain adjust of A2 input signal	not used in 1F
R43	TP8	IF gain adjust of GP: A3 input (2F), A2 input (1F)	–
R275	TP24	no use in GP	–
R286	TP71	IF gain adjust of CLR input signal (A3 signal from J7)	–
aerial IF path		*phase adjustment*	
R166	TP13	Phase adjust of A2 IF signal for Width channel	–
	TP11	used for mid set of R166 resistance range	–
R353	TP25	Phase adjust of CLR signal; no need for GP; no use in 1F	factory aligned
R345	TP27	Phase adjust of CLR signal; no need for GP; no use in 1F	factory aligned
	TP26	used for mid set of R345 resistance range; no use in 1F	–
R150	TP6	Phase adjust of A3 IF for Posn. channel (1F, B−Type: A2)	factory aligned
R146	TP9	Phase adjust of A3 IF for Posn. channel (1F, B−Type: A2)	–
	TP7	used for mid set of R146 resistance range	–
R189	TP14	Phase adjust of A1 IF signal for Width channel; no use in 1F	factory aligned
R185	TP17	Phase adjust of A1 IF signal for Width channel; no use in 1F	–
	TP15	used for mid set of R185 resistance range	–
aerial IF path		*Level adjustment output*	
R377	TP51	IF level sum adjust of GP CRS Posn. output signal	–
R372	TP62	A3 IF level adjust of CRS Posn. signal path (1F B−Type: A2)	–
R379	TP63	A3 IF level adjust of CRS Width signal path (1F: A1 or A1+A2)	–
R383	TP64	A2 IF level adjust of CRS Width signal path	–
R386	TP65	**GP−2F active:** A1 IF level adjust of CRS Width signal path	–
R382	TP53	IF level sum adjust of CRS Width output signal	–
R327	TP37	not used in GP	–
R343	TP39	**GP−2F only:** IF level adjust of CLR output signal	–



* GP−2F active ** GP−2F only

Fig. 3−3 Stby and On−Air Combiner (SOAC), front view, controls and test points

Control	Test point	Function	Remarks
stdby RF in		*Gain adjustment input*	
R2 R511 R25 R240 R217	TP2,TP47 TP75 TP4 TP22 TP20	IF gain adjust of Stby CSB (GP−2F active: Stby CSB A1) **GP−2F active only:** IF gain adjust of Stby CSB A2 IF gain adjust of Stby SBO (GP−2F active: Stby SBO A3) no use in GP IF gain adjust of Stby CLR	− − − − −
stdby IF path		*phase adjustment*	
R524 R123 R136 R305 R318	TP76 TP75 TP1 TP5 TP3 TP19 TP23 TP21	**GP−2F active only:** Phase adjust of Stby CSB A2 signal used for mid set of R524 resistance range Phase adjust of Stby CSB (GP−2F active: Stby CSB A1) Phase adjust of Stby SBO (GP−2F active: Stby SBO A3) used for mid set of R136 resistance range Phase adjust of Stby CLR signal no use in GP used for mid set of R318 resistance range	− factory aligned factory aligned − factory aligned factory aligned − factory aligned
stdb IF path		*Level adjustment output*	
− − R499 R133 R312	TP77 TP47 TP72 TP49 TP34	**GP active only:** IF level measurement Stby CSB A2 path IF level measurement Stby CRS Posn. output signal IF level adjust of Stby CSB (CSB A1) for CRS Width path IF level sum adjust of Stby CRS Width output signal IF level adjust of Stby CLR (Width) output signal	− − − − −
GP only:		*Phase detector (Optional)*	not used in LLZ
R485	TP69 TP67	**GP only:** Phase zero adjustment used for mid set of R485 resistance range	factory aligned factory aligned

Antenna configuration and signal processing mode selection:

Control	Selection	Processing Mode	Remarks
Switch bank J19	1−2	Hardware setting of signal processing mode, see also 6.6.5. M−array standard (GP standard, M−Type)	factory aligned also 3−4
	3−4	M−array TSIS* (GP active, M−Type)	also 2F standard
	5−6	Sideband reference (GP, B−Type)	−
	7−8	Null reference (GP 0−Type)	−
	9−10	Dual frequency LLZ detector mode *(Dipole/Reflector, LPD antenna)*	−
	11−12	Dual frequency LLZ int. width *(LPD ant. and CU part no. 120631−0001)*	−
	13−14	spare	−
	15−16	spare	−

* TSIS = True Signal in Space

Other test point:

Control	Test point	Function	Remarks
	TP55	Transfer switch signal from ECU	−

Power supply test points:

Control	Test point	Function	Remarks
	TP56 TP57 TP58 TP30	+15 V +5 V −15 V GND	− − − −

3.4 NORMAL OPERATION

3.4.1 Switching on DC Supply

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 TX1 and/or TX2 on front of the power supply subrack 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 Operating the Key−lock switch at LCP of the Station

Three station states can be set with the key−lock switch at the LCP of the Station:
REMOTE, LOCAL and MAINTENANCE (Fig. 3−1). The key−lock switch is set to 'REMOTE' for normal operational mode. 'Remote mode' means the system is controlled by the remote equipment (e.g. RCSE 443 or other).

− Position 'REMOTE'
  The monitor system is enabled. It can change over or shutdown the transmitter on alarm condition. Control commands from the remote site (e.g. RCSE or MCS) are enabled, local controls at the LCP not available. The remote control unit shows the station status. The station is in operational mode.

  A local or remote connected PC with the PC User Program (ADRACS or MCS) achieves according to the password level to read out data (< level 3) or to control the station and to change parameters (> level 2). Performing a login with a level >2 the indication 'Remote Maint.' appears in the LCP menu 'Show Alerts'. The station is then out of operation.
− Switch to position 'LOCAL'
  'LOCAL' is used to perform adjustments on site with the LCP (e.g. during flight check). The monitor system is enabled but can be locally set to 'Monitor Bypass' in the 'Control' menu of the LCP. Control commands and parameter changes from the remote site (e.g. RCSE or MCS) are disabled. Local controls at the LCP are available. The station is not in operational mode.

  NOTE: The bypass mode should be set if operating values of monitor or transmitter have to be adjusted. 'Monitor Bypass' inhibits the shutdown of the system by the subassembly ECU (Executive Control Unit) of the station.

  A local connected PC with the PC User Program (ADRACS or MCS) achieves according to the password level to read out data (< level 3) or to control the station and to change parameters (> level 2). The indication 'local' appears in the LCP menu 'Show Alerts'. The station is then out of operation.

  NOTE: If the station was shutdown in key−switch position REMOTE by the tower it remains "off" in position LOCAL.
  The setting to 'aerial' on site depends then on the position of switch SW4 (*SW1*)/No.2 at the ECU. With the ECU −SW4 (*SW1*)/No.2 in position 'open' (default, Station Interlock enabled) the station can be set to 'aerial' only with the key−lock switch turned to REMOTE after arrangement with the tower to accept a changed RWY−bit ('on') . Then turn to LOCAL again to continue work on site. If the ECU −SW4 (*SW1*)/No.2 is or was set to position 'closed' (Station Interlock bypassed, i.e. Standalone) it is possible to set 'aerial' also in key−lock switch position LOCAL.
− Switch to position 'MAINTENANCE'
  'MAINTENANCE' is used to perform maintenance works on site. Compared to position 'LOCAL' the monitor system is disabled: 'Monitor Bypass' is permanently set and cannot be disabled. The MAIN STATUS shows 'ALARM'. The station is not in operational mode.

  A local or remote connected PC with the PC User Program (ADRACS or MCS) achieves according to the password level to read out data (< level 3) or to control the station and to change parameters (> level 2). The indication 'local' appears in the LCP menu 'Show Alerts'. The station is then out of operation.

3.4.3 Monitoring ATIS or Voice

Not applicable for Glide Path.

3.4.4 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.

3.4.5 Switching off DC Supply

Use switches TX1 and TX2 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.

3.4.6 LCP and LCD Screen for Indication and Control of the System

3.4.6.1 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.

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 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.

NOTE: The alarm indication 'AL' behind certain parameter values (monitor exec./field/standby or power supply parameters) shows that the value is out of the defined alarm limits

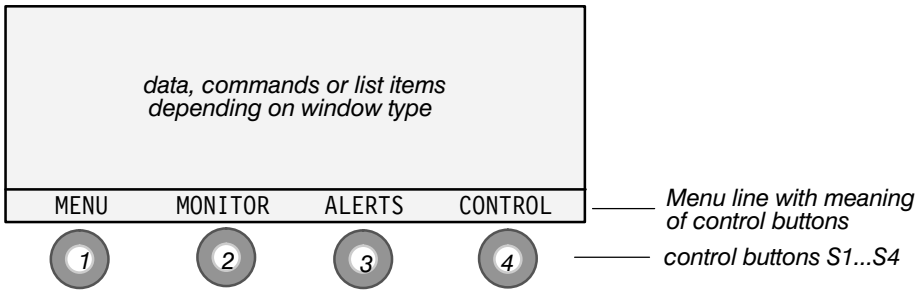


Fig. 3−4 Structure of an LCP window (example)

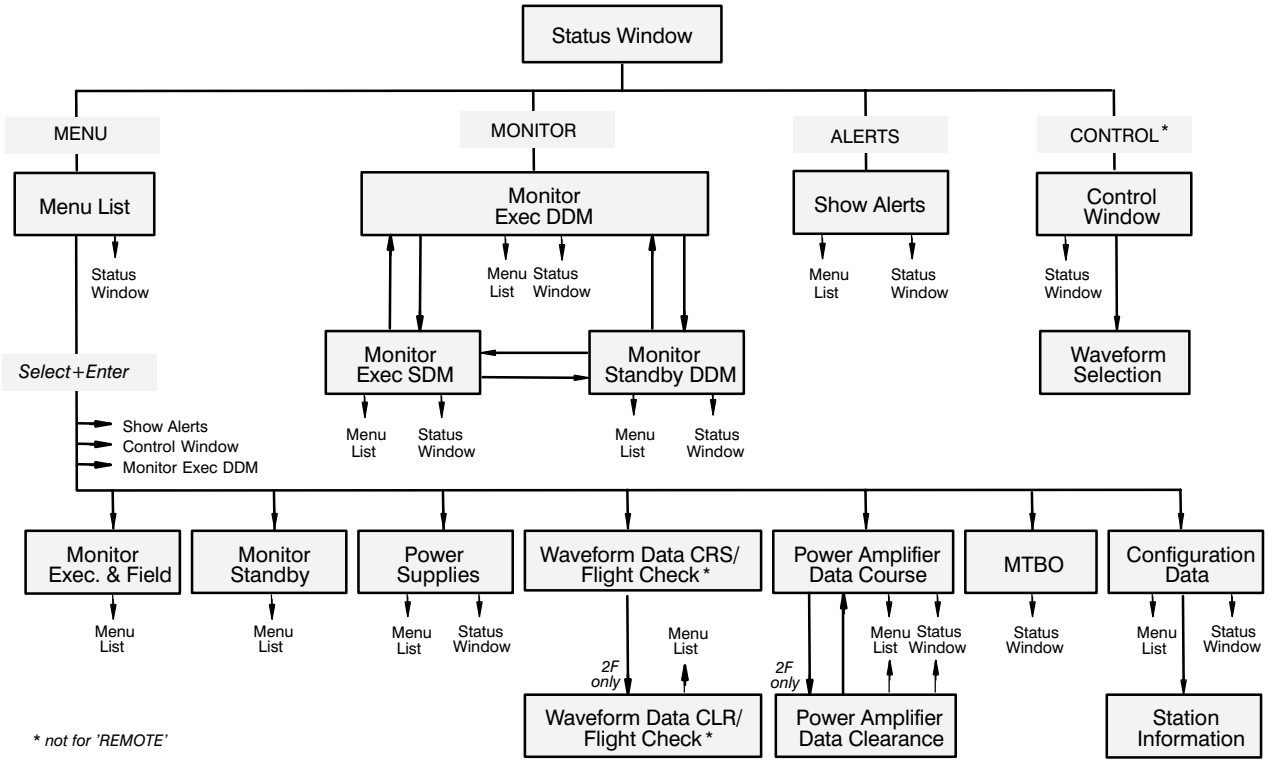


Fig. 3−5 Hierarchy of all LCP windows

3.4.6.2 Principle Operation of the Menu

Figures 3−6 to 3−28 show the examples of the selectable windows. The examples show windows of a 2F system (GP 2F active).

In the Status window the following button definitions are used:

S1	MENU	to go to Menu List window (see Fig. 3−15)
S2	MONITOR	to go to Monitor Quick Access windows (see Figs. 3−7 to 3−10)
S3	ALERTS	to get information about pre−alarms or alarms (see Fig. 3−12)
S4	CONTROL	to go to Control window (see Fig. 3−13)

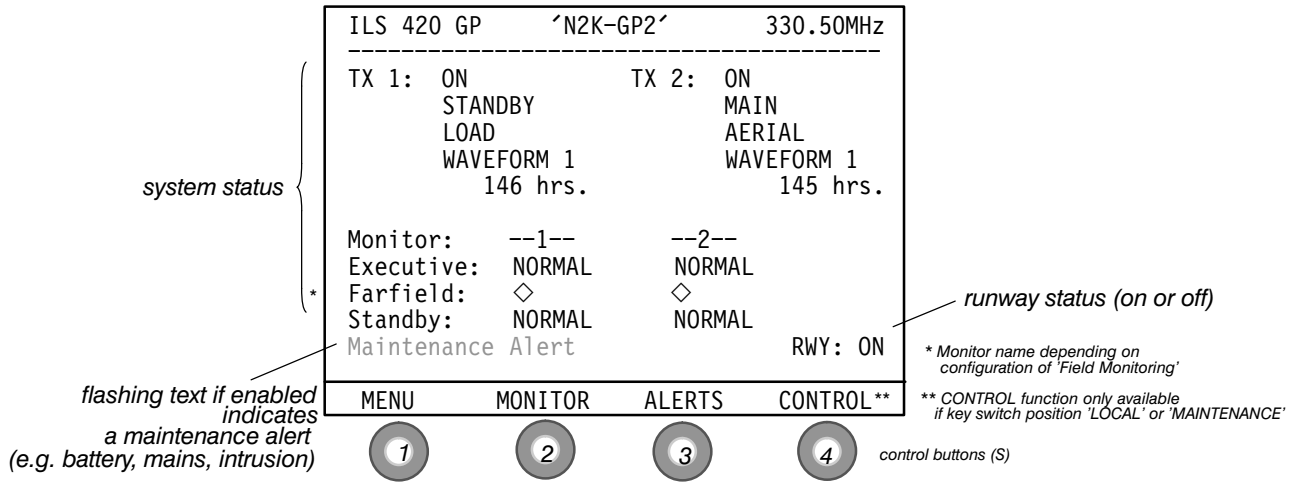


Fig. 3−6 Status window after start of application (example, main state NORMAL)

The following Monitor Quick Access windows provide Monitor data on 4 different windows:

– In the Monitor Exec. DDM window the following button definitions are used:

S1	MENU	to go to Menu List window (see Fig. 3−15)
S2	STBY-DDM	to change to Monitor Standby DDM window (see Fig. 3−9)
S3	EXE-SDM	to change to Monitor Exec. SDM window (see Fig. 3−8)
S4	STATUS	to return to the Status window (see Fig. 3−6)

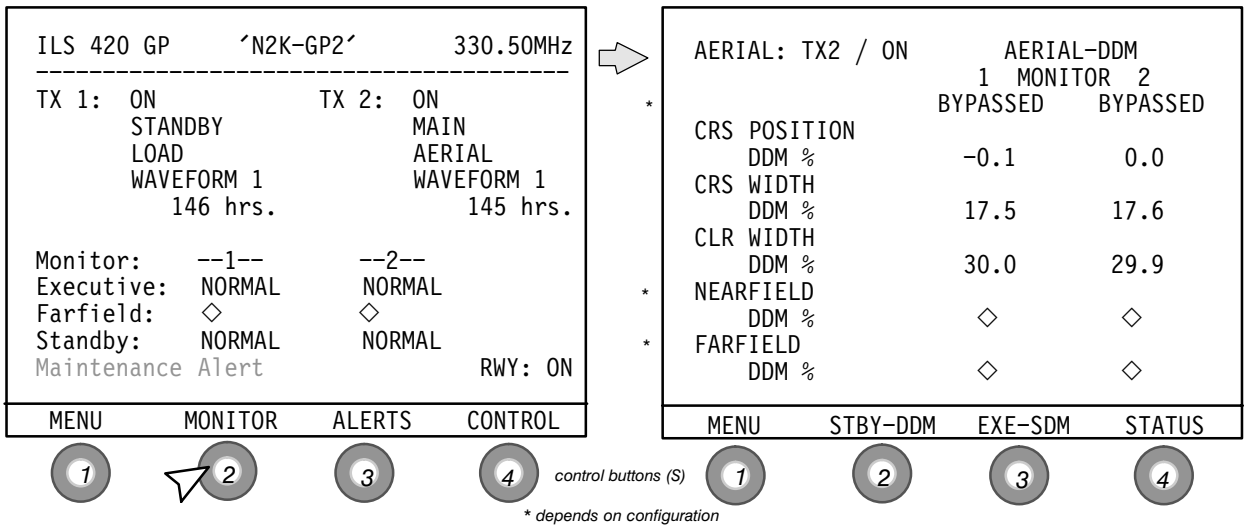


Fig. 3−7 MONITOR select and Monitor Exec. DDM window (example)

– In the Monitor Exec. SDM window the following button definitions are used:

S1	MENU	to go to Menu List window (see Fig. 3–15)
S2	EXE-DDM	to change to Monitor Exec. DDM window (see Fig. 3–7)
S3	STBY-SDM	to change to Monitor Standby SDM window (see Fig. 3–9)
S4	STATUS	to return to the Status window (see Fig. 3–6)

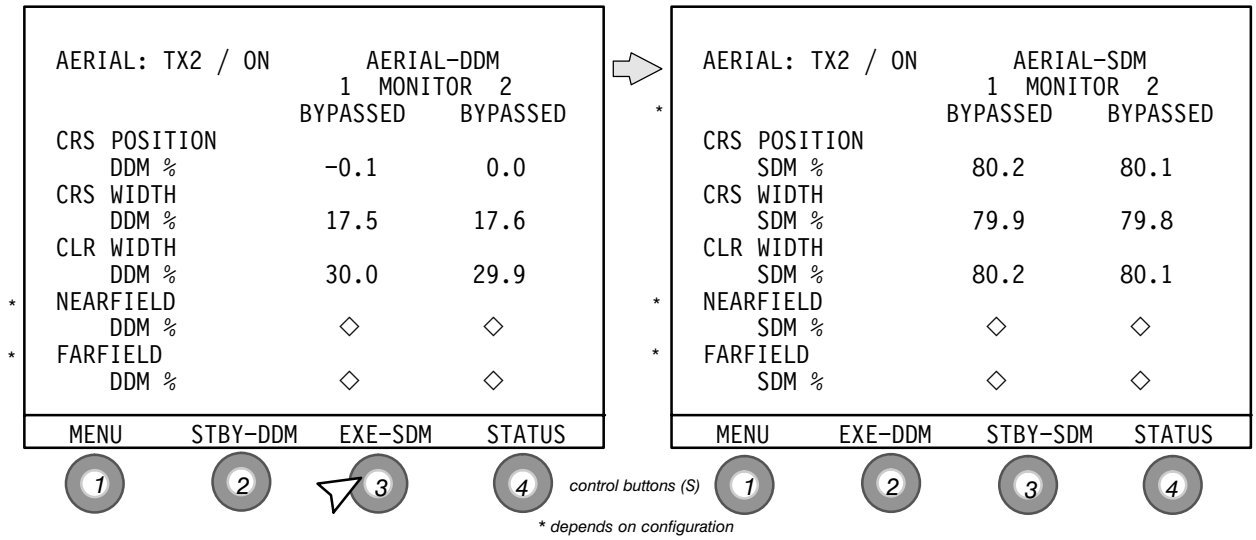


Fig. 3–8 EXE–SDM select and Monitor Exec. SDM window (example)

– In the Monitor Standby SDM window the following button definitions are used:

S1	MENU	to go to Menu List window (see Fig. 3–15)
S2	STBY-DDM	to change to Monitor Standby DDM window (see Fig. 3–10)
S3	EXE-SDM	to change to Monitor Exec. SDM window (see Fig. 3–8)
S4	STATUS	to return to the Status window (see Fig. 3–6)

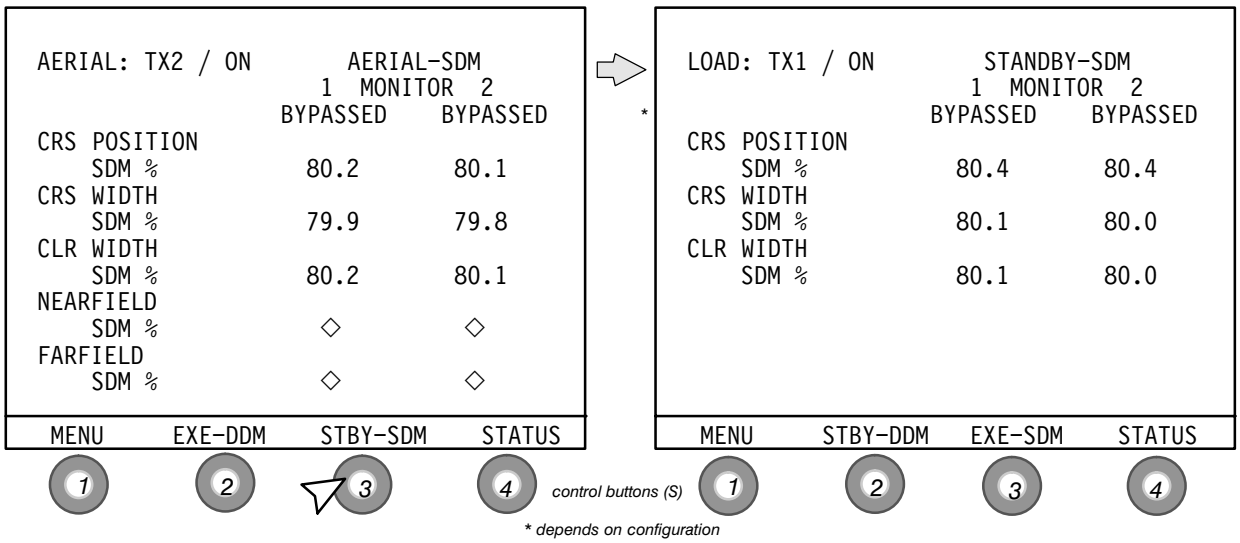


Fig. 3–9 STBY–SDM select and Monitor Standby SDM window (example)

– In the Monitor Standby DDM window the following button definitions are used:

S1	MENU	to go to Menu List window (see Fig. 3–15)
S2	EXE-DDM	to change to Monitor Exec. DDM window (see Fig. 3–7)
S3	STBY-SDM	to change to Monitor Standby SDM window (see Fig. 3–9)
S4	STATUS	to return to the Status window (see Fig. 3–6)

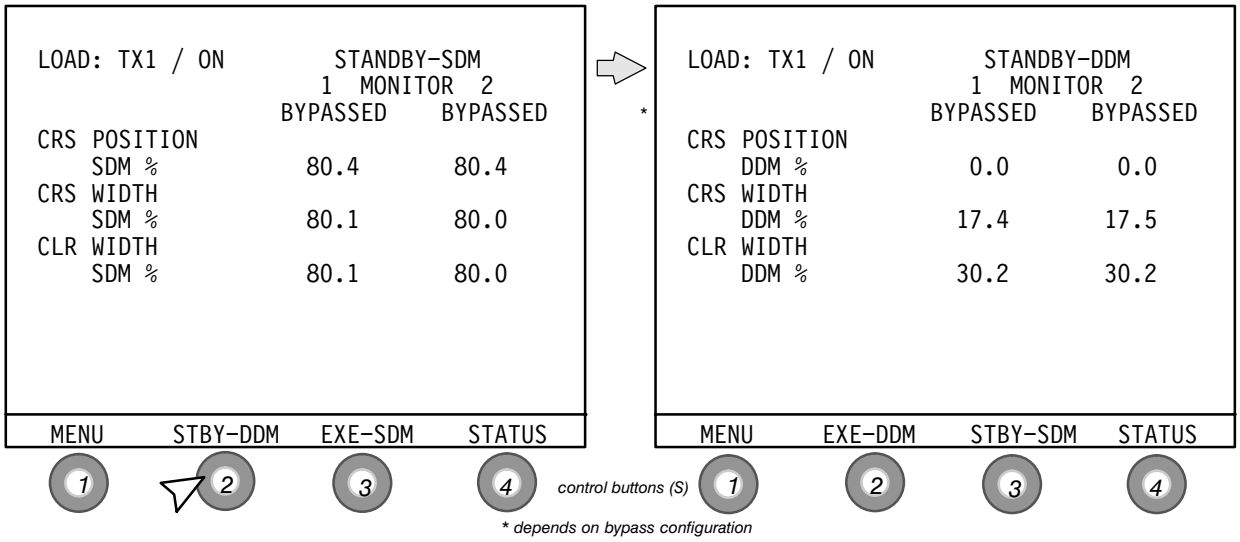


Fig. 3–10 STBY–DDM select and Monitor Standby DDM window (example)

To return to the Status window each Monitor Quick Access window provides also the STATUS button on control button S4:

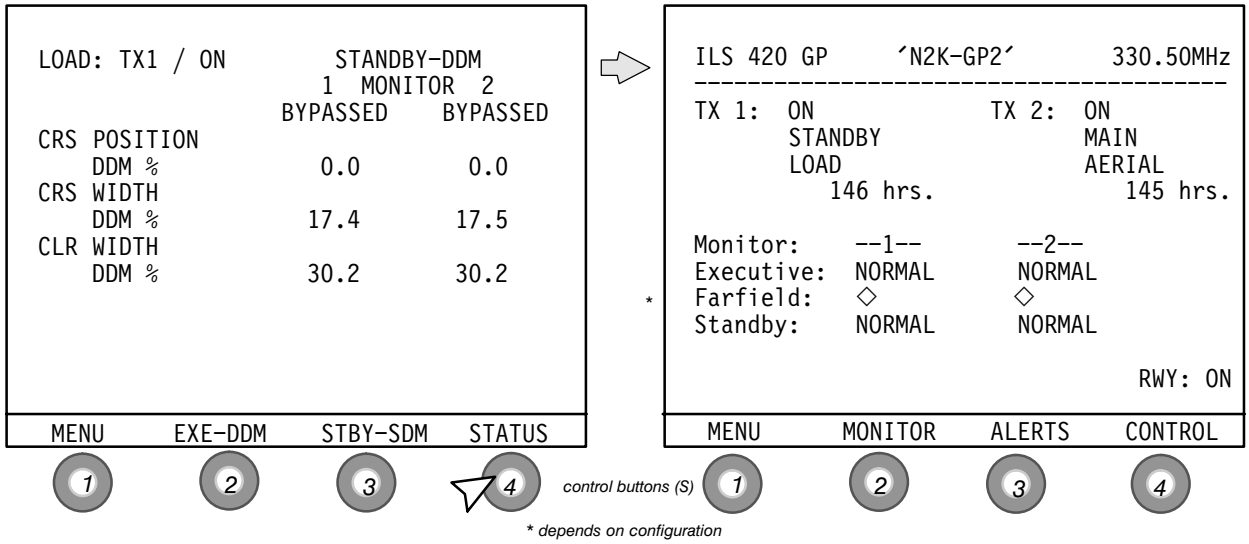
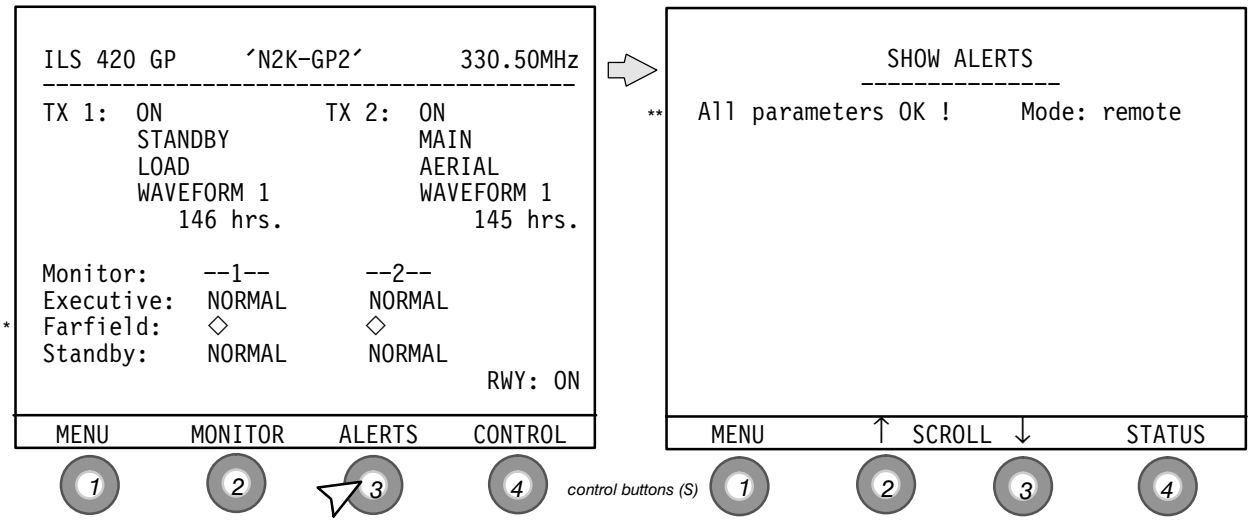


Fig. 3–11 STATUS select and return to Status window (example)

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

S1	MENU	to go to Menu List window (see Fig. 3−15)
S2	↑	to select item, upwards
S3	↓	to select item, downwards
S4	STATUS	to return to the Status window (see Fig. 3−6)



** depends on configuration*

*** contents of window depends on alarm status (list of possible (pre−)alarms see below*

Fig. 3−12 ALERTS select and SHOW ALERTS window (example)

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

- ECU Data Communication error
- ECU fault
- Executive monitor bypass on
- Farfield* monitor bypass on
- Standby monitor bypass on
- Executive prealarm
- Standby prealarm
- Farfield * prealarm
- Monitor fault
- Monitor BITE
- Transmitter change over
- Aerial Transmitter off
- Transmitter operational off
- Standby Transmitter off
- Transmitter fault
- Transmitter BITE
- Remote control communication lost
- AC 1 failure
- AC 2 failure
- Internal voltage alert
- Battery low
- Battery driven off
- Battery fuse defect
- Mains OFF
- TX1 5V DC OFF
- TX2 5V DC OFF
- BCPS OFF
- Intrusion alarm
- Smoke detector alarm
- Obstruction light alarm
- Temperature alarm
- LGM−1 data communication error
- LGM−2 data communication error
- LGA−1 data communication error
- LGA−2 data communication error
- Configuration mismatch
- Monitors disagree
- Spare A/D Alert

* Monitor name depends on configuration of 'Field Monitoring'.

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

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

S1	SWITCH	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	↑	to select item, upwards
S3	↓	to select item, downwards
S4	STATUS	to return to the Status window (see Fig. 3−6)

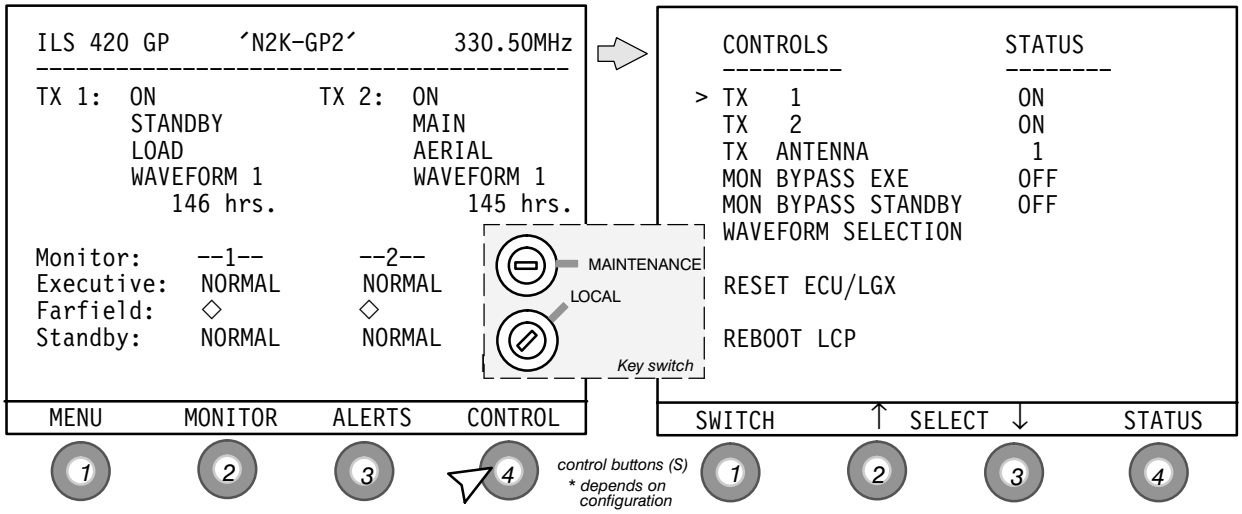


Fig. 3−13 CONTROL select and Control window (example)

In the Control window the submenu 'Waveform Selection' can be called using the SELECT keys S2 and/or S3 and then the key SWITCH. In the Waveform Selection window the defined waveform names are listed, and the following button definitions are used:

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

NOTE: After reset, WAVEFORM1 is the default setting, i.e. it should be defined as standard waveform.

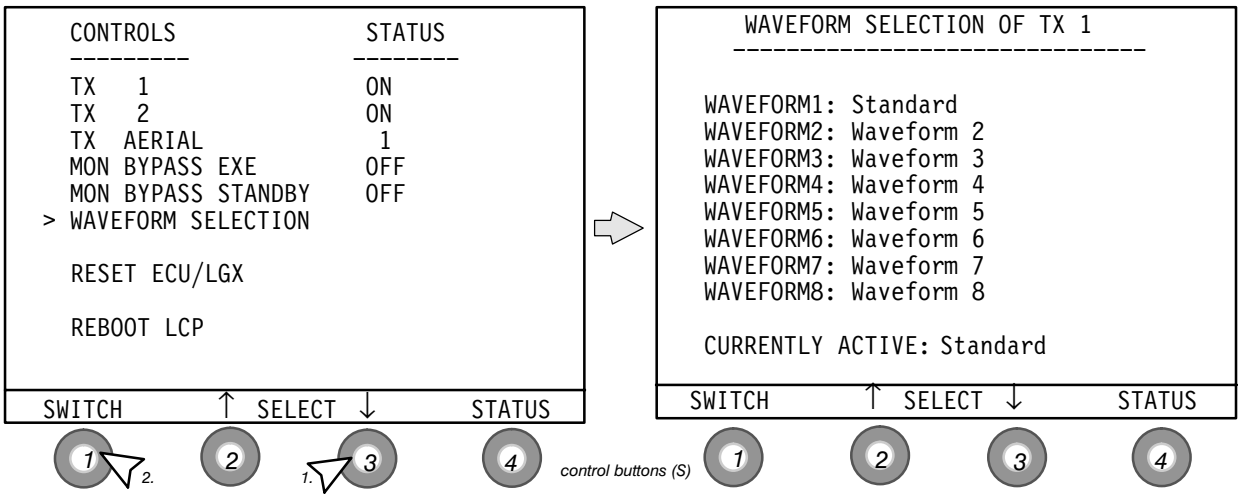


Fig. 3−14 Waveform Selection select and Waveform Selection window (example)

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

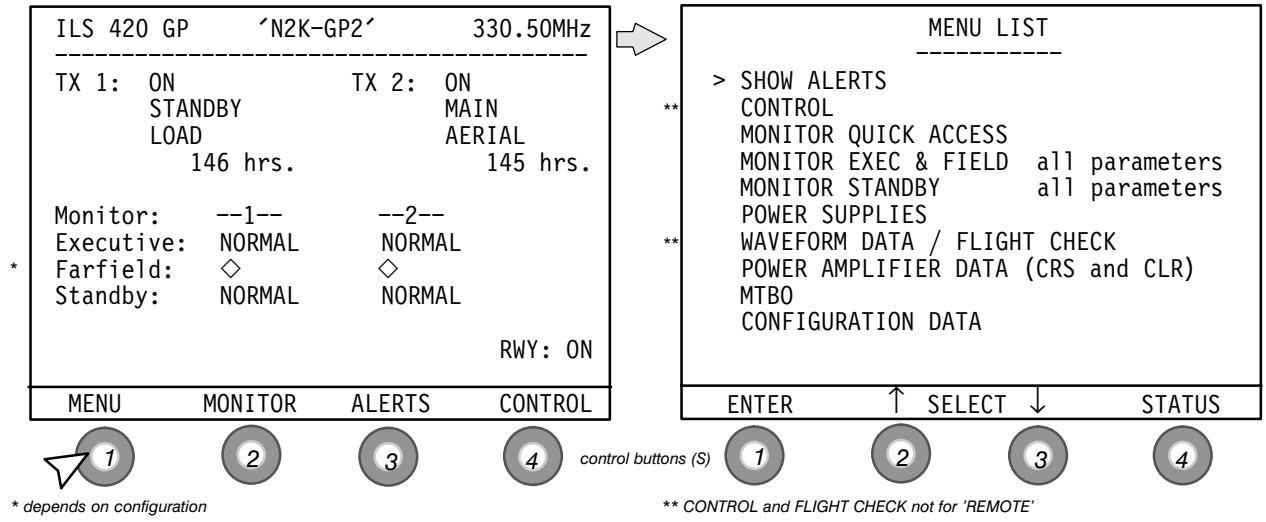


Fig. 3–15 MENU select and MENU LIST window (example)

The windows shown after selecting STATUS, SHOW ALERTS, CONTROL and MONITOR QUICK ACCESS Menu List items are already described and shown in previous Figs. 3–6 to 3–14.
Following Figs. 3–16 to 3–20 show/describe the Menu List windows after selecting the other items:

In the Monitor Exec. & Field window the following button definitions are used:
– S1 MENU to return to the Menu List window (see Fig. 3–15)
– S2 ↑ to scroll parameters upwards
– S3 ↓ to scroll parameters downwards
– S4 STBY–MON to go to Monitor Standby window (see Fig. 3–17)

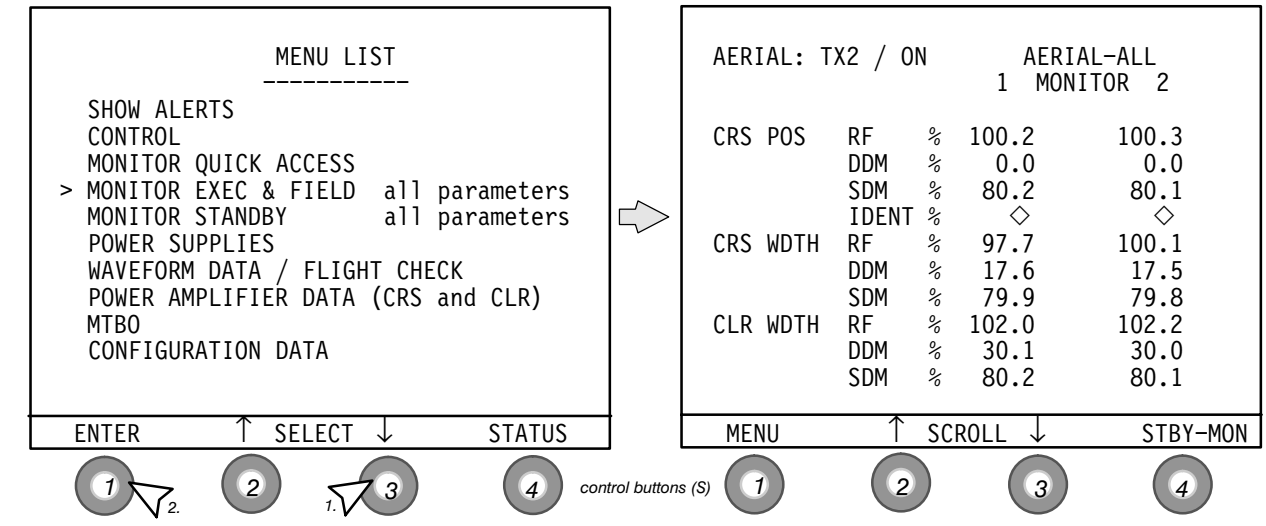


Fig. 3–16 MONITOR EXEC. & FIELD select and Monitor Exec. & Field window (example)

In the Monitor Standby window the following button definitions are used:
– S1 MENU to return to the Menu List window (see Fig. 3–15)
– S2 *blank* not used in this window
– S3 *blank* not used in this window
– S4 EXE–MON to go to Monitor Exec. & Field window (see Fig. 3–16)

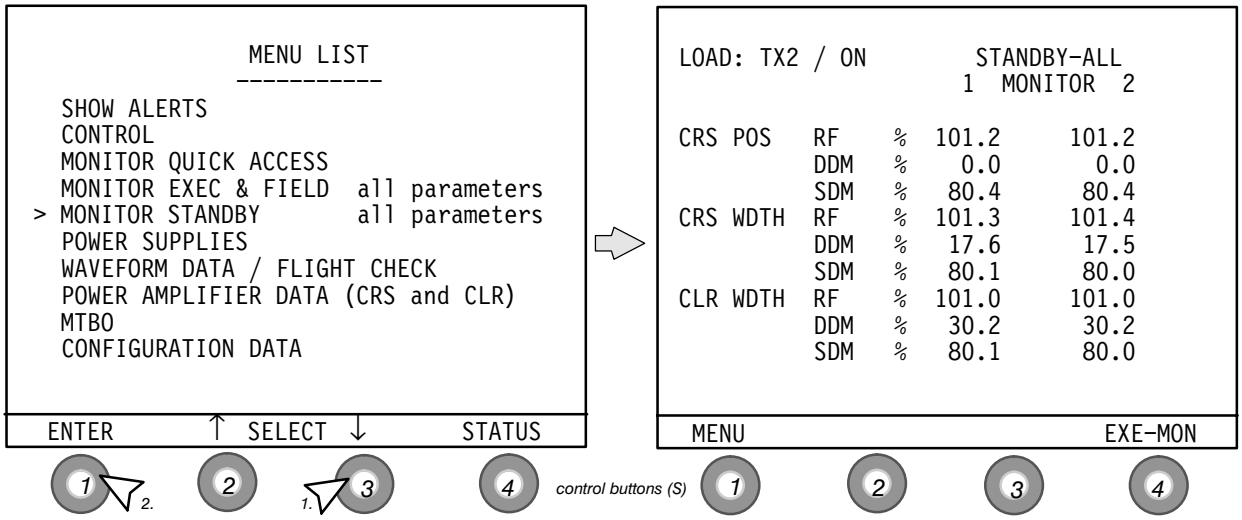


Fig. 3–17 MONITOR STANDBY select and Monitor Standby window (example)

In the Power Supplies window the following button definitions are used:
– S1 MENU to return to the Menu List window (see Fig. 3–15)
– S2 *blank* not used in this window
– S3 *blank* not used in this window
– S4 STATUS to return to the Status window (see Fig. 3–6)

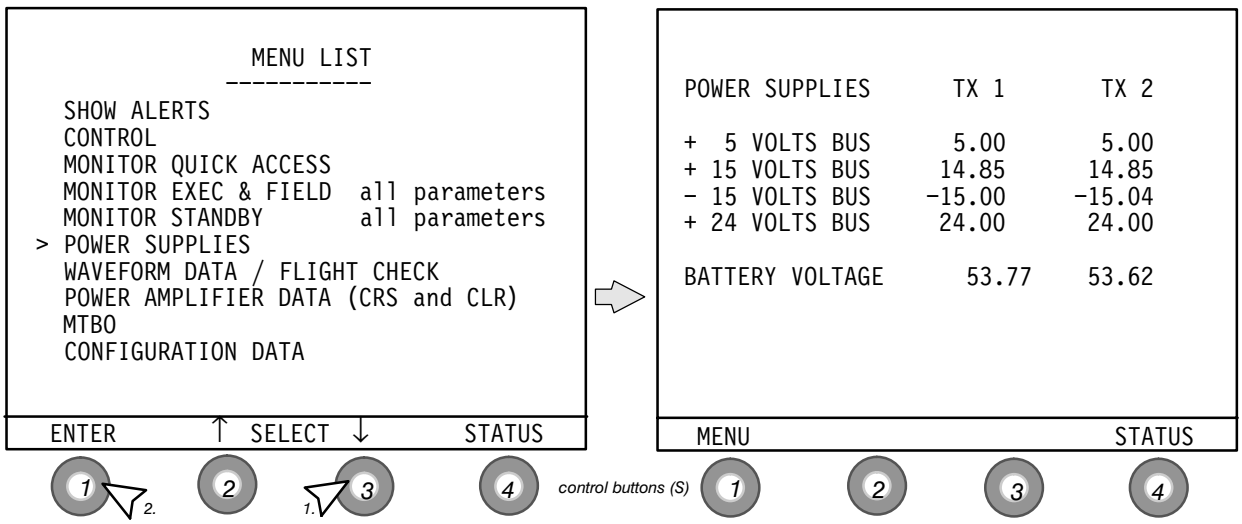


Fig. 3–18 POWER SUPPLIES select and Power Supplies window (example)

In the Waveform Data window the following button definitions are (key switch position 'REMOTE') :
– S1 MENU used to return to the Menu List window (see Fig. 3–15)
– S2 *blank* not used in this window
– S3 *blank* not used in this window
– S4 *blank* not used in this window

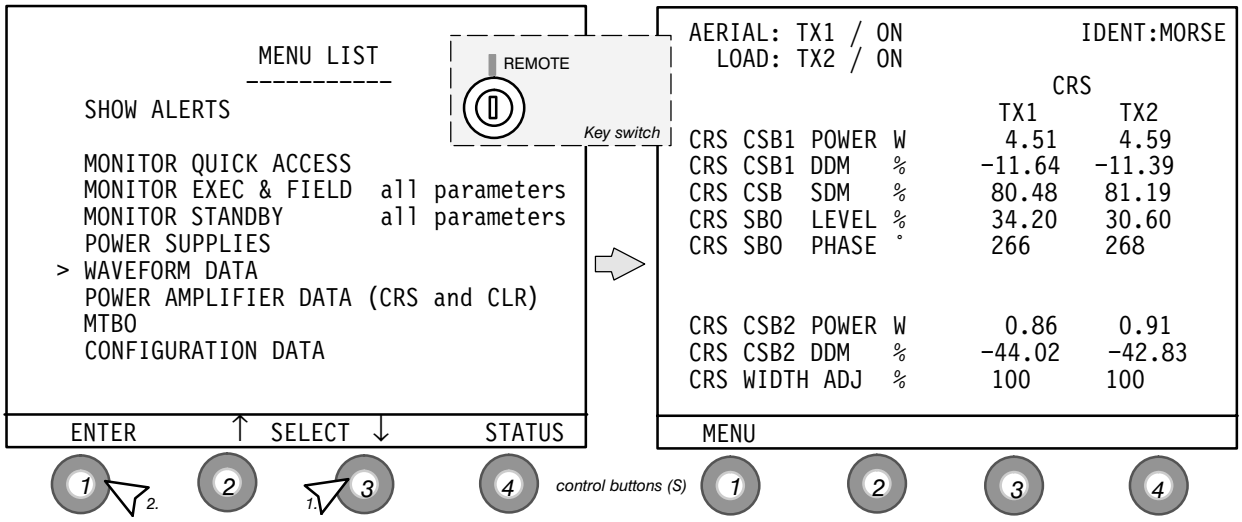


Fig. 3–19 WAVEFORM DATA select and Waveform Data window (example)

For adjustments during flight check, the LCP list item FLIGHT CHECK is visible and available in the MENU LIST in key switch position 'LOCAL' or 'MAINTENANCE' (see Fig. 3–20). This feature is used for quick access to some settings. The feature needs three steps (3 windows) to perform the settings.

In the Active Waveform Data Course window (1st step) the following button definitions are used:
– S1 CLEARANCE to go to the Active Waveform Data Clearance window
– S2 ↓ to scroll parameters downwards; selected value with black background
– S3 → to switch to parameter right; selected value with black background
– S4 MODIFY to select the parameter to be adjusted (see Fig. 3–21)

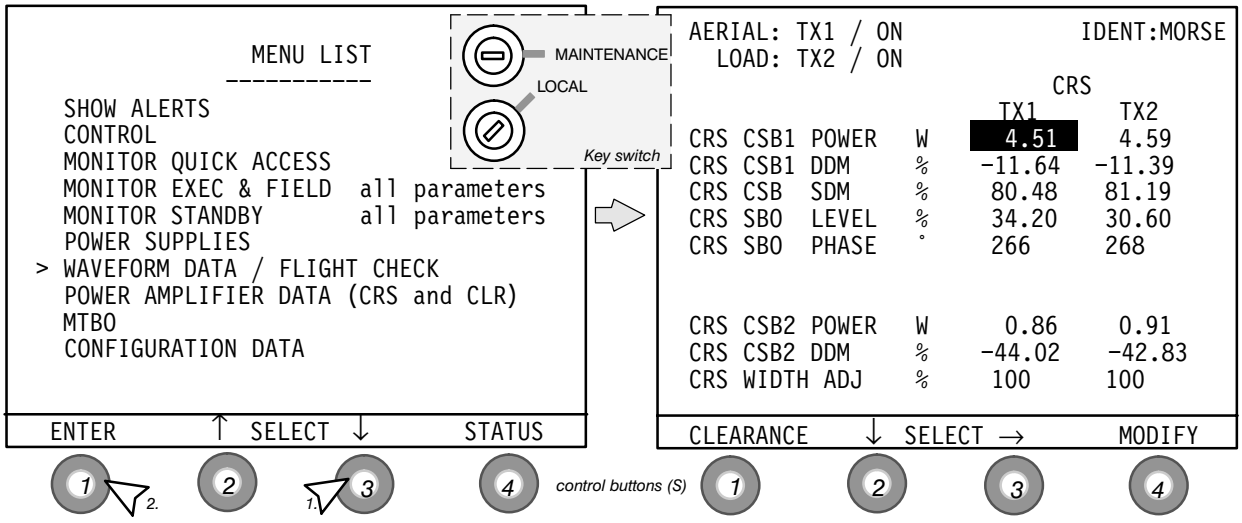


Fig. 3–20 FLIGHT CHECK select and Active Waveform Data CRS window, 1st step (example)

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

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

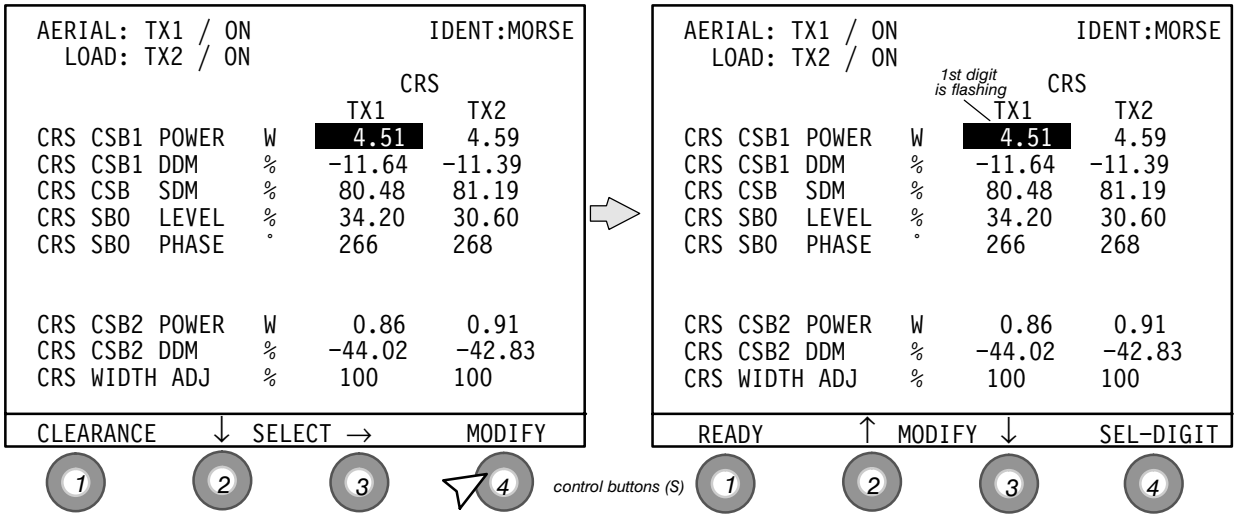


Fig. 3–21 Select parameter to change in Active Waveform Data CRS window, 2nd step (example)

Select the digit of parameter to be changed with SEL–DIGIT; the selected digit is flashing (Fig. 3–22, 1.). Change value of digit with scroll buttons (up or down; Fig. 3–22, 2.). Use READY (Fig. 3–22, 3.) to finish the setting procedure. The next window (3rd step) with changed buttons appears.

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

– S1 *blank* not used in this window
– S2 ABORT to abort the adjustment procedure without change of values
– S3 PROGRAM to confirm/program the changed value of the selected parameter
– S4 MODIFY to change again a parameter value (return to Fig. 3–21)

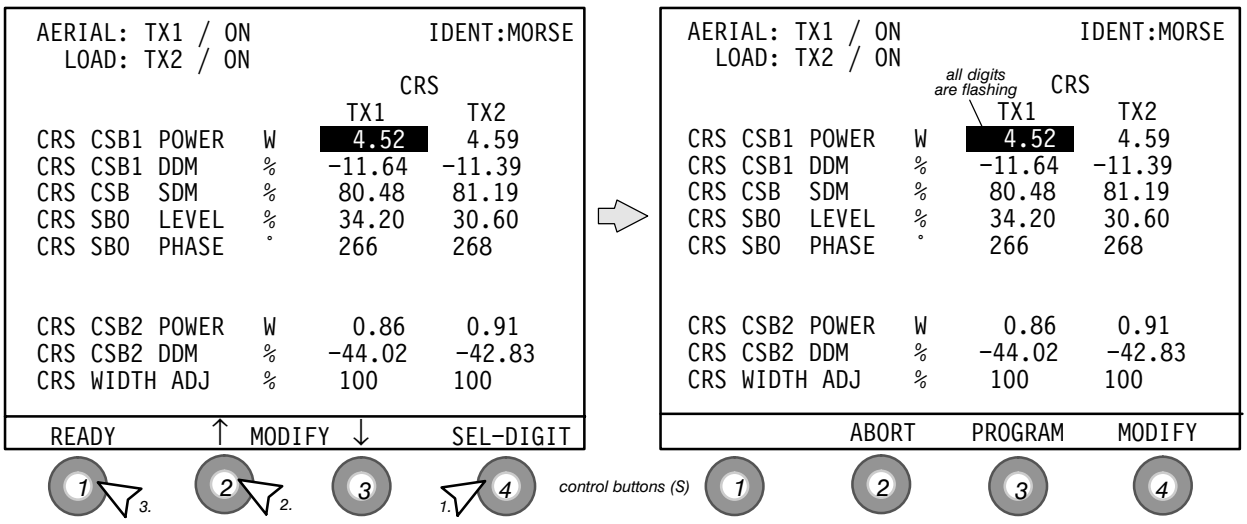


Fig. 3–22 Select digit, change value in Active Waveform Data CRS window, 3rd step (example)

Select PROGRAM to perform the change (see Fig. 3−23) or ABORT to reject the change. Both selections return automatically to the 1st step window (see Fig. 3−20). Select MODIFY to change again a parameter value in the 2nd step window (see Fig. 3−21).

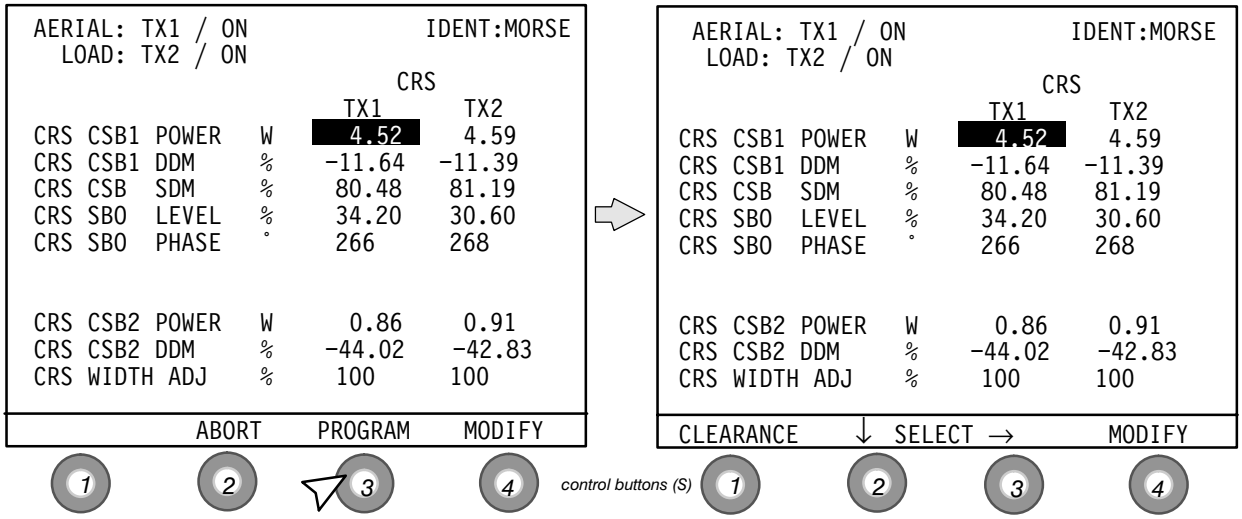


Fig. 3−23 Confirm changes in Active Waveform Data CRS window (example)

To return to the MENU LIST select CLEARANCE; the Active Waveform Data CLR window appears. Select then button MENU to return to the MENU LIST window (see Fig. 3−20).

In the Power Amplifier Data Course window the following button definitions are used:

- S1 MENU to return to the Menu List window (see Fig. 3−15)
- S2 CLEARANCE to go to the Power Amplifier Data Clearance window (see Fig. 3−25)
- S3 *blank* not used in this window
- S4 STATUS to return to the Status window (see Fig. 3−6)

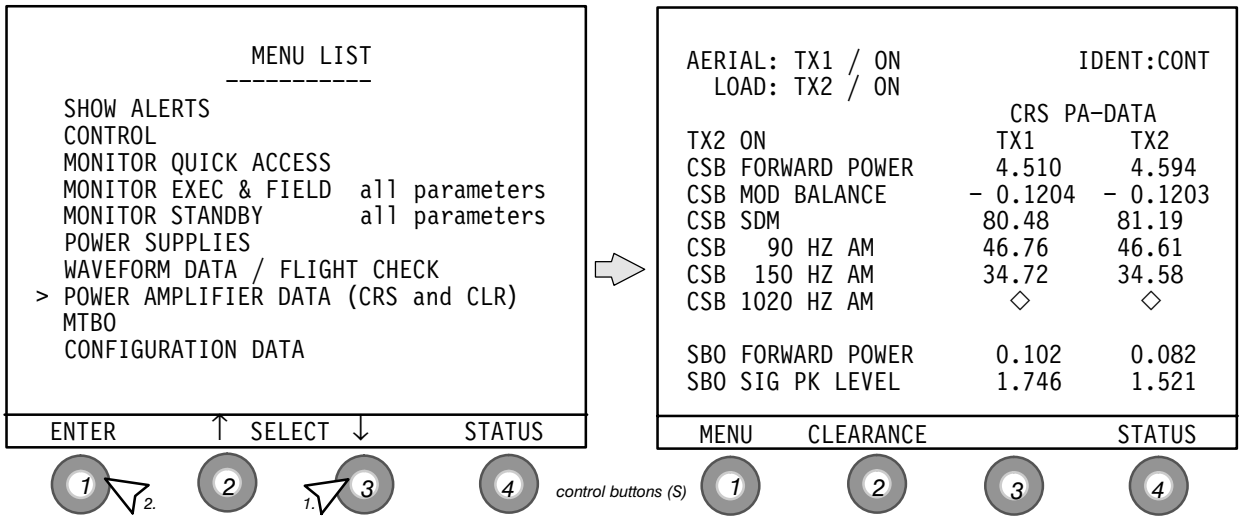
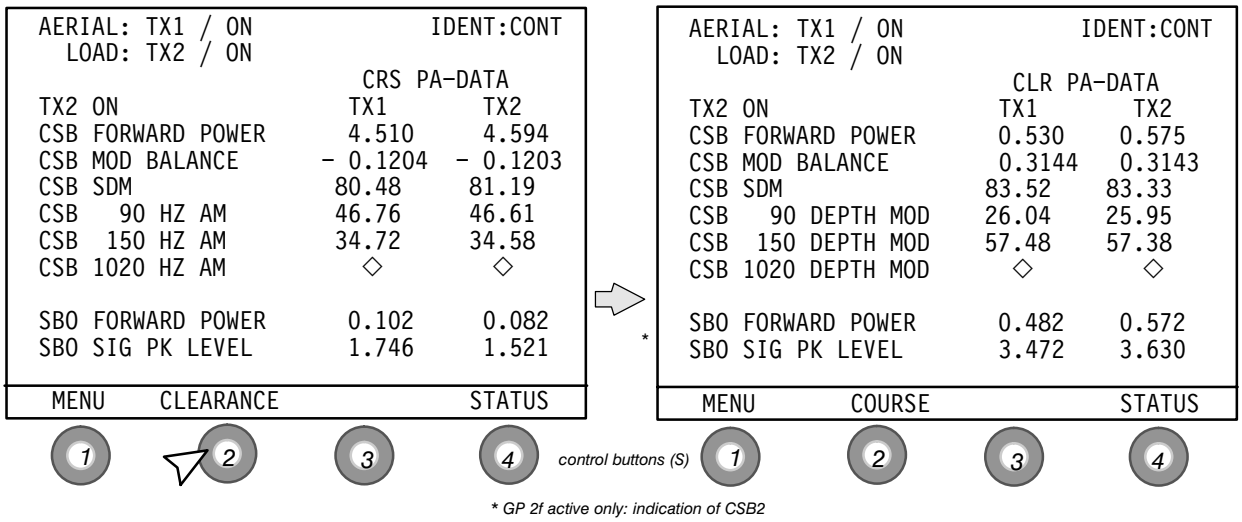


Fig. 3−24 POWER AMPLIFIER DATA (CRS and CLR) select and PA Data CRS window (example)

In the Power Amplifier Data Clearance window the following button definitions are used:

– S1 MENU to return to the Menu List window (see Fig. 3–15)
– S2 COURSE to go to the Power Amplifier Data Course window (see Fig. 3–24)
– S3 *blank* not used in this window
– S4 STATUS to return to the Status window (see Fig. 3–6)



** GP 2f active only: indication of CSB2*

Fig. 3–25 CLEARANCE select and Power Amplifier Data Clearance window (example)

In the MTBO (Mean Time Between Outage) window the following button definitions are used:

– S1 DEL/INIT to delete one or all MTBO data, or to initialize the MTBO initial value
– S2 ↑ to scroll list entries upwards for selection of an MTBO event
– S3 ↓ to scroll list entries downwards for selection of an MTBO event
– S4 STATUS to return to the Status window (see Fig. 3–6)

Select DEL/INIT, another MTBO window contains instructions for further action: to delete all MTBO data and re–initialize it (INITIAL), to delete the selected MTBO event (DELETE), or to abort the MTBO menu (ABORT). For re–initialization the MTBO INITIAL value (default: 5000) can be modified within a further MTBO window (MODIFY). Confirm new setting with READY.

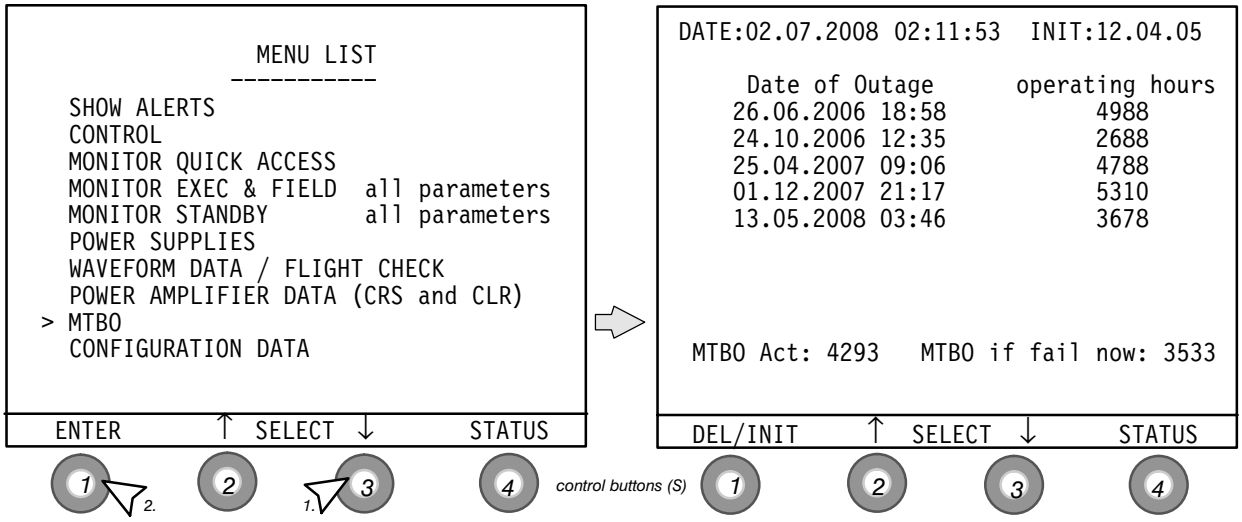


Fig. 3–26 MTBO select and MTBO list window (example)

In the Configuration Data window the following button definitions are used:

– S1 MENU to return to the Menu List window (see Fig. 3–15)
– S2 *blank* not used in this menu item
– S3 INFO to go to the Station Information window (see Fig. 3–28)
– S4 STATUS to return to the Status window (see Fig. 3–6)

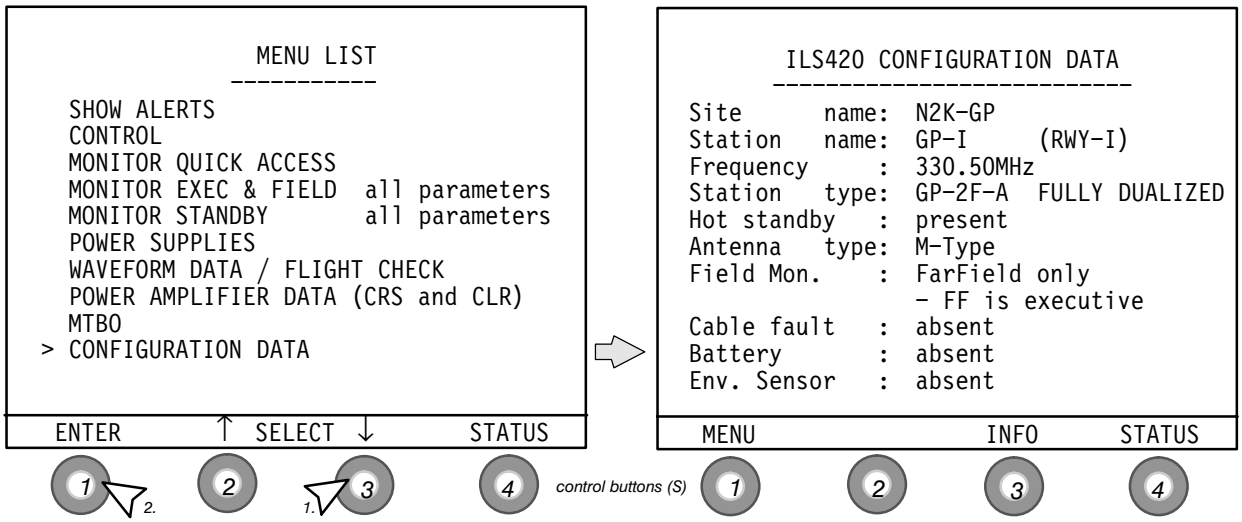


Fig. 3–27 CONFIGURATION DATA select and Configuration Data window (example)

Select INFO in the Configuration Data window (see also Fig. 3–27) to get the Station Information.

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

S1 MENU to go to the Menu List window (see Fig. 3–15)
S2 CONFIG to return to the Configuration Data window (see Fig. 3–27)
S3 ALERTS to go to the Show Alerts window (see Fig. 3–12)
S4 STATUS to return to the Status window (see Fig. 3–6)

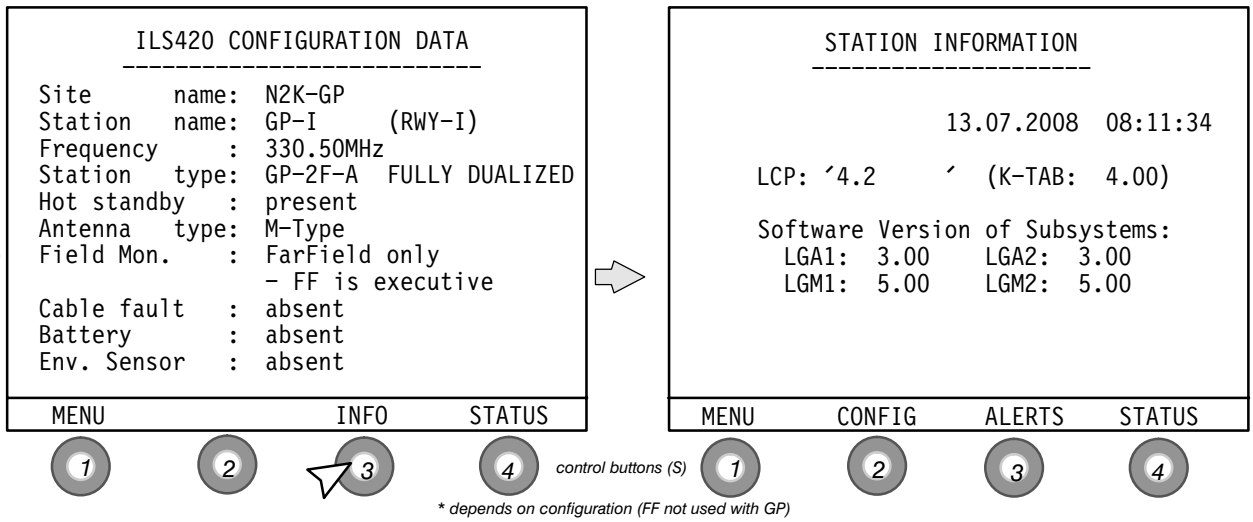


Fig. 3–28 INFO select and Station Information window (example)

CHAPTER 4
ALIGNMENT PROCEDURE
GP−1F, 0−REFERENCE AND B−TYPE

The alignment procedure of a GP−1F including prerequisites is described in a step by step way starting with 4.1. The following list is a summary and also a detailed table of contents.

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 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 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 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 thruline wattmeter
- 1 oscilloscope (dual trace, trigger delay facility)
- 1 W, 10 W measuring element (330 MHz)
- 1 DDM instrument and field strength meter (portable)
- 1 terminating resistor, 50 ohms, 10 W
- Reducers and phase adapters (TNC and SMA), possibly 90˚ or 180˚ cable (used for phasing)
- 1 RF test cable: RG 223, ca. 720 mm mechanical length, 435˚ at 328...335 MHz, TNC/f – TNC/f
- 1 pair of radiotelephones

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
- Nearfield monitor dipole* (option), installed and cabling complete.
  (* The exact location and the foundation are usually defined after flight check)
- 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 printed circuit boards (refer also to chapter 6, section 6.6.5) have to be in accordance with the system version. To enable battery backup on specific printed circuit boards and for initial settings on site refer to 4.2.1.1.
- The MCS resp. ADRACS software has been loaded to PC (refer to 4.1.1).

4.1.4 Check of Antenna Installation

This information about will be found in Part 3, Antenna System Description of the GP Technical Manual.

4.2 FIRST SWITCHING ON

4.2.1 Status of the System

— Mains OFF (mains distribution unit, 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)
— DC—switches TX1 and TX2 on subrack PS (transmitter cabinet) in position OFF

CAUTION

All CSB and SBO RF—outputs must either be terminated with a dummy load or connected to antenna. Otherwise the transmitter may be damaged when switching on the equipment.

4.2.1.1 Special Jumper Settings before Start Up

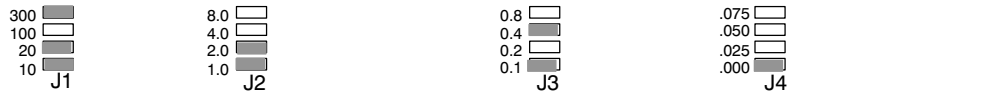
Individual jumpers have to be set before the first switching on. The location of jumpers is shown in chapter 6, section 6.6.5. Perform the following settings:

— LCP: Set jumper X36 (enabling backup battery for RTC).
— SOAC: Check that jumper J1 and J6 are set to *1—3*, *2—4* (1F installation only).
— SYN: Set jumpers J1 to J4 according to the selected operating frequency:

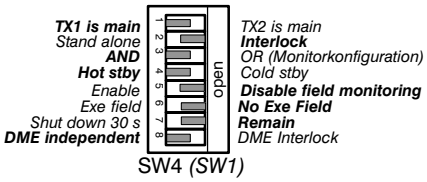
J1:	300 or 100 and tenth	J2:	units
J3:	one tenth	J4:	one hundreds and thousandths

Example: The GP frequency is selected to *333.50* MHz. Perform following settings:

330 = 300+20+10 *3 = 2+1* *.5 = .4+ .1* *.00* *= 333.50*



— ECU: Set switch SW4 (*SW1*) according to selected station configuration and jumpers J6, J7, if specific DME operation is required. This setting must correspond to software configuration data. Standard setting of SW4 (*SW1*) is:



SW4 *(SW1)*

Standard setting:	1	closed	Transmitter 1 is main
	2	open	Interlock on (control follows interlock bit)
	3	closed	Monitor AND configuration enabled
	4	closed	Hot Standby set
	5	open	Closed if farfield monitor available (FFM, LLZ)
	6	open	Closed if field monitor available and executive
	7	open	Station remains operable
	8	closed	No DME

4.2.2 Switch On

a) Connect PC serial interface connector (e.g. COM1) to RS232 connector 'Local PC' on top of the cabinet with a 'zero modem cable' (rx/tx crossed).
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 6.3.3.
d) Set DC switches TX1 and TX2 on subrack PS (transmitter cabinet) to ON.
e) Switch to local control with the key—lock switch on the Local Control Panel (LCP).

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 menus of the user program before performing the first set up procedure. The user program specific actions/procedures, which are:

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

are described in detail in the **ANNEX 'PC User Program−specific Procedures'** of this manual (see Register 8).

4.2.4 Preparing the Installation SITE with PC

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 OS.

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 function 'LOGIN' of the MASTER MENU. Enter *REU* as 'UserName' and confirm blank characters in 'Password'.

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

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

f) Select function '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 function 'SET SITE DATE & TIME'. Enter date and time.

i) Select function 'EXIT' in the MASTER MENU to close 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 start window.

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

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

g) Click 'Reset SITE' of menu 'RC Management' 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 start window.

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

k) Click 'Exit' to close program.

4.2.5 Enter Station Configuration Data

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

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

b) Switch both TX on and set all monitor bypass on.

c) Open the Station Configuration dialog.

d) Enter all required parameters in the dialog window. Verify that the parameter 'Standby configuration' is set to 'Hot'.

NOTE: Settings in d) must correspond to the settings of the DIP–FIX switch SW4(SW1) on ECU board!

e) Switch both TX off.

NOTE: It is recommended for the first setup procedure to note down all settings and values which have been performed in the individual steps of alignment. This is useful because the values should be remembered in the setup sequence of the procedure.

4.3 CHECK ANTENNA MATCHING

NOTE: Use same power probe for the ratio measurement !

Check the matching of all antennas, one after the other, as described below:

a) Connect cable for A1, coming from transmitter, via wattmeter directly to the supply cable of the antenna which must be measured. Terminate output A2 with dummy load 50 ohms/10 W.

b) Switch TX1 on. Set TX1 on aerial.

c) Open dialog 'Transmitter1−Waveform Data#1'.

d) With 0−Reference: Set 'CRS CSB RF−Level' to 1 W.

With B−Type: Set 'CRS CSB RF−Level' to 1 W. Set 'SBO RF Level' to 0 %.

NOTE: If need be, set CRS CSB DDM=0 % and CRS CSB SDM=0 % (depends on instrument used).

e) Form the ratio between the forward and reverse signals with the wattmeter. The matching value should be >20 dB. If not, examine the antenna and the supply cable.

f) Switch TX1 off.

g) Connect next antenna cable (A2) to wattmeter and repeat steps b), e), f).

h) Connect all the RF cables as normal again at the end of the matching measurements.

4.3.1 B−Type only: Power distribution Power Adder (PAD−S)

REMARK: Phase shifter Z3 (Fig. 4−1) is set to 0° as default setting. A change of this setting may be performed during field phasing or flight check measurements.

a) Measurement procedure:
This check entails supplying the CRS CSB signal to the input COURSE SBO (see Section 4.3.1b). The inputs not in use must be terminated each with a 50 ohm resistor. The CRS SBO power remains set to 0.

NOTE: With B−Type, the input J3 CLEARANCE of the PAD−S is used as input for CRS SBO.

The power at the outputs to the antennas is measured by the wattmeter, where A1= lower antenna (L), A2= upper antenna (U).

Connect all RF cables as normal again after the measurements.

CAUTION

Set CSB to 1 W before supplying to input J3 of the PAD−S. Remove external attenuator if used!

b) CSB supplied to input J3 (CLEARANCE) of the PAD−S. Set CRS CSB to 1 W. Check power ratio: A1 : A2 = 0 dB (±0.3 dB)

NOTE: Corresponds to level ratio difference of ±3.5 %. Note value: .....dB

REMARK: Install 6 to 10 dB attenuator at PIN diode transfer switch again if previously removed !

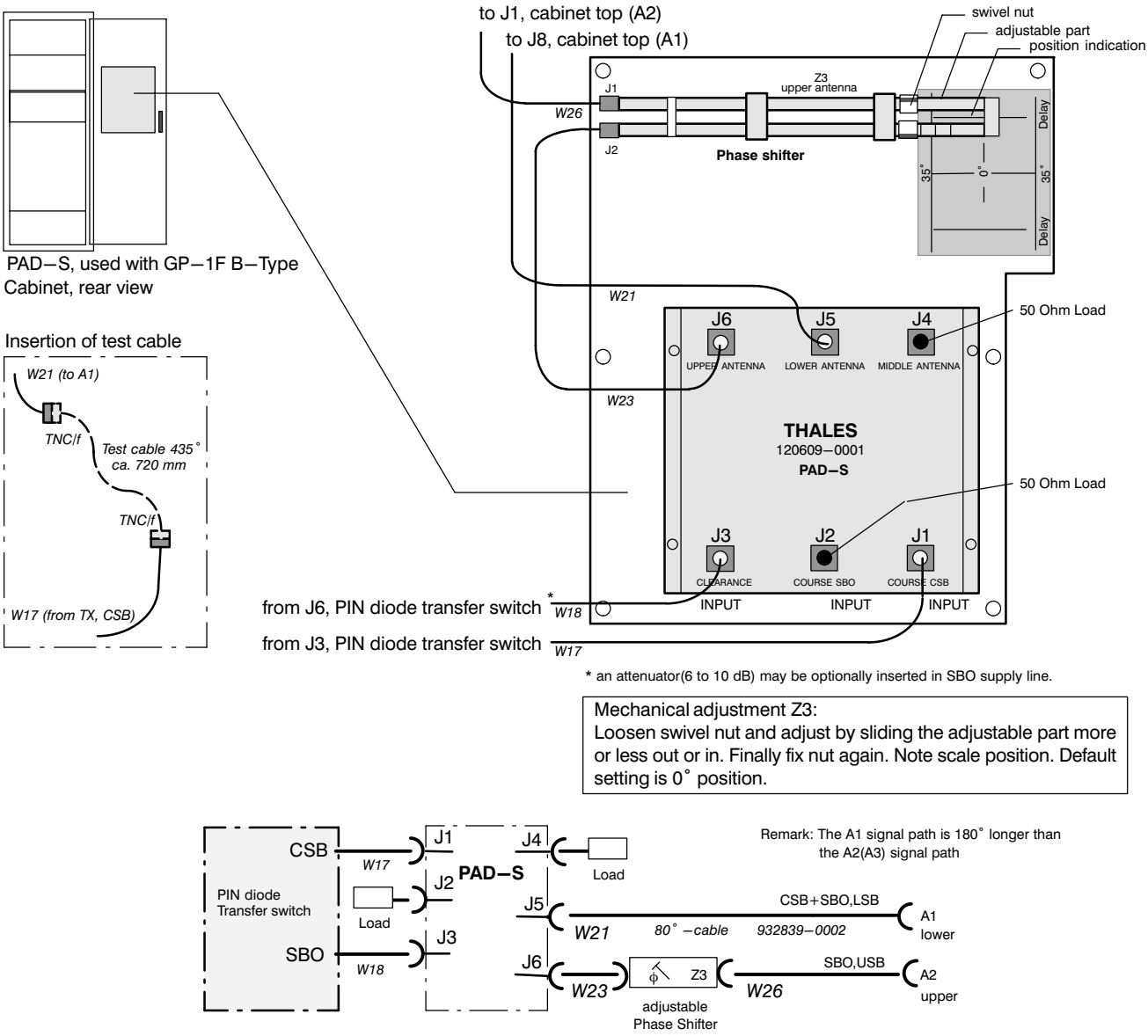


Fig. 4–1 Power Adder PAD–S

4.4 SETTING OF TRANSMITTER

4.4.1 CRS CSB Power

a) TX1 and TX2 are switched off.

b) Connect cable for A1, coming from transmitter, via wattmeter.

c) Switch both TX on and set TX1 on aerial.

d) Open dialog 'Transmitter1−Waveform Data#1', open dialog 'Transmitter2−Waveform Data#1'.

NOTE: If need be set CRS CSB DDM=0 % and CRS CSB SDM=0 % (depends on instrument used).

e) With 0−Reference: Set 'CRS CSB RF−Level' to a value to measure 4.0 W at wattmeter.

With B−Type: Set 'CRS CSB RF−Level' to a value to measure 1.0 W at wattmeter. Note value.

f) Set TX2 on aerial.

g) Adjust TX2 according to TX1.

h) Switch both TX off.

i) Connect RF cable for A1 as normal again.

4.4.2 SDM and DDM Setting

a) TX1 and TX2 are switched off.

b) Connect Field Receiver to integral monitor cable from A1.

c) Switch TX1 on.

d) Open dialog 'Transmitter1−Waveform Data#1', open dialog 'Transmitter2−Waveform Data#1'.

e) With 0−Reference: Set CRS CSB SDM and DDM value to measure 80 % SDM and 0 % DDM at the receiver.

With B−Type: Set 'CRS SBO Amplitude' to 0 %. Set CRS CSB SDM and DDM value to measure 80 % SDM and 0 % DDM at the receiver.

f) Switch TX2 on.

g) Set TX2 on aerial.

h) Adjust TX2 according to TX1.

i) Switch both TX off.

j) Connect integral monitor cable for A1 as normal again.

4.5 RF PHASING

4.5.1 0−Reference

a) TX1 and TX2 are switched off.

b) Switch TX1 on.

c) Open dialog 'Transmitter1−Waveform Data#1', open dialog 'Transmitter2−Waveform Data#1'.

d) Set 'CRS CSB DDM' and 'CRS CSB SDM' to the set values adjusted in 4.4.2, to get 80 % SDM, 0 % DDM.

e) Set 'CRS SBO Amplitude' to 50 %.

f) Measure the DDM on centerline at the middle marker (or with farfield antenna at the counter Localizer) with the portable DDM instrument, then set the 'CRS SBO phase' so that the DDM instrument indicates 0 % DDM (quadrature phase).

NOTE: All antennas A1 and A2 should be visible ! If not change location to get view on all antennas.

g) Add or subtract 90° to or from the phase value determined and enter as the new value. The DDM instrument should now indicate a DDM with predominant 150 Hz. If not, a further 180° must be either added or subtracted.

NOTE: 150 Hz >90 Hz according +..,.% (the sign depends on the DDM instrument used)

h) Switch TX2 on.

i) Set TX2 on aerial.

j) Adjust TX2 according to TX1, steps d) to g).

k) Switch both TX off.

4.5.2 B−Type

4.5.2.1 CSB/SBO Phasing via Antenna A1 and CRS SBO Setting

a) TX1 and TX2 are switched off.
Connect output J6 (A2) of the Power Adder PAD−S (see Fig. 4−1) to a 50 ohm terminating resistor (instead of the antenna). Connect Field Receiver to integral monitor cable from A1.

NOTE: A1 radiates CSB and SBO

b) Switch TX1 on. Open dialog 'Transmitter1−Waveform Data#1'.

c) Set 'CRS SBO Amplitude' to 50 %.

d) Measure the DDM with the DDM instrument. Set the CRS SBO phase so that the DDM instrument indicates DDM 0.

NOTE: Range of values: 0...359°.

e) Add or subtract 90° to or from the phase value determined in d) and enter as the new value. The DDM instrument should now indicate a high DDM with predominant 90 Hz (90 >150 Hz). If not, a further 180° must be either added or subtracted.

NOTE: Range of values: 0...359°; note value: .....

f) Adjust 'CRS SBO Amplitude' to measure 23.3 % (90>150 Hz) on DDM instrument for 0° Forward Slope, see table and graph in Fig. 5−8.

NOTE: With B−Type, the setting DDM corresponds to twice the indicated value in the table for DDM1 [A1].

g) Switch TX2 on. Set TX2 on aerial.

h) Adjust TX2 according to TX1.

i) Switch both TX off.

j) Connect cable for A2 as normal again.

4.5.2.2 A1 − A2 RF Phasing

a) The following preliminary steps must be taken at the the Power Adder:

- Connect output A2 on cabinet top to the antenna A2 as normal.
- Disconnect cable to input J1 COURSE CSB and cable to output J5 from PAD−S.
- Terminate input J1 COURSE CSB and connector J5 of PAD−S with 50 ohm load.
- Insert ”Test Cable” for phasing between removed cables W17 and W21 of J1 and J5 (Fig. 4−1).

NOTE: The electrical length (435°) of the test cable represents to the phase response of PAD−S internal path J1 to J5. A1 radiates CSB, A2 radiates SBO

b) Switch TX1 on. Open dialog ’Transmitter1−Waveform Data#1’.

c) Add +90° to the phase value determined in 4.5.2.1e) and enter.

NOTE: Value of 4.5.2.1e) = ...°

d) Adjust with e.g. phasing cables, phase plugs or with mechanical Phase Shifter Z3 (Fig. 4−1) so that the DDM instrument indicates DDM 0 at the middle marker.

e) Reset the ’CRS SBO phase’ to its original value as in 4.5.2.1e) and check that the DDM instrument now indicates a DDM with predominant 150 Hz (150 >90 Hz)

NOTE: If not, insert additional 180° cable at the output of A2.

f) Switch TX1 off.

g) Connect all antenna cables as normal again.

4.6 SETTING THE MONITORS

See Figs. 4−2 to 4−7.

The Stby and On−Air Combiner (SOAC) unit processes the input monitoring signals of the aerial and standby transmitter. It is supposed that the SOAC is factory pre−aligned. However, on site field adjustment is necessary. For correct operation the 5 monitor channels have to be set in a certain manner:

1) The RF input signal of each path on the SOAC is down converted to an 8 kHz IF signal. This signal has to be adjusted to an output signal of approx. 3.6 Vpp. The 8 kHz IF amplitudes are measured with an oscilloscope at the corresponding test points. Coarse adjustment of the input level is performed with attenuators which are inserted or bypassed with the corresponding jumpers (see section 6.6.5), if need be. Figs. 4−3 (0−Type), 4−4 (B−Type), 4−5 (Stby−channels) show the signal path, the potentiometers and the corresponding testpoints of each channel on the SOAC. Recommendation: Use a special alignment screw driver with immersed blade for the potentiometers.
If need be, e.g. phase cannot be adjusted, insert phase adapters or cables to the concerned input.

2) When the signals in the field are set correctly, the input signal to the monitors, the measured values, represent nominal values and have to be entered in the data windows (open dialog 'Monitor1−Nominal Values' or open dialog 'Monitor2−Nominal Values').

3) The monitor has to be supplied with a calibration signal (CRS CSB) adjusted to 80 % SDM and 0 % DDM. This signal is used to calibrate the monitor channel. With a known SDM and DDM, the monitor is able to calculate the third unknown parameter: the RF−LEVEL.

4) Finally the original signal is supplied to the monitor. With this signal, the monitor has to be normalized. The automatic normalization procedure runs only if the actual DDM and SDM values do not vary to much from the Nominal Values !

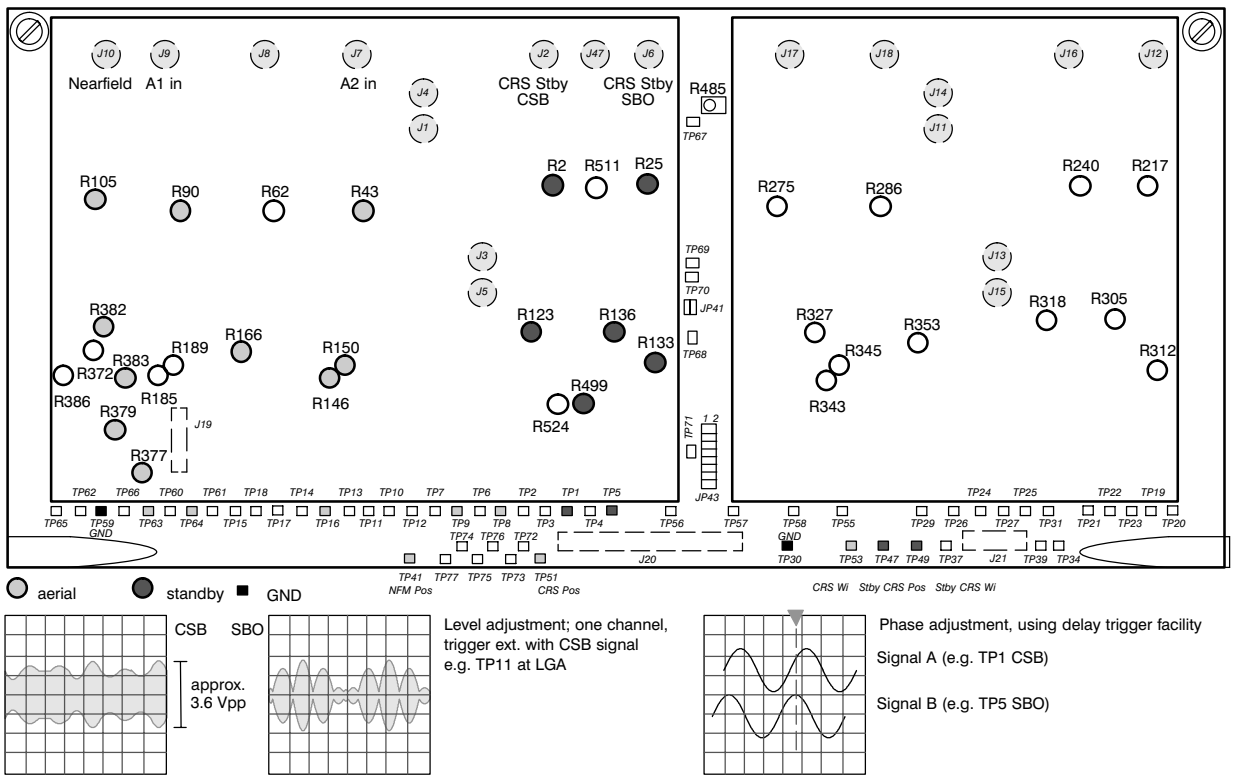


Fig. 4−2 Adjustment controls and test points of SOAC

4.6.1 Adjustment Procedure of Aerial Channels

See Figs. 4−2, 4−3, 4−4, 4−6 and 4−7. The SOAC signal path used is set to *7−8 (0−Ref.)* or *5−6 (B−Type)* on J19 of SOAC. Use amplifier (+15 dB) in the input path only if absolutely necessary.

4.6.1.1 0−Reference

4.6.1.1.1 CRS Posn. Channel (Input connector J9 (A1))

a) Connect oscilloscope to TP51 and TP59 (GND). Measure output level.

b) Adjust IF gain to achieve approx. 3.6 Vpp output: perform first coarse alignment removing or inserting attenuators with JP16,17 or J18,19; perform fine adjustment with R90 and finally R377.

4.6.1.1.2 CRS Width Channel (Input connector J7 (A2) and A1 IF signal)

a) Connect oscilloscope to TP8 and TP59 (GND). Measure output level.
Adjust IF gain of A2 path (SBO) to measure approx. 1 Vpp at TP8: perform first coarse alignment removing or inserting attenuators with JP7,8 or J9,10; perform fine adjustment with R43.

b) Check relative A1 − A2 phase with oscilloscope: measure between TP63 (A1) and TP64 (A2), see Fig. 4−3, 4−6, 4−7. Adjust with R166 to 180°.

c) Connect oscilloscope in succession to TP63 (A1), TP64 (A2) and finally to TP53 and TP59 (GND). Initially adjust with R379 to approx. 3 Vpp at TP63. R382 is set to mid position. CRS Width DDM is defined by the CSB/SBO ratio set with R383 (SBO) and R379 (CSB), measured at the correspondent testpoints. The levels should approximately be: CSB=TP63=3 Vpp; SBO=TP64=0.3 Vpp. Finally adjust output level with R382 to approx. 3.6 Vpp at TP53, after setup of Width DDM.

4.6.1.1.3 NFM Channel (Input connector J10). Refer also to 4.6.3.3

a) Connect oscilloscope to TP41 and TP59 (GND). Measure output level.

b) Adjust IF gain to achieve approx. 3.6 Vpp output: perform first coarse alignment removing or inserting attenuators with JP22 or J23,24; perform fine adjustment with R105.

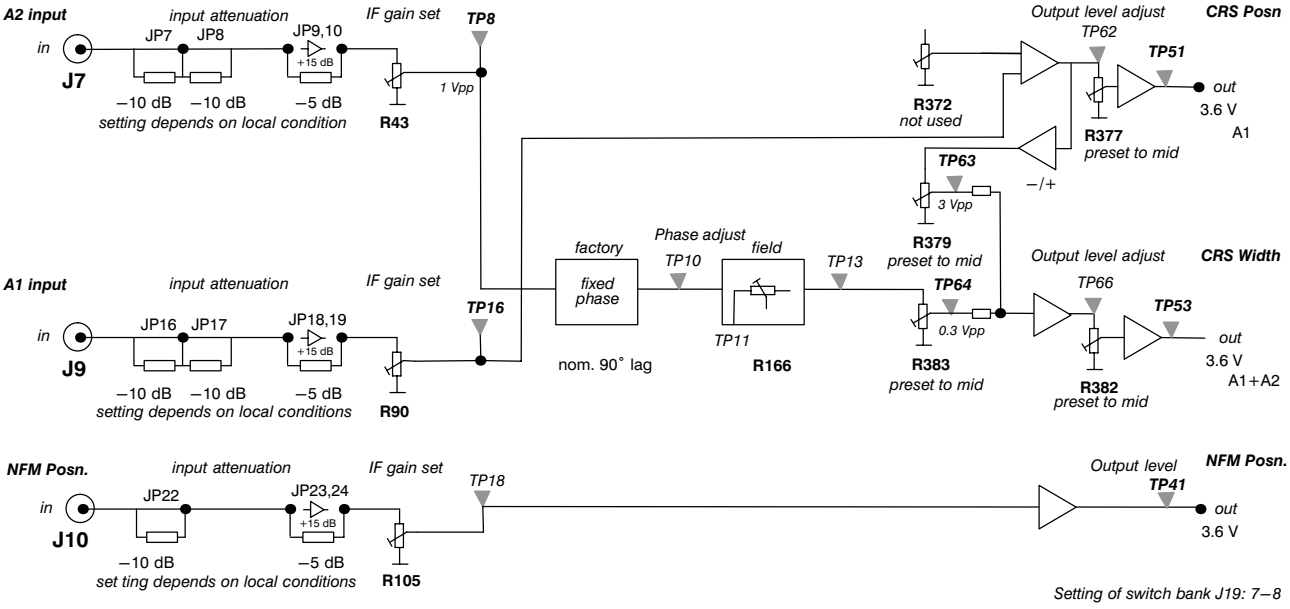


Fig. 4−3 Adjustment of detector channels for aerial monitoring (GP−1F 0−Reference)

4.6.1.2 B−Type

4.6.1.2.1 CRS Posn. Channel (Input connector J9 (A1) and J7 (A2))

a) Connect oscilloscope to TP16 (or TP62) and TP59 (GND). Measure output level.
Adjust IF gain of A1 path to measure approx. 6 Vpp at TP16 or TP62: perform first coarse alignment removing or inserting attenuators with JP16,17 or JP18,19; perform fine adjustment with R90.

b) Connect oscilloscope to TP8 and TP59 (GND).
Adjust IF gain of A2 path to measure approx. 1 Vpp at TP8: perform first coarse alignment removing or inserting attenuators with JP7,8 or JP9,10; perform fine adjustment with R43.

c) Check relative A1 − A2 phase with oscilloscope: measure between TP16 (A1) and TP9 (A2), see Fig. 4−4, 4−6, 4−7. Adjust with R146 to 180˚. R150 is factory set.

d) Connect oscilloscope to TP62 or TP51 and TP59 (GND).
CRS Posn. DDM is defined by A1 to A2 ratio: adjust with R372, measured at TP62, to cancel the SBO component. Finally adjust output level with R377 to achieve approx. 3.6 Vpp at TP51.

4.6.1.2.2 CRS Width Channel (Input connector J7 (A2) and (A1+A2) IF signal)

a) IF gain of A2 path is already aligned in 4.6.1.2.1 .

b) Check relative A1 − A2 phase with oscilloscope: measure between TP63 (A1) and TP64 (A2), see Fig. 4−4, 4−6, 4−7. Adjust with R166 to 180˚. R150 is factory set.

c) Connect oscilloscope in succession to TP63 (A1), TP64 (A2) and finally to TP53 and TP59 (GND). Initially adjust with R379 to approx. 3 Vpp at TP63. R382 is set to mid position. CRS Width DDM is defined by the CSB/SBO ratio set with R383 (SBO) and R379 (CSB), measured at the correspondent testpoints. The levels should approximately be: CSB=TP63=3 Vpp; SBO=TP64=0.3 Vpp. Finally adjust output level with R382 to approx. 3.6 Vpp at TP53, after setup of Width DDM.

4.6.1.2.3 NFM Channel (Input connector J10). Refer also to 4.6.3.3.

a) Connect oscilloscope to TP41 and TP59 (GND). Measure output level.

b) Adjust IF gain to achieve approx. 3.6 Vpp output: perform first coarse alignment removing or inserting attenuators with JP22 or J23,24; perform fine adjustment with R105.

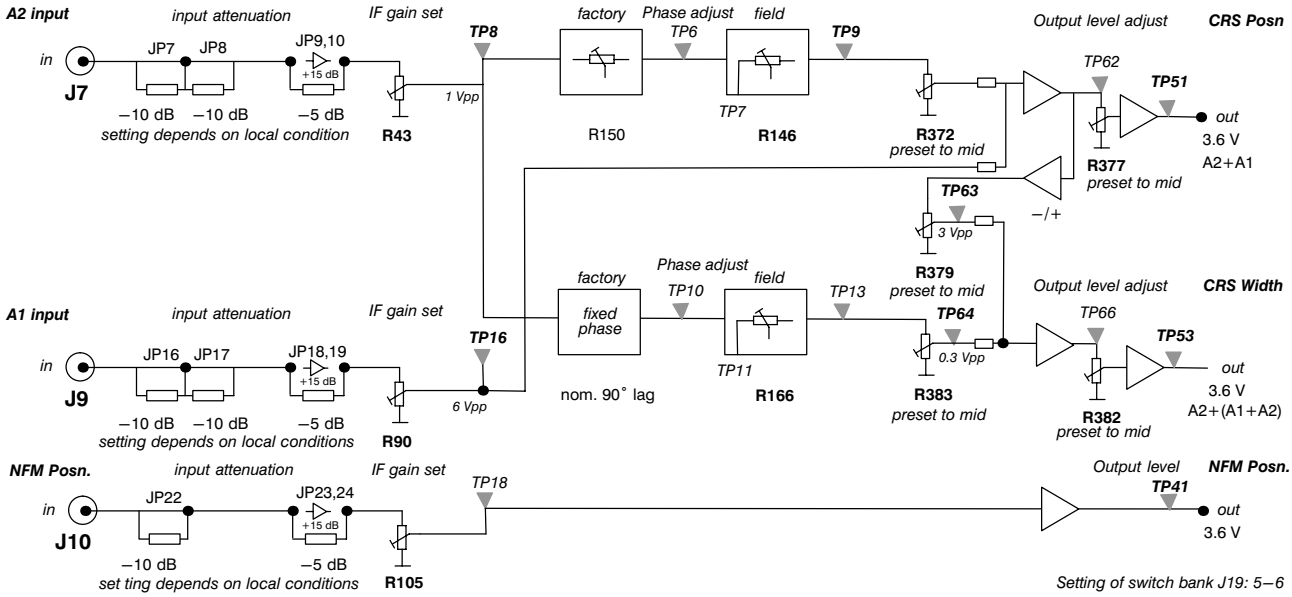


Fig. 4−4 Adjustment of detector channels for aerial monitoring (GP−1F B−Type)

4.6.2 Adjustment Procedure of Standby Channels

See Figs. 4−2, 4−5 to 4−7.

4.6.2.1 **StbyCRS Posn. Channel** (Input connector J2)

a) Connect oscilloscope to TP47 and TP59 (GND). Measure output level.

b) Adjust IF gain to achieve approx. 3.6 Vpp output: R499 is set to mid position. Perform first coarse alignment removing or inserting attenuators with JP2,3; perform fine adjustment with R2. Phase adjustment with R123 is factory set and not needed for Posn. channel.

4.6.2.2 **Stby CRS Width Channel** (Input connector J6)

a) Connect oscilloscope to TP4 and TP59 (GND).
Adjust IF gain of SBO path to measure approx. 0.3 Vpp at TP4: perform first coarse alignment removing or inserting attenuators with JP4,5; perform fine adjustment with R25.

b) Check relative CSB − SBO phase with oscilloscope, measure between TP1 (CSB) and TP5 (SBO), see Fig. 4−5, 4−6, 4−7. Adjust with R136 to 0˚. R123 is factory set.

c) Connect oscilloscope in succession to TP72, TP73 and finally to TP49 and TP59 (GND). Initially adjust with R499 to approx. 3 Vpp at TP72. Stby CRS Width DDM is defined by CSB/SBO ratio set with R25 (SBO) and R499 (CSB), measured at the correspondent testpoints. The levels should approximately be: CSB=TP72=3 Vpp; SBO=TP73=0.3 Vpp. Finally adjust output level with R133 to approx. 3.6 Vpp, after setup of Width DDM.

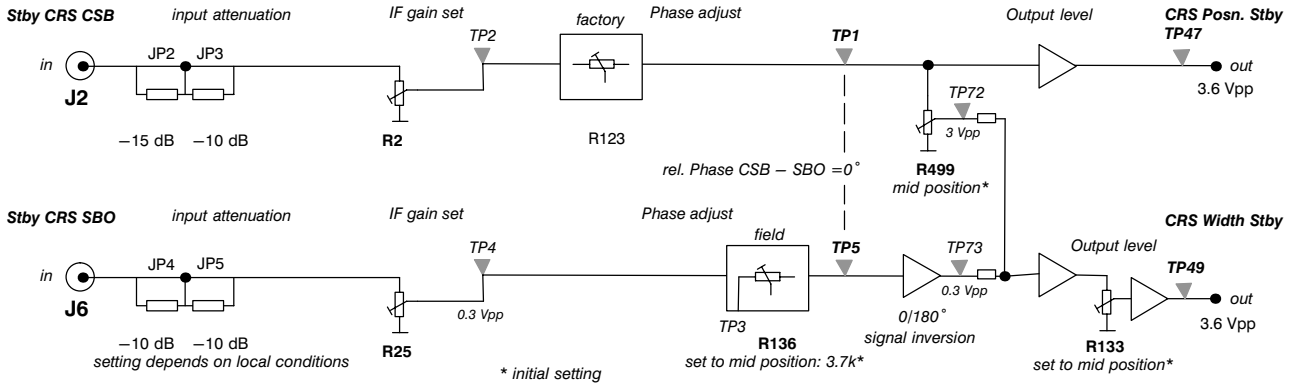
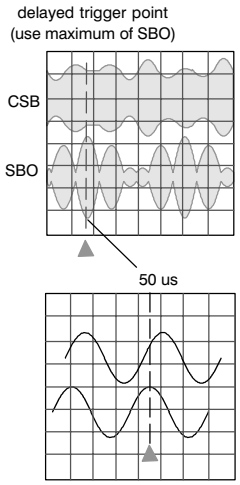


Fig. 4−5 Adjustment of detector channels for standby monitoring



Phase adjustment, using delay trigger option
Signal A (e.g. TP63 CSB)
Signal A (e.g. TP1 CSB) stby
Signal B (e.g. TP64 SBO)
Signal B (e.g. TP5 SBO) stby

NOTE:
For more clear representation, the use of an analog oscilloscope is recommended. For the phase alignment procedure, the delayed trigger segment of 50 us has to be in a range of the signals where the amplitudes rise in the same direction to get correct phasing. Check the trigger position of the signal if the result seems to be in the opposite phase range (e.g. 180˚ rotated); read also PC user program monitor result for correct sign. If the phase cannot be adjusted insert phase adapters or phasing cables to achieve a sufficient setting range of the potentiometers.

Recommended measurement procedure:
Adjust the scope so that both signals are equal in amplitude. Turn on the ADD and INVERT functions. Make the signal now created on the scope as flat as possible. This will ensure the signals are within a couple of degrees. It is very important that these two signals are in phase.

Oscilloscope setting:

Channel 1	CSB
Channel 2	SBO, position below or on same line
V/div.	0.5
Trigger	internal, channel 1 (or ext., from LGA, TP11)
Time sweep	0.1 ms; delayed: 50 us
Time delay	Adjust to show a sine curve segment

Fig. 4−6 Relative phase adjustment procedure

4.6.3 Calibration and Normalization of Integral Monitors

NOTE: Before performing this procedure it is recommended to check alarm limits acc. 4.6.5.

a) Switch both TX on and set TX1 on aerial.

4.6.3.1 Integral Monitoring CRS POS (DDM 0 %)

a) RF—level of the corresponding path on the SOAC (Figs. 4—2, 4—3 or 4—4) is set to amplitude of 3.6 Vpp as described in 4.6.1.

b) Open dialog 'Monitor1—Nominal Values' and open dialog 'Monitor2—Nominal Values'. Enter the measured values (DDM 0 %; SDM 80 %) for 'EXEC CRS Position DDM' and 'EXEC CRS Position SDM'.

c) Send to Monitor1/2 the command 'Calibration, Executive CRS Position detector'.

d) Send to Monitor1/2 the command 'Normalization, Executive CRS Position detector'.

NOTE: The automatic normalization procedure runs only if the actual DDM and SDM values do not vary to much from the nominal values !

4.6.3.2 Integral Monitoring CRS Width (DDM 17.5 %)

a) RF—level of the corresponding path on the SOAC (Figs. 4—2, 4—3 or 4—4) is set to amplitude of 3.6 Vpp as described in 4.6.1.

b) Open dialog 'Monitor1—Nominal Values' and open dialog 'Monitor2—Nominal Values'. Enter the measured values (DDM 17.5 %; SDM 80 %) for 'EXEC CRS Width DDM'.

c) Disconnect SBO A2 cable from input to SOAC and terminate both with 50 ohms.

d) Send to Monitor1/2 the command 'Calibration, Executive CRS Width detector'.

e) Connect SBO A2 cable as normal.

NOTE: The procedure enables to calibrate to 17.5 % within a range of about 17 % to 18 %. This is normally achieved by an accurate adjustment of the ratio of CSB to SBO as performed in 4.6.1.1.2 or 4.6.1.2.2 . If the value is out of range it may be necessary to adjust to a reading of 17.5 % with R383.

f) Send to Monitor1/2 the command 'Normalization, Executive CRS Width detector'.

4.6.3.3 Nearfield Monitor (DDM 0 %), optional (if available)

REMARK: Usually the location of the optional nearfield monitor dipole is exactly determined really during flight check. The check and adjustment described here can be executed either after determination of the location or using a provisionally mounted monitor dipole at the theoretical location (see section 4.10).

a) Set the RF—level of the corresponding path on the SOAC (Figs. 4—2, 4—3 or 4—4) to amplitude of 3.6 Vpp as described in 4.6.1.

b) Open dialog 'Monitor1—Nominal Values' and open dialog 'Monitor2—Nominal Values'. Enter the measured values (DDM 0 %, SDM 80 %) for 'Nearfield Pos. DDM' and 'Nearfield Pos. SDM'.

c) Send to Monitor1/2 the command 'Calibration, Executive Nearfield Pos. detector' (or 'Executive Ch. 4 Width detector').

d) Send to Monitor1/2 the command 'Normalization, Executive Nearfield Pos. detector' (or 'Executive Ch. 4 Width detector').

4.6.4 Calibration and Normalization of Standby Monitors

NOTE: Before performing this procedure it is recommended to check alarm limits acc. 4.6.5.

a) Switch TX2 on.

4.6.4.1 Adjustment of Standby Monitoring CRS POS (DDM 0 %)

a) RF—level of the corresponding path on the SOAC (Figs. 4—2, 4—5) is set to 3.6 Vpp amplitude as described in 4.6.2.

b) Open dialog 'Monitor1—Nominal Values' and open dialog 'Monitor2—Nominal Values'. Enter the nominal values (DDM 0 %; SDM 80 %) for 'Stby CRS Position DDM' and 'Stby CRS Position SDM'.

c) Send to Monitor1/2 the command 'Calibration, Standby CRS Position Detector'.

d) Send to Monitor1/2 the command 'Normalization, Standby CRS Position Detector'.

4.6.4.2 Adjustment of Standby Monitoring CRS WIDTH (DDM 17.5 %)

a) RF—level of the corresponding path on the SOAC (Figs. 4—2, 4—5) is set to 3.6 Vpp amplitude as described in 4.6.1 and 4.6.2.

b) Open dialog 'Monitor1—Nominal Values' and open dialog 'Monitor2—Nominal Values'. Enter the nominal values (DDM 17.5 %; SDM 80 %) for 'Stby CRS Width DDM'.

c) Disconnect SBO A2 cable from input to SOAC and terminate both with 50 ohms.

d) Send to Monitor1/2 the command 'Calibration, Standby CRS Width detector'.

e) Connect SBO A2 cable as normal.

NOTE: The procedure enables to calibrate to 17.5 % within a range of about 17 % to 18 %. This is normally achieved by an accurate adjustment of the ratio of CSB to SBO as performed in 4.6.2.2. If the value is out of range it may be necessary to adjust to a reading of 17.5 % with R25.

f) Send to Monitor1/2 the command 'Normalization, Standby CRS Width detector'.

4.6.5 Check Alarm Limits

NOTE: If upper limit is equal to lower limit, executive monitoring is not available. The alarm limits are recommended values. A part of these will be checked and defined during Flight Check.

4.6.5.1 Executive Alarm Limits

a) Open dialog 'Monitor 1 − Executive Alarm Limits' and open dialog 'Monitor 2 − Executive Alarm Limits' (for MCS: dialogs 'Monitor 1/2 − Limits: Current Executive Data').

b) Check that RF level alarm limits for all monitors are set to:
71 % (lower limit) and 110 % (upper limit); also used: 120 % (upper limit).

c) Check that SDM alarm limits for all monitors are set to:
76 % (lower limit) and 84 % (upper limit).

d) Check that POS DDM alarm limits for all monitors are set to:
−5.4 % (lower limit) and +5.4 % (upper limit) (CAT I to III).

e) Check that CRS WIDTH DDM alarm limits for all monitors are set to:
−4.3 % (lower limit) and +4.3 % (upper limit) of the actual value;
example for 17.5 %: 13.2 % (lower limit) and 21.8 % (upper limit).

NOTE: CAT II and III only !

f) Check that RF level alarm limit for the monitors is set to:
71 % (lower limit) and 129 % (upper limit).

g) Check that SDM alarm limit for the monitors is set to:
76 % (lower limit) and 84 % (upper limit).

h) Check that POS DDM alarm limit for the monitors are set to:
−5.4 % (lower limit) and +5.4 % (upper limit) (CAT I to III).

NOTE: Values of f) to h) are the alarm limits for the optional nearfield monitor.

i) Check that Alarm delay time is set to: CAT I: 10 s; CAT II: 5 s; CAT III: 2 s (prefer. 1 s); NF: 20 s.

4.6.5.2 Standby Alarm Limits

a) Open dialog 'Monitor 1 − Standby Alarm Limits' and dialog 'Monitor 2 − Standby Alarm Limits' (for MCS: dialogs 'Monitor 1/2 − Limits: Current Standby Data').

b) Check that RF level alarm limits for all monitors are set to:
71 % (lower limit) and 110 % (upper limit); also used: 120 % (upper limit).

c) Check that SDM alarm limits for all monitors are set to:
76 % (lower limit) and 84 % (upper limit).

d) Check that POS DDM alarm limits for all monitors are set to:
−5.4 % (lower limit) and +5.4 % (upper limit) (CAT I to III).

e) Check that CRS WIDTH DDM alarm limits for all monitors are set to:
−4.3 % (lower limit) and +4.3 % (upper limit) of the actual value;
example for 17.5 %: 13.2 % (lower limit) and 21.8 % (upper limit).

NOTE: CAT II and III only !

REMARK: Check pre−alarm limits. If need be adjust to 80 % of alarm limit value (recommended).

4.7 BATTERY MONITORING

If emergency batteries are available, the battery voltage can be monitored to avoid over discharge of batteries. For this purpose, a warning level can be set and a low level limit can be set.

NOTE: A battery switch off to avoid deep discharge is executed via the separate LVS—circuit and the relay located on the BP—PS subrack.

a) Open dialog 'LRCI — Environmental Setup'.

b) Enable 'Battery Low Monitoring' by selecting 'Alarm Maint. Alert' or 'Alarm Degradation'.

NOTE: 'Alarm Maint. Alert' means indication only, 'Alarm Degradation' means action.

c) Set 'Battery Warning Level' to e.g. 46.0 V.

NOTE: Setting range: 40 to 50 V.

d) Set 'TX off if battery lower than' to e.g. 44.0 V.

NOTE: Setting range: 40 to 50 V.

4.8 NORMAL OPERATION

a) Switch both TX on and set TX1 on aerial.

b) Check that no MONITOR ALARM or TX WARNING is on, otherwise locate and eliminate the fault.

c) Set TX2 on aerial.

d) Check that no MONITOR ALARM or TX WARNING is on, otherwise locate and eliminate the fault.

e) Set TX1 on aerial.

f) Set all Monitor Bypass off.

NOTE: NORMAL should light up in MAIN STATUS field.

4.9 FLIGHT CHECK

The following describes procedures for flight check. However scope and sequence of this procedures may vary depending on the individual flight check crew. It is assumed that TX1 is the aerial transmitter. Set to monitor bypass mode during flight check procedure.

NOTE: A local LCP menu "FLIGHT CHECK ADJUSTMENT" is available for some level or phase adjustments during flight check, e.g. for CSB and SBO. This menu item is only available in *'Local'* mode position of the key switch on the LCP.

4.9.1 Antenna Height Check

The height of each antenna must be checked separately by measuring the field strength null.

NOTE: These measurements are complex. Either fly along the null, which is however almost impossible, or fly horizontally and evaluate the nulls.

The following null requirements must be fulfilled:

		0–Reference	B–Type
– A1	=	2 • glide angle	4 • glide angle
– A2	=	Glide angle (most important null)	4/3 • glide angle

The Glide angle is generated by SBO radiated over A1 and A2

If not, correct the antenna heights individually: $h_{new} = h_{old}$ • *(actual angle : setpoint)*

The following steps must be taken prior to the flight check:

a) Switch TX1 off.

b) Remove RF cables for A1, A2 on top of the cabinet. Terminate A2 output with 50 ohms/10 W.

c) Connect the antenna to be checked directly to output for A1 (CSB out).
REMARK: Before connecting the next antenna, switch off TX each time !

d) Switch TX1 on. Let the flight check perform a level run.

e) Switch TX1 off.

f) Interconnect equipment as normal.

4.9.2 SDM and DDM 0 Check (TX1, TX2)

a) 0–Reference: Connect SBO output (A2) to a dummy load (50 ohms/10 W).
B–Type: Disconnect SBO supply cable W18 from J3 of PAD–S (see Fig. 4–1).
Terminate W18 and J3 with a dummy load (50 ohms/10 W).

b) Switch both TX on and set TX1 on aerial.

c) Correct DDM and SDM, if necessary, according to the flight check measurements.

d) Set TX2 on aerial and make the same corrections as in step c).

e) Switch both TX off. Reconnect output (A2) or supply cable W18 as normal.

4.9.3 Phasing CSB – SBO

a) 0–Reference: Switch both TX on and set TX1 on aerial. Proceed with step b).
B–Type: Disconnect supply cable W23 from output J6 (A2) of the PAD–S (see Fig. 4–1).
Terminate J6 with a 50 ohm resistor. A1 radiates CSB and SBO.
Switch both TX on and set TX1 on aerial. Proceed with step b).

b) Add 90° to the actual phase (quadrature condition).

c) Correct the phase so that the flight check measures 0 µA.

d) Add or subtract 90° again. A predominant 150 Hz signal should be measured below the glide angle by the flight check.

e) Set TX2 on aerial and repeat step b), c), d) for TX2.

f) Switch both TX off. B–Type: Reconnect supply cable W23 as normal.

4.9.3.1 B−Type only: RF Phasing A1 − A2

a) The following preliminary steps must be taken at the the Power Adder (PAD−S):
   − Connect output A2 on cabinet top to antenna A2 as normal.
   − At PAD−S, disconnect cable W17 to input J1 COURSE CSB and cable W21 to output J5. Terminate connector J1 COURSE CSB and J5 of PAD−S with 50 ohm load.
   − Insert ”Test Cable” for phasing between removed cables W17 and W21 of J1 and J5 (Fig. 4−1).

   NOTE: The electrical length (435°) of the test cable represents to the phase response of PAD−S internal path J1 to J5. A1 radiates CSB, A2 radiates SBO.

b) Switch both TX on and set TX1 on aerial. This check is to be performed only with one TX.

c) Add 90° to the actual phase (quadrature condition). Correct the phase with e.g. phasing cables, phase plugs or with mechanical Phase Shifter Z3 so that the flight check measures 0 µA.

d) Add or subtract 90° again. A predominant 150 Hz signal should be measured below the glide angle by the flight check.

e) Switch both TX off. Connect all antenna cables as normal again.

4.9.4 Glide Angle Check

If the measured glide angle deviates too much from the nominal glide angle, the heights of antennas A1, A2 must be corrected.

4.9.5 Width Setting

a) Switch TX1 on.

b) According to the announcement of the flight check crew, the transmitter parameter ’CRS SBO Amplitude’ must be corrected as specified by the flight check crew.

   NOTE: The correction corresponds to the SBO setting for the 0−Reference Glide Path.

4.9.6 Monitor Readjustment

The settings made during the flight check make it necessary to readjust some of the monitor parameters. Repeat the appropriate steps in Sections 4.6.

4.9.7 Course Alarm

NOTE: See also section 4.11 Alarm Limits and Width Calculation.

a) Open dialog ’Monitor 1 − Current Executive Data’ (for MCS: dialog ’Monitor 1 − Measurements/ Limits: Current Executive Data’). Select indication ’Exec. CRS Pos. DDM’.

b) Open dialog ’Transmitter 1 − Waveform Data #1. Change ’CRS CSB DDM’ (e.g. ±5.4 %) to reach the preset alarm limits.

c) If necessary, restrict or enlarge as specified by the flight check crew.

4.9.8 Width Alarm

a) Open dialog ’Monitor 1 − Current Executive Data’ (for MCS: dialog ’Monitor 1 − Measurements/ Limits: Current Executive Data’). Select indication ’Exec. CRS Width DDM’.

b) Open dialog ’Transmitter 1 − Waveform Data #1. Change course width with parameter ’CRS SBO Amplitude’ to reach the preset alarm limits.

c) If necessary, restrict or enlarge the alarm limits as specified by the flight check crew.

4.9.9 Miscellaneous

Some other parameters must also be checked, e.g. the range. No further settings must be made with the transmitter or monitor however.

Finally, the system has to be set to normal operation, i.e. monitor bypass is removed, TX1 is aerial and the key−lock switch at the LCP is set to ”Remote”.

4.10 DETERMINING THE MONITOR LOCATION

a) TX1 is radiating as normal.

b) Calculate the theoretical location with the approximate equation:

$$D_{MON} = \frac{184827}{f \times (Glide\ Angle)^2} \qquad \text{(0−reference)}$$

$$D_{MON} = \frac{(h_2^{\,2} - h_1^{\,2}) \times f}{2 \times 300} \qquad \text{(B−type)}$$

NOTE: Glide Angle in °; f in MHz; h= antenna height in m

c) Using the portable DDM instrument to determine the point with the greatest DDM change about DDM 0, when the height of the dipole is altered by the same amount in both directions in the region of this location.

4.11 MONITOR ALARM LIMITS, COURSE WIDTH CALCULATION

– ILS, Glide path monitor alarm limits

Parameter	ICAO Annex 10	Reference−§ Annex 10	Standard setting for GP 422 (DDM)	Nom. values for flight check glideangle:3 °;coursewidth:1.44 °
90 Hz−Mod. depth	40 % ± 2.5 %	(3.1.5.5.1)		
150 Hz−Mod. depth	40 % ± 2.5 %	(3.1.5.5.1)		
SDM	80 % ± 5 %		80 % ± 4 %	
Alarm low (CAT I...III)	−7.5 % of nom. glide angle	(3.1.5.7.1)	−5.50 %	2.78°
Alarm up (CAT I...III)	+10 % of nom. glide angle		+7.30 %	3.3°
Width alarm Course CAT I	±31 % of nom. width (± 5.43 % DDM)	(3.1.5.7.1)	12.1 % ... 22.9 %	
Width alarm Course CAT II/III	±25 % of nom. width (±4.37 % DDM)	(3.1.5.7.1)	13.2 % ... 21.8 %	wide: 1.92° / narrow: 1.15°
Width alarm Clearance	>22 % DDM (>0.3 Θ)	(3.1.5.6.4)	4 % of nom. value	Fly up: >190 µA
RF Level (Integr., Intern.)	1F: 71 %	(3.1.5.7.1)	71 % ... 129 % *	
RF Level (Nearfield)			71 % ... 129 % *	
Alarm delay time	CAT I: 10 s; CAT II: 5 s; CAT III: 2 s (preferably 1 s); Nearfield: 20 s.			

* also possible: 90 ... 110 % (or 120 %)

– Calculation of resulting course width on change of the ”Displacement Sensitivity” according ICAO ANNEX 10 for *x* %:

Resulting Width = Nominal Width / [(100−x) / 100] ==> for 3° glide angle:

Width wide = 1.44° / [(100−25) / 100] = 1.92°;
Width narrow = 1.44° / [(100+25) / 100] = 1.15°

Nominal DDM at course width:

±17.5 % ==> DDM [%] = DDM [µA] /150 • 17.5
and
±150 µA ==> DDM [µA] = DDM [%] /17.5 • 150

4.12 CONVERSION OF RETURN LOSS TO VSWR VALUES

The following table shows the return loss in dB and the correspondent VSWR value.

Return Loss [dB]	Reflection Coefficient	VSWR
1	0.891	17.391
2	0.794	8.724
3	0.708	5.848
4	0.631	4.419
5	0.562	3.570
6	0.501	3.010
7	0.447	2.615
8	0.398	2.323
9	0.355	2.100
10	0.316	1.925
11	0.282	1.785
12	0.251	1.671
13	0.224	1.577
14	0.200	1.499
15	0.178	1.433
16	0.158	1.377
17	0.141	1.329
18	0.126	1.288
19	0.112	1.253
20	0.100	1.222

Return Loss [dB]	Reflection Coefficient	VSWR
21	0.089	1.196
22	0.079	1.173
23	0.071	1.152
24	0.063	1.135
25	0.056	1.119
26	0.050	1.106
27	0.045	1.094
28	0.040	1.083
29	0.035	1.074
30	0.032	1.065
31	0.028	1.058
32	0.025	1.052
33	0.022	1.046
34	0.020	1.041
35	0.018	1.036
36	0.016	1.032
37	0.014	1.029
38	0.013	1.025
39	0.011	1.023
40	0.010	1.020

4.13 PRESENTATION OF SOAC PHASE ADJUSTMENT AT OSCILLOSCOPE

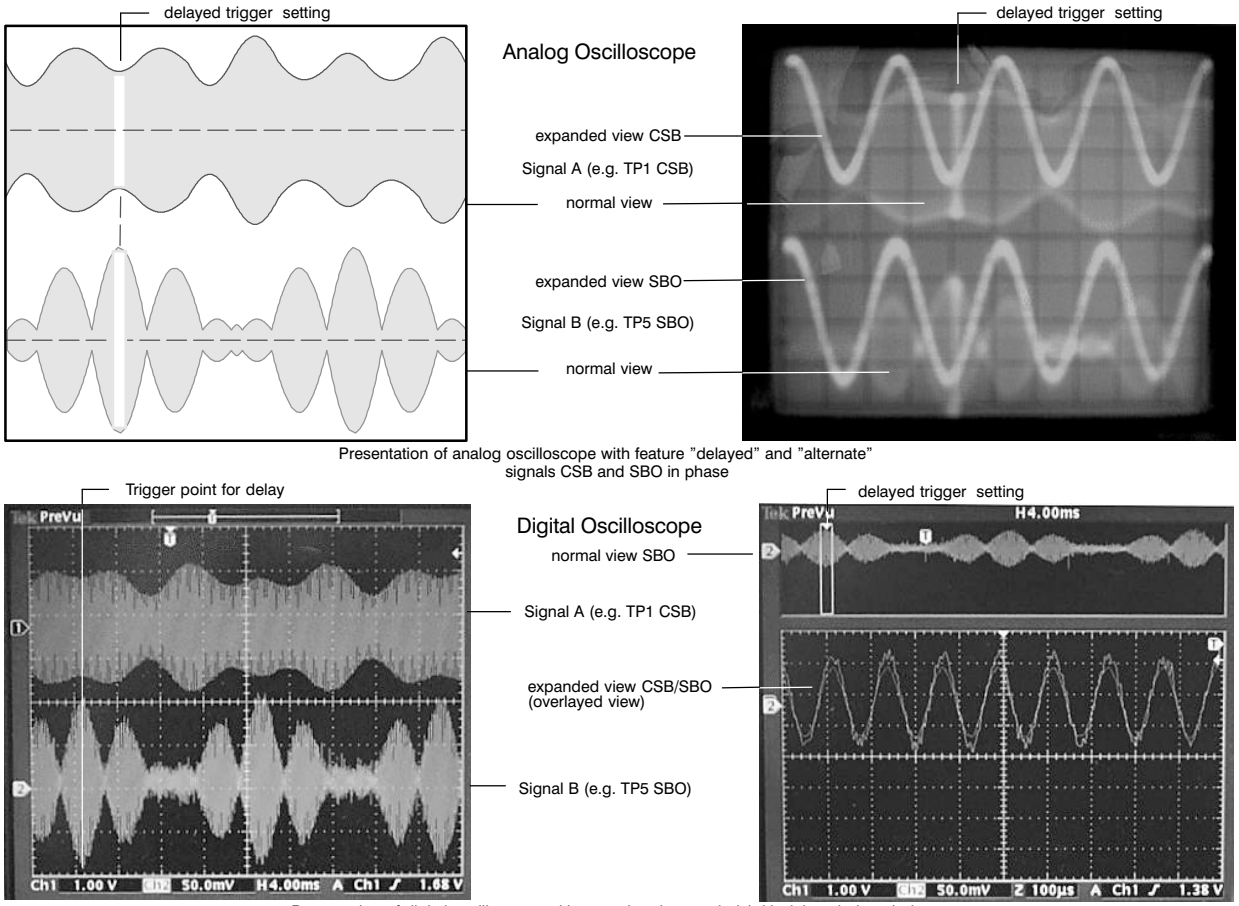


Fig. 4–7 Presentation example at oscilloscope of SOAC phase adjustment CSB/SBO

CHAPTER 5
ALIGNMENT PROCEDURE GP−2F, M−TYPE (ACTIVE)

This chapter describes the alignment procedure for the GP−2F active* version (M−Type or Capture Effect). The procedure of the GP−2F standard version is contained in chapter 7. The alignment procedure of a Glide Path system (2F) including prerequisites is described in a step by step manner starting with 5.1. The following list is a summary and also a detailed table of contents.

* 'active' means a direct feeding method of RFOut to antenna A2 via a separate path (CSB2) of the Modulator/Amplifier

5.1 GENERAL PREREQUISITES

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

5.1.1 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.

5.1.1.1 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 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 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)

5.1.1.2 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).

5.1.2 Recommended Measuring Equipment

– 1 thruline wattmeter
– 1 oscilloscope (dual trace, trigger delay facility)
– 1 W, 10 W measuring element (330 MHz)
– 1 DDM instrument and field strength meter (portable)
– 3 terminating resistors, 50 ohms, 10 W
– Reducers and phase adapters (TNC and SMA), possibly 90° or 180° cable (used for phasing)
– 1 RF measuring cable, 0.5 m SMA/SMA−angle and adapter SMA/N (female/male)
– 1 pair of radiotelephones
– 1 Divider/adder (3 dB)
– Attenuators for the SBO output (SMA) or input (TNC), 2 attenuators 30 dB/10 W for test setup

5.1.3 Status of Installation

Before operation, the system must complete as follows:

– Transmitter cabinet, installed,
– Power supply, installed,
– Batteries, installed,
– Antenna system and
– Nearfield monitor dipole* (option), installed and cabling complete.
  (* The exact location and the foundation are usually defined after flight check)
– 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 printed circuit boards (refer also to chapter 6, section 6.6.5) have to be in accordance with the system version. To enable battery backup on specific printed circuit boards and for initial settings on site refer to 5.2.1.1.
– The MCS resp. ADRACS software has been loaded to PC (refer to 5.1.1).

5.1.4 Check of Antenna Installation

The information about this will be found in Part 3, Antenna System Description of the GP Technical Manual.

5.2 FIRST SWITCHING ON

5.2.1 Status of the System

— Mains OFF (mains distribution unit, 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)
— DC—switches TX1 and TX2 on subrack PS (transmitter cabinet) in position OFF

CAUTION

All CSB and SBO RF—outputs must either be terminated with a dummy load or connected to antenna. Otherwise the transmitter may be damaged when switching on the equipment.

5.2.1.1 Special Jumper Settings before Start Up

Individual jumpers have to be set before the first switching on. The location of jumpers is shown in section 6.6.5. Perform the following settings:

— LCP: Set jumper X36 (enabling backup battery for RTC).

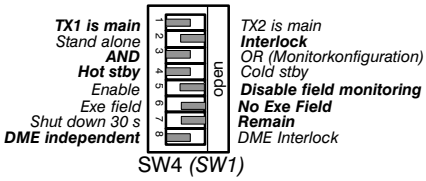
— SYN: Set jumpers J1 to J4 according to the selected operating frequency:

J1:	300 or 100 and tenth	J2:	units
J3:	one tenth	J4:	one hundreds and thousandths

Example: The GP frequency is selected to *333.50* MHz. Perform following settings:

330 = 300+20+10 *3 = 2+1* *.5 = .4+ .1* *.00* *= 333.50*

— ECU: Set switch SW4 (*SW1*) according to selected station configuration and jumpers J6, J7, if specific DME operation is required. This setting must correspond to software configuration data. Standard setting of SW4 (*SW1*) is:



SW4 *(SW1)*

Standard setting:			
	1	closed	Transmitter 1 is main
	2	open	Interlock on (control follows interlock bit)
	3	closed	Monitor AND configuration enabled
	4	closed	Hot Standby set
	5	open	Closed if farfield monitor available (FFM, LLZ)
	6	open	Closed if field monitor available and executive
	7	open	Station remains operable
	8	closed	No DME

5.2.2 Switch On

a) Connect PC serial interface connector (e.g. COM1) to RS232 connector 'Local PC' on top of the cabinet with a 'zero modem cable' (rx/tx crossed).
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.
c) Close battery fuse switches (battery fuse box, inside shelter).
NOTE: Matching the charging voltage of BCPS modules to environmental conditions: Refer to 6.3.3.
d) Set DC switches TX1 and TX2 on subrack PS (transmitter cabinet) to ON.
e) Switch to local control with the key—lock switch on the Local Control Panel (LCP).

5.2.3 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 menus of the user program before performing the first set up procedure. The user program specific actions/procedures, which are:

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

are described in detail in the **ANNEX 'PC User Program−specific Procedures'** of this manual (see Register 8).

5.2.4 Preparing the Installation SITE with PC

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.

5.2.4.1 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 OS.

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 function 'LOGIN' of the MASTER MENU. Enter *REU* as 'UserName' and confirm blank characters in 'Password'.

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

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

f) Select function '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 function 'SET SITE DATE & TIME'. Enter date and time.

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

5.2.4.2 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 start window.

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

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

g) Click 'Reset SITE' of menu 'RC Management' 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 start window.

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

k) Click 'Exit' to close program.

5.2.5 Enter Station Configuration Data

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

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

b) Switch both TX on and Set all monitor bypass on.

c) Open the Station Configuration dialog.

d) Enter all required parameters in the dialog window. Verify that the parameter 'Standby configuration' is set to 'Hot'.

NOTE: Settings in d) must correspond to the settings of the DIP−FIX switch SW4(SW1) on ECU board!

e) Switch both TX off.

NOTE: It is recommended for the first setup procedure to note down all settings and values which have been performed in the individual steps of alignment. This is useful because the values should be remembered in the setup sequence of the procedure.

5.3 CHECK ANTENNA MATCHING

NOTE: Use same power probe for the ratio measurement !

Check the matching of all antennas, one after the other, as described below:

a) Connect cable for A1, coming from transmitter, via wattmeter directly to the supply cable of the antenna which must be measured. Terminate output A2 and A3 with dummy load 50 Ω/10 W.

b) Switch TX1 on. Set TX1 on aerial.

c) Open dialog 'Transmitter1—Waveform Data#1'.

d) Set 'CRS CSB1 RF—Level' to 1 W. Set 'CLR RF—Level' to 0 W.

NOTE: If need be set CRS CSB1 DDM=0 % and CRS CSB1 SDM=0 % (depends on instrument used).

e) Form the ratio between the forward and reverse signals with the wattmeter. The matching value should be >20 dB. If not, examine the antenna and the supply cable.

f) Switch TX1 off.

g) Connect next antenna cable (A2 respectively A3) to wattmeter and repeat steps b), e), f).

h) Connect all the RF cables as normal again at the end of the matching measurements.

5.4 SETTING THE TRANSMITTER POWER

5.4.1 CRS CSB1 Power

a) TX1 and TX2 are switched off.

b) Connect cable for A1, coming from transmitter, via wattmeter.

c) Switch both TX on and set TX1 on aerial.

d) Open dialog 'Transmitter1—Waveform Data#1', open dialog 'Transmitter2—Waveform Data#1'.

NOTE: If need be set CRS CSB1 DDM=0 % and CRS CSB1 SDM=0 % (depends on instrument used).

e) Set parameter 'CRS CSB1 RF—Level' to a value to measure approx. 2.0 W at wattmeter ('CLR RF—Level' is set to 0 W), feasible without phase shifter option (integrated in the feeding to A1 and A3, cabinet rear door). In a GP cabinet configuration with optional phase shifters to A1 and A3 the value is set to measure approx. 1.5 W.

NOTE: Note down value for CRS CSB1 RF Level.

f) Set TX2 on aerial.

g) Adjust TX2 according to TX1.

h) Switch both TX off.

i) Connect RF cable for A1 as normal again.

5.4.2 CRS CSB2 Power

a) TX1 and TX2 are switched off.

b) Connect cable for A2, coming from transmitter, via wattmeter.

c) Switch both TX on and set TX1 on aerial.

d) Open dialog 'Transmitter1—Waveform Data#1', open dialog 'Transmitter2—Waveform Data#1'.

e) Set 'CRS CSB2 RF—Level' to a value to measure approx. 0.5 W at the wattmeter, feasible without integrated phase shifter option (integrated in the feeding to A1 and A3, cabinet rear door).

In a GP cabinet configuration with optional phase shifters to A1 and A3 the value is set to measure approx. 0.375 W at the wattmeter.

NOTE: Power is −6 dB related to A1. Thus the measured power depends on the setting in 5.4.1. If need be set CRS CSB2 DDM and CRS CSB2 SDM = 0 % (depends on instrument used). Record internal power measurement of "Transmitter Power Amplifier Data" and note down value for CRS CSB2 RF Level.

f) Set TX2 on aerial.

g) Adjust TX2 according to TX1.

h) Switch both TX off.

i) Connect cable for A2 as normal again.

5.4.3 Clearance Power

a) TX1 and TX2 are switched off.

b) Connect cable for A3, coming from transmitter, via wattmeter.

c) Switch both TX on and set TX1 on aerial.

d) Open dialog 'Transmitter1−Waveform Data#1', open dialog 'Transmitter2−Waveform Data#1'.

e) Set 'CRS SBO Amplitude' to 0 %. Set 'CLR RF Level' to a value to measure approx. 0.13 W at the wattmeter, feasible without integrated phase shifter option (integrated in the feeding to A1 and A3, cabinet rear door).

In a GP cabinet configuration with optional phase shifters to A1 and A3 the value is set to measure approx. 0.094 W at the wattmeter.

NOTE: Power is −12 dB related to A1. Thus the measured power depends on the setting in 5.4.1. If need be set CLR DDM and CLR SDM=0 % (depends on instrument used). Note down value for CLR RF Level.
It may be necessary to modify the optionally inserted attenuator (6 dB or 9 dB) in the CLR path to the PAD to get the above mentioned RF power level for CLR.

f) Set TX2 on aerial.

g) Adjust TX2 according to TX1

h) Switch both TX off.

i) Connect cable for A3 as normal again.

5.5 SDM AND DDM SETTING

5.5.1 SDM and DDM of CRS CSB1 (A1)

a) TX1 and TX2 are switched off.

b) Connect Field Receiver to integral monitor cable from A1.

c) Switch TX1 on.

d) Open dialog 'Transmitter1−Waveform Data#1', open dialog 'Transmitter2−Waveform Data#1'.

e) Set 'CLR RF−Level' to 0. Adjust 'CRS CSB1 SDM' and 'CRS CSB1 DDM' to a value to measure 80 % SDM and 0 % DDM at the receiver.

f) Adjust 'CRS CSB1 DDM' value depending on the "Forward Slope" (−11.7 % (90>150 Hz) on DDM instrument for 0° Forward Slope), see table and graph in Fig. 5−8.

g) Switch TX2 on.

h) Set TX2 on aerial.

i) Adjust TX2 according to TX1.

j) Switch both TX off.

k) Connect integral monitor cable for A1 as normal again.

5.5.2 SDM and DDM of Clearance (A1,A3)

a) TX1 and TX2 are switched off.

b) Connect Field Receiver to integral monitor cable from A3.

c) Switch TX1 on.

d) Open dialog 'Transmitter1−Waveform Data#1', open dialog 'Transmitter2−Waveform Data#1'.

NOTE: CRS SBO Amplitude is set to 0 %.

e) Set 'CLR RF Level' to original value as determined in 5.4.3. Set 'CLR SDM' and 'CLR DDM' values to measure 80 % SDM and 30 % DDM (150 Hz>90 Hz) at the receiver.

f) Switch TX2 on.

g) Set TX2 on aerial.

h) Adjust TX2 according to TX1.

i) Switch both TX off.

j) Connect integral monitor cable for A3 as normal again.

5.5.3 SDM and DDM of CRS CSB2 (A2)

a) TX1 and TX2 are switched off.

b) Connect Field Receiver to integral monitor cable from A2.

c) Switch TX1 on.

d) Open dialog 'Transmitter1−Waveform Data#1', open dialog 'Transmitter2−Waveform Data#1'.

e) Set 'CRS CSB2 SDM' and 'CRS CSB2 DDM' value to measure 80 % SDM and 0 % DDM at the receiver.

f) Adjust 'CRS CSB2 DDM' value depending on the "Forward Slope" (−46.7 % (90>150 Hz) on DDM instrument for 0° "Forward Slope"), see table and graph in Fig. 5−8.

NOTE: For normal M−Type operation the DDM of CSB2 is four times in magnitude than the DDM of CSB1.

g) Switch TX2 on.

h) Set TX2 on aerial.

i) Adjust TX2 according to TX1.

j) Switch both TX off.

k) Connect integral monitor cable for A2 as normal again.

5.6 RF PHASING

5.6.1 Clearance Phasing

This procedure has to be executed only during first alignment; one transmitter only.

The signal phases over A1 and A3 have to be checked and, if necessary, corrected so that the Clearance signals of antennas A1 and A3 are radiated in phase.

a) TX1 and TX2 are switched off.

b) Remove clearance supply cable at J4, power adder (see Fig. 5−1), and terminate cable with 50 ohms/10 W.

c) Loosen CRS SBO supply cable at J1, power adder, and connect cable to J4 using an extension cable. Terminate J1 with 50 ohms/10 W.

d) Remove supply cable for A3 at output transmitter cabinet. Terminate output with 50 ohms/10 W.

e) Remove CRS CSB 1 (A1) supply cable at input J2, power adder (Fig. 5−1). Terminate cable with 50 ohms/10 W.

NOTE: If CRS CSB1 power is set to 0 W, the CRS SBO amplitude is automatically set to 0%. Phasing is then not possible.

f) Switch TX1 on.

g) Open dialog 'Transmitter1−Waveform Data#1'.

h) Set 'CRS CSB2 DDM' to 0 %.

i) Set 'CRS SBO Amplitude' of A3 to approx. 80 %.

j) Measure the DDM on centerline at the middle marker (or with farfield antenna at the counter Localizer) with the portable Field Receiver, then set the CRS SBO phase so that the DDM instrument indicates DDM 0 (quadrature phase).

NOTE: All antennas A1 to A3 should be visible ! If not change location to get view on all antennas.

k) Add or subtract 90° to or from the determined phase value and enter as the new value. Measure resulting DDM value (with predominant frequency) and note down.

l) Switch TX1 off.

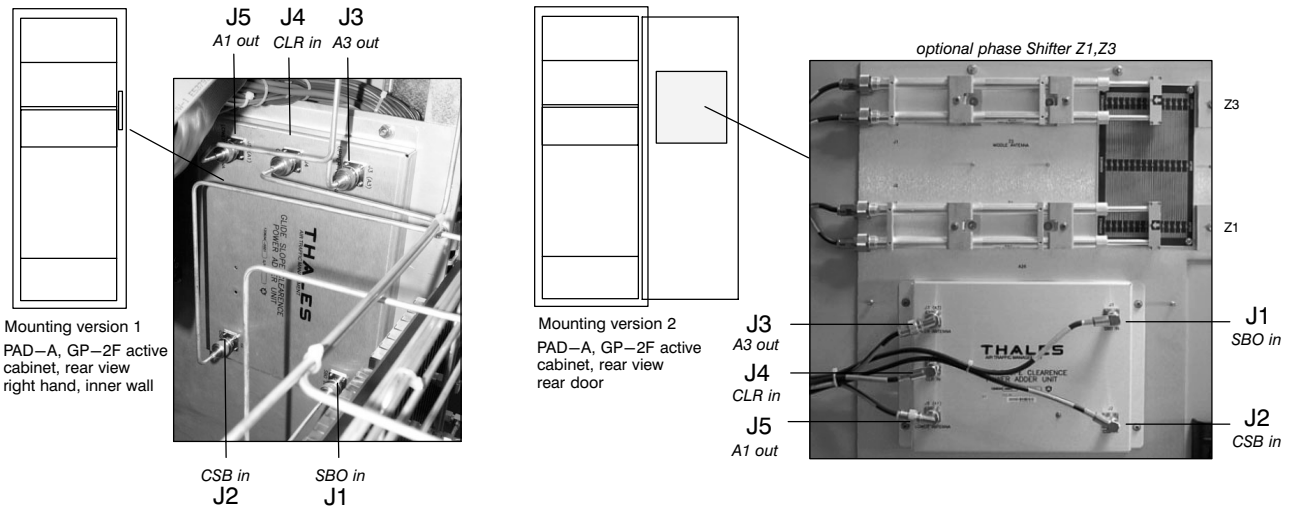


Fig. 5−1 Power Adder PAD−A, GP−2F active, connectors

m) Connect supply cable for A3 as normal again.

n) Remove supply cable for A1 at output transmitter cabinet. Terminate output with 50 ohms/10 W.

o) Switch TX1 on.

p) Set in j) determined quadrature phase for CRS SBO.

q) If the radiation from antennas A2 and A3 is in phase, 0 % DDM must be measured on centerline at the middle marker.

NOTE: If not so, the phase length to antenna A3 has to be corrected by altering length of the RF supply cable to antenna A3 or, if need be, extent cable to A1 instead of cutting cable to A3.

Switch off transmitter before altering cable !

Repeat measurement of q), and correct cable until 0 % is reached.

r) With normal phase for CRS SBO Phase, the same DDM predominant frequency as in the 1. phasing step must result, see 5.6.1 k). If not so, switch off transmitter, insert additional 180˚ cable. Repeat procedure starting with step o).

s) Switch TX1 off. Connect system as normal again.

5.6.2 Phasing A1 — A3

a) TX1 and TX2 are switched off.

b) Remove supply cable for A2 at output transmitter cabinet. Terminate output with 50 ohms/10 W.

c) Switch TX1 on.

d) Open dialog 'Transmitter1—Waveform Data#1'.

e) Set 'CRS CSB1 DDM' and 'CRS CSB1 SDM' to the set values adjusted in 5.5.1 e), to get 80 % SDM, 0 % DDM.

f) Set 'CRS SBO Amplitude' to approx. 80 %.

g) Set 'CLR RF—Level' to 0 W.

h) Measure the DDM on centerline at the middle marker (or with farfield antenna at the counter Localizer) with the portable DDM instrument, then set the CRS SBO phase so that the DDM instrument indicates 0 % DDM (quadrature phase).

NOTE: All antennas A1 to A3 should be visible ! If not change location to get view on all antennas.

i) Add or subtract 90˚ to or from the phase value determined and enter as the new value. The DDM instrument should now indicate a DDM with predominant 90 Hz.
If not, a further 180˚ must be either added or subtracted.

NOTE: 90 Hz >150 Hz according +..,.% (the sign depends on the DDM instrument used)

j) Note down 'CRS SBO Phase' value.

k) Switch TX2 on.

l) Set TX2 on aerial.

m) Adjust TX2 according to TX1, steps e) to j).

n) Switch both TX off

o) Connect system as normal again.

5.6.3 Phasing A2 − A3

a) TX1 and TX2 are switched off.

b) Remove supply cable for A1 at output transmitter cabinet. Terminate output with 50 ohms/10 W.

c) Switch TX1 on.

d) Open dialog 'Transmitter1−Waveform Data#1'.

e) Set 'CRS CSB2 RF−Level' to the value determined in 5.4.2.

f) Set 'CRS CSB2 DDM' and 'CRS CSB2 SDM' to the set value adjusted in 5.5.3 e), to get 80 % SDM, 0 % DDM.

g) Set 'CRS SBO Amplitude' to approx. 80 %.

h) Set 'CLR RF−Level' to 0 W.

i) Measure the DDM on centerline at the middle marker (or with farfield antenna at the counter Localizer) with the portable Field Receiver, then set the CRS CSB2 Phase so that the DDM instrument indicates 0 % DDM (quadrature phase).

NOTE: All antennas A1 to A3 should be visible ! If not change location to get view on all antennas.

j) Add or subtract 90° to or from the phase value determined and enter as the new value. The DDM instrument should now indicate a DDM with predominant 150 Hz. Note down the CRS CSB2 Phase value. If not, a further 180° setting must be either added or subtracted.

NOTE: 150 Hz >90 Hz according −..,.% (the sign depends on the DDM instrument used)

k) Switch TX2 on.

l) Set TX2 on aerial.

m) Adjust TX2 according to TX1, steps e) to k).

n) Switch both TX off.

o) Connect system as normal again.

p) Repeat adjustments for CRS CSB2 in 5.4.2 (RF−Level) and 5.5.3 (SDM, DDM) and 5.6.3 step a) to o). Use internal measurement (RF−Level) as reference and adjust to noted value.

NOTE: This is recommended because phase and level adjustment are not completely independent from each other.

5.6.4 Pre−adjustment of CRS SBO Amplitude

The adjustment of the CRS SBO Amplitude in the field can not be realized in practice with ground measurements, because it must be measured in the farfield of the antenna at an elevation angle of 3°. At this elevation angle the SBO Amplitude has to be adjusted so that the sum of the signals of A1, A3 in the field results in 0 % DDM. A pre−adjustment of the SBO Amplitude can be executed with the aid of two attenuators (30 dB) and a divider/adder (3 dB), see Fig. 5−2. The accuracy of the obtained setting depends on their quality (equality of attenuation and amplitude response of the divider).

a) TX1 and TX2 are switched off.

b) Remove supply cables for A1 and A3 at output transmitter cabinet. Terminate outputs with attenuators identical in type (30 dB/10 W) and connect auxiliary cables of identical length to the outputs of the 3 dB divider.

NOTE: If the output branches of the divider differ in phase (e.g. 90°), it has to be taken into account entering the SBO phase.

c) Connect Field Receiver to the input of the 3 dB divider.

d) Switch TX1 on.

e) Measure resulting DDM at the input of the 3 dB divider with DDM instrument. Carry out phasing A1 − A3 for transmitter 1 as in 5.6.2 e) to j), however measure at the divider (Fig. 5−2).

f) Set 'CRS CSB1 DDM' and 'CRS CSB1 SDM' determined in 5.5.1 f) to get 80 % SDM and 11.7 % DDM (90 Hz > 150 Hz).

g) Add or subtract 180° to the "normal phase" value of A3 determined in the actual test setup for level measurement so that the SBO signal of A3 is superimposed to the CRS CSB1 signal of A1 in opposite phase.

NOTE: This corresponds to the addition of the signal in the field at 3° elevation, where the diagram phase of A3 (2. diagram beam) is shifted about 180° against the diagram phase of A1 (1. diagram beam).

h) Set 'CRS SBO Amplitude' so that the measured value results in 0 % DDM at the input of the 3 dB divider. If 90 Hz>150 Hz increase the SBO Amplitude, if 150 Hz>90 Hz decrease the SBO Amplitude.

NOTE: It may be necessary to modify the optionally inserted attenuator (6 dB or 9 dB) in the SBO path to the PAD to get a suitable setting range of the SBO amplitude.

i) Switch TX2 on.

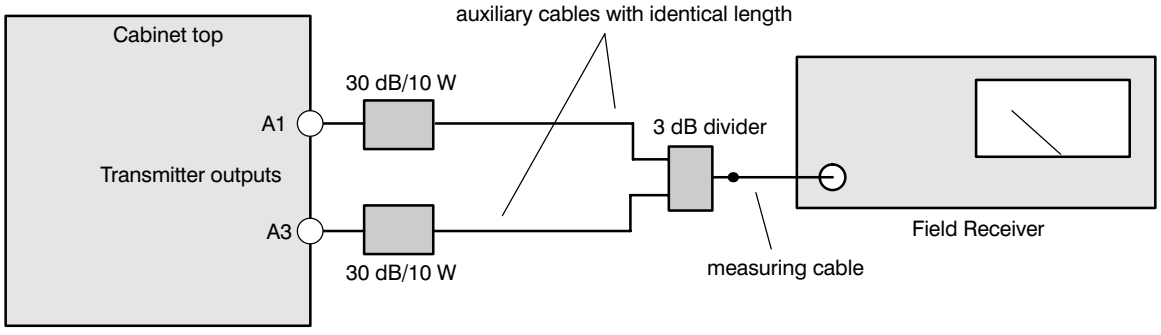
j) Set TX2 on aerial.

k) Adjust TX2 according to TX1, steps e) to h).

l) Set again 'CRS SBO Phase' of TX1/TX2 to values determined in 5.6.2.
Set Clear. RF Level to value adjusted in section 5.4.3.

m) Switch both TX off.

n) Connect cables for A1 and A3 as normal again.



If a cable is used to connect attenuators to connectors on top A1 and A3 cables must have identical length!

Fig. 5−2 Setup for pre−adjustment of CRS SBO Amplitude for A3

5.7 SETTING THE MONITORS

See Figs. 5−3 to 5−7.

The Stby and On−Air Combiner (SOAC) unit processes the input monitoring signals of the aerial and standby transmitter. It is supposed that the SOAC is factory pre−aligned. However, on site field adjustment is necessary. For correct operation the 7 monitor channels have to be set in a certain manner:

1) The RF input signal of each path on the SOAC is down converted to an 8 kHz IF signal. This signal has to be adjusted to an output signal of approx. 3.6 Vpp. The 8 kHz IF amplitudes are measured with an oscilloscope at the corresponding test points. Coarse adjustment of the input level is performed with attenuators which are inserted or bypassed with the corresponding jumpers (see section 6.6.5), if need be. Figs. 5−4, 5−6 show the signal path, the potentiometers and the corresponding testpoints of each channel on the SOAC. Recommendation: Use a special alignment screw driver with immersed blade for the potentiometers.
   If need be, e.g. phase cannot be adjusted, insert phase adapters or cables to the concerned input.
2) When the signals in the field are set correctly, the input signal to the monitors, the measured values, represent nominal values and have to be entered in the data window (Open dialog 'Monitor1−Nominal Values' or open dialog 'Monitor2−Nominal Values').
3) The monitor has to be supplied with a calibration signal (CRS CSB) adjusted to 80 % SDM and 0 % DDM. This signal is used to calibrate the monitor channel. With a known SDM and DDM, the monitor is able to calculate the third unknown parameter: the RF−LEVEL.
4) Finally the original signal is supplied to the monitor. With this signal, the monitor has to be normalized. The automatic normalization procedure runs only if the actual DDM and SDM values do not vary too much from the Nominal Values !

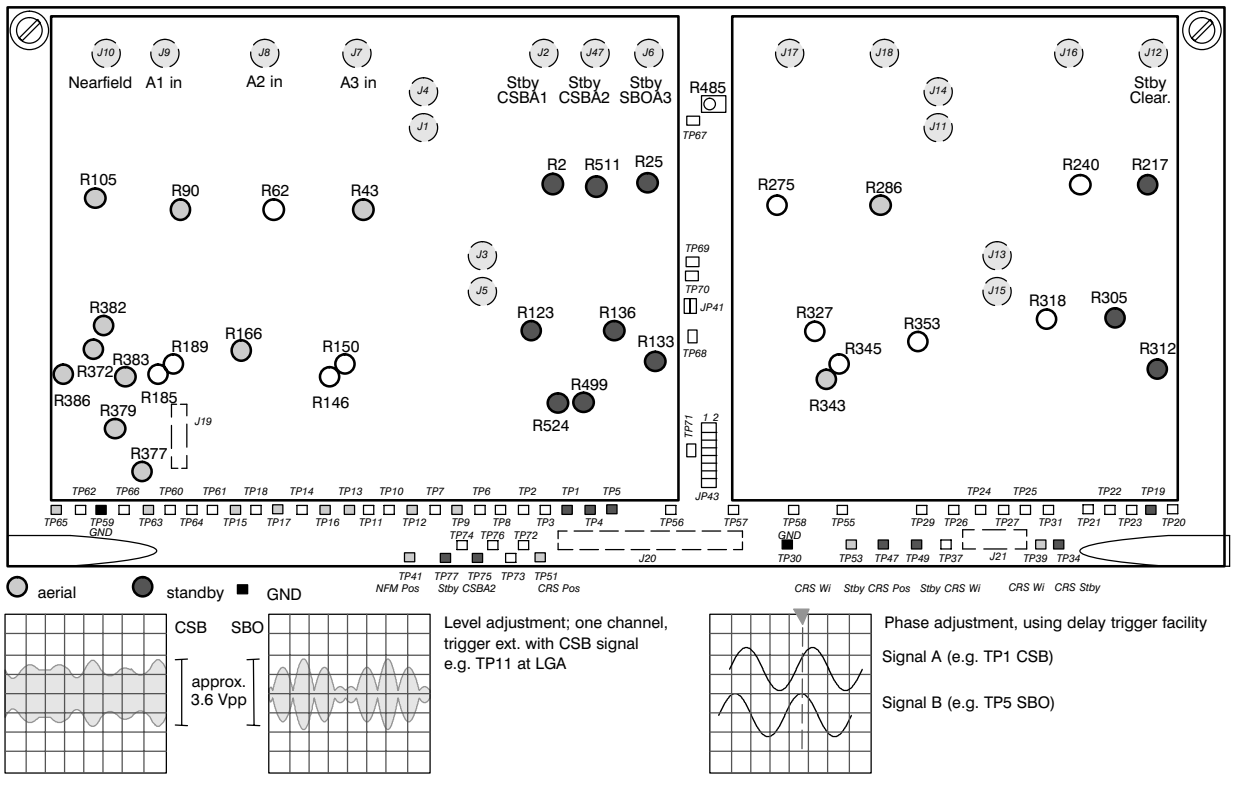


Fig. 5−3 Adjustment controls and test points of SOAC

5.7.1 Adjustment Procedure of Aerial Channels

See Fig. 4−7, 5−3, 5−4, 5−5. The signal path used within the SOAC is set to *3−4* at J19 of SOAC. Use amplifier (+15 dB) in the input path only if absolutely necessary.

5.7.1.1 **CRS Posn. Channel** (Input connector J9 (A1) and J7 (A3))

a) Connect oscilloscope to TP16 (TP62) and TP59 (GND).
Adjust IF gain of A1 path to measure approx. 6 Vpp at TP16 or TP62: perform first coarse alignment removing or inserting attenuators with JP16,17 or JP18,19; perform fine adjustment with R90.

b) Connect oscilloscope to TP8 and TP59 (GND).
Adjust IF gain of A3 path to measure approx. 1 Vpp at TP8: perform first coarse alignment removing or inserting attenuators with JP7,8 or JP9,10; perform fine adjustment with R43.

c) Check relative A1 − A3 phase with oscilloscope: measure between TP16 (A1) and TP9 (A3), see Fig. 4−7, 5−4, 5−5. Adjust with R146 to 0°. R150 is factory set.

d) Connect oscilloscope to TP62 or TP51 and TP59 (GND).
CRS Posn. DDM is defined by A1 to A3 ratio set with R372, measured at TP62, to cancel the SBO component. Finally adjust output level with R377 to achieve approx. 3.6 Vpp at TP51.

5.7.1.2 **CRS Width Channel** (Input connector J9 (A1), J8 (A2) and J7 (A3))

a) Connect oscilloscope to TP12 and TP59 (GND).
Adjust IF gain of A2 path to measure approx. 4 Vpp at TP12: perform first coarse alignment removing or inserting attenuators with JP12,13 or JP14,15; perform fine adjustment with R62.

NOTE: IF gain for A1 and A3 has been set above for CRS Posn. channel.

b) Check relative A2 − A3 phase with oscilloscope: measure between TP13 (A2) and TP8 (A3), see Fig. 4−7, 5−4, 5−5. Adjust with R166 to 180°.

c) Check relative A1 − A3 phase with oscilloscope: measure between TP17 (A1) and TP8 (A3), see Fig. 4−7, 5−4, 5−5. Adjust with R185 to 0°. R189 factory set.

d) Connect oscilloscope to TP53 and TP59 (GND). Initially adjust output level with R382 to approx. 3.6 Vpp. CRS Width DDM is defined by the A1/A2/A3 ratio set with R386 (A1), R383 (A2) and R379 (A3), measured at the correspondent testpoints. Connect oscilloscope in succession to TP65, TP64, TP63 and finally to TP53 and TP59 (GND). The ratio related to a glide angle of 3° should be: A1=TP65=1.0; A2=TP64=0.74; A3=TP63=0.46 (for other values refer to 5.14).

e) To adjust these ratios, disconnect the supply cable to J7 (A3 in) and J8 (A2 in). Adjust the level at TP65 to 3.0 Vpp with R386 (ref. level). Remove the supply line of A1 (J9) and connect it in succession to J8 (A2 in) and J7 (A3 in). Adjust A2 level (at TP64) and A3 level (at TP63) to the required ratio. Finally adjust output level with R382 to approx. 3.6 Vpp at TP53, after setup of Width DDM.

NOTE: The ratio of A1/A2/A3 may vary according to the actual glide angle.

5.7.1.3 **CLR Channel** (Input from J7 (A3 in) via JP11 and JP36)

a) Connect oscilloscope to TP39 and TP59 (GND). Measure output level.

b) Adjust IF gain to achieve approx. 3.6 Vpp output: perform first coarse alignment removing or inserting attenuators with JP37,38 or JP39,40; perform fine adjustment with R286 and finally R343 to approx. 3.6 Vpp. Phase adjustment with R353 is factory set. R345 remains in mid position.

5.7.1.4 **NFM channel** (Input connector J10. Refer also to 5.7.3.4)

a) Connect oscilloscope to TP41 and TP59 (GND). Measure output level.

b) Adjust IF gain to achieve approx. 3.6 Vpp output: perform first coarse alignment removing or inserting attenuators with JP22 or JP23,24; perform fine adjustment with R105 to approx. 3.6 Vpp.

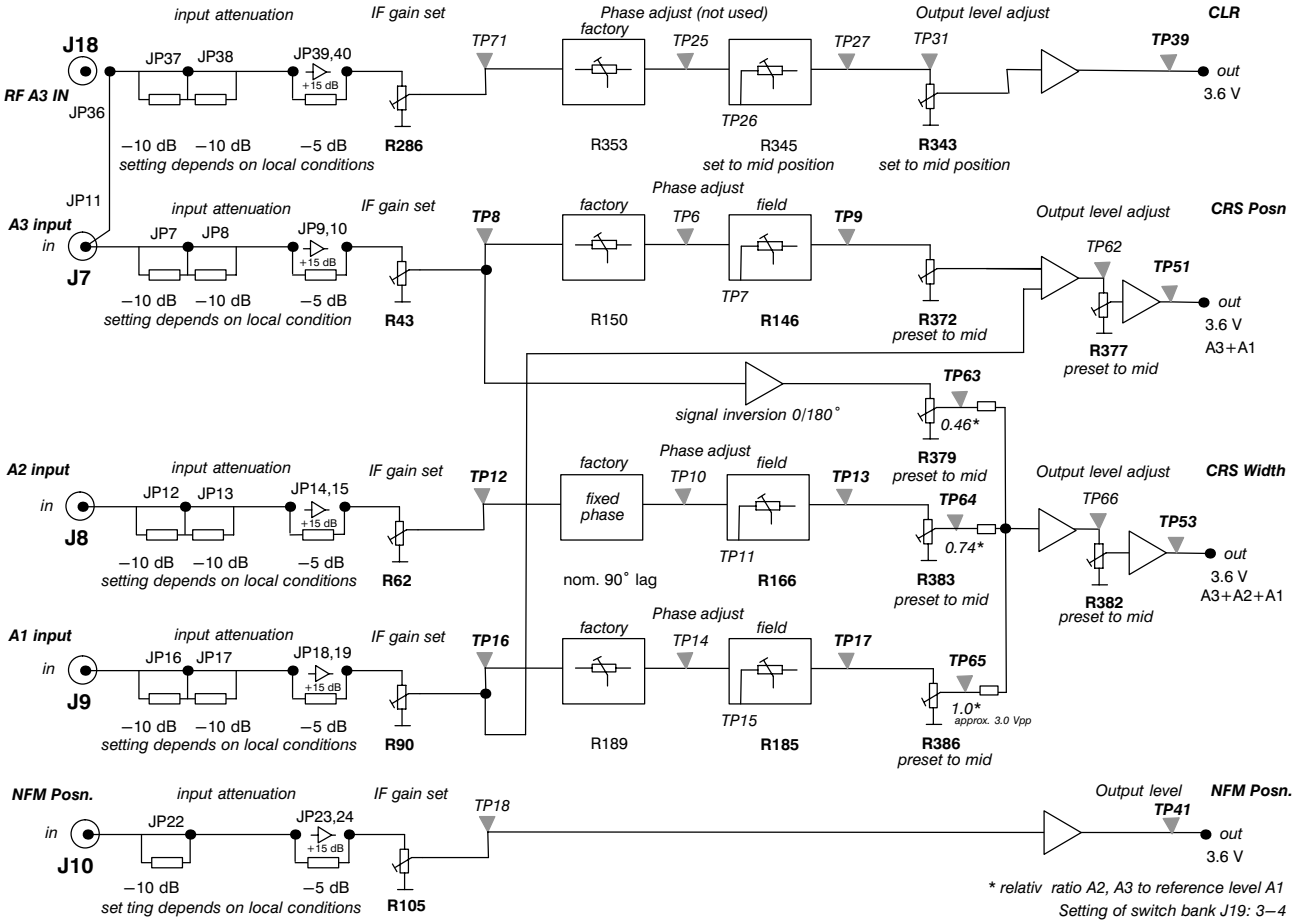
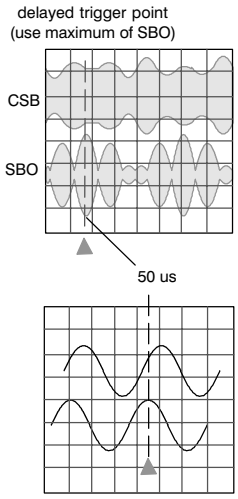


Fig. 5−4 Adjustment of detector channels for aerial monitoring (GP−2F active)



Phase adjustment, using delay trigger option

Signal A (e.g. TP17 CSB)

Signal B (e.g. TP8 SBO)

NOTE:
For more clear representation, the use of an analog oscilloscope is recommended. For the phase alignment procedure, the delayed trigger segment of 50 us has to be in a range of the signals where the amplitudes rise in the same direction to get correct phasing. Check the trigger position of the signal if the result seems to be in the opposite phase range (e.g. 180° rotated); read also PC user program monitor result for correct sign. If the phase cannot be adjusted insert phase adapters or phasing cables to achieve a sufficient setting range of the potentiometers.

Recommended measurement procedure:
Adjust the scope so that both signals are equal in amplitude. Turn on the ADD and INVERT functions. Make the signal now created on the scope as flat as possible. This will ensure the signals are within a couple of degrees. It is very important that these two signals are in phase.

Oscilloscope setting:

Channel 1	CSB
Channel 2	SBO, position below or on same line
V/div.	0.5
Trigger	internal, channel 1 (or ext., from LGA, TP11)
Time sweep	0.1 ms; delayed: 50 us
Time delay	Adjust to show a sine curve segment

Fig. 5−5 Relative phase adjustment procedure

5.7.2 Adjustment Procedure of Standby Channels

See Fig. 4−7, 5−3, 5−6, 5−7. JP46 is set for use of Stby CSBA2 input.

5.7.2.1 **StbyCRS Posn. Channel** (Input connector J2)

a) Connect oscilloscope to TP47 and TP59 (GND). Measure output level.

b) Adjust IF gain to achieve approx. 3.6 Vpp output: R499 is set to mid position. Perform first coarse alignment removing or inserting attenuators with JP2,3; perform fine adjustment with R2. Phase adjustment with R123 is factory set and not needed for Posn. channel.

5.7.2.2 **Stby CRS Width Channel** (Input connect. J2 (CSBA1),J6 (SBOA3),J47 (CSBA2)

a) Connect oscilloscope to TP75 and TP59 (GND).
Adjust IF gain of CSBA2 path to measure approx. 1.0 Vpp at TP75: perform first coarse alignment removing or inserting attenuators with JP44,45; perform fine adjustment with R511.

NOTE: IF gain for CSBA1 has been set above for Stby CRS Posn. channel.

b) Check relative CSBA1 − CSBA2 phase with oscilloscope: measure between TP77 (CSBA2) and TP1 (CSBA1), see Fig. 4−7, 5−6, 5−7. Adjust with R524 to 180˚. R123 is factory set.

c) Connect oscilloscope to TP4 and TP59 (GND).
Adjust IF gain of SBOA3 path to measure approx. 0.2 Vpp at TP4: perform first coarse alignment removing or inserting attenuators with JP4,5; perform fine adjustment with R25.

d) Check relative CSBA1 − SBOA3 phase with oscilloscope: measure between TP1 (CSBA1) and TP5 (SBOA3), see Fig. 4−7, 5−6, 5−7. Adjust with R136 to 0˚. R123 is factory set.

e) CRS Width Stby DDM is defined by the Stby CSBA1/CSBA2/SBOA3 ratio set with R499 (CSBA1), R511 (CSBA2) and R25 (SBOA3), measured at the correspondent testpoints. Connect oscilloscope in succession to TP72, TP74, TP73 and finally to TP49 and TP59 (GND). The ratio related to a glide angle of 3˚ should be: A1=TP72=1.0; A2=TP74=0.74 (*x0.56, see note*); A3=TP73=0.46 (*x0.56, see Note*). For other values than 3˚ refer to 5.14.

f) To adjust these ratios, disconnect the supply cable to J47 (Stby CSBA2) and J6 (Stby SBOA3). Connect oscilloscope to TP72 and TP59 (GND). Initially adjust with R499 to approx. 3 Vpp at TP72 (reference level). Remove the supply line of J2 (Stby CSBA1), and connect it in succession to the J47 (Stby CSBA2 input) and J6 (Stby SBOA3 input). Adjust Stby CSBA2 level (at TP74) and Stby SBOA3 level (at TP73) to the required ratio. Finally adjust output level with R133 to approx. 3.6 Vpp at TP49, after setup of Width DDM.

NOTE: "x0.56" is a factor to equalize 5 dB more attenuation in the Stby CSBA1 decoupling of the PIN diode transfer switch. Check actual value of this attenuation and calculate factor if need be.

5.7.2.3 **Stby CLR Channel** (Input connector J12)

a) Connect oscilloscope in succession to TP19, TP34 and TP59 (GND). Measure output level.

b) Adjust IF gain to achieve approx. 3.6 Vpp output: perform first coarse alignment removing or inserting attenuators with JP26,27. Perform fine adjustment with R217 to achieve 2 Vpp at TP19. Finally adjust output level with R312 to approx. 3.6 Vpp. Phase adjustment with R305 is factory set.

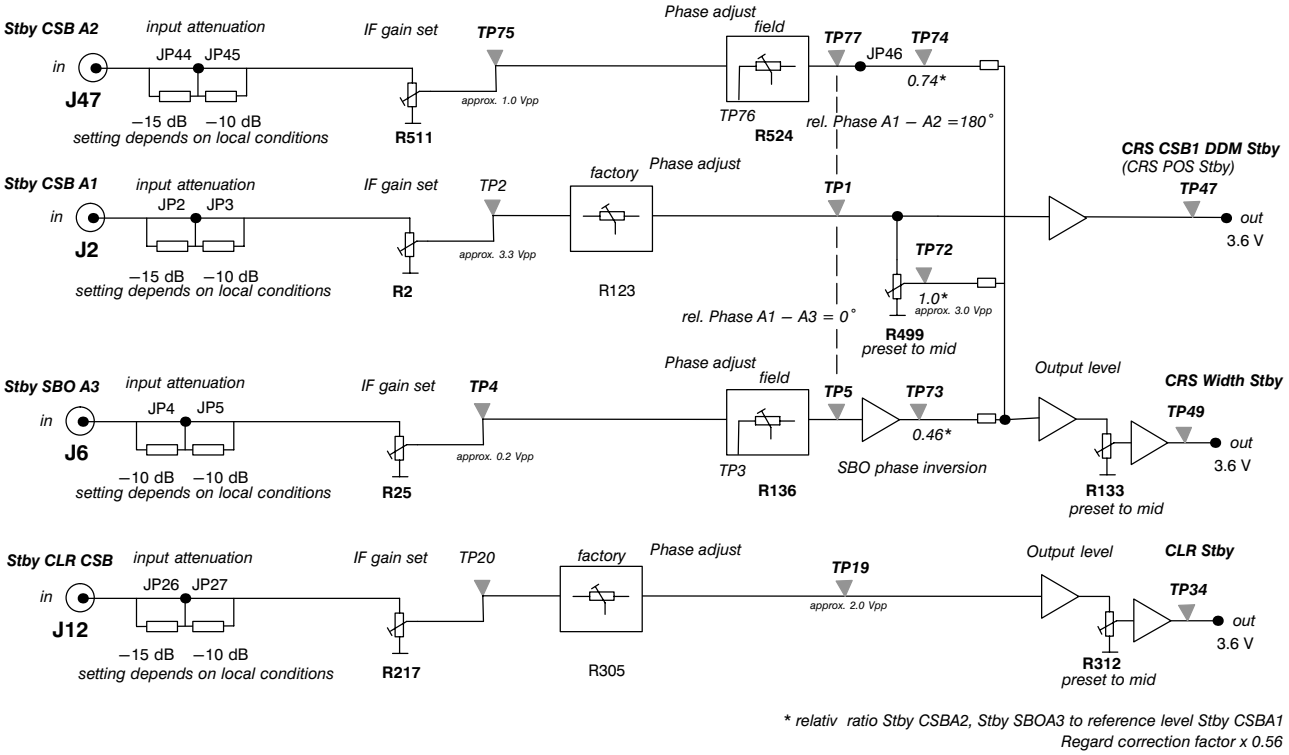
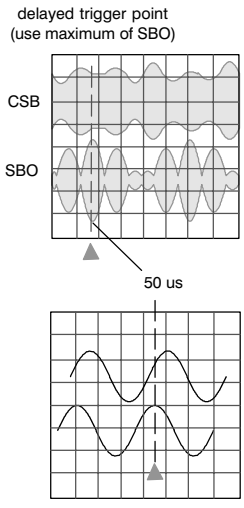


Fig. 5−6 Adjustment of detector channels for standby monitoring (GP−2F active)



NOTE:
For more clear representation, the use of an analog oscilloscope is recommended. For the phase alignment procedure, the delayed trigger segment of 50 us has to be in a range of the signals where the amplitudes rise in the same direction to get correct phasing. Check the trigger position of the signal if the result seems to be in the opposite phase range (e.g. 180˚ rotated); read also PC user program monitor result for correct sign. If the phase cannot be adjusted insert phase adapters or phasing cables to achieve a sufficient setting range of the potentiometers.

Recommended measurement procedure:
Adjust the scope so that both signals are equal in amplitude. Turn on the ADD and INVERT functions. Make the signal now created on the scope as flat as possible. This will ensure the signals are within a couple of degrees. It is very important that these two signals are in phase.

Oscilloscope setting:

Channel 1	CSB
Channel 2	SBO, position below or on same line
V/div.	0.5
Trigger	internal, channel 1 (or ext., from LGA, TP11)
Time sweep	0.1 ms; delayed: 50 us
Time delay	Adjust to show a sine curve segment

Fig. 5−7 Relative phase adjustment procedure

5.7.3 Calibration and Normalization of Integral Monitors

NOTE: Before performing this procedure it is recommended to check alarm limits acc. 5.7.5.

a) Switch both TX on and TX1 on aerial.

5.7.3.1 Integral Monitoring POS (DDM 0 %)

a) RF−level of the corresponding path on the SOAC (Fig. 5−3, 5−4) is set to approx. 3.6 Vpp amplitude as described in 5.7.1.

b) Open dialog 'Monitor1−Nominal Values' and open dialog 'Monitor2−Nominal Values'. Enter the measured values (DDM 0 %; SDM 80 %) for 'EXEC CRS Position DDM' and 'EXEC CRS Position SDM'.

c) Send to Monitor1/2 the command 'Calibration, Executive CRS Position detector'.

d) Send to Monitor1/2 the command 'Normalization, Executive CRS Position detector'.

NOTE: The automatic normalization procedure runs only if the actual DDM and SDM values do not vary to much from the nominal values !

5.7.3.2 Integral Monitoring Width (DDM 17.5 %)

a) RF−level of the corresponding path on the SOAC (Fig. 5−3, 5−4) is set to approx. 3.6 Vpp amplitude as described in 5.7.1.

b) Open dialog 'Monitor1−Nominal Values' and open dialog 'Monitor2−Nominal Values'. Enter the measured values (DDM 17.5 %; SDM 80 %) for 'EXEC CRS Width DDM'.

c) Open dialog 'Transmitter1−Waveform Data#1'. Note down the values of 'CRS CSB1 DDM', 'CRS CSB2 DDM' and 'CRS SBO'; set them all to 0 %.

d) Send to Monitor1/2 the command 'Calibration, Executive CRS Width detector'.

e) Restore values changed in c) back to noted down values.

NOTE: The procedure enables to calibrate to 17.5 % within a range of about 17 % to 18 %. This is normally achieved by an accurate adjustment of the ratios of the inputs of A1, A2, A3 as performed in 5.7.1.2. If the value is out of range it may be necessary to adjust to a reading of 17.5 % with R383 (this is the A2 path). Check 'Exec. Course Width RF−Level' of CSBA2 again and adjust if necessary. Repeat steps c) to e). Proceed with f).

f) Send to Monitor1/2 the command 'Normalization, Executive CRS Width detector'.

5.7.3.3 Integral Monitoring CLR (DDM 30 %)

a) RF−level of the corresponding path on the SOAC (Fig. 5−3, 5−4) is set to approx. 3.6 Vpp amplitude as described in 5.7.1.

b) Open dialog 'Monitor1−Nominal Values' and open dialog 'Monitor2−Nominal Values'. Enter measured values (DDM 30 %; SDM 80 %) for 'EXEC CLR Width DDM' and 'EXEC CLR Width SDM'.

c) Send to Monitor1/2 the command 'Calibration, Executive CLR Width detector'.

d) Send to Monitor1/2 the command 'Normalization, Executive CLR Width detector'.

5.7.3.4 Nearfield Monitor (DDM 0 %), optional (if available)

REMARK: Usually the location of the optional nearfield monitor dipole is exactly determined really during flight check. The check and adjustment described here can be executed either after determination of the location or using a provisionally mounted monitor dipole at the theoretical location (see section 5.11).

a) Set the RF−level of the corresponding path on the SOAC (Fig. 5−3, 5−4) to approx. 3.6 Vpp amplitude as described in 5.7.1.4.

b) Open dialog 'Monitor1−Nominal Values' and open dialog 'Monitor2−Nominal Values'. Enter the measured values (DDM 0 %, SDM 80 %) for 'Nearfield Pos. DDM' and 'Nearfield Pos. SDM'.

c) Send to Monitor1/2 the command 'Calibration, Executive Nearfield Pos. detector' (or 'Executive Ch. 4 Width detector').

d) Send to Monitor1/2 the command 'Normalization, Executive Nearfield Pos. detector' (or 'Executive Ch. 4 Width detector').

5.7.4 Calibration and Normalization of Standby Monitors

NOTE: Before performing this procedure it is recommended to check alarm limits acc. 5.7.5.

5.7.4.1 Adjustment of Standby Monitoring CLR (DDM 30 %)

a) RF−level of the corresponding path on the SOAC (Fig. 5−3, 5−6) is set to approx. 3.6 Vpp amplitude as described in 5.7.2.

b) Open dialog 'Monitor1−Nominal Values' and open dialog 'Monitor2−Nominal Values'. Enter nominal values (DDM 30%; SDM 80%) for 'STBY CLR Width DDM' and 'STBY CLR Width SDM'.

c) Open dialog 'Transmitter2−Waveform Data#1'. Set 'CLR RF−LEVEL', 'CLR DDM' and 'CLR SDM' of the standby transmitter to the same value as defined in 5.5.2.

d) Send to Monitor1/2 the command 'Calibration, Standby CLR Width Detector'.

e) Send to Monitor1/2 the command 'Normalization, Standby CLR Width Detector'.

5.7.4.2 Adjustment of Standby Monitoring CRS POS (DDM −11.7 %)

a) RF−level of the corresponding path on the SOAC (Fig. 5−3, 5−6) is set to approx. 3.6 Vpp amplitude as described in 5.7.2.

b) Open dialog 'Monitor1−Nominal Values' and open dialog 'Monitor2−Nominal Values'. Enter the nominal values (DDM −11.7 %; SDM 80 %) for 'Stby CRS CSB1 DDM' and 'Stby CRS CSB1 SDM'.

NOTE: The DDM means value of CSB1 DDM. Refer to 5.5.1 f) for the actual CSB1 DDM value.

c) Open dialog 'Transmitter2−Waveform Data#1'. Note down the value of 'Stby CRS CSB1 DDM'; set it to 0 %.

d) Send to Monitor1/2 the command 'Calibration, Standby CRS Position Detector'.

e) Restore values changed in c) back to noted down values.

f) Send to Monitor1/2 the command 'Normalization, Standby CRS Position Detector'.

5.7.4.3 Adjustment of Standby Monitoring CRS WIDTH (DDM 17.5 %)

a) RF−level of the corresponding path on the SOAC (Fig. 5−3, 5−6) is set to approx. 3.6 Vpp amplitude as described in 5.7.2.

b) Open dialog 'Monitor1−Nominal Values' and open dialog 'Monitor2−Nominal Values'. Enter the nominal values (DDM 17.5 %; SDM 80 %) for 'Stby CRS Width DDM'.

c) Open dialog 'Transmitter2−Waveform Data#1'. Note down the values of 'CRS CSB1 DDM', 'CRS CSB2 DDM' and 'CRS SBO' of standby transmitter; set them all to 0 %.

d) Send to Monitor1/2 the command 'Calibration, Standby CRS Width detector'.

e) Restore values changed in c) back to noted down values.

NOTE: The procedure enables to calibrate to 17.5 % within a range of about 17 % to 18 %. This is normally achieved by an accurate adjustment of the ratios of the Stby inputs of CSBA1, CSBA2, SBOA3 as performed in 5.7.2.2. If the value is out of range it may be necessary to adjust to a reading of 17.5 % with R511 (this is the A2 path). Check 'Standby Course Width RF Level' of CSBA2 again and adjust if necessary. Repeat steps c) to e). Proceed with f).

f) Send to Monitor1/2 the command 'Normalization, Standby CRS Width detector'.

5.7.5 Check Alarm Limits

NOTE: If upper limit is equal to lower limit, executive monitoring is not available. The alarm limits are recommended values. A part of these will be checked and defined during Flight Check.

5.7.5.1 Executive Alarm Limits

a) Open dialog 'Monitor 1 − Executive Alarm Limits' and open dialog 'Monitor 2 − Executive Alarm Limits' (for MCS: dialogs 'Monitor 1/2 − Limits: Current Executive Data').

b) Check that RF level alarm limits for all monitors are set to:
90 % (lower limit) and 110 % (upper limit); also used: 120 % (upper limit).

c) Check that SDM alarm limits for all monitors are set to:
76 % (lower limit) and 84 % (upper limit).

d) Check that POS DDM alarm limits for all monitors are set to:
−5.4 % (lower limit) and +5.4 % (upper limit) (CAT I to III).

e) Check that CRS WIDTH DDM alarm limits for all monitors are set to:
−4.3 % (lower limit) and +4.3 % (upper limit) of the actual value;
example for 17.5 %: 13.2 % (lower limit) and 21.8 % (upper limit).
NOTE: CAT II and III only !

f) Check that CLR WIDTH DDM alarm limits for all monitors are set to:
−4 % (lower limit) and +4 % (upper limit) of the actual measured value.

g) Check that RF level alarm limit for the monitors is set to:
71 % (lower limit) and 129 % (upper limit).

h) Check that SDM alarm limit for the monitors is set to:
76 % (lower limit) and 84 % (upper limit).

i) Check that POS DDM alarm limit for the monitors are set to:
−5.4 % (lower limit) and +5.4 % (upper limit) (CAT I to III).

j) Check that Alarm delay time is set to: CAT I: 10 s; CAT II: 5 s; CAT III: 2 s (prefer. 1 s); NF: 20 s.
NOTE: Values of g) to i) are the alarm limits for the optional nearfield monitor.

5.7.5.2 Standby Alarm Limits

a) Open dialog 'Monitor 1 − Standby Alarm Limits' and dialog 'Monitor 2 − Standby Alarm Limits' (for MCS: dialogs 'Monitor 1/2 − Limits: Current Standby Data').

b) Check that RF level alarm limits for all monitors are set to:
90 % (lower limit) and 110 % (upper limit); also used: 120 % (upper limit).

c) Check that SDM alarm limits for all monitors are set to:
76 % (lower limit) and 84 % (upper limit).

d) Check that POS DDM alarm limits for all monitors are set to:
−5.4 % (lower limit) and +5.4 % (upper limit) of the actual value setting, e.g. CSB1 DDM setting −11.7 % (CAT I to III).

e) Check that CRS WIDTH DDM alarm limits for all monitors are set to:
−4.3 % (lower limit) and +4.3 % (upper limit) of the actual value;
example for 17.5 %: 13.2 % (lower limit) and 21.8 % (upper limit).
NOTE: CAT II and III only !

f) Check that CLR WIDTH DDM alarm limits for all monitors are set to:
−4 % (lower limit) and +4 % (upper limit) of the actual measured value.

REMARK: Check pre−alarm limits. If need be adjust to 80 % of alarm limit value (recommended).

5.8 BATTERY MONITORING

If emergency batteries are available, the battery voltage can be monitored to avoid over discharge of batteries. For this purpose, a warning level can be set and a low level limit can be set.

NOTE: A battery switch off to avoid deep discharge is executed via the separate LVS−circuit and the relays located on the BP−PS subrack.

a) Open dialog 'LRCI − Environmental Setup'.

b) Enable 'Battery Low Monitoring' by selecting 'Alarm Maint. Alert' or 'Alarm Degradation'.

NOTE: 'Alarm Maint. Alert' means indication only, 'Alarm Degradation' means action.

c) Set 'Battery Warning Level' to e.g. 46.0 V.

NOTE: Setting range: 40 to 50 V.

d) Set 'TX off if battery lower than' to e.g. 44.0 V.

NOTE: Setting range: 40 to 50 V.

5.9 NORMAL OPERATION

a) Switch both TX on and set TX1 on aerial.

b) Check that no MONITOR ALARM or TX WARNING is on, otherwise locate and eliminate the fault.

c) Set TX2 on aerial.

d) Check that no MONITOR ALARM or TX WARNING is on, otherwise locate and eliminate the fault.

e) Set TX1 on aerial.

f) Set all Monitor Bypass off.

NOTE: NORMAL should light up in MAIN STATUS field.

5.10 FLIGHT CHECK

The following describes procedures for flight check. However, scope and sequence of this procedures may vary depending on the individual flight check crew. It is assumed that TX1 is used as aerial transmitter. Set to monitor bypass mode during flight check procedure.

NOTE: A local LCP menu ”FLIGHT CHECK ADJUSTMENT” is available for some level or phase adjustments during flight check, e.g. for CSB and SBO for course and clearance. This menu item is only available in *'Local'* mode position of the key switch on the LCP.

5.10.1 Antenna Height Check

The height of each antenna must be checked separately by measuring the field strength null.

NOTE: These measurements are complex. Either fly along the null, which is however almost impossible and makes no sense in critical terrain, where usually a M type is required, or fly horizontally and evaluate the nulls. It is important during a level flight that A1 and A3 are cancelled out on the glide angle.

The following null requirements must be fulfilled:

- *A1 = 2x glide angle*
- *A2 = Glide angle (most important null)*
- *A3 = 2/3 or 4/3 or 6/3 etc. • glide angle*

If not, correct the antenna heights individually: $h_{new} = h_{old}$ • *(actual angle : setpoint)*

If, however, flights along the null are made, the following steps must be taken prior to the flight check:

a) Switch TX1 off.

b) Loosen antenna cables for A1, A2, A3 on top of the cabinet. Terminate outputs on cabinet for A2, A3 with 50 ohms/10 W.

c) Connect the antenna to be checked directly to output for A1 (CSB out).

REMARK: Before connecting the next antenna, switch off TX each time !

d) Switch TX1 on. Let the flight check perform a level run.

e) Switch TX1 off.

f) Interconnect equipment as normal.

5.10.2 SDM and DDM 0 Check (TX1)

DDM check:
The DDM check makes no sense for the active Glide Path and can be omitted, because no DDM 0 is radiated and the DDM for CRS CSB1 and CRS CSB2 (e.g. 11.7 % and 46.7 %) which are adjusted in the first alignment procedure are changed anyway by a width correction during flight check.

SDM check:
Due to the use of calibrated instruments, the SDM values are actually very exactly adjusted in the first alignment, that a flight check is not necessary. If SDM values are however checked during flight check, consequently the SDM values of the course signals CSB1, CSB2 and CLR of both transmitters have to be checked.

5.10.3 Phasing A1 — A3

REMARK: This check is only necessary for first flight check and if required main flight check.

a) Switch TX1 off. Perform the same setup as described in section 5.6.2 a) to i).

b) Approach at 3° elevation (nominal glide angle).

c) Change the CRS SBO Phase (normal phase + 90˚) until indication is 0 % DDM in the aircraft. If there is 150 Hz >90 Hz at the measured DDM value, the required phase change for quadrature phasing must be > 90° related to the normal phase determined during the ground phasing. The other way round, if 90 Hz >150 Hz the phasing must be < 90°.

d) CRS SBO Phase (normal phase) = *determined value* − 90°

e) If phase has changed, repeat phase adjustment (see section 5.7.1).

f) Set TX2 on aerial.

g) Same parameter variation as for TX1. Correct CRS SBO Phase until 'DDM Course Pos. Integral' indicates 0 %.

h) Switch both TX off.

5.10.4 SBO Level A3

a) Output of cabinet for A2 terminated with 50 ohm/10 W. Both TX are switched on. TX1 is set on aerial.

b) Setting of transmitter:

- CRS CSB1 DDM = nominal value according 5.5.1.
- CRS SBO Phase = normal phase
- CRS SBO Amplitude = nominal value
- CLR RF−Level = 0 W

c) Approach at 3˚ elevation.

d) Change 'CRS SBO Amplitude' until indication is 0 % DDM in the aircraft.
If there is 150 Hz > 90 Hz at the measured DDM value, the SBO amplitude must be decreased. The other way round, if 90 Hz >150 Hz, the SBO amplitude must be increased.

e) If amplitude of SBO has changed, repeat amplitude adjustment.

f) Set TX2 on aerial.

g) Same parameter variation as for TX1. Correct CRS SBO Amplitude until 'DDM Course Pos. Integral' indicates 0 %.

h) Switch both TX off.

i) Interconnect equipment as normal.

5.10.5 Phasing A2 − A3

a) Both TX are switched off.

b) Remove supply cable for A1 on top of transmitter cabinet. Terminate output of cabinet for A1 with 50 ohm/10 W.

c) Switch both TX on. Set TX1 on aerial.

d) Setting of transmitter:

- CRS SBO Amplitude = normal (as set in 5.10.4)
- CRS CSB2 DDM = 0 %
- CRS CSB2 Phase = + 90˚ (quadrature)
- CLR RF−Level = 0 W

e) Approach at 0.4 θ_0 resp. 1.6 θ_0 (1.2˚ resp. 4.8˚ at θ_0 = 3˚)

NOTE: Chiefly in critical apron a higher elevation angle is advantageously, because a lower distortion caused by reflections is expected here.

f) Change the CRS CSB2 Phase (normal phase + 90°) until indication is 0 % DDM in the aircraft. If there is 150 Hz > 90 Hz for the measured DDM value (at 1.2°), the required phase change for quadrature phasing must be > 90° related to the normal phase determined during the ground phasing. The other way round if 90 Hz > 150 Hz the phasing must be < 90°.

NOTE: At 4.8° the relations are reversed.

g) CSB CSB2 Phase (normal phase) = *determined value* − 90°

h) Switch TX1 off.

i) Interconnect equipment as normal.

j) If phase has changed, repeat phase adjustment.

k) Set TX2 on aerial.

l) Adjust CRS CSB2 Phase with indication 'Course Width Integral' to optimal value. Normally the phase variation is like TX1.

5.10.6 Glide Angle Check

If the measured glide angle deviates too much from the nominal glide angle, the heights of antennas A1, A2, A3 must be corrected.

5.10.7 Width Setting

a) Switch TX1 on.

b) According to the announcement of the flight check crew the transmitter parameter 'CRS CSB1 DDM', 'CRS CSB2 DDM' and the 'CRS SBO Amplitude' must be corrected in proportion to the determined offset. Use command 'Width Adjustment' (in ADRACS: menu 'Extras', submenu 'Tools') to correct all three parameters in the same percentage.

NOTE: The altering corresponds to the SBO altering for the standard Glide Path.
The command 'Width Adjustment' is currently not available in the MCS user program.

5.10.8 Monitor Readjustment

The settings made during the flight check make it necessary to readjust some of the monitor parameters. Repeat the appropriate steps in Sections 5.7.

5.10.9 Course Alarm

NOTE: See also section 5.12 Alarm Limits and Width Calculation.

a) Open dialog 'Monitor 1 — Current Executive Data' (for MCS: dialog 'Monitor 1 — Measurements/ Limits: Current Executive Data'). Select indication 'Exec. CRS Pos. DDM'.

b) Open dialog 'Transmitter 1 — Waveform Data #1'. Change 'CRS CSB1 DDM' (e.g. ±5.4 %) to reach the preset alarm limits. If necessary, restrict or enlarge as specified by the flight check crew.

5.10.10 Width Alarm

a) Open dialog 'Monitor 1 − Current Executive Data' (for MCS: dialog 'Monitor 1 − Measurements/ Limits: Current Executive Data'). Select indication 'Exec. CRS Width DDM'.

b) Change course width with command 'Width Adjustment' (in ADRACS: menu 'Extras', submenu 'Tools') to reach the preset alarm limits.

NOTE: The command 'Width Adjustment' is currently not available in the MCS user program.

c) If necessary, restrict or enlarge the alarm limits as specified by the flight check crew.

5.10.11 Miscellaneous

Some other parameters must also be checked, e.g. the range. No further settings must be made with the transmitter or monitor however.

Finally, the system has to be set to normal operation, i.e. monitor bypass is removed, TX1 is aerial and the key−lock switch at the LCP is set to "Remote".

5.11 DETERMINING THE MONITOR LOCATION

a) Calculate the theoretical location with the approximate equation:

$$D_{MON} = \frac{(h_3^{\,2} - h_1^{\,2}) \times f}{2 \times 300}$$

NOTE: h = antenna height in m; f in MHz.

b) Calculate monitor height:

$H_{Mon} = D_{Mon} \; x \; \tan \theta_0$

c) To optimize the calculated distance with the aid of measuring technique, A1 should radiate CSB only and A3 should radiate SBO only.

d) Switch both TX off.

e) Remove supply cable for A2 on top of transmitter cabinet. Terminate output of cabinet for A2 with 50 ohm/10 W.

f) Switch TX1 on..

g) Setting of transmitter (remember original settings):

- Set 'CRS CSB1 DDM' to 0 %
- Add +90° to 'CRS SBO Phase' (quadrature)
- Set 'CLR RF−Level' to 0 W

h) Using the portable DDM instrument and an auxiliary mast measure DDM at the calculated monitor point (D_{Mon} , H_{Mon}). If the measured DDM deviates from 0 %, alter the distance until a DDM=0 % is achieved.

i) Switch TX1 off.

j) Interconnect equipment as normal, connect cable of A2 again.

k) Switch TX1 on.

l) Setting of transmitter:

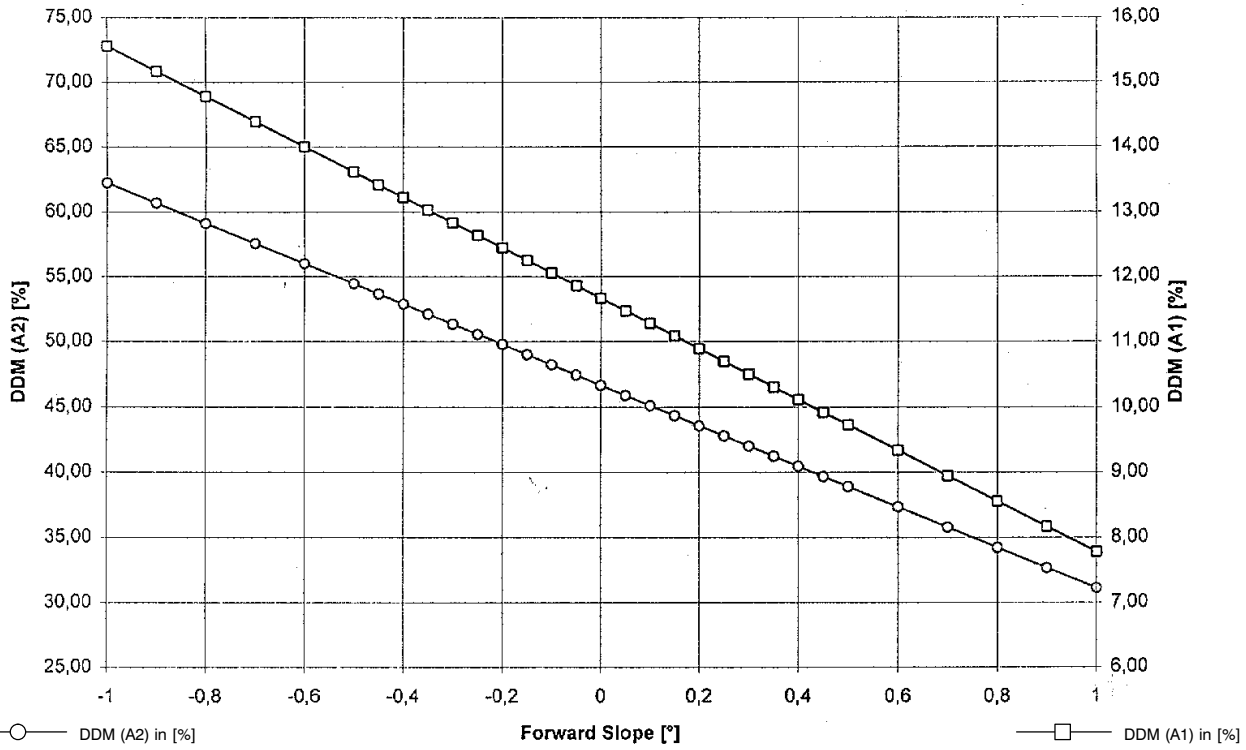
- Set 'CRS CSB1 DDM' and 'CRS SBO Phase' back to original values.
- Set 'CLR RF−Level' to 0 W.

m) Alter the height of the receiving antenna at the determined optimal distance point until DDM=0 % is achieved.

NOTE: When altering the monitor antenna height two nulls may occur. The monitor is to adjust in a way that the DDM is reversed in comparison to the farfield with altering the height: height lower, 90 Hz > 150 Hz at the nearfield monitor.

n) Set 'CLR RF−Level' back to original value. This must not lead to any change in the course position (< ±0.1 %).

o) Finally switch TX2 on. TX1 is set to aerial.



NOTE: DDM adjustment values of antennas A1 and A2 of the active Glide Path in dependence upon the Forward Slope. In normal case the GP width is determined by the antenna height and the default DDM values. With rising or falling terrain a smaller or greater glide angle as e.g. 3° has to be realized, whereby the width must not be altered for the nominal angle (3°).

Forward Slope [°]	Res. Glide Angle [°]	DDM (A2) [µA]	DDM (A1) [µA]	DDM (A2) [%]	DDM (A1) [%]
−1	4	533,5	133,4	62,24	15,56
−0,9	3,9	520,1	130,0	60,68	15,17
−0,8	3,8	506,8	126,7	59,13	14,78
−0,7	3,7	493,4	123,4	57,56	14,39
−0,6	3,6	480,1	120,0	56,01	14,00
−0,5	3,5	466,8	116,7	54,46	13,62
−0,45	3,45	460,1	115,0	53,68	13,42
−0,4	3,4	453,4	113,4	52,90	13,22
−0,35	3,35	446,8	111,7	52,13	13,03
−0,3	3,3	440,1	110,0	51,35	12,84
−0,25	3,25	433,4	108,4	50,56	12,64
−0,2	3,2	426,8	106,7	49,79	12,45
−0,15	3,15	420,1	105,0	49,01	12,25
−0, 1	3,1	413,4	103,4	48,23	12,06
−0,05	3,05	406,8	101,7	47,46	11,87
0	**3**	**400**	**100,0**	**46,67**	**11,67**
+0,05	2,95	393,4	98,4	45,90	11,47
+0,1	2,9	386,8	96,7	45,13	11,28
+0,15	2,85	380,1	95,0	44,35	11,09
+0,2	2,8	373,4	93,4	43,56	10,89
+0,25	2,75	366,8	91,7	42,79	10,70
+0,3	2,7	360,1	90,0	42,01	10,50
+0,35	2,65	353,4	88,4	41,23	10,31
+0,4	2,6	346,8	86,7	40,46	10,12
+0,45	2,55	340,1	85,0	39,68	9,92
+0,5	2,5	333,5	83,4	38,91	9,73
+0,6	2,4	320,1	80,0	37,35	9,34
+0,7	2,3	306,8	76,7	35,79	8,95
+0,8	2,2	293,5	73,4	34,24	8,56
+0,9	2,1	280,1	70,0	32,68	8,17
+1	2	266,8	66,7	31,13	7,78

Nominal glide angle: 3°

Fig. 5−8 DDM settings for A1, A2 of the active GP

5.12 MONITOR ALARM LIMITS, COURSE WIDTH CALCULATION

– ILS, Glide Path monitor alarm limits

Parameter	ICAO Annex 10	Reference−§ Annex 10	Standard setting for GP 422 (DDM)	Nom. values for flight check glideangle:3 °;coursewidth:1.44 °
90 Hz−Mod. depth	40 % ± 2.5 %	(3.1.5.5.1)		
150 Hz−Mod. depth	40 % ± 2.5 %	(3.1.5.5.1)		
SDM	80 % ± 5 %		80 % ± 4 %	
Alarm low (CAT I...III)	−7.5 % of nom. glide angle	(3.1.5.7.1)	−5.50 %	2.78°
Alarm up (CAT I...III)	+10 % of nom. glide angle		+7.30 %	3.3°
Width alarm Course CAT I	±31 % of nom. width (± 5.43 % DDM)	(3.1.5.7.1)	12.1 % ... 22.9 %	
Width alarm Course CAT II/III	±25 % of nom. width (±4.37 % DDM)	(3.1.5.7.1)	13.2 % ... 21.8 %	wide: 1.92° / narrow: 1.15°
Width alarm Clearance	>22 % DDM (>0.3 Θ)	(3.1.5.6.4)	4 % of nom. value	Fly up: >190 µA
RF Level (Integr., Intern.)	2F: 90 % (71 % possible)	(3.1.5.7.1)	71 % ... 129 % *	
RF Level (Nearfield)			71 % ... 129 % *	
Alarm delay time	CAT I: 10 s; CAT II: 5 s; CAT III: 2 s (preferably 1 s); Nearfield: 20 s.			

* also possible: 90 ... 110 % (or 120 %)

– Calculation of resulting course width on change of the ”Displacement Sensitivity” according ICAO ANNEX 10 for *x* %:

Resulting Width = Nominal Width / [(100−x) / 100] ==> for 3˚ glide angle:

Width wide = 1.44˚ / [(100−25) / 100] = 1.92˚;
Width narrow = 1.44˚ / [(100+25) / 100] = 1.15˚

Nominal DDM at course width:

±17.5 % ==> DDM [%] = (DDM [µA] /150) • 17.5
and
±150 µA ==> DDM [µA] = (DDM [%] /17.5) • 150

5.13 CONVERSION OF RETURN LOSS TO VSWR VALUES

The following table shows the return loss in dB and the correspondent VSWR value.

Return Loss [dB]	Reflection Coefficient	VSWR	Return Loss [dB]	Reflection Coefficient	VSWR
1	0.891	17.391	21	0.089	1.196
2	0.794	8.724	22	0.079	1.173
3	0.708	5.848	23	0.071	1.152
4	0.631	4.419	24	0.063	1.135
5	0.562	3.570	25	0.056	1.119
6	0.501	3.010	26	0.050	1.106
7	0.447	2.615	27	0.045	1.094
8	0.398	2.323	28	0.040	1.083
9	0.355	2.100	29	0.035	1.074
10	0.316	1.925	30	0.032	1.065
11	0.282	1.785	31	0.028	1.058
12	0.251	1.671	32	0.025	1.052
13	0.224	1.577	33	0.022	1.046
14	0.200	1.499	34	0.020	1.041
15	0.178	1.433	35	0.018	1.036
16	0.158	1.377	36	0.016	1.032
17	0.141	1.329	37	0.014	1.029
18	0.126	1.288	38	0.013	1.025
19	0.112	1.253	39	0.011	1.023
20	0.100	1.222	40	0.010	1.020

5.14 RATIO LEVELS A1/A2/A3 FOR WIDTH ADJUSTMENT

The following table lists the normalized ratio levels A1/A2/A3 used for the integral monitoring width adjustment, depending on a forward slope of terrain which deviates from 0°.

Apron (Fwd. Slope) Setting value	Physical glide angle	A1 normalized	A2 normalized	A3 normalized
− 1,000	4,00	1,00	0,56	0,69
− 0,900	3,90	1,00	0,57	0,67
− 0,800	3,80	1,00	0,59	0,66
− 0,700	3,70	1,00	0,60	0,64
− 0,600	3,60	1,00	0,62	0,62
− 0,500	3,50	1,00	0,64	0,60
− 0,400	3,40	1,00	0,65	0,57
− 0,300	3,30	1,00	0,67	0,55
− 0,200	3,20	1,00	0,69	0,52
− 0,100	3,10	1,00	0,71	0,49
0,000	**3,00**	**1,00**	**0,74**	**0,46**
+ 0,100	2,90	1,00	0,76	0,42
+ 0,200	2,80	1,00	0,79	0,38
+ 0,300	2,70	1,00	0,81	0,34
+ 0,400	2,60	1,00	0,84	0,29
+ 0,500	2,50	1,00	0,87	0,24
+ 0,600	2,40	1,00	0,91	0,18
+ 0,700	2,30	1,00	0,94	0,11
+ 0,800	2,20	1,00	0,98	0,03
+ 0,900	2,10	0,97	1,00	0,05
+ 1,000	2,00	0,93	1,00	0,14

Nominal Glide Angle = 3°

CHAPTER 6
MAINTENANCE, FAULT LOCATION AND REPAIR

6.1 MAINTENANCE

6.1.1 Introduction to Maintenance Activities

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 (see document ICAO DOC 8071, Vol. I, chapter 4 for ILS) recommends verifying the most important signal parameters of the ground station within the framework of periodic maintenance to maintain the operational integrity and serviceability. In addition, flight testing is required to confirm the correctness of the setting of essential signal—in—space parameters to determine the operational safety and acceptability of the ILS installation.

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). Changes to the established monitor alarm limits should only be done during flight check procedure.

In the Navaids ILS 420, all the main parameters are maintained at the preset values throughout the entire life of the system by means of a digital 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 faulty 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. In addition to the periodic maintenance work, 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!

6.1.2 Work on Equipment sensitive to electrostatic charge

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 electrostatic 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.

6.2 PERIODIC MAINTENANCE

We recommend for a CAT. III installation to perform the maintenance activities listed in the table below weekly, quarterly, half−yearly or yearly (more details are given in ICAO DOC 8071, Vol. I, 4th Ed.). For other categories (CAT. II or I) the scope of activities should be defined accordingly. The half−yearly checks (items 13 to 15) are performed mandatory. Besides the recommended activities, the responsible authorities may define individual procedures depending on local guide lines and requirements.

The following measuring instruments are recommended for maintenance on site:

- Desktop PC or Laptop with PC User Program (ADRACS or MCS) used for maintenance on site
- ILS test set for field measurement (e.g. PIR)
- Multimeter, frequency counter, frequency generator, spectrum analyzer (e.g. HP8561E, 30 Hz to 6.5 GHz), cables, adapters
- If non maintenance free batteries are used:
  Battery maintenance equipment (acidimeter, acid syringe, areometer, thermometer, funnel). Refer to the instructions of the manufacturer.

Ground test requirements for ILS performance CAT. III:

No.	**Weekly maintenance** (recommended)
1	Check system status and make a visual inspection of building equipment and antenna (6.2.1).
2	Check course alignment and course shift monitoring (6.2.2).
3	Check displacement sensitivity and displacement sensitivity monitoring (6.2.2).
4	LLZ only: Check reduction of clearance DDM deflection < 150 uA, 2F systems only (6.2.2).
5	Check reduction in power monitoring (6.2.2).
6	Check total time to shutdown, if out−of− tolerance radiation (6.2.2.1).

No.	**Quarterly maintenance, additional to weekly** (recommended)
7	Check Off course clearance (6.2.2).
8	Check settings of all parameters of both transmitters and monitoring for each parameter (6.2.2).
9	Check output power and power alarm (6.2.2).
10	Remote control system (line loss): Check LCD window 'Alerts' for remote control alert message.
11	Check battery function by simulating a power failure (6.2.5).
12	Clean all equipment thoroughly (6.2.7).
No.	**Half−yearly maintenance, additional to quarterly** (mandatory)
13a	Check shutdown circuits and control logics (refer to 6.2.3).
13b	If the interlock function is used: Check of ECU interlock shutdown control 6.2.3.1).
14	Check MIT function (refer to 6.2.4, or with ECU 120571−0003 only: 6.2.4.1).
15	Check lead batteries including voltage check (refer to 6.3.2, 6.3.3).

No.	**Yearly maintenance, additional to half−yearly** (recommended)
16	Check synthesizer carrier frequency (6.2.2.2).
17	Check transmitter signals with respect to further parameters like harmonics or spurious (6.2.2).
18	Take a complete memory readout of all possible parameters (6.2.6).
19	Check for damages: RF cable connections, mechanical parts (6.2.1)

Fig. 6−1 Periodic maintenance ground test requirements

6.2.1 Damage Check

The following system parts have to be checked visually for entirety and damage:

- Shelter and equipment, fence around the station
- Antenna installation, Monitor dipole, monitor mast and cable
- Obstruction lights
- Tight fitting of all RF cable connections (internal and external), performed yearly only
- Tight fitting of all mechanical parts (screws and nuts), performed yearly only

6.2.2 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. For example course alignment may be checked by center line runs with a test vehicle weekly, but in case a farfield monitor is available and by integrity and stability history, the maintenance intervals may be increased.
The check of monitor parameter alarms is proposed to be done with a change of corresponding transmitter parameter (power level, DDM, SDM etc). In addition, there are some special checks to be performed which are described separately. Item 4 is only performed with LLZ systems. For item 17, it is recommended to use a spectrum analyzer connected to a 50 dB directional coupler which is inserted in the feeding cable at the output on top of the cabinet.

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.

6.2.2.1 Shut Down Timing Test (STT)

The purpose of the Shutdown Timing Test is to measure the time it takes to accomplish a complete shutdown when the radiating signal source(s) is (are) invalid. The STT measures the time to complete shutdown both on dual—equipment (DE) systems and on single equipment (SE) systems. The test is performed with the PC User Program.

a) Use menu 'Commands' — 'More commands' — 'Transmitters' — 'TX Miscellaneous'. Select 'Initiate transfer/shutdown test' to activate the STT. The result is shown in the window MON1(2) 'Transfer Timing Data': the item 'Test Procedure Result' must show 'OK'.

6.2.2.2 Check of Carrier Frequency

Validate set station frequency with a frequency counter or similar. The measurement is performed at the affected TX in Stdby mode (this RF path includes a 35 dB attenuator):

a) Switch off both TX1 and TX2. Remove RF cable from J25 (Stby CRS CSB) at PIN—Diode Transfer Switch, rear side of cabinet. Connect Frequency Counter to J25 (stby CSB out).

b) Switch on both TX1 and TX2. Open dialog 'Transmitter1—Waveform Data#1' and 'Transmitter2—Waveform Data#1'. Note down value of 'CRS CSB SDM' of standby transmitter. Set it to 0 %. Validate indication of station frequency. After measurement, reset 'CRS CSB SDM' of standby transmitter to noted value. Change transmitter, repeat step b).

c) Finally switch off both TX and connect as normal again. Switch on both TX.

6.2.3 Performing Check of Shutdown Circuits and Control Logics

Transmitter shutdown occurs with the activation of either the modulation shutdown (Shutdown B, modulation signal at LGA off), or the synthesizer shutdown (Shutdown A, synthesizer carrier generation off). To ensure that no latent failure exists in the shutdown paths (LGA or SYN) that would prevent its capability, it is to verify that a transmitter shutdown occurs solely due to this path. To perform the test, refer to section 6.2.8. Follow the procedure described in the ECU test data sheet.

6.2.3.1 Check of ECU Interlock Shutdown Control

NOTE: Perform this test only if the ECU Interlock function is really used.

Preparation: The runway to which the station under test belongs, must be the inactive one. The correspondent station status must be 'OFF'. Verify that the DIP—switch SW4*(SW1)*/2 at the ECU subassembly is set to 'open': Interlock enabled.

Test action	Expected result
At the LCP of the station , perform a 'TX on ' command.	The transmitter is turned on, but station remains not radiating because the ECU keeps both shut down paths 'OFF' (SYN and MOD shutdown). Station status changes from 'OFF' to 'Runway OFF'.
After test has passed return to normal operation	

6.2.4 Performing Check of MIT Function

Test action	Expected result
Set monitors to bypass; open dialog 'TX Integrity Test Waveforms' for the transmitter that is on the aerial. Open dialog 'Integrity Test Data' for monitor 1 and monitor 2. Open dialog 'LRCI System Status'. Change test signal A DDM from 0.0 % DDM to 1.5 % DDM.	Verify MON1 Test Signal A DDM goes to alarm. Verify MON2 Test Signal A DDM goes to alarm. Verify "MON-1 Integrity Test Res.= failed". Verify "MON-2 Integrity Test Res.= failed".
Set test signal A DDM to 0.0 %	Verify all reading return to normal conditions.
Change signal B RF level from 70 % to 80 %.	Verify MON1 Test Signal B RF Level goes to alarm. Verify MON2 Test Signal B RF Level goes to alarm. Verify "MON-1 Integrity Test Res.= failed". Verify "MON-2 Integrity Test Res.= failed".
Set signal B RF level to 70 %.	Verify all reading return to normal condition.
Change test signal A SDM and B SDM to 72 % for GP.	Verify MON1 Test Signal A SDM and B SDM goes to alarm. Verify MON2 Test Signal A SDM and B SDM goes to alarm. Verify "MON-1 Integrity Test Res.= failed". Verify "MON-2 Integrity Test Res.= failed".
Change test signal A SDM to the original setting, change test signal B SDM to the original setting.	Verify all reading return to normal conditions.
End MIT verification test.	

NOTE: The test values are referenced to the LGM MIT alarm limit defaults of the monitor integrity test signals:

GP – Monit. Integrity Test	**Test signal A**	RF Level	SDM	DDM	**Test signal B**	RF Level	SDM	DDM	Unit
Default value		90	80	0		70	76	3.0	%
Alarm limit defaults	Lower/Upper	88/92	78/82	–1.0/1.0	Lower/Upper	68/72	74/78	2.0/4.0	%

6.2.4.1 Performing advanced Check of MIT Function (ECU 120571–0003 only)

With the ECU 120571–0003 an advanced check of the MIT–Function is introduced. This check must not be performed with the ECU –0001 and –0002. The MIT check in section 6.2.4 can be performed for both the ECU –0001/–0002 and the ECU –0003.

Test action	Expected result
Verify monitor bypass off; key switch is in 'Remote' or 'Local' position. – Open dialog 'TX Integrity Test Waveforms' for the transmitter that is on aerial (e.g. TX1), and that is on Standby (e.g. TX2). – Open dialog 'Integrity Test Data' for monitor 1 and monitor 2. – Open dialog 'LRCI System Status'.	Verify all reading in normal conditions.
Change 'Integrity test signal A DDM' (TX1/ LGA1) from 0.0 % DDM to 1.5 % DDM.	Verify changeover of TX1 aerial to TX2 standby, now aerial. Check at ECU front: LED 'Alarm MON1' and 'ALARM MON2' (Standby) lit.
Change 'Integrity test signal B DDM' (TX2/ LGA2) from 3.0 % DDM to 0.0 % DDM.	Verify shutdown of also TX2: Both TX off Check at ECU front: LED 'Alarm MON1' and 'ALARM MON2' (Exec. & Standby) lit. LED 'Integrity Fail' lit.
Set changed 'Integrity test signal A DDM' (TX1) and changed 'Integrity test signal B DDM' (TX2) back to the original setting: 0.0% (A) and 3.0 % (B).	Verify all reading return to normal conditions.
Perform 'Reset ECU' to restart the system.	Both TX on. Verify all reading return to normal conditions. Equipment is serviceable. End MIT check.

6.2.5 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 'AC1 Failure' and 'AC2 Failure'.

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.

6.2.6 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.

6.2.7 Cleaning

CAUTION

Cleaning aids, such as brushes and dusters, must be made of antistatic material. See also the instructions in Section 6.1.2.

– 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 months. 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. Cleaning procedure: Moisten a cloth a little 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 6.1.2 for voltage−sensitive semiconductors.

– Antenna
  Inspect complete antenna, monitor dipole and the equipment installation for any damage caused by corrosion, rodents, termites, or others. Air traffic control should be informed before the antenna will be inspected. Normally the antenna is not radiating while inspection.

6.2.8 Performing Check of Shutdown Paths

NOTE: This procedure will take the station out of service.

The shutdown paths are checked for both Shutdown A path (carrier off) and Shutdown B path (modulation off) for the TX1 and TX2 each. Use Oscilloscope with probes for signal check at ECU (voltage) and MODPA TP1 (CSB) and TP2 (SBO). If any test fails the ECU, SYN or LGA card should be replaced before the system is put back into service. The procedure should be accomplished without removing the ECU card from the equipment cabinet. The jumper should be repositioned without removing power from the ECU card. When a jumper is in any of the 'park' positions, the ECU will not have a test fault. The park positions are used only to hold jumpers. To perform this check, use proposed form and maintain it in station records. Fig. 6−2 shows the jumper and testpoints. With ECU board 120571−0003, regard the different jumper label noted. Proceed as follows:

- Set key lock switch at LCP to 'Maintenance'. After the test set key lock switch to previous position.
- Log on to system in level 4. With transmitters on verify that there are no alarms, alerts or ECU faults other than the maintenance switch notice indicated on the LCP screen. If there are, troubleshoot and correct before continuing.

The form comprises following checks:

- Functional test modulation shutdown path TX1 (Shutdown 1B, Shutdown 1A disabled)
- Functional test modulation shutdown path TX2 (Shutdown 2B, Shutdown 2A disabled)
- Functional test Synthesizer carrier shutdown path TX1 (Shutdown 1A, Shutdown 1B disabled)
- Functional test Synthesizer carrier shutdown path TX2 (Shutdown 2A, Shutdown 2B disabled)
- Functional test of Control Logic 1 and 2 and 3rd Shutdown Path (incl. clock detector)

Up to 8 jumpers should be available to perform the test settings.

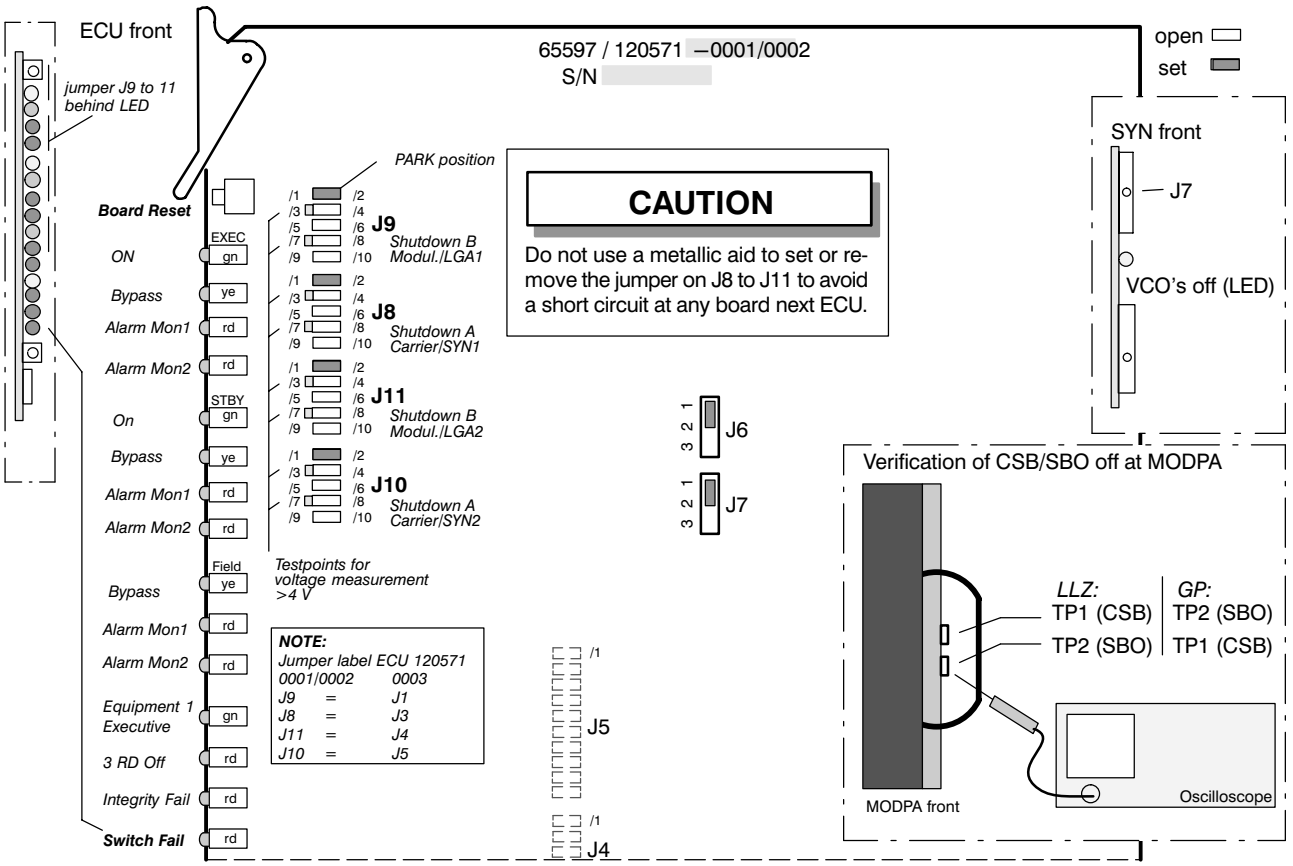


Fig. 6−2 ECU, location of J8,J10, J9,J11 and testpoints; MODPA location of testpoints TP1,TP2

Test Data Sheet: Shutdown Path testing (with ECU –0001/–0002)

Test Item	Jumper set	Purpose	Action	Expected Result	Passed	Failed
Prerequisite: Equipment in 'Normal' condition, both TX on, TX1 main	*ECU –0001/–0002*		On LCP: Switch key lock switch to 'MAINTENANCE'.	– 'Monitor Bypass' set – Status 'Alarm' (defeats the 20 s min. off time control)		
TX1	J8:1–2, 9–10	Park position				
Modulation shutdown path (LGA1) * *GP active only*	J8: 3–4 J8: 5–6	forces Syn 1 carrier gener. remain enabled: Shutdown 1A path will fail	Set 'TX1 off'. check TP1, TP2 at MODPA1 *2F equipment:* check TP1, TP2 also at MODPA2	– Shutdown 1B should act – ECU shows 'Switch Fail' – Alert warning 'ECU fault' – SYN1: LED 'VCO off' off – CSB, SBO not present (CRS) – CSB, SBO not present (CLR); GP: CLR, CSB2*		
TX2	J10:1–2,9–10	Park position				
Modulation shutdown path (LGA2) * *GP active only*	J10: 3–4 J10: 5–6	forces Syn 2 carrier gener. remain enabled: Shutdown 2A path will fail	Set 'TX2off'. check TP1, TP2 at MODPA1 *2F equipment:* check TP1, TP2 also at MODPA2	– Shutdown 2B should act – ECU shows 'Switch Fail' – Alert warning 'ECU fault' – SYN2: LED 'VCO off' off – CSB, SBO not present (CRS) – CSB, SBO not present (CLR); GP: CLR, CSB2*		
ECU	J8,J10		Set to park posit.			
Set "TX1 on" and "TX2 on" TX1 is main			Reset ECU .	Clears the ECU fault: – 'Switch fail' is off – ECU Fault maint. warning is removed (time < 30 s).		
TX1	J9:1–2,9–10	Park position				
Syn. carrier shutdown path (SYN1) * *GP active only*	J9: 3–4 J9: 5–6	forces modulation gener. path (LGA1) remain enabled: Shutdown 1B path will fail	Set 'TX1 off'. check TP1, TP2 at MODPA1 *2F equipment:* check TP1, TP2 also at MODPA2	– Shutdown 1A should act – ECU shows 'Switch Fail' – Alert warning 'ECU fault' – SYN1: LED 'VCO off' on – CSB, SBO not present (CRS) – CSB, SBO not present (CLR); GP: CLR, CSB2*		
TX2	J11:1–2,9–10	Park position				
Syn. carrier shutdown path (SYN2) * *GP active only*	J11: 3–4 J11: 5–6	forces modulation gener. path (LGA2) remain enabled: Shutdown 2B path will fail	Set 'TX2 off'. check TP1, TP2 at MODPA1 *2F equipment:* check TP1, TP2 also at MODPA2	– Shutdown 2A should act – ECU shows 'Switch Fail' – Alert warning 'ECU fault' – SYN2: LED 'VCO off' on – CSB, SBO not present (CRS) – CSB, SBO not present (CLR); GP: CLR, CSB2*		
ECU	J9,J11		Set to park posit.			
Set "TX1 on" and "TX2 on" TX1 is main.			Reset ECU .	Clears the ECU fault: – 'Switch fail' is off – ECU Fault maint. warning is removed (time < 30 s).		
Set equipment to 'Normal' condition, both TX ON.			Set key switch to required mode.	Status 'Normal', equipment is in service again		

Date: Sign:

Test Data Sheet ECU: Control Logic 1 and 2, 3rd Shutdown Logic (with ECU —0001/—0002)

Test Item	Jumper set	Purpose	Action	Expected Result	Passed	Failed
Prerequisite: Equipment in 'Normal' condition, both TX on, TX1 main	*ECU —0001/—0002*		On LCP: Switch key lock switch to 'LOCAL'.	— 'Monitor Bypass' not set — Status 'NORMAL' **		
ECU	J8,J9,J10,J11: 1—2, 9—10	Park position		** If 'Maint. Generate LCP Warning' in dialogue 'LRCI Station configuration' is set to 'yes', the status is 'Warning'.		
ECU Control logic 1 TX1	J8: 5—6, 7—8 J9: 5—6, 7—8	Disablecontr. log. 2+3rd shutd.logic: control logic1 remains enabled	Press LGA1 reset until a station alarm is induced Check voltage at J8/3 & J9/3: >4 V	— station shutdown (si)* *or* — change over to TX2 (du)* — ECU shows 'Switch Fail' — Both totem poles are off (1A/1B)		
ECU Control logic 1 TX2	J10: 5—6, 7—8 J11: 5—6, 7—8	Disablecontr. log. 2+3rd shutd.logic: control logic1 remains enabled	Press LGA2 reset until a station alarm is induced Check voltage at J10/3 & J11/3: >4 V	— station shutdown (dual) — ECU shows 'Switch Fail' — Both totem poles are off (2A/2B)		
ECU	J8,J9,J10,J11: 1—2, 9—10	Park position	— park jumper — Reset ECU	TX1 and TX2 are on again; TX1 is main		
ECU Control logic 2 TX1	J8: 3—4, 7—8 J9: 3—4, 7—8	Disablecontr. log. 1+3rd shutd.logic: control logic2 remains enabled	Press LGA1 reset until a station alarm is induced Check voltage at J8/3 & J9/3: >4 V	— station shutdown (si) *or* — change over to TX2 (du) — ECU shows 'Switch Fail' — Both totem poles are off (1A/1B)		
ECU Control logic 2 TX2	J10: 3—4, 7—8 J11: 3—4, 7—8	Disablecontr. log. 1+3rd shutd.logic: control logic2 remains enabled	Press LGA2 reset until a station alarm is induced Check voltage at J10/3 & J11/3: >4 V	— station shutdown (dual) — ECU shows 'Switch Fail' — Both totem poles are off (2A/2B)		
ECU	J8,J9,J10,J11: 1—2, 9—10	Park position	— park jumper — Reset ECU	TX1 and TX2 are on again; TX1 is main		
ECU 3rd Shutdown logic			Disconnect cable at connector J7 (upper) of SYN1.	Causes an executive alarm condition.		
NOTE: The next step will reboot the LCP. Due to missing communications from the LCP during the reboot time, the executive bypass, although asserted, is disabled for the 3rd control logic. On the ECU, the flashing LED 'Exec. Bypass' indicates this state. The 3rd shutdown control integrates the duration of an exec. alarm condition while it is not bypassed. When this integration reaches 6 s, the control then suppresses the clock to the clock detector which triggers a complete station shutdown.						
ECU 3rd Shutdown logic (incl. Clock Detector)			On LCP, Issue a 'Reboot LCP' command. Check voltage at J8/7, J9/7, J10/7 & J11/7: >4 V	— during LCP reboot, LED 'Exec. Bypass' goes off after ~10 s, and on again after ~5 s until station shutdown indicated by ECU LED 'Exec.On' and 'Stby On' off — '3rdShutdown Path Off' lit — verifies 3rd shutd. logic as cause of 'off' condition		
			Reconnect cable to J7 of SYN1. Reset ECU.	Clears the ECU.		
Set equipment to 'Normal' condition, both TX ON. TX1 main.			Set LCP key switch to required mode.	Status 'Normal', equipment is in service again, no alarms or alerts indicated.		

For this test, 8 jumpers are used.

Date: Sign:

** (si)= single, (du)= dual*

Test Data Sheet: Shutdown Path testing (with ECU –0003)

Test Item	Jumper set	Purpose	Action	Expected Result	Passed	Failed
Prerequisite: Equipment in 'Normal' condition, both TX on, TX1 main	*ECU –0003*		On LCP: Switch key lock switch to 'Maintenance'	– 'Monitor Bypass' set – Status 'Alarm' (defeats the 20 s min. off time control)		
TX1	J3: 1–2, 9–10	Park position				
Modulation shutdown path (LGA1) * *GP active only*	J3: 3–4 J3: 5–6	forces Syn 1 carrier gener. remain enabled: Shutdown 1A path will fail	Set 'TX1 off'. check TP1, TP2 at MODPA1 *2F equipment:* check TP1, TP2 also at MODPA2	– Shutdown 1B should act – ECU shows 'Switch Fail' – Alert warning 'ECU fault' – SYN1: LED 'VCO off' off – CSB, SBO not present (CRS) – CSB, SBO not present (CLR); GP: CLR, CSB2*		
TX2	J5: 1–2, 9–10	Park position				
Modulation shutdown path (LGA2) * *GP active only*	J5: 3–4 J5: 5–6	forces Syn 2 carrier gener. remain enabled: Shutdown 2A path will fail	Set 'TX2off'. check TP1, TP2 at MODPA1 *2F equipment:* check TP1, TP2 also at MODPA2	– Shutdown 2B should act – ECU shows 'Switch Fail' – Alert warning 'ECU fault' – SYN2: LED 'VCO off' off – CSB, SBO not present (CRS) – CSB, SBO not present (CLR); GP: CLR, CSB2*		
ECU	J3,J5		Set to park posit.			
Set "TX1 on" and "TX2 on" TX1 is main			Reset ECU .	Clears the ECU fault: – 'Switch fail' is off – ECU Fault maint. warning is removed (time < 30 s).		
TX1	J1: 1–2, 9–10	Park position				
Syn. carrier shutdown path (SYN1) * *GP active only*	J1: 3–4 J1: 5–6	forces modulation gener. path (LGA1) remain enabled: Shutdown 1B path will fail	Set 'TX1 off'. check TP1, TP2 at MODPA1 *2F equipment:* check TP1, TP2 also at MODPA2	– Shutdown 1A should act – ECU shows 'Switch Fail' – Alert warning 'ECU fault' – SYN1: LED 'VCO off' on – CSB, SBO not present (CRS) – CSB, SBO not present (CLR); GP: CLR, CSB2*		
TX2	J4: 1–2, 9–10	Park position				
Syn. carrier shutdown path (SYN2) * *GP active only*	J4: 3–4 J4: 5–6	forces modulation gener. path (LGA2) remain enabled: Shutdown 2B path will fail	Set 'TX2 off'. check TP1, TP2 at MODPA1 *2F equipment:* check TP1, TP2 also at MODPA2	– Shutdown 2A should act – ECU shows 'Switch Fail' – Alert warning 'ECU fault' – SYN2: LED 'VCO off' on – CSB, SBO not present (CRS) – CSB, SBO not present (CLR); GP: CLR, CSB2*		
ECU	J1,J4		Set to park posit.			
Set "TX1 on" and "TX2 on" TX1 is main.			Reset ECU .	Clears the ECU fault: – 'Switch fail' is off – ECU Fault maint. warning is removed (time < 30 s).		
Set equipment to 'Normal' condition, both TX ON.			Set key switch to required mode.	Status 'Normal', equipment is in service again		

Date: Sign:

Test Data Sheet ECU: Control Logic 1 and 2, 3rd Shutdown Logic (with ECU –0003)

Test Item	Jumper set	Purpose	Action	Expected Result	Passed	Failed
Prerequisite: Equipment in 'Normal' condition, both TX on, TX1 main	*ECU –0003:*		On LCP: Switch key lock switch to 'LOCAL'.	– 'Monitor Bypass' not set – Status 'NORMAL' **		
ECU	J3,J1,J5,J4: 1–2, 9–10	Park position		** If 'Maint. Generate LCP Warning' in dialogue 'LRCI Station configuration' is set to 'yes', the status is 'Warning'.		
ECU Control logic 1 TX1	J3: 5–6, 7–8 J1: 5–6, 7–8	Disablecontr. log. 2+3rd shutd.logic: control logic1 remains enabled	Press LGA1 reset until a station alarm is induced Check voltage at J3/3 & J1/3: >4 V	– station shutdown (si)* *or* – change over to TX2 (du)* – ECU shows 'Switch Fail' – Both totem poles are off (1A/1B)		
ECU Control logic 1 TX2	J5: 5–6, 7–8 J4: 5–6, 7–8	Disablecontr. log. 2+3rd shutd.logic: control logic1 remains enabled	Press LGA2 reset until a station alarm is induced Check voltage at J5/3 & J4/3: >4 V	– station shutdown (dual) – ECU shows 'Switch Fail' – Both totem poles are off (2A/2B)		
ECU	J3,J1,J5,J4: 1–2, 9–10	Park position	– park jumper – Reset ECU	TX1 and TX2 are on again; TX1 is main		
ECU Control logic 2 TX1	J3: 3–4, 7–8 J1: 3–4, 7–8	Disablecontr. log. 1+3rd shutd.logic: control logic2 remains enabled	Press LGA1 reset until a station alarm is induced Check voltage at J3/3 & J1/3: >4 V	– station shutdown (si) *or* – change over to TX2 (du) – ECU shows 'Switch Fail' – Both totem poles are off (1A/1B)		
ECU Control logic 2 TX2	J5: 3–4, 7–8 J4: 3–4, 7–8	Disablecontr. log. 1+3rd shutd.logic: control logic2 remains enabled	Press LGA2 reset until a station alarm is induced Check voltage at J5/3 & J4/3: >4 V	– station shutdown (dual) – ECU shows 'Switch Fail' – Both totem poles are off (2A/2B)		
ECU	J3,J1,J5,J4: 1–2, 9–10	Park position	– park jumper – Reset ECU	TX1 and TX2 are on again; TX1 is main		
ECU 3rd Shutdown logic			Disconnect cable at connector J7 (upper) of SYN1.	Causes an executive alarm condition.		
NOTE: The next step will reboot the LCP. Due to missing communications from the LCP during the reboot time, the executive bypass, although asserted, is disabled for the 3rd control logic. On the ECU, the flashing LED 'Exec. Bypass' indicates this state. The 3rd shutdown control integrates the duration of an exec. alarm condition while it is not bypassed. When this integration reaches 6 s, the control then suppresses the clock to the clock detector which triggers a complete station shutdown.						
ECU 3rd Shutdown logic (incl. Clock Detector)			On LCP, Issue a 'Reboot LCP' command. Check voltage at J3/7, J1/7, J5/7 & J4/7: >4 V	– during LCP reboot, LED 'Exec. Bypass' goes off after ~10 s, and on again after ~5 s until station shutdown indicated by ECU LED 'Exec.On' and 'Stby On' off – '3rdShutdown Path Off' lit – verifies 3rd shutd. logic as cause of 'off' condition		
			Reconnect cable to J7 of SYN1. Reset ECU.	Clears the ECU.		
Set equipment to 'Normal' condition, both TX ON. TX1 main.			Set LCP key switch to required mode.	Status 'Normal', equipment is in service again, no alarms or alerts indicated.		

For this test, 8 jumpers are used.

Date: Sign:

** (si) = single, (du) = dual*

6.3 NORMAL MAINTENANCE

6.3.1 Replacing the Lithium Battery (LCP)

To back up the real time clock in case of a voltage drop, the subassembly LCP contains a Lithium battery (LS 14250, 3.6V/0.95Ah, make SAFT; Thales Ref. Nr. 97991 28479). Lithium batteries have an extended life time. Also not in use, it ages as a result of self−discharging. Therefore it is recommended to install a replacement battery after about five years operation, or its voltage drops below 3.0 V. The battery back up function is enabled via jumper, 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 batteries are not approved by Thales.

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. Regard national regulations.

The backup battery can be replaced without switching off the power. The battery is disconnected with jumper X36 on the LCP. To unsolder the battery 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.
Replace the Lithium battery as follows:

- Open the cabinet front door. Remove jumper X36 on the LCP.
- Unsolder the minus and plus pole of the old battery from the soldering terminals on the LCP board.
- Remove the old battery
- Re−tin the soldering terminals of the new battery in order to ensure a good soldered connection.
- Insert the new battery, and solder the minus and plus pole of the battery to the soldering terminals.
- Set jumper X36 on the LCP. Close the cabinet front door.

6.3.2 Check of Emergency Battery Voltage

The overall battery voltage is monitored by the transmitter assembly LCP. However it is recommended to measure the battery voltage to check the performance of the battery. The voltage measured is that between the BAT1 or BAT2 terminals against GND (BAT0), see 2−13, 2−14. 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. The battery half to be examined may be determined as follows.

Voltage ratio:	locate faulty cell:
> 2:1 (e.g. 47: 23 V = 2.043:1)	between center and minus
< 2:1 (e.g. 47: 24 V = 1.958:1)	between center and plus

CAUTION

Before replacing the battery or individual cells, always check:

- Is the battery−charged power supply switched on ?
- Switch off fuse switch F20 (50 A) in battery fuse box, if the BCPS is on.

6.3.3 Matching the charging Voltage of BCPS Modules

6.3.3.1 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 have 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.

6.3.3.2 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 6.3.3.1 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.

6.4 STARTUP, CARE AND MAINTENANCE OF THE LEAD BATTERY

6.4.1 Startup Specifications for the Lead Battery in Navigation Installations

6.4.1.1 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.

NOTE: Maintenance free batteries need no further maintenance activities.

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 6.4.1.3.2 and 6.4.1.3.3). 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 6.4.1.3)
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 6.4.1.2.2).

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 %)

6.4.1.2 Preliminary Operations

6.4.1.2.1 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), ac-

cording 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.

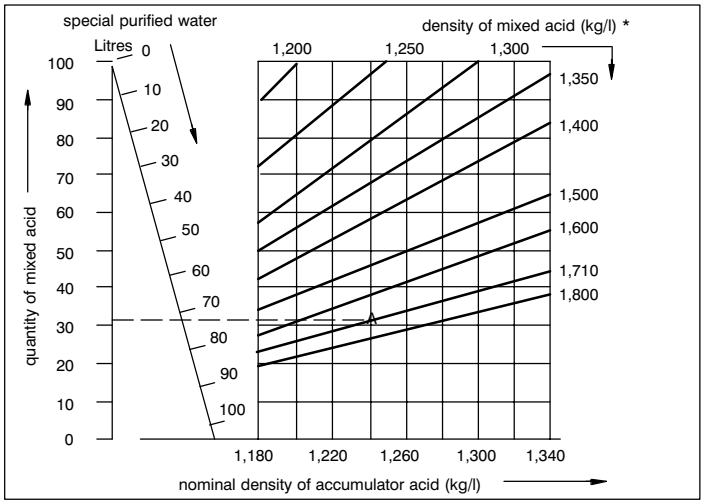
The sulphuric acid and the water should be kept in glass or plastic containers, which must be sealed and covered carefully. Dust and vapors which penetrate may contaminate originally pure liquids.

6.4.1.2.2 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. 6−3).

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. 6−3 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 chart Fig. 6−3 is obtained as follows:

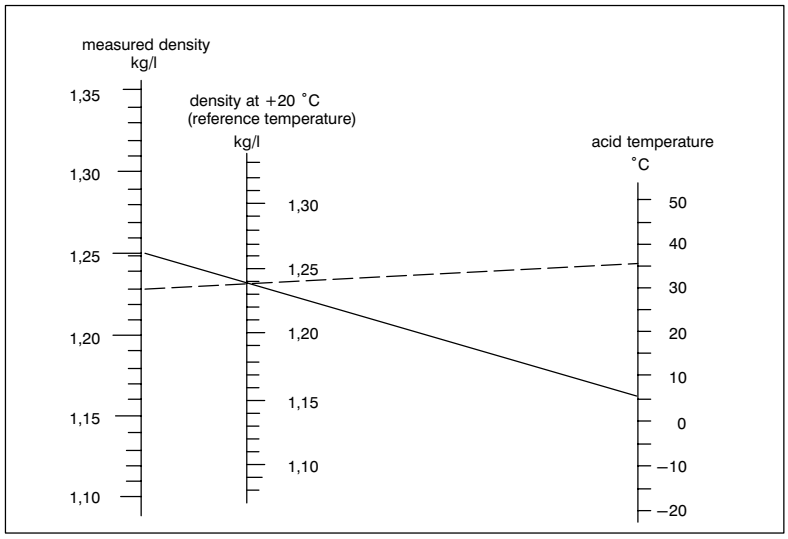
The slope *1.71* (density of mixed acid) intersects the vertical *1.24* (nominal density of accumulator acid). The horizontal through point A intersects the slope at *72 l* (specified purified water) and the vertical at *31 l* (quantity of mixed acid) in the left−hand section of the chart. The two quantities 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 6.4.1.2.3 .

When purchasing mixed acid it may be that the quantity is specified in kilograms on the container. The chart (Fig. 6—3) is however only valid for quantities specified in liters. Kilograms can be converted to liters as follows:

$$\text{Quantity in l} = \frac{\text{Quantity in kg}}{\text{Acid density in kg/l}}$$

6.4.1.2.3 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. 6—4) 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. 6—4 Chart showing the relationship between the acid density and the temperature

6.4.1.2.4 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.

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, this should be taken into consideration when performing measurements (the density decreases with higher temperatures and increases with lower temperatures).

6.4.1.2.5 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 6.4.1.1).

6.4.1.3 Startup

Initial charging or activation.

6.4.1.3.1 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 6.4.1.1, 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 (PbO_2), whilst the negative plate is light grey (Pb).

6.4.1.3.2 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.

6.4.1.3.3 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.

6.4.1.3.4 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 6.4.1.1. 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 6.4.1.2 (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 precharged. A higher charging current can be used in such cases.
4	Charging as per data, see also **WARNING** note in section 6.4.1.3.4 .	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 6.4.1.2.4 (basic rules for handling batteries).
12	Operate battery in standby parallel mode.	—	

6.4.2 Care and Maintenance of the Lead Battery

6.4.2.1 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 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 6.4.1.2.4) should be observed.

6.4.2.1.1 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.

6.4.2.1.2 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 6.4.1.2.4 . 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.

6.4.2.1.3 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.

6.4.2.1.4 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 V or 115 V mains voltage resulting in discharging of the batteries, the cell voltage will be 2.1 to 1.75 V after about 5 minutes up to disconnection of the mains power supply.

The cell voltage should not fall below 1.75 V during discharging. The cell voltage can be measured as described in 6.3.2 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.

6.5 FAULT LOCATION

6.5.1 General

Fault location in the ILS (LLZ and GP) can be executed with the PC User Program (see Section 6.5.2).

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: In the active Glide Path the CSB1 (A1) and CSB2 (A2), SBO (A3) and Clear. are used as term for the RF signals.

6.5.2 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 system configuration window of the PC user program:

– Move mouse cursor to field TRANSMITTER or MONITOR or LRCI.

– Click twice left mouse button for more data information about transmitter or monitor or LCP. The ensuing BIT results are displayed and can be interpreted or printed out.

6.5.3 Fault Location Support ILS–Glide Path (2F or 1F, if applicable)

In addition to the check results (see 6.5.2), the following fault location tables list typical faults, which may occur in an ILS–GP 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.

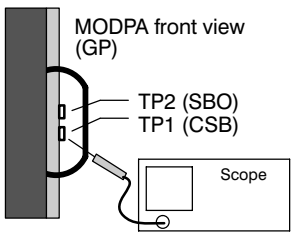
6.5.3.1 Fault Location with Indicators at Power Supply and Modules

The BIT data report (see 6.5.2) 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.

Step	Fault	A	B	C
1	ACC	Power LED off?	ACC switched to ON?	Check mains power supply to ACC or change ACC
2	DCC–MV	green LED off?	ACC switched to ON? TX1/TX2 switched on?	Check power supply to DCC or change DCC
3	LCP	Live–lamp off?	DC operating voltage ok?	Reset LCP
	LCP, not operable	No DC voltage supply? TX1 and/or TX2 switched on?	DC operating voltage 5V of DCC–5 available?	Check fuse F4. Replace once if blown.
4	LG–M	CPU_NORM lamp off?	DC operating voltage ok?	Reset board
5	LG–A	CPU_NORM lamp off?	DC operating voltage ok?	Reset board

6.5.3.2 Fault on Transmitter Subassemblies

The Fault Location for the transmitter subassemblies requires a correct working monitor system. If the monitor is faulty start with 6.5.3.3. In the former chapter it is validated that power supplies and LCP are operational and o.k. As reference for further measurement use PC user program data recordings made after flight check.

Step	Fault	A	B	C
1	a) Aerial Alarm or b) StdbyAlarm	If a) and not b) go to 2. If b) and not a) change aerial and go to 2. If a) and b) go to B.	Check Transfer Assembly. If faulty change Transfer Assembly. If not go to C.	Change Monitor Interface Board (INTFC).
2	a) Course Alarm or b) Clearance Alarm	If a) and not b) go to 3. If b) and not a) go to 7. If a) and b) go to B.	Check and measure Synthesizer Signals. If signals faulty (frequency) change Synthesizer, if not go to C.	Check in dialog Audio Generator Data against Reference Data. If deviations change LG—A. Check antenna system including cables from/to.
3	a) CRS Pos. Alarm b) CRS Width Alarm	a) CRS Pos. DDM Alarm b) CRS Width RF—Alarm or SDM Alarm	If a) and not b) go to B, If b) and not a) go to 4 If a) and b) go to 4	Check CRS SBO measurements of RF Power Amplifier Data against Reference Data. If deviations change CRS MODPA, if not go to C. Check antenna system including cable from/ to.
4	a) CRS RF—Alarm b) CRS SDM	If a) and not b) go to B, If b) and not a) go to 6. If a) and b) go to 6.	Check CRS CSB measurements of RF Power Amplifier Data against Reference Data. If deviations change CRS MODPA, if not go to C	Check antenna system including cables from/to.
5	Alarm indication ”Lower power” or ”no power”	Check VSWR at testpoints TP1 (CSB path) and TP2 (SBO path) at the front of the MODPA’s: Use an oscilloscope for testing. Hook the probe to either test point TP1 and TP2.	Verify that a normal detected waveform appears. If pulses are seen it indicates a high VSWR i.e. it is in VSWR shutdown. Check PIN diode Transfer Switch and antenna system including cables from/to.	
6	CRS Pos. SDM Alarm	Check data in dialog* Audio Generator Data against Reference Data. If deviations change LG—A, if not go to C.	Check CRS CSB measurements of RF Power Amplifier Data against Reference Data. If deviations change CRS MODPA, if not go to C	Check antenna system including cables from/to.
7	CRS Width Alarm and no CRS Pos Alarm	Check data in dialog* Audio Generator Data against Reference Data. If deviations change LG—A, if not go to C.	Check CRS CSB2 measurements of RF Power Amplifier Data against Reference Data. If deviations change CLR MODPA, if not go to C.	Check antenna system including cables from/to.

Step	Fault (cont.)	A	B	C
8	a) CLR SDM or DDM Alarm b) CLR RF− Level Alarm	If a) and not b) go to B. If b) and not a) go to 9. If a) and b) go to 9.	Check data in dialog* Audio Generator Data against Reference Data. If deviations change LG−A, if not go to C.	Check antenna system including cables from/to.
9	CLR RF−Alarm	Check data in dialog* Audio Generator Data against Reference Data. If deviations change LG−A, if not go to C	Check CLR measurements of RF Power Amplifier Data against Reference Data. If deviations change CLR MODPA, if not go to C	Check antenna system including cables from/to.

* in PC User Program

6.5.3.3 Fault on Monitor Subassemblies

Step	Fault	A	B	C
1	Integrity Fail Indication (ECU)	a) Integrity Fail Monitor 1 b) Integrity Fail Monitor 2	If a) and not b) go to C. If b) and not a) go to C. If a) and b) go to 2.	Replace the LG−M board showing the Integrity Fail condition.
2	Integrity Fail of both Monitors	Change Main Transmitter and if no Integrity Fail indicated, change LG−A of the transmitter being now in Standby mode, If Integrity Fail again go to B.	Change ECU board and check again.	

6.5.3.4 Fault of the Local Control Panel (LCP)

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
1	Live lamp off	LCP board: live lamp on LC−CPU off. Liquid crystal display screen is dark. Keys do not function.	Standstill of LCP−processor or/and possibly no power supply.	Measure at BP−Digital supply voltage+5V3 (and −15 V) against GND. If +5V3 is missing, check fuse F4, which supplies the DCC−5 for the LCP. Replace F4 once if blown.
	LCI: LCD screen dark	LCP board: live lamp on LC−CPU on.	Check −15 V voltage supply.	If ok, replace LCI board with LCD display.
2	Live lamp on		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.
3	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 not ok: – Correct port used at 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 port at PC? Check programs. Reload PC User Program if necessary.
4	No interrogations to monitor or transmitter.	Audio_ON LED (lower of two LED) at the LG−M or LG−A 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−Digital, connector J13 to LCP are defective or have come loose.	The LCP interrogates only processors which are switched on. Replace or fix cables.
cont.		Both LG−M and both LG−A are not interrogated. At least one LG−M and LG−A 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 (LG−M or LG−A)	Replace the LCP completely. Replace first LG−M or LG−A, than LCP (or LC−CPU) if replacement of LG−M/LG−A was not successful.
cont.	No interrogations to monitor or transmitter.	Audio_ON LED (lower of two LED) at the LG−M or LG−A 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−Digital, connector J13 to LCP are defective or have come loose.	The LCP interrogates only processors which are switched on. Replace or fix cables.

6.6 REPAIRS

6.6.1 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 6.6.1.1.3 .

6.6.1.1 Safety Precautions

6.6.1.1.1 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 (i.e. > level 2) to the PC user program (ADRACS or MCS). Changes to the established monitor alarm limits should only be done during flight check procedure.

The mark (!) used in Fig. 6−7 (Adjustments after change) means an important action after repair. Normally it is recommended to repeat ground or flight check as defined in the Chapter 4, 5 or 7 (Alignment Procedure). However the necessity to do so is a decision of the customer. Indicated adjustments after change are normally performed using the PC User Program (e.g. measurement values) and repeating the correspondent sections of the Alignment Procedure, if necesssary.

6.6.1.1.2 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 6.6.3.1 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 off DC−supply before working on the PIN−Diode transfer switch subassembly with removed covers of the driver and bias supply and the PIN−Diode switches. Regard that the internal generated PIN−Diode reverse bias supply is up to −140 V/30 mA, to be measured at TP1.

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.

6.6.1.1.3 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.

6.6.1.1.4 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:

- MODPA GP : Transistor types MRF166C

6.6.1.1.5 Handling Lead Batteries

See chapter 6, Section 6.4ff and Part 1, Section 1.4.

6.6.2 Correcting a Processor Standstill

See Fig. 6−5.

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.

6.6.2.1 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.
- LED CPU_Normal on the LG−M must light (flashing). If it is off, press button board reset on LG−M.
- Close door again.
- Perform login and enter password if more commands must be entered, otherwise this step may be ignored.

The installation should be fully operational again.

6.6.2.2 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.
- LED CPU_Normal on the LG−A must light (flashing). If it is off, press button board reset on LG−A.
- Close door again.
- Perform login and enter password if more commands must be entered, otherwise this step may be ignored.

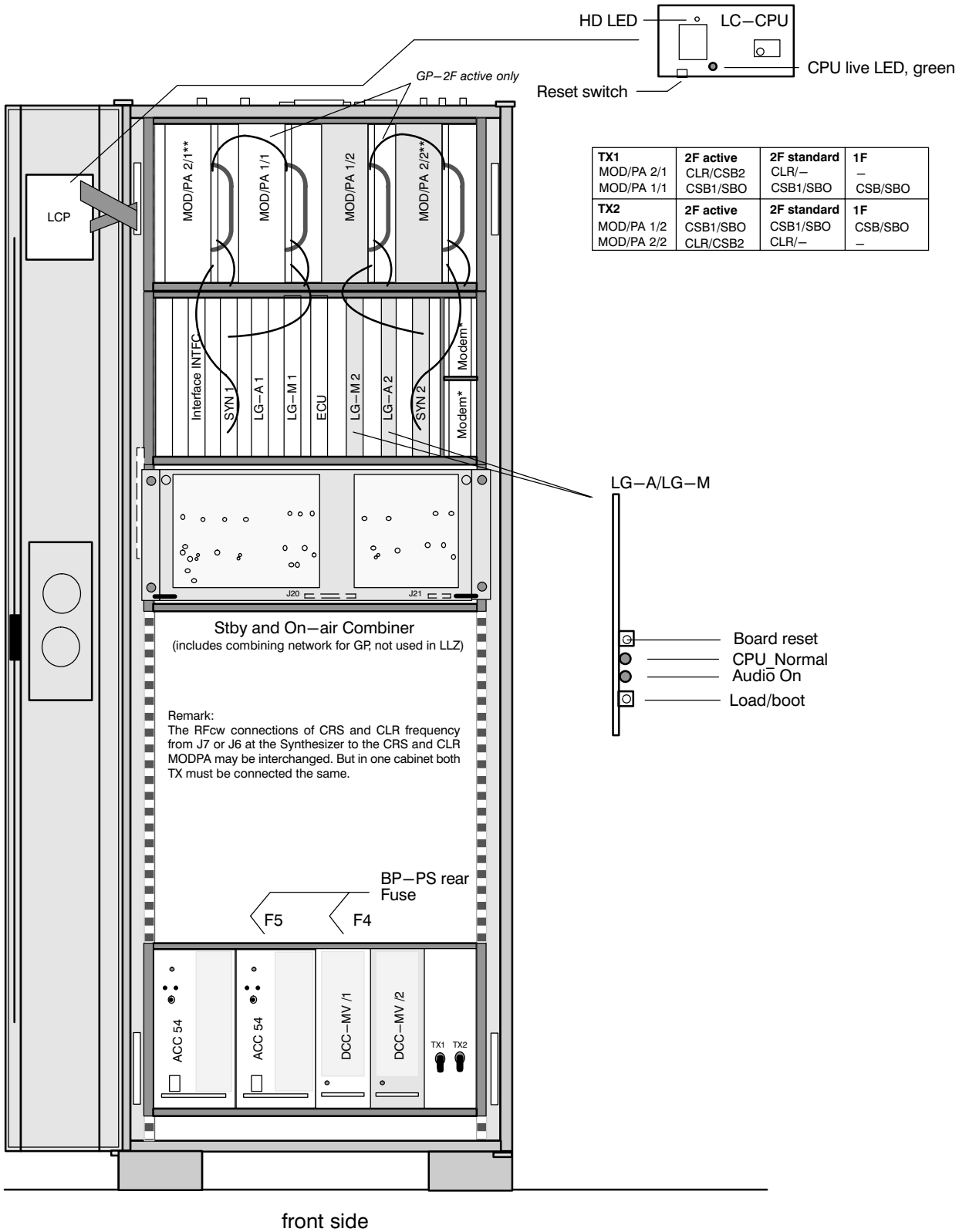
The installation should be fully operational again.

6.6.2.3 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.



TX1	**2F active**	**2F standard**	**1F**
MOD/PA 2/1	CLR/CSB2	CLR/–	–
MOD/PA 1/1	CSB1/SBO	CSB1/SBO	CSB/SBO
TX2	**2F active**	**2F standard**	**1F**
MOD/PA 1/2	CSB1/SBO	CSB1/SBO	CSB/SBO
MOD/PA 2/2	CLR/CSB2	CLR/–	–

** 2F only

* optional

Fig. 6−5 Reset button and live indication on subassembly LG−A/LG−M, LC−CPU

6.6.3 Replacing Subassemblies

WARNING

The heat sinks of the modulators (MODPA) 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).

Take care not to touch the spiky pins of the pin bank close above the lever of subassemblies LG−A/LG−M and ECU when release this lever to remove it. Danger of injury.

Do not work on parts conducting mains voltage. Switch mains off before.

6.6.3.1 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 the respective transmitter with either of switches TX1 or TX2. The transmitter subassemblies without DC supply assemblies can also be switched off by means of a PC command. If the LCP or/and the LVS board must be changed, both TX1 **and** TX2 must be switched off beforehand.

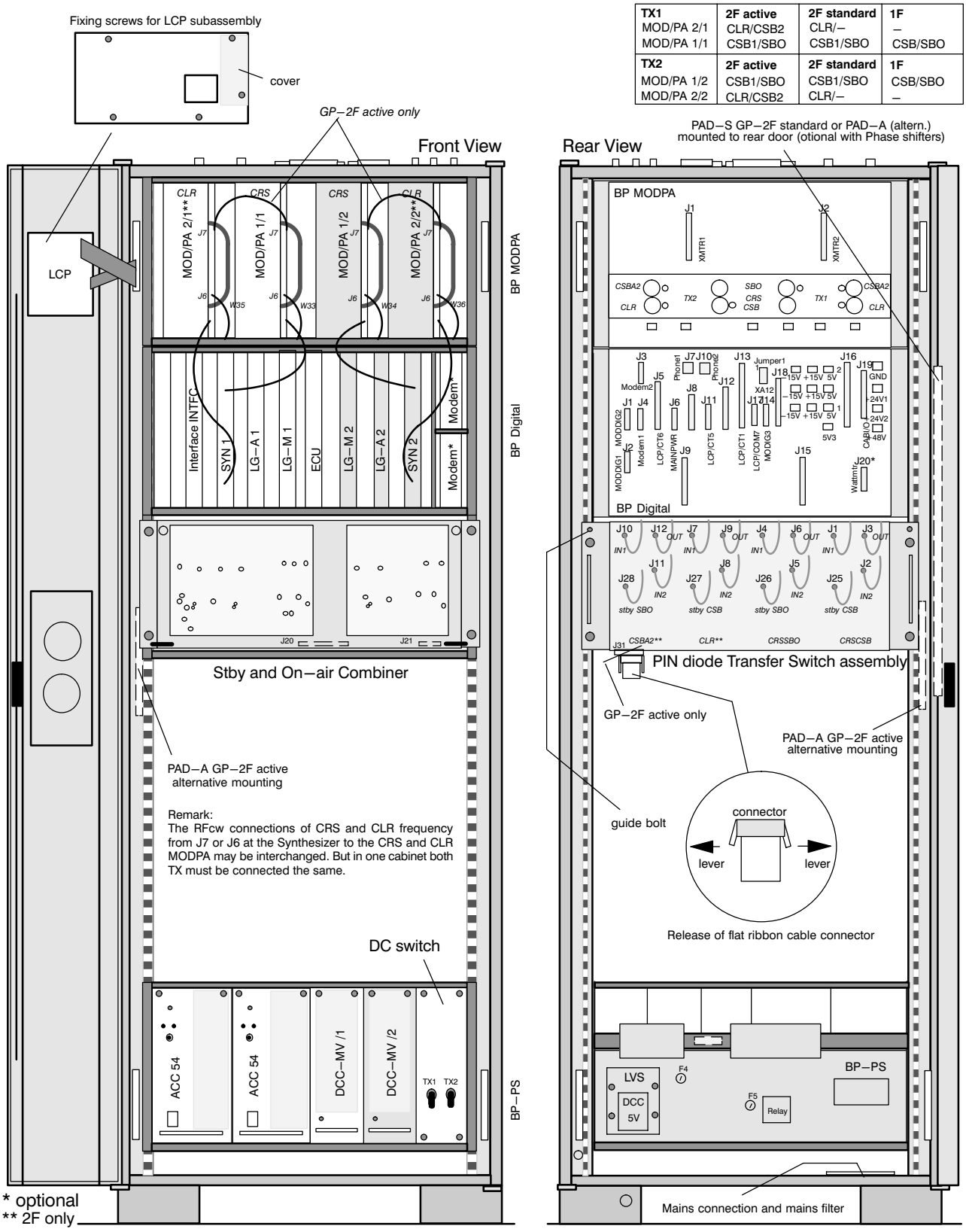
The MODEM subassemblies may be removed and installed when live. The special design of their contacts prevents damage from occurring.

Before replacing an ACC−module the BCPS must always be disconnected from mains.

6.6.3.2 Remarks to Subassemblies in the Transmitter Rack and Power Supply

The table shown in Fig. 6−7 lists the work which may be necessary after a subassembly has been replaced. Please also refer to Sections 6.6.1.1 and 6.6.1.1.3 . Regard the following remarks.

- The relevant transmitter must be de−energized before removing or installing subassemblies, preferably by switching it off with TX1/TX2. It should be noted that the following subassemblies are only de−energized if both power supply switches are switched off: LCP, LVS/DCC−5.
- Several of the subassemblies have DIP−FIX 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 6.6.5 contains a list of the DIP−FIX switches and jumpers.
- Subassemblies LG−A and LG−M are assigned to their location for TX1 or TX2. It is not possible to change LG−A and LG−M between TX1 and TX2 without reloading the associated software. Subassemblies MODPA GP are also not interchangeable without setting of jumper JP5 to the correct value for location in left (CSB/SBO) or right (CLR/CSB2) position of TX1 or TX2 in GP−2F active installations.
- 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 MODPA and the PIN−Diode transfer switch 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. For MODPA some corrections to fit the RF connectors may be necessary. Take care for correct fitting.
- 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 and SBO, course and clearance (2F)).
- After a maintenance action which has removed and restored DC power to either transmitter, a system reset command should be issued or the ECU should be reset using the ECU reset button.



TX1	2F active	2F standard	1F
MOD/PA 2/1	CLR/CSB2	CLR/–	–
MOD/PA 1/1	CSB1/SBO	CSB1/SBO	CSB/SBO
TX2	**2F active**	**2F standard**	**1F**
MOD/PA 1/2	CSB1/SBO	CSB1/SBO	CSB/SBO
MOD/PA 2/2	CLR/CSB2	CLR/–	–

Fig. 6−6 Locations in the GP−1F/2F rack

Unit to be changed	Preparation *(see also Fig. 6–6)*	Adjustments after change *
SYN	remove RF cables at front side	Adjust station frequency
MODPA LLZ	remove RF cables at front side use handle to withdraw	check RF level, modulation depths, phasing
MODPA GP	remove RF cables at front side use handle to withdraw	regard location of MODPA GP: check correct jumper setting of upper RF path. check RF level, modulation depths, phasing
INTFC	–	Change of INTFC 120498 against 120628: (!) calibrate and normalise monitor
LG–A	–	(!) load LG–A firmware (see 6.6.3.4); load all transmitter data; the location of the LG–A (TX1 or TX2) must be regarded. readjustment of transmitter necessary
LG–M	–	(!) load LG–M firmware (see 6.6.3.4); load all monitor data; the location of the LG–M (TX1 or TX2) must be regarded. readjustment of transmitter necessary
ECU	–	Check setting of switch bank SW4*(SW1)*. It must correspond to the software configuration setting !
Stby and On–Air Combiner (SOAC)	hinge down board, remove cables rear side, hinge up board and fix it; support the board, loosen 2 screws left and right	(!) calibrate detector paths (!) calibrate monitor (!) readjust for standby transmitter
PIN–Diode Transfer Switch	remove cables, support the board with the handles and loosen 2 screws left and right	check RF level, modulation depths, phasing
GP only: – Power Adder	remove RF cables	check RF level, modulation depths, phasing (!) calibrate monitor
LCP (complete)	remove cables, loosen 5 screws	Configure to system (see 6.6.3.4); (!) re–load installation type, configuration, site and PTT file.
Modem LGM28.8	loosen screw (if in plastic cover)	–
Modem LGM 1200MD	loosen screw (if in plastic cover)	–
VAM (LLZ, optional)	–	–
DCC–MV	loosen 2 screws on front panel, use handle to withdraw	–
LVS/DCC–5	remove cables, loosen 4 screws, withdraw board from BP–PS	–
TX1/TX2 switch panel	loosen 4 screws, remove cables	–
ACC–54	loosen 2 screws on front panel	If need be, adjust charging voltage (R32)

* The mark (!) in Adjustments after change means an important action after repair. See also section 6.6.1.1.1 .

Fig. 6–7 Preparation and adjustments during a subassembly replacement

6.6.3.3 Replacing GP Antenna

A large number of settings or alignments must usually be remade after replacing components of the GP antenna system or nearfield monitor dipole. A special flight test is also necessary. For the GP antennas refer also to the corresponding Part 3, Antenna Description, of the Technical Manual.

6.6.3.4 Replace and reconfigure Subassemblies LCP, LG−A and LG−M

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 the basic subassembly LG−*X*. LG−*X* means that the spare processor board is not assigned to be an Audio Generator (−A) or Monitor board (−M). This is performed by SW after inserting the LG−*X* board to its defined location.

The load and boot routine assigns the neutral board to its destination in either TX1 or TX2 as LG−A or LG−M. This procedure has also to be done when replacing LG−A or LG−M from TX1 to TX2. The LCP routine checks the LCP hardware. The LG−*X* update routine performs an internal COM port link between the LCP communication port COM1/PC1 (and a connected PC/Laptop) and one of the LG−*X* communication ports. For LG−*X* update, the application "420ILS LGX Flash memory Configuration" has to be installed and started on the PC. The LG−*X* software itself is stored on floppy disks (or a CD−ROM).

During LCP reset and system start, two LCP screen contents are available:

− the LCP Control Menu (Fig. 6−8 a), if buttons S1 and S4 have been pressed and hold,

− the LCP Warning text (Fig. 6−8 b), 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 6.6.3.4.1) use commands of the PC user program:

a) Using ADRACS program, click the 'Control' button in the Main Status window, select 'File Transfer'.

   Using the 'MCS File Transfer' tool, select 'FILE OPERATIONS' in the MASTER MENU.

b) Select ADRACS command 'Copy PC file to RAM' resp. 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.

6.6.3.4.1 Reconfigure the LCP board

The spare subassembly LCP is not configured to a specific subsystem (i.e. ILS 420 or CVOR/DVOR). For configuration or update of the LCP software the PC user program is used.

NOTE: The LCP software upload comprises the files *LCP.ZIP* and in addition the conversion table *konv_dat.dat*. 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. 6−8 b).

b) Copy the file *LCP.ZIP* for ILS 420 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 finishing this procedure 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) Copy the conversion table file *konv_dat.dat* for ILS 420 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); refer to chapters ”Alignment Procedure”.

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. 6−8 a).

c) Press button S3 at least 1 s to select ”Start Transfer to copy LCP−SW” (Fig. 6−8 a). This starts a routine to establish communication between PC (user program) and the LCP. Copy the file *LCP.ZIP* for ILS 420 to the LCP with the PC user program. Finishing this procedure the LCP is ready.

d) Copy the conversion table file *konv_dat.dat* for ILS 420 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); refer to chapters ”Alignment Procedure”.

f) Restart the system. Finally check all station settings in the LCP.

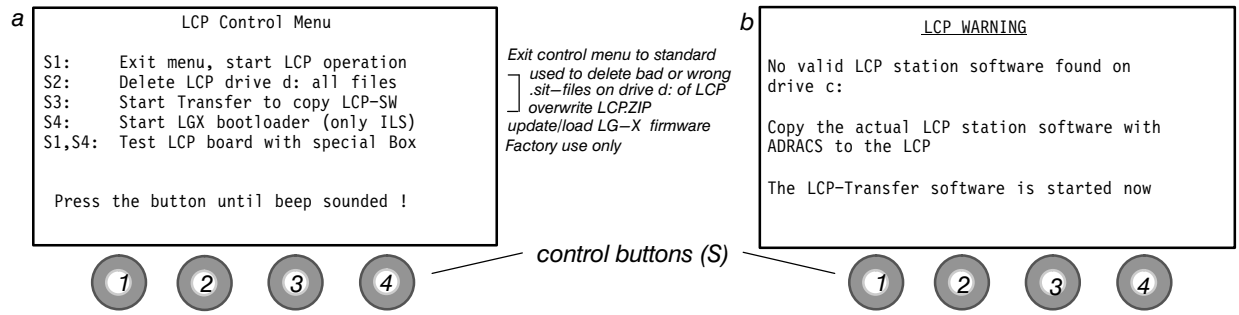


Fig. 6−8 LCP front panel with LCP Control Menu and LCP Warning Text (example)

6.6.3.4.2 Load Firmware and Configuration of LG−A or LG−M

The spare subassembly LG−*X*, used as LG−A or LG−M, is not configured to its task. To perform this item, prepare the system as follows: Connect a data terminal (e.g. PC or Laptop) to connector ’PC/RS232’ on top of the cabinet.

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. Use application "420ILS LGX Flash memory Configuration". Make available corresponding firmware for the board which has to be replaced.

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 and hold pressed until screen of LCP contains Control menu information (see Fig. 6−8 a).

c) Press button S4 at least 1 s to start the LGX bootloader menu (Fig. 6−9 a).

d) Select one of the upcoming menu points (Fig. 6−9 a) according to the board which has to be installed.

   For the next steps the following example is used: LG−*X* shall be configured as LG−A for TX1. For other boards the procedure has to be performed accordingly.

e) Press S1 to select: "Load firmware to LGA−1" .

f) Confirm upcoming next menu "Load firmware to LGA−1 ?" pressing S4. The program menu answers with "Connection to LGA−1 established !" (Fig. 6−9 b). The bottom line shows the indication of bytes copied from PC to the LG−A board.

g) Insert the floppy disk (or CD, if available) with program "Config420Setup_ITCU.exe" to the Laptop. Start the program and follow the instructions (select menu *Function*, command *Load*). The loading process is now controlled by this software. As requested prepare the subassembly (here: LG−A of TX1) for loading procedure (see Fig. 6−5):

   − Press *load* button and hold.
   − Press *reset* button.
   − Release *load* button.

   Both green LED at the front of the board light. The board is ready for loading the firmware.

h) Confirm "OK" in the ready message of the configuration program at the Laptop. Upper green LED flickers until communication is installed, then both LED are lit. The program starts now for downloading the firmware (load corresponding ***.ROM*** file, only visible if selected file type is "all files"). The transfer can be observed on the laptop screen. After transfer is finished both LED are off.

i) Press button S4 two times to confirm. Shutdown (switch off) the equipment with switches TX1 and TX2 and switch on again.

   NOTE: If the LG−A or LG−M board has been replaced by a new one, that board is not configured to the installation. This is indicated with the upper LED lighting only. The configuration is performed with the PC user program dialog 'LRCI Station Configuration'.

j) Open the Station Configuration dialog (see Annex 'PC User Program−specific Procedures'). After confirmation of the settings, the configuration is loaded to the LG−A or LG−M boards.

k) Perform a hard reset of the system using PC user program, see Annex 'PC User Program−specific Procedures'. Two commands are necessary: First, send to Transmitter1/2 the command 'Miscellaneous, (Perform) Hard Reset', then send to Transmitter1/2 the command 'Miscellaneous, Perform Audio Gen(erator) Calibration' (possibly 2 times).

l) Download previously stored or noted equipment data to the new board (with ADRACS 'Data' submenu 'Up−/Download Data' resp. with MCS 'Snapshot' submenu 'Open'). Perform readjustment procedure of transmitter and monitor.

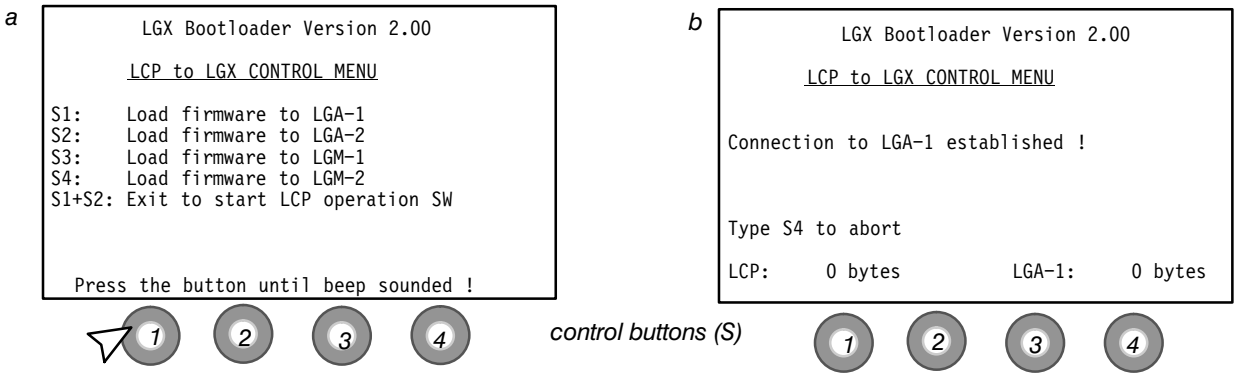


Fig. 6−9 LGX bootloader menu (example)

6.6.3.4.3 Load Firmware of LG−A and LG−M to the same LG−*X* board

The procedure of loading the firmware for LG−A or LG−M to an individual LG−*X* as described in 6.6.3.4.2 is one recommended possibility. A second one is to load both firmware versions to the same LG−*X* board. This allows to insert this board both in the locations of LG−A or L−M for the individual transmitter. Doing this the loaded firmware remains stored, but the specific data are lost.

NOTE: The specific data (e.g. alarm limits, nominal values, transmitter parameter, calibration and normalization data) are lost changing the LG−*X* operational function. The specific data have to be reloaded !

Perform the firmware loading procedure as follows.

NOTE: The sequence of the firmware loading procedure is as described in 6.6.3.4.2 e) to i), but it is performed inserting the LG−*X* each to the location of LG−A respectively LG−M. Switch off equipment before inserting/replacing the board.

a) Shutdown equipment with switches TX1 and TX2.

b) Insert LG−*X* board to location LG−A.

c) 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 screen of LCP contains Control menu information (see Fig. 6−8 a).

d) Press button S4 at least 1 s to start the LGX bootloader menu (Fig. 6−9 a).

e) Select one of the upcoming menu points (Fig. 6−9 a) according to the board which has to be installed. Perform loading procedure as described in 6.6.3.4.2 e) to i).

f) Shutdown equipment with switches TX1 and TX2.

g) Insert LG−*X* board to location LG−M.

h) 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 screen of LCP contains Control menu information (see Fig. 6−8 a).

i) Press button S4 at least 1 s to start the LGX bootloader menu (Fig. 6−9 a).

j) Select one of the upcoming menu points (Fig. 6−9 a) according to the board which has to be installed. Perform loading procedure as described in 6.6.3.4.2 e) to i).

k) Shutdown equipment with switches TX1 and TX2.

NOTE: The firmware is now loaded to the board. However, the specific parameter have to be reloaded using the board as LG−A respectively LG−M.

Loading the specific data for changing from location LG−M to LG−A:

a) The equipment is switched off. Replacing the board from location LG−M to LG−A. Switch on equipment with TX1 and TX2.

b) Open the Station Configuration dialog (see Annex 'PC User Program−specific Procedures'). After confirmation of the settings, the configuration is loaded to the LG−A board.

c) Download previously stored or noted equipment data to the board (with ADRACS 'Data' submenu 'Up−/Download Data', resp. with MCS 'Snapshot' submenu 'Open'). Perform readjustment procedure of transmitter and monitor.

Loading the specific data for changing from location LG−A to LG−M:

a) The equipment is switched off. Replacing the board from location LG−A to LG−M. Switch on equipment with TX1 and TX2.

b) Open the Station Configuration dialog (see Annex 'PC User Program−specific Procedures'). Select 'Farfield (Ch. 5) is executive: No'. Confirm the setting.

c) Open the Station Configuration dialog (see Annex 'PC User Program−specific Procedures'). Select 'Farfield (Ch. 5) is executive: Yes'. Confirm the setting.

d) Download previously stored or noted equipment data to the board (with ADRACS 'Data' submenu 'Up−/Download Data', resp. with MCS 'Snapshot' submenu 'Open'). Perform readjustment procedure of transmitter and monitor (calibration and normalization of all channels).

6.6.4 Test after Repair

After repair and mechanical check, the installation is switched on as normal. The necessary adjustments indicated in Fig. 6−7 have to be performed. All parameters have to be within limits and the system state indicates NORMAL again. The system is then operable.

NOTE: If the LED "Switch Fail" (Fig. 6−10) at the ECU is flashing, check correct fitting of subassemblies in the BP−MODPA and BP−Digital.

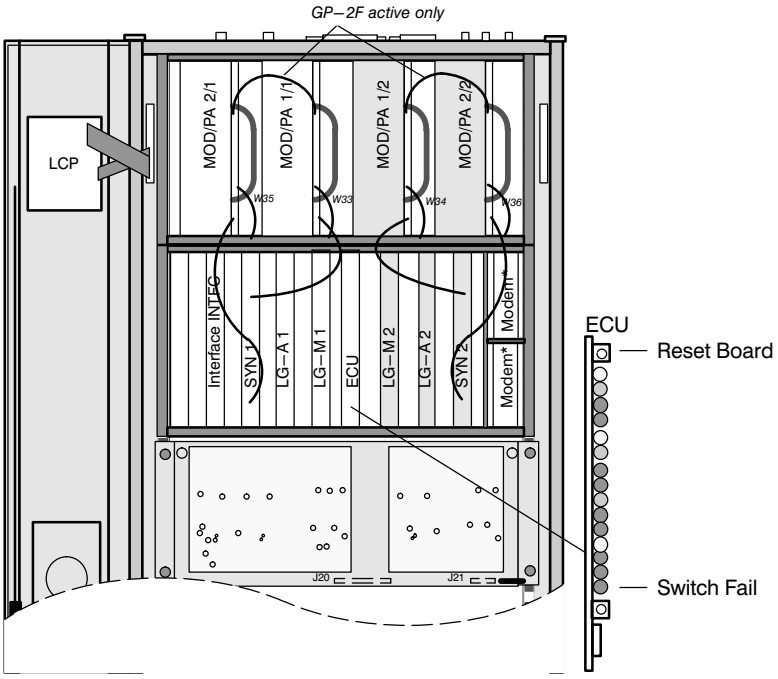


Fig. 6−10 Location of "Switch Fail" indication at ECU

6.6.5 List of DIP—FIX—Switches and Jumpers

6.6.5.1 General

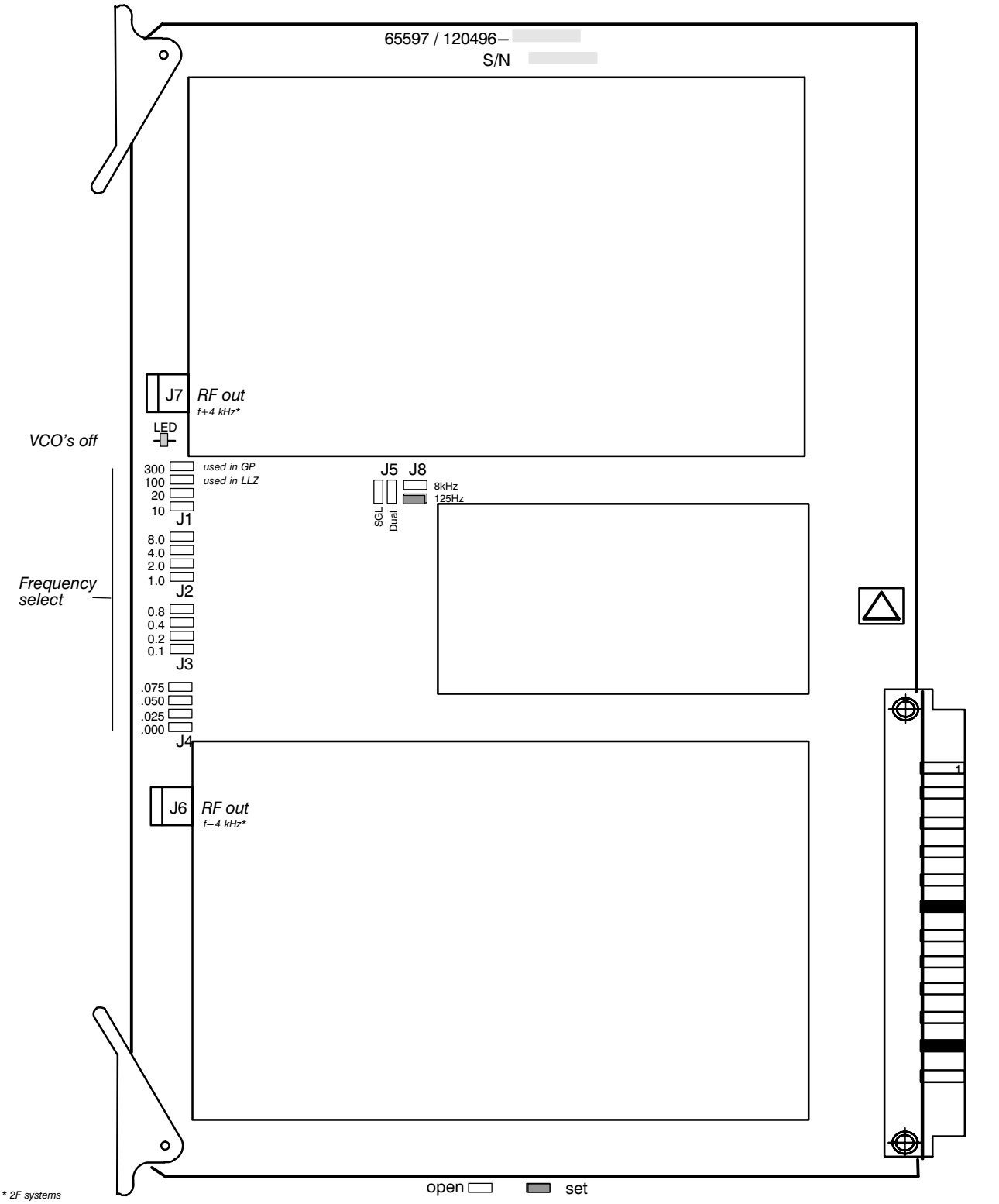
Some of the subassemblies have DIP—FIX switches or jumpers on the component side. The jumpers act either as on/off switches or as changeover switches. The DIP—FIX switches and jumpers can be set or placed to particular positions in order to adapt universal subassemblies to specific equipment types. Other switches or jumpers must be actuated for test and maintenance purposes, or in case of interconnection with a DME. Under normal climatic conditions it is not necessary to solder the DIP—FIX switches in their limit positions.

NOTE: Before installing a spare subassembly check and correct if necessary position of the DIP—FIX switches and jumpers.

Overview of subassemblies containing DIP—FIX switches and jumpers:

No.	Subassembly	Short name	Reference number
1	Synthesizer	SYN	120496—0002 (83138 22100)
2a	Localizer/Glide Path Audio Generator Localizer/Glide Path Monitor	LG—A LG—M	120570—0003 (83138 23101) 120570—0003 (83138 23101)
2b	Localizer/Glide Path Audio Generator Localizer/Glide Path Monitor	LG—A LG—M	120570—0004 120570—0004
3a	Executive Control Unit	ECU	120571—0001 / 120571—0002 (83138 25100)
3b	Executive Control Unit	ECU	120571—0003
4a	Local Control Panel	LCP	83135 21001 / 21002
4b	Local Control Panel	LCP	83135 21003
4c	Local Control Panel	LCP	83135 21004
5	Low Voltage Sense board (on BP—PS)	LVS	83138 30511
6	Stby and On—Air Combiner	SOAC	120621—0001 (83138 27100)
7	PIN—Diode Transfer Switch	—	120622—0002 (83138 28100)
8a 8b	Modulator/Power Amplifier (GP only) Modulator/Power Amplifier (GP only)	MOD/PA MOD/PA	120589—0001 (83138 26300) 120589—0002
9	Switched or dedicated line modem (opt)	LGM28.8	84045 83245
10	Dedicated or Party line modem (option)	LGM1200D	84045 83233
11	LLZ/GP Monitor Interface	INTFC	120628—0001

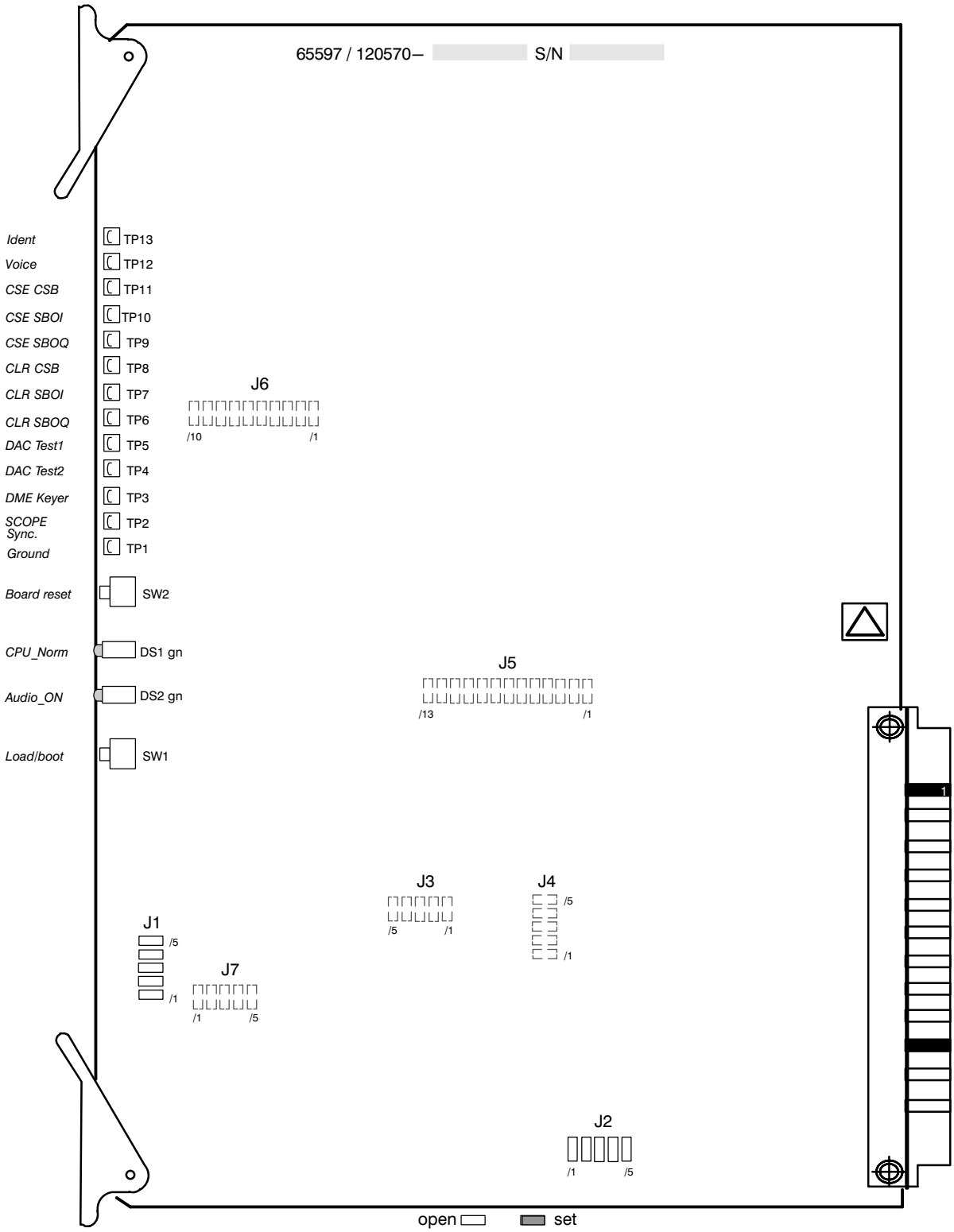
Ref. No. in brackets () represent previous/alternative german reference numbers.



1 Synthesizer (SYN)	120496–0002 (83138 22100)	1 of 2

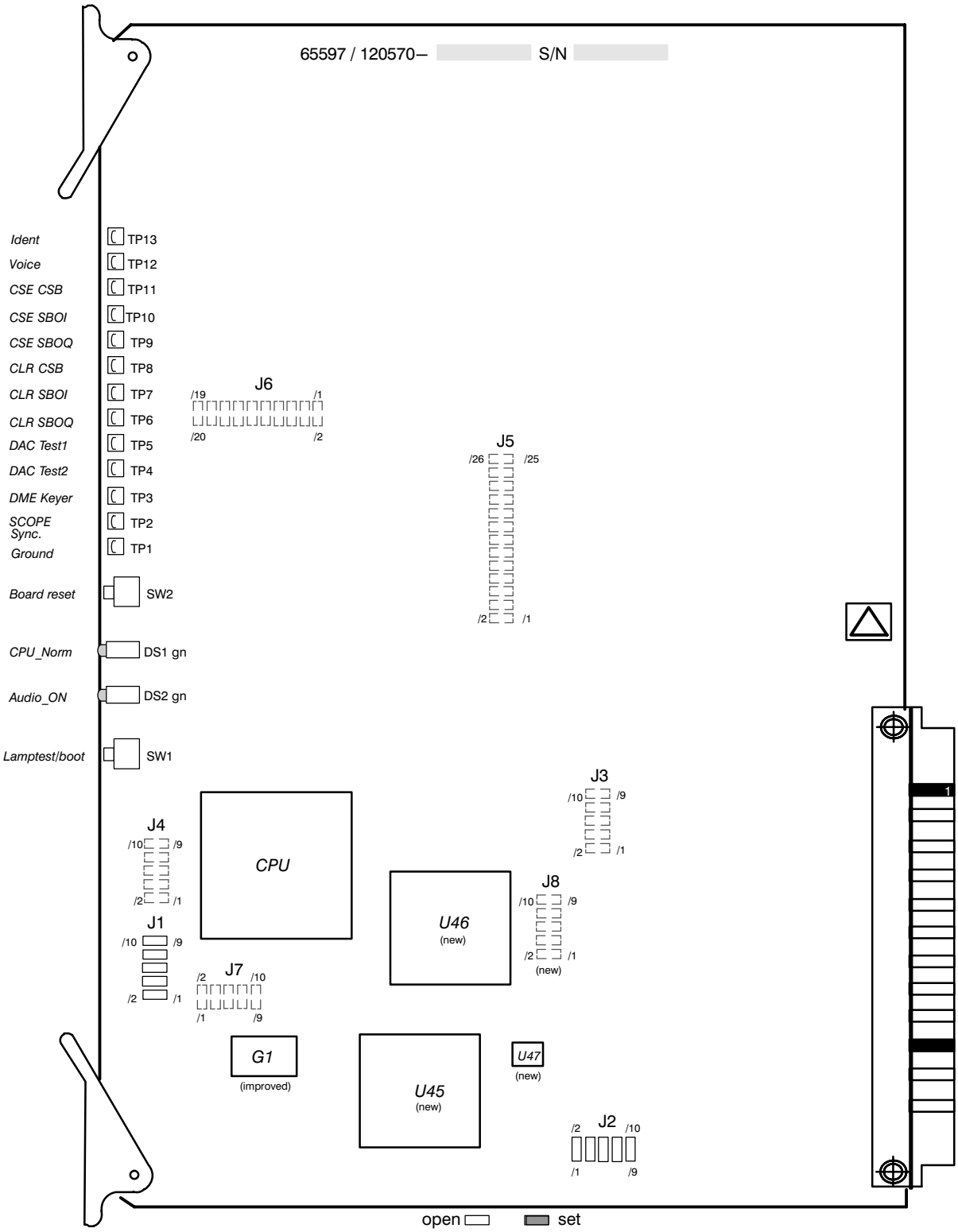
JUMPER	POSITION	DEFINITION	REMARKS
Frequency			
J1 300 100 20 10	set set set set	Selection of 300 MHz or 100 MHz Selection of tenth: 10, 20 or 30 MHz	Set to frequency BCD
J2 8.0 4.0 2.0 1.0	set set set set	Selection of units: 0 to 9 MHz	Set to frequency BCD
J3 .8 .4 .2 .1	set set set set	Selection of one tenth: .0 to .9 MHz	Set to frequency BCD
J4 .075 .050 .025 .000	set set set set	Selection of one hundreds and thousandths of MHz in steps of .025	Set to frequency BCD
Type			
J5 SGL Dual	set/open open/set	Single Dual	alternatively set
J8 8kHz 125Hz	open/set set/open	Frequency difference CRS/CLR: 8 kHz Frequency difference CRS/CLR: 125 Hz	alternatively to ”125Hz” default for ILS 420 *
1 Synthesizer (SYN)		**120496–0002 (83138 22100)**	**2 of 2**

* Set for internal divider.



2a LLZ/GP Audio Generator/Monitor (LG–A, LG–M) 120570–0003 (83138 23101) 1 of 2

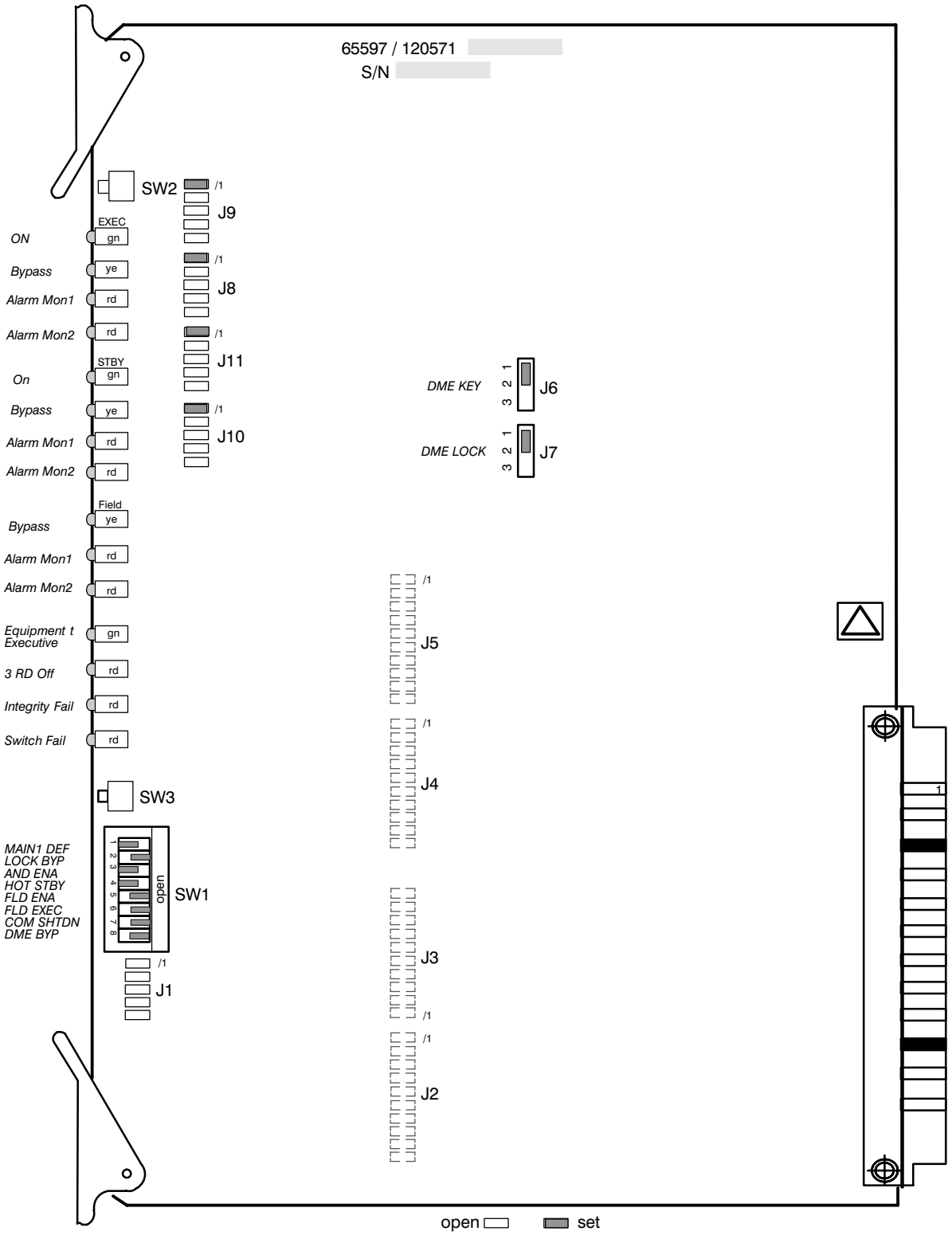
JUMPER	POSITION	DEFINITION	REMARKS
J1	–	used to program PLD	factory use
J2 /	–	used for processor debug	factory use
J3	–		not assembled
J4	–		not assembled
J5	–		not assembled
J6	–		not assembled
J7	–		not assembled
SWITCH	**POSITION**	**DEFINITION**	**REMARKS**
SW1	key	Load/Boot	Enable programming of flash. State label when asserted and coming out of reset. SW1 is pressed simultaneously with SW2 to start loading program of the board.
SW2	key	Board Reset	Reset of board processor
2a LLZ/GP Audio Generator/Monitor (LG–A, LG–M) 120570–0003 (83138 23101) 2 of 2			



2b LLZ/GP Audio Generator/Monitor (LG–A, LG–M) 120570–0004 **1 of 2**

JUMPER	POSITION	DEFINITION	REMARKS
J1	–	used to program PLD	factory use
J2	–	used for processor debug	factory use
J3	–		not assembled
J4	–		not assembled
J5	–		not assembled
J6	–		not assembled
J7	–		not assembled
J8	–		not assembled
SWITCH	**POSITION**	**DEFINITION**	**REMARKS**
SW1	key	Lamp test/Boot	Normally used for lamp test. Enables also programming of flashing state label. If pressed when coming out of reset it will start the boot programming of the board: Press SW1 simultaneously with SW2 to start loading program of the board.
SW2	key	Board Reset	Reset of board processor
2b LLZ/GP Audio Generator/Monitor (LG–A, LG–M) 120570–0004			**2 of 2**

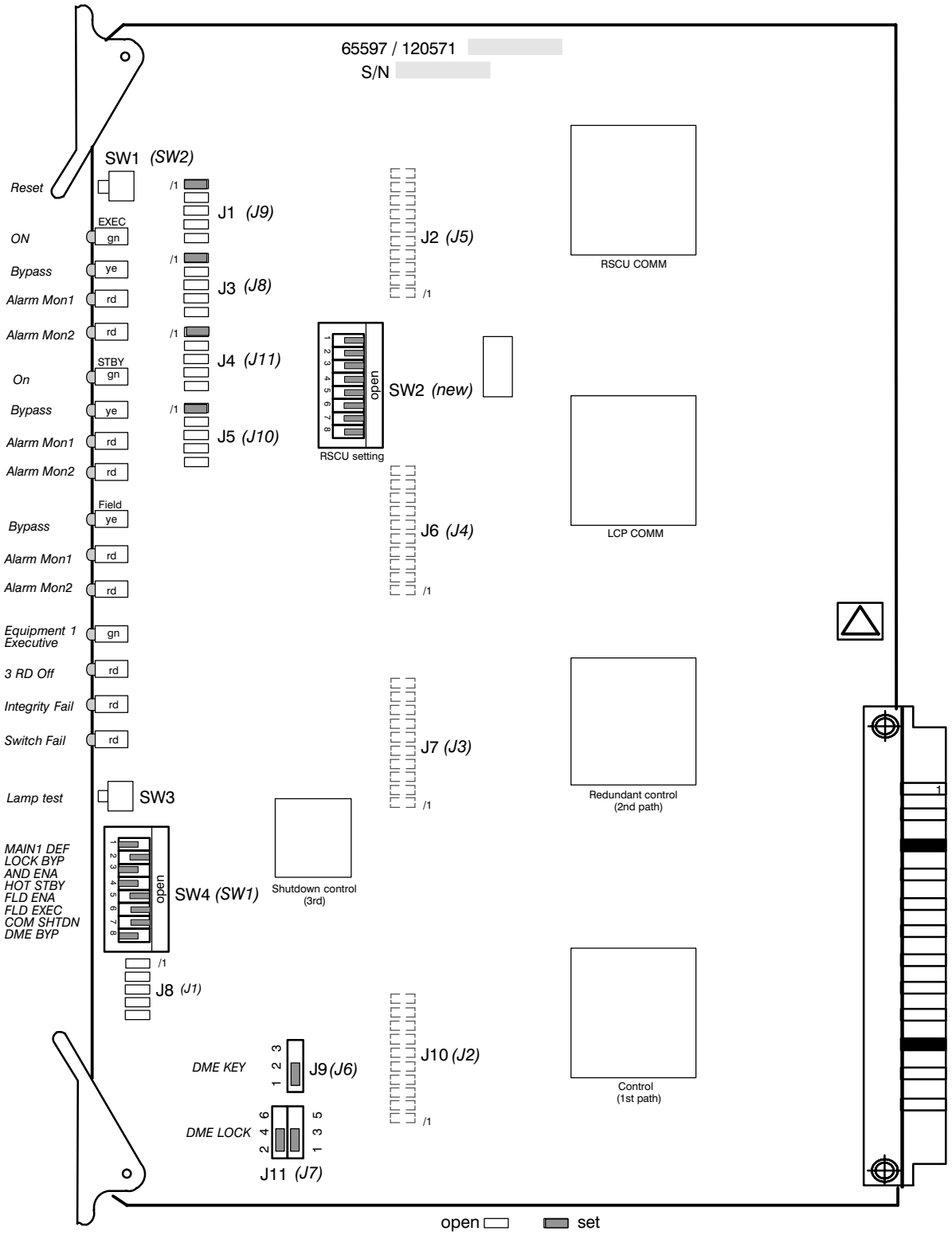
NOTE: The LLZ or GP installation can be equipped with the LGx Ref. 120570–0004, e.g. for replacement. The LGx 120570–0004 is backward compatible to the LGx –0003 version and can be used with former standard Export SW kits used by the 120570–0003.



3a Executive Control Logic (ECU) **120571−0001/−0002 (83138 25100) 1 of 2**

JUMPER	POSITION	DEFINITION	REMARKS
J1	–	Used to program PLD	Factory use
J2	–		not assembled
J3	–		not assembled
J4	–		not assembled
J5	–		not assembled
J6	1–2 2–3	Path open: closed per relayK1 (DMEkey NO) Path closed: open per relayK1 (DMEkey NC)	default (DME_KEY_COM) –
J7	1–2 2–3	Path open: closed per relayK2 (DMElockNO) Path closed: open per relayK2 (DMElockNC)	default (DME_LOCK_COM) Set, if DME collocation (LLZ)
J8 to J11	3–4 5–6 7–8	Checks top transistor Checks middle transistor Checks bottom transistor	Installing a jumper on J8 through J11 permit validation of totem pole check logic by shortening a selected transistor. Leave jumper on either end to store.
SWITCH	**POSITION**	**DEFINITION**	**REMARKS**
SW1 /1	closed open	Equipment #1 power on default main Equipment #2 power on default main	Default setting –
/2	closed open	Station interlocked bypassed (standalone) Station interlocked enable	– Default setting
/3	closed open	Both monitors must alarm before station transfer Either monitor alarm initiates station transfer	Default setting (AND–Konf.) (OR–Konfiguration)
/4	closed open	Hot standby transmitter monitored Cold standby transmitter	Default setting –
/5	closed open	Field monitoring enabled Field monitoring disabled	LLZ only; integrated FFM Default setting
/6	closed open	Field monitor has executive control Field monitoring does not have exec. control	Depends on application Default setting
/7	closed open	Station shutdown if lost LCP communications Station maintains same operation if lost LCP communications	Depends on application Default setting
/8	closed open	DME shutdown when the on–antenna transmitter is shutdown (DME remains on even if the ILS is alarmed off or turned off by the user for maintenance or such). DME shutdown when interlock signal removed (DME is on only if ILS exec. TX is on).	Default setting (LLZ) Depends on application (LLZ)
SW2	key	Board reset	
SW3	key	Lamp test	

3a Executive Control Logic (ECU) 120571–0001/–0002 (83138 25100) 2 of 2



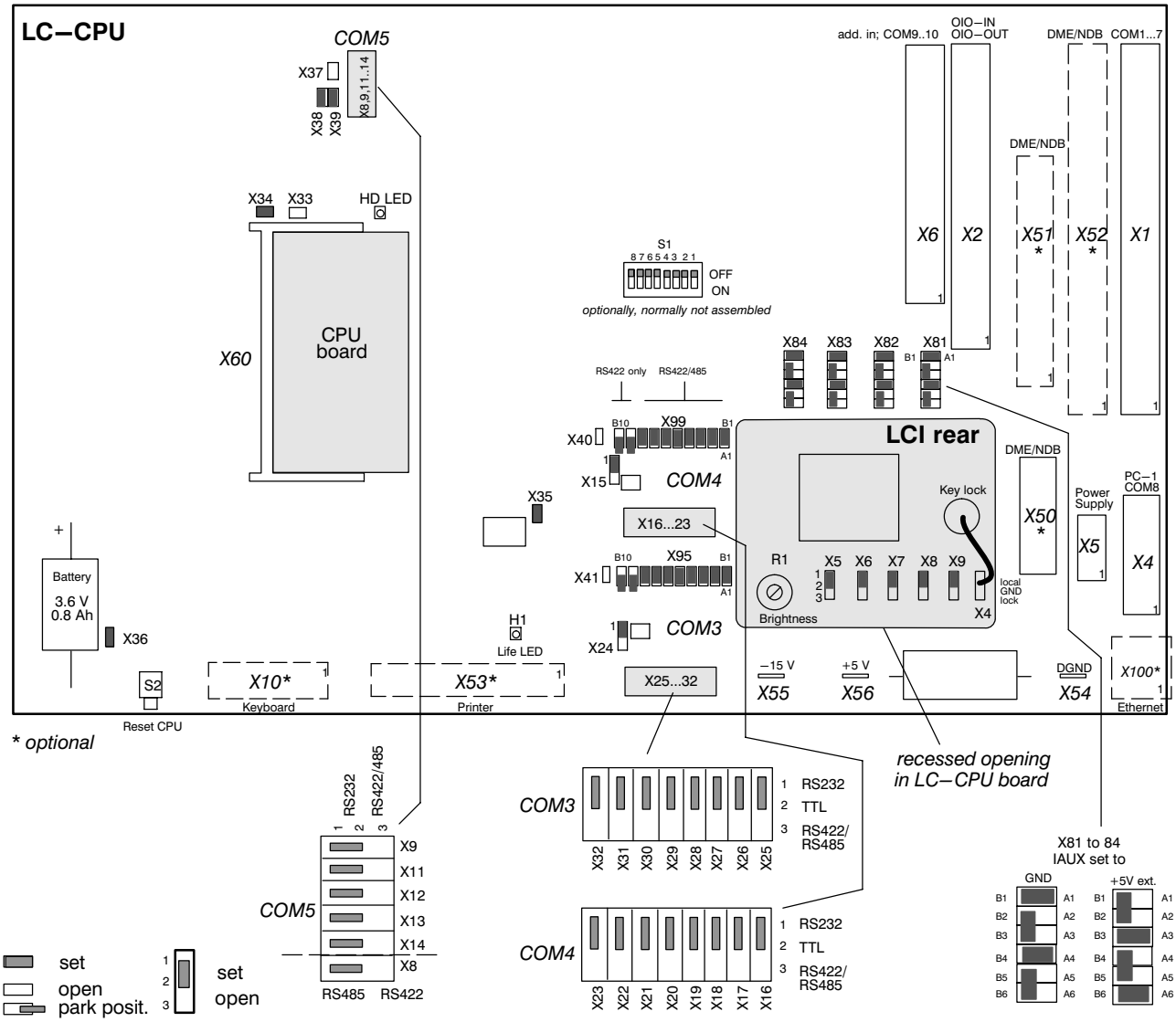
NOTE: Jumper and switch assignments of previous ECU 120571−0001 and −0002 are indicated in brackets, e.g. *(SW1)* .

3b Executive Control Unit (ECU)	**120571−0003**	**1 of 3**

JUMPER	POSITION	DEFINITION	REMARKS
J8	–	Used to program EPLD	Factory use
J2	–		not assembled
J6	–		not assembled
J7	–		not assembled
J10	–		not assembled
J9	1–2 2–3	Path open: closed per optorelay (DMEkey NO) Path closed: open per optorelay (DMEkey NC)	default (DME_KEY_COM) –
J11	1–3, 2–4 3–5, 4–6	Path open: closed per optorelay (DMElock NO) Path closed: open per optorelay (DMElockNC)	default (DME_LOCK_COM) Set, if DME collocation (LLZ)
J1, J3 to 5	3–4 5–6 7–8	Checks top transistor Checks middle transistor Checks bottom transistor	Installing a jumper on J1, J3 to J5 permit validation of totem pole check logic by shortening a selected transistor. Leave jumper on either end to store.
SWITCH	**POSITION**	**DEFINITION**	**REMARKS**
SW4 /1	closed open	Equipment #1 power on default main Equipment #2 power on default main	Default setting –
/2	closed open	Station interlock bypassed (standalone) Station interlock enable	– Default setting
/3	closed open	Both monitors must alarm bef.station transfer Either monitor alarm initiates station transfer	Default setting (AND–Konf.) (OR–Konfiguration)
/4	closed open	Hot standby transmitter monitored Cold standby transmitter	Default setting –
/5	closed open	Field monitoring enabled Field monitoring disabled	LLZ only; integrated FFM Default setting
/6	closed open	Field monitor has executive control Field monitoring does not have exec. control	Depends on application Default setting
/7	closed open	Station shutdown if communications with RSCU/RSCE is lost (includes LCP if remote communication is through that: SW2/5 open) Station maintains same operation if communications lost to LCP or RSCU/RSCE.	Depends on application Default setting
/8	closed open	DME shutdown when interlock signal removed (DME remains on even if the ILS is alarmed off or turned off by the user for maintenance or such). DME shutdown when the on–antenna transmitter is shutdown (DME is on only if ILS exec. TX is on).	Default setting (LLZ) Depends on application
SW1	key	Board reset	
SW3	key	Lamp test	

SWITCH	POSITION	DEFINITION	REMARKS
SW2		Switch bank SW2 selects the RSCU communication method (which also affects the LCP/ECU protocol). The setting of SW2 is installation dependent.	Depends on application
SW2 /1	closed	RSCU/ECU communication hardware handshakes enabled	Relevant only if SW2/5 closed
	open	RSCU/ECU communication hardware handshakes disabled	Default setting
/2	closed	Undefined LCP communication PLD option	Default setting
	open	–	–
/3	closed	Undefined redundant control PLD option	Default setting
	open	–	–
/4	closed	HW interlock to opposing runway enabled	Default setting
	open	HW interlock to opposing runway disabled	–
/5	closed	RSCU COMM to ECU	–
	open	RSCU/RSCE COMM to LCP	Default setting (standard ILS)
/6, /7, /8		RSCU address A2, A1, A0 respectively:	Relevant only if SW2/5 closed
/6	closed	A2	RSCU address A2
/7, /8	open		–
/7	closed	A1	RSCU address A1
/6, /8	open		–
/8	closed	A0	RSCU address A0
/6, /7	open		–
3b Executive Control Unit (ECU)		**120571–0003**	**3 of 3**

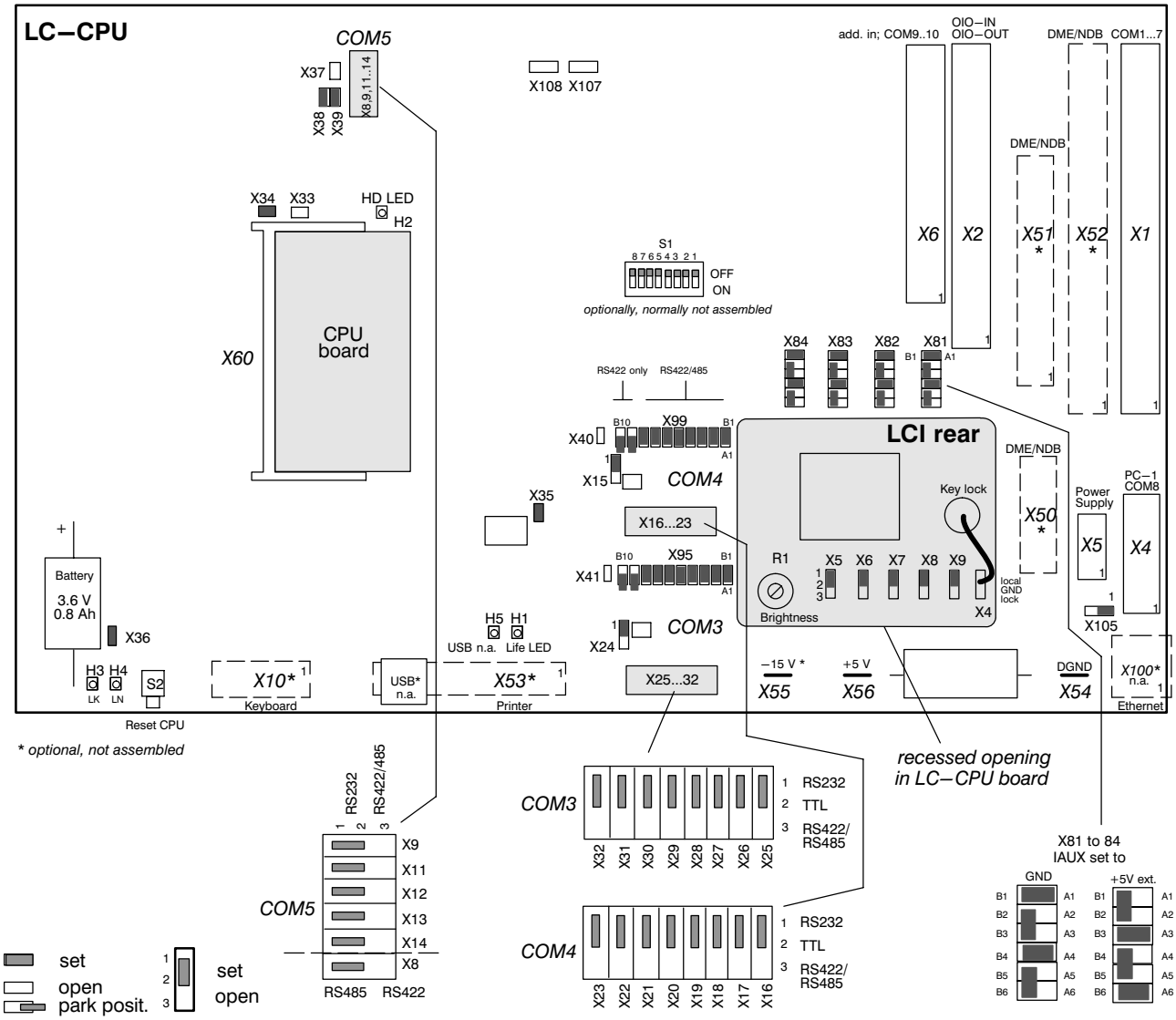
NOTE: If the LLZ or GP installation shall be equipped with the ECU Ref. 120571–0003, e.g. for replacement, it is allowed to use both the –0001 or 0002 and the new –0003 version together in one system. But, to get the benefit of the –0003 (e.g. advanced MIT–test) it is recommended to replace and use the –0003 in both LLZ and GP of a runway system; this is two ECU –0003 for LLZ and GP each even there is only one ECU to be replaced.



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 Ω 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 Ω 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**

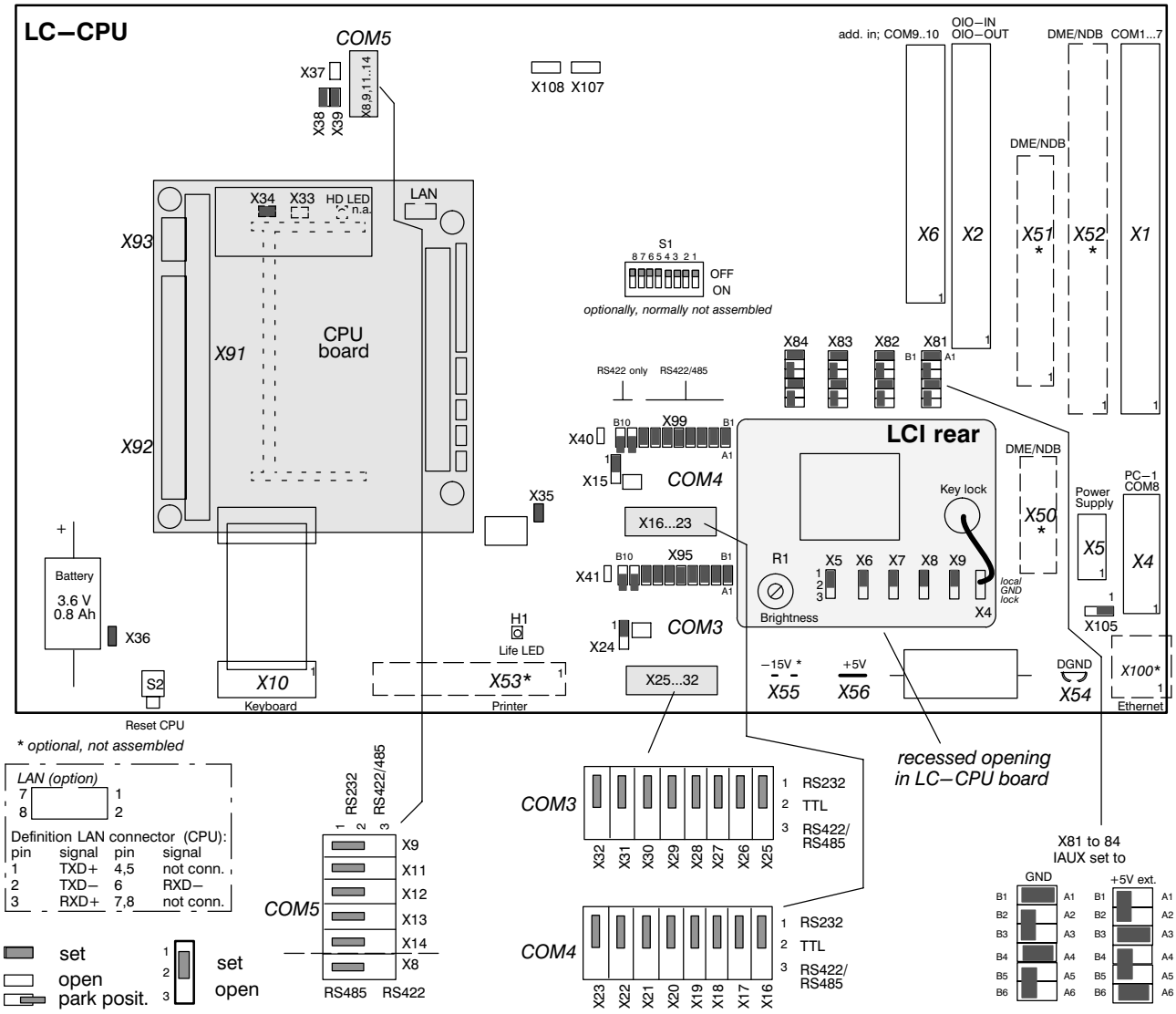
JUMPER	POSITION	DEFINITION	REMARKS
X38,39 X9,11...14 X8/X37	open 1–2 not used	serial port5 set to RS232 –	**Port 5** (COM5) –
X38,39 X9,11...14 X8 X37	open 2–3 2–3 open	serial port5 set to RS422 full duplex –	 default setting –
X38,39 X9,11...14 X8 X37	set 2–3 1–2 set	serial port5 set to RS485 half duplex adds 100 Ω 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 passed to CPU – IRQ6 passed 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 always 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. All other settings are the same as described for LC–CPU 83135 21402 (refer to 4a).

Also, the power supply is achieved now via a flat ribbon cable to connector X5 fed from BP–Digital connector J11. Connectors X55, X56, X54 remain unused. Connectors USB and X100 are not applicable or assembled.

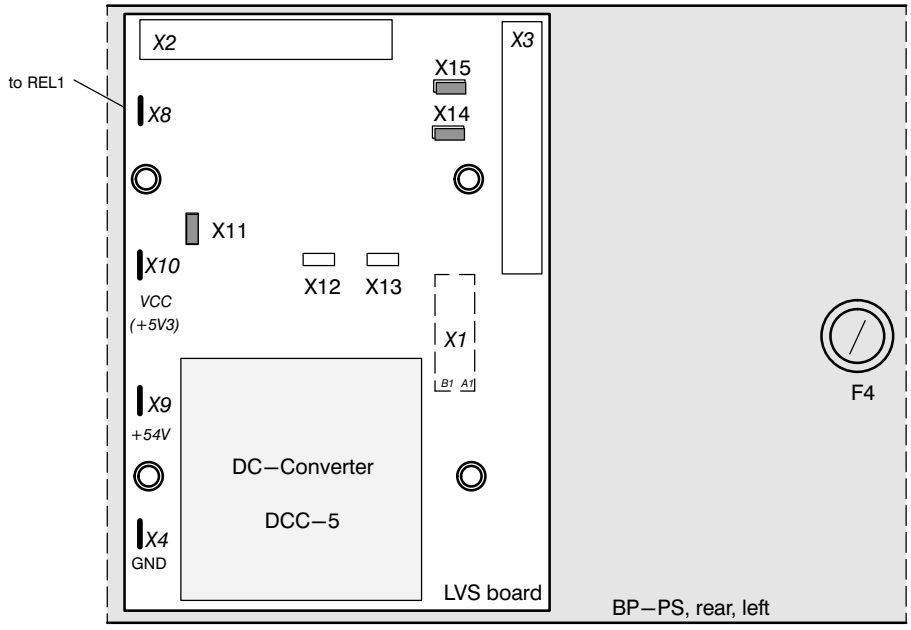
JUMPER	POSITION	DEFINITION	REMARKS
X105	1–2 2–3	–15 V from external –15 V from internal	default setting not applicable
X107	set open	Maint. ILS, LCD control –	special setting ILS FAA default setting ILS, (D)VOR
X108	set open	Local ILS, LCD control –	special setting ILS FAA default setting ILS, (D)VOR
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. All other settings are the same as described for LC−CPU 83135 21402 (refer to 4a).

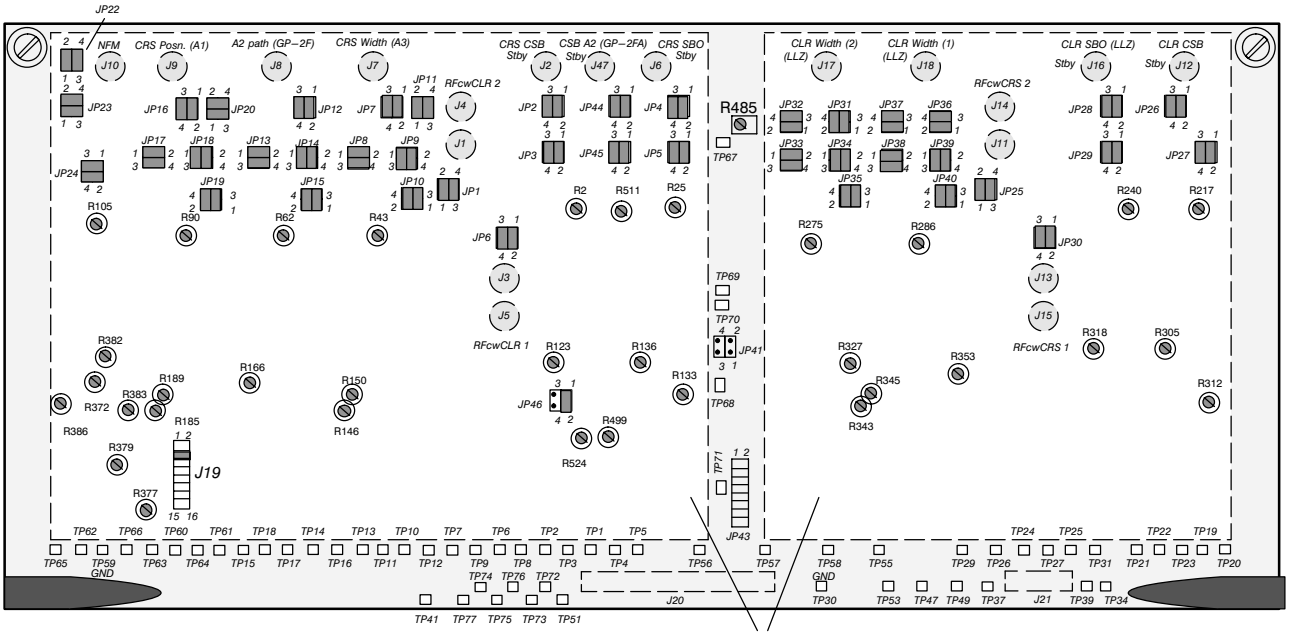
Due to the advanced processor board, the power supply requires additional supply cables for +5V (red: 027474−0001) and GND (black: 027475−0001) to connector X56 and X54 fed from BP−Digital connector E23 and E13. Connector X55 is not assembled any more.

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**



open set

Jumper	POSITION	DEFINITION	REMARKS
X11	set	cut−off relay REL1 enabled	low voltage sense action active
	open	cut−off relay REL1 disabled	low voltage sense action off
X12, X13		shutdown threshold low voltage	only jumper one set same time
X12 X13	open open	threshold value set to 45 V	depends on battery environment
X12 X13	set open	threshold value set to 43.2 V	depends on battery environment
X12 X13	open set	threshold value set to 40.8 V	depends on battery environment
X14, X15		enable remote on/off for DCC−MV	optional, actually fixed to ON
X14	set	remote on/off disabled, fixed ON	default setting
	open	remote on/off enabled DCC−MV 2	not applicable
X15	set	remote on/off disabled, fixed ON	default setting
	open	remote on/off enabled DCC−MV 1	not applicable
5 BP−PS, Low Voltage Sensor (LVS)		**83138 30511**	**1 of 1**



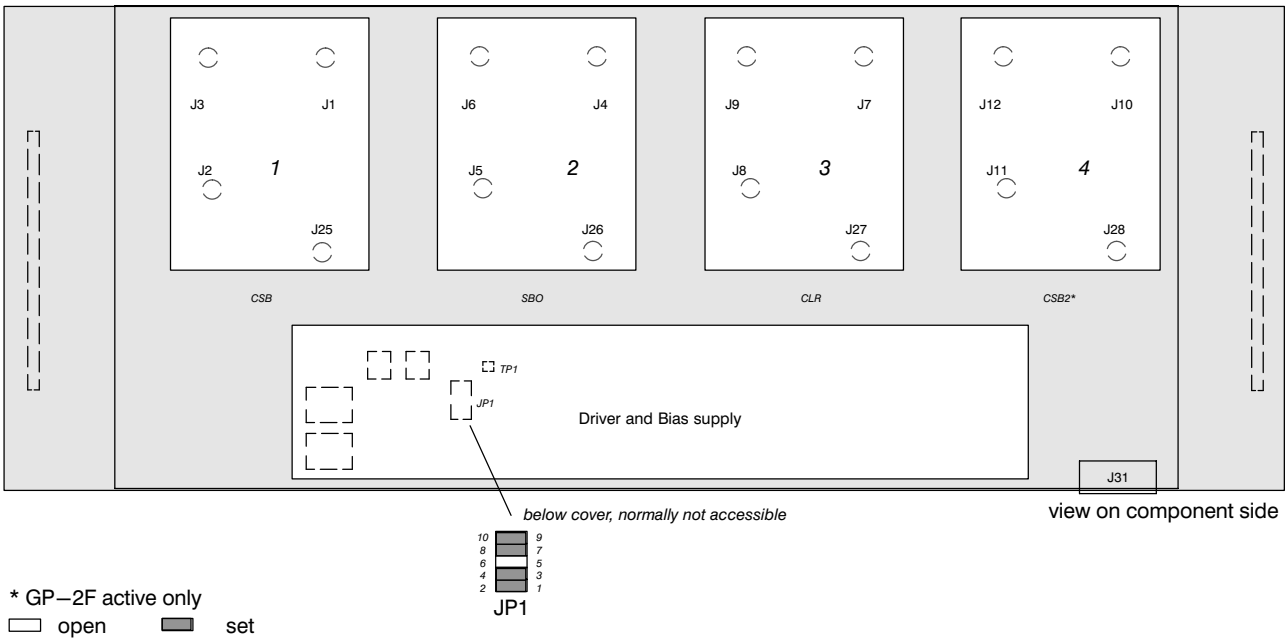
NOTE: The jumper setting above is an example setting for GP−2F active. Actual setting depends on installation !
If a single frequency (1F) installation is used jumper J1 and J6 have to be set to 1−3, 2−4 !

Jumper	POSITION	DEFINITION	REMARKS
RFcw input			
JP1	1−2, 3−4	RFcw from CLR SYN TX2 *(for 1F: 1−3, 2−4)*	default setting ILS 420 (2F)
JP6	1−2, 3−4	RFcw from CLR SYN TX1 *(for 1F: 1−3, 2−4)*	default setting ILS 420 (2F)
JP25	1−2, 3−4	RFcw from CRS SYN TX2	default setting ILS 420 (2F)
JP30	1−2, 3−4	RFcw from CRS SYN TX1	default setting ILS 420 (2F)
NFM (1)			
JP22	1−2, 3−4 1−3, 2−4	10 dB attenuator bypassed 10 dB attenuator enabled	default setting −
JP23,JP24 JP23,JP24	1−2, 3−4 1−3, 2−4	+15 dB gain amplifier enabled, −5 dB attenuator disabled +15 dB gain amplifier bypassed, −5 dB attenuator enabled	− default setting
CRS Posn./A1			
JP20	1−2, 3−4 1−3, 2−4	portion of A1 RF input available portion of A1 RF not available	opt. use in GP applications default setting
JP16	1−2, 3−4 1−3, 2−4	10 dB attenuator bypassed 10 dB attenuator enabled	default setting −
JP17	1−2, 3−4 1−3, 2−4	10 dB attenuator bypassed 10 dB attenuator enabled	default setting −
JP18,JP19 JP18,JP19	1−2, 3−4 1−3, 2−4	+15 dB gain amplifier enabled, −5 dB attenuator disabled +15 dB gain amplifier bypassed, −5 dB attenuator enabled	− default setting
6 Stby and On−Air Combiner (SOAC)		**120621−0001 (83138 27100)**	**1 of 3**

Jumper	POSITION	DEFINITION	REMARKS
A2 path (GP)			*Glide Path 2F only*
JP12	1−2, 3−4 1−3, 2−4	10 dB attenuator bypassed 10 dB attenuator enabled	default setting −
JP13	1−2, 3−4 1−3, 2−4	10 dB attenuator bypassed 10 dB attenuator enabled	default setting −
JP14,JP15 JP14,JP15	1−2, 3−4 1−3, 2−4	+15 dB gain amplifier enabled, −5 dB attenuator disabled +15 dB gain amplifier bypassed, −5 dB attenuator enabled	− default setting
CRS Width/A3			*GP−2F: A3 in; GP−1F: A2 in*
JP11	1−2, 3−4 1−3, 2−4	portion of A3 RF input available portion of A3 RF not available	default setting GP−2F, CLR GP−1F
JP7	1−2, 3−4 1−3, 2−4	10 dB attenuator bypassed 10 dB attenuator enabled	default setting −
JP8	1−2, 3−4 1−3, 2−4	10 dB attenuator bypassed 10 dB attenuator enabled	default setting −
JP9,JP10 JP9,JP10	1−2, 3−4 1−3, 2−4	+15 dB gain amplifier enabled, −5 dB attenuator disabled +15 dB gain amplifier bypassed, −5 dB attenuator enabled	− default setting
CLR Width (2)			*LLZ only*
JP31	1−2, 3−4 1−3, 2−4	GP A1 RF monit. LLZ CLR Width (2) input; no A1 RF monit.	opt. use in GP applications default setting
JP32	1−2, 3−4 1−3, 2−4	10 dB attenuator bypassed 10 dB attenuator enabled	default setting −
JP33	1−2, 3−4 1−3, 2−4	10 dB attenuator bypassed 10 dB attenuator enabled	default setting −
JP34,JP35 JP34,JP35	1−2, 3−4 1−3, 2−4	+15 dB gain amplifier enabled, −5 dB attenuator disabled +15 dB gain amplifier bypassed, −5 dB attenuator enabled	− default setting
CLRWidth (1)			
JP36	1−2, 3−4 1−3, 2−4	GP A3 CLR monit. LLZ CLR Width (1) monit. input	default setting GP−2F, CLR −
JP37	1−2, 3−4 1−3, 2−4	10 dB attenuator bypassed 10 dB attenuator enabled	default setting −
JP38	1−2, 3−4 1−3, 2−4	10 dB attenuator bypassed 10 dB attenuator enabled	default setting −
JP39,JP40 JP39,JP40	1−2, 3−4 1−3, 2−4	+15 dB gain amplifier enabled, −5 dB attenuator disabled +15 dB gain amplifier bypassed, −5 dB attenuator enabled	− default setting
6 Stby and On−Air Combiner (SOAC)		**120621−0001 (83138 27100)**	**2 of 3**

Jumper	POSITION	DEFINITION	REMARKS
Stby CSBA2			*active GP−2F only*
JP44	1−2, 3−4 1−3, 2−4	15 dB attenuator bypassed 15 dB attenuator enabled	default setting −
JP45	1−2, 3−4 1−3, 2−4	10 dB attenuator bypassed 10 dB attenuator enabled	default setting −
JP46	1−2 2−4	active GP monitoring Stby CSB A2 all other GP and LLZ arrays	default setting GP−2F active GP−1F/−2F standard
Stby CRS CSB/CSBA1			
JP2	1−2, 3−4 1−3, 2−4	15 dB attenuator bypassed 15 dB attenuator enabled	default setting −
JP3	1−2, 3−4 1−3, 2−4	10 dB attenuator bypassed 10 dB attenuator enabled	default setting −
StbyCRS SBO/SBOA3			
JP4	1−2, 3−4 1−3, 2−4	15 dB attenuator bypassed 15 dB attenuator enabled	default setting −
JP5	1−2, 3−4 1−3, 2−4	10 dB attenuator bypassed 10 dB attenuator enabled	default setting −
Stby CLR CSB/CLR			
JP26	1−2, 3−4 1−3, 2−4	15 dB attenuator bypassed 15 dB attenuator enabled	default setting −
JP27	1−2, 3−4 1−3, 2−4	10 dB attenuator bypassed 10 dB attenuator enabled	default setting −
Stby CLR SBO (LLZ)			
JP28	1−2, 3−4 1−3, 2−4	15 dB attenuator bypassed 15 dB attenuator enabled	default setting −
JP29	1−2, 3−4 1−3, 2−4	10 dB attenuator bypassed 10 dB attenuator enabled	default setting −
Switch bank J19 1−2 3−4 5−6 7−8 9−10 11−12 13−14 15−16	 open set * open open open open open open	Used to select processing mode of antenna type: GP: standard M−Type GP: active M−Type (TSIS) * GP: sideband reference (B−Type) GP: 0 reference (0−Type) LLZ: localizer detector mode LLZ: internal spare spare	Depends on application: default GP−2F standard default GP−2F active* default GP−1F B−Type default GP−1F 0 reference default LLZ only for LPD antenna with CU part no. 120631−0001 − −
JP43,JP41	−	optional use in GP systems only	not applicable for LLZ
6 Stby and On−Air Combiner (SOAC)		**120621−0001 (83138 27100)**	**3 of 3**

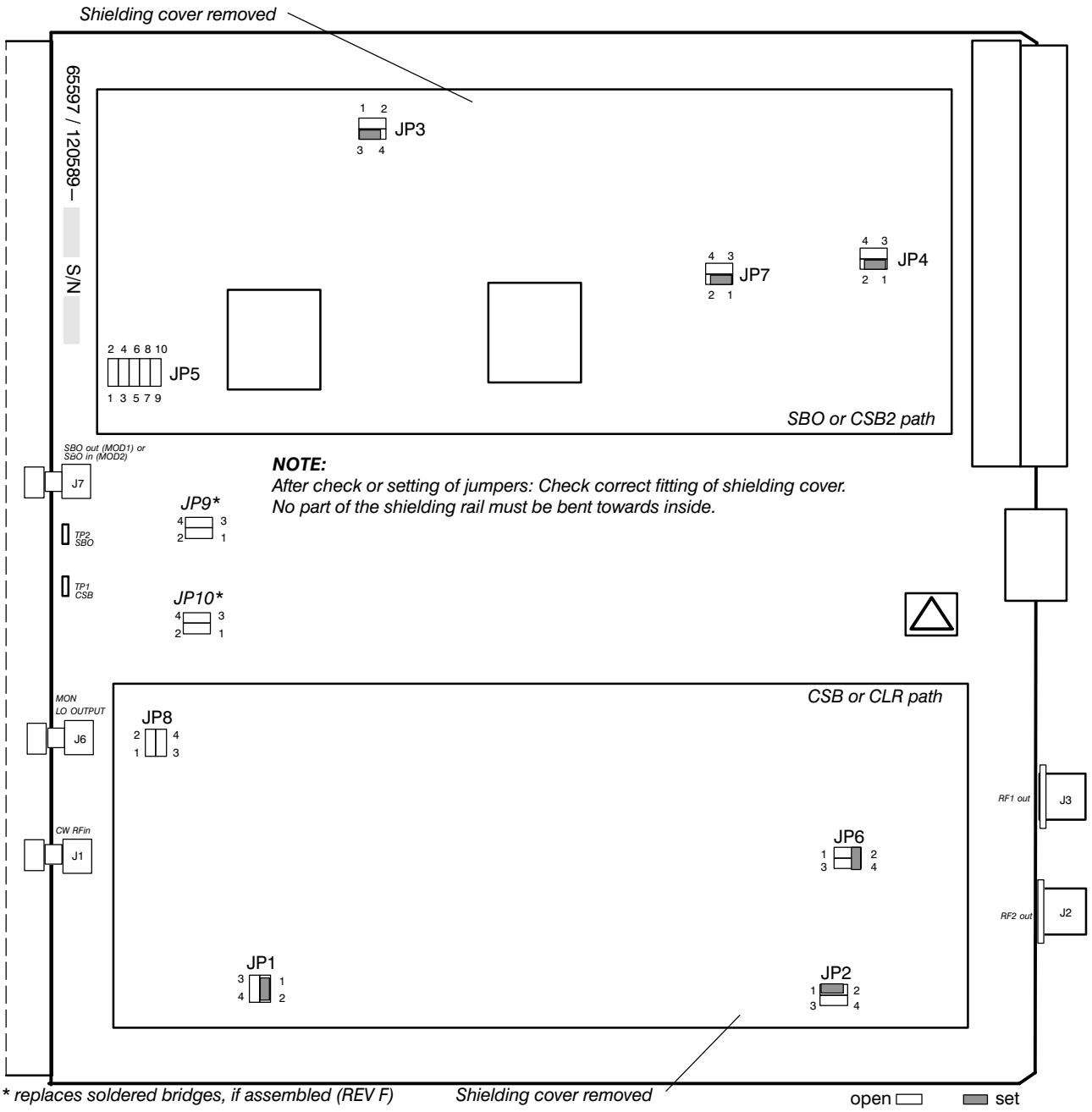
Remark: * Setting example: this setting can also be used as option instead of ”1−2” with defined installations of GP−2F standard.



Jumper	POSITION	DEFINITION	REMARKS
Jumper bank JP1		Used for DC−DC test purposes: disconnection of DC−DC supply	Factory use only
9−10	set	+5V In	default setting
7−8	set	+5V In	default setting
5−6	open	GND	default setting
3−4	set	−140V In	default setting
1−2	set	−140V In	default setting
7 PIN−Diode Transfer Switch		**120622−002 (83138 28100)**	**1 of 1**

WARNING

Do not remove the cover of the driver and bias supply and the PIN−Diode switches. Switch off DC−supply before working on the subassembly with removed covers. Regard that the internal generated PIN−Diode reverse bias supply is −140 V/30 mA, to be measured at TP1.



Setting for active GP–2F

JP5	example MODPA1 (CSB/SBO) Int. SBO RF out	JP8	example MODPA1 (CSB/SBO) for internal SBO carrier
JP5	example MODPA2 (CSB2/CLR) Ext. SBO RF in	JP8	example MODPA2 (CSB2/CLR) for external SBO carrier

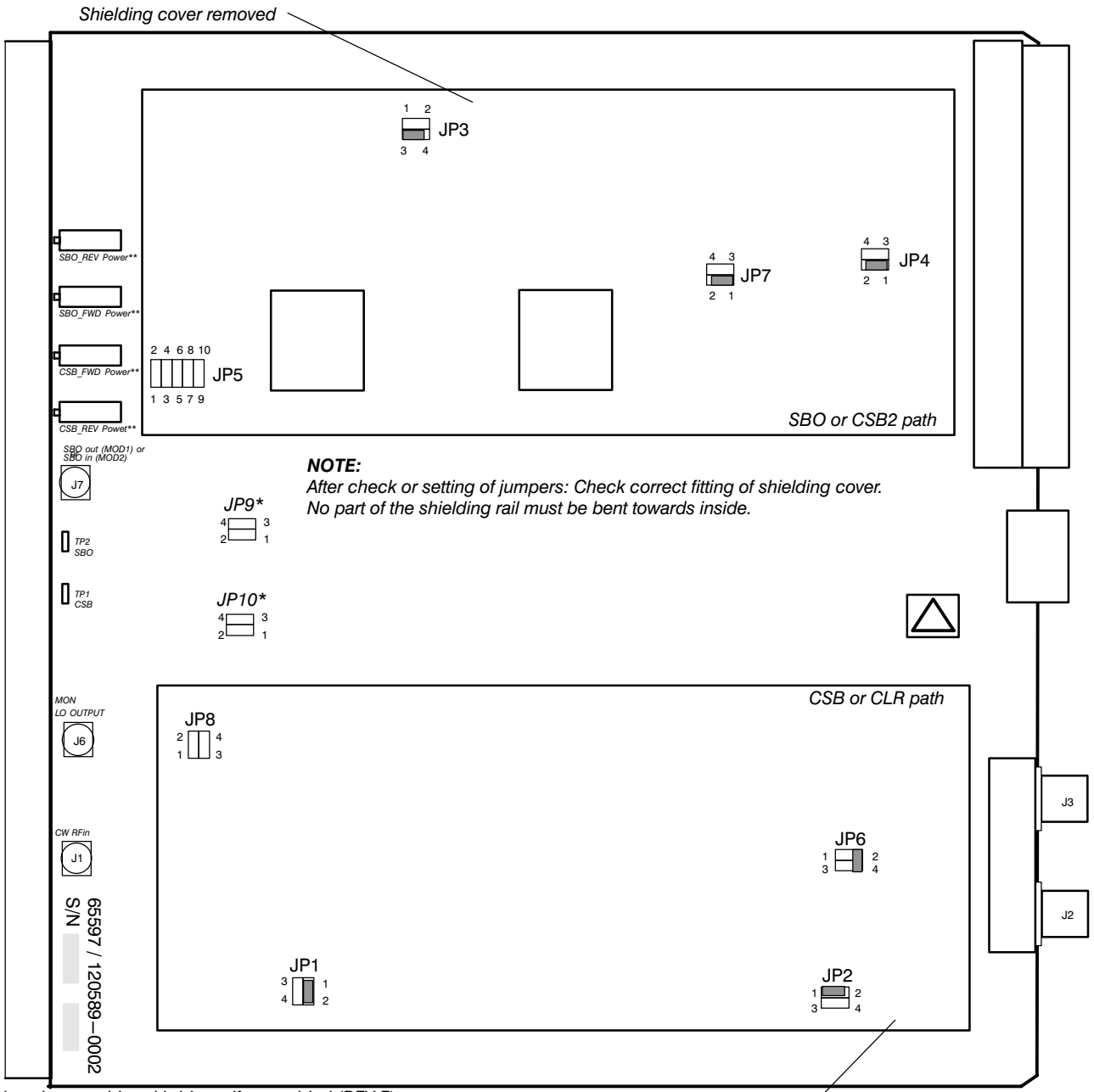
*JP9**	example MODPA1 (CSB/SBO)
*JP9**	example MODPA2 (CLR/CSB2) SBO input capacitor bridged
*JP10**	example MODPA1 and MODPA2 SBO output enabled, active GP

Setting for GP–1F and GP–2F standard

JP5	example MODPA1 (CSB/SBO) example MODPA2 (CLR)	JP8	example MODPA1 (CSB/SBO) for internal SBO carrier
		*JP9**	example MODPA1 (CSB/SBO)

*JP10**	example MODPA1 (CSB/SBO) SBO output enabled
*JP10**	example MODPA2 (CLR) SBO output disabled

8a Glide Path Modulator Power Amplifier (MODPA–GP) 120589–0001 (83138 26300) 1 of 3



* replaces soldered bridges, if assembled (REV F) ** Factory adjustment Shielding cover removed open set

Setting for active GP–2F

JP5 example MODPA1 (CSB/SBO) Int. SBO RF out

JP8 example MODPA1 (CSB/SBO) for internal SBO carrier

JP9* example MODPA1 (CSB/SBO)

example MODPA2 (CLR/CSB2) SBO input capacitor bridged

JP5 example MODPA2 (CSB2/CLR) Ext. SBO RF in

JP8 example MODPA2 (CSB2/CLR) for external SBO carrier

JP10* example MODPA1 and MODPA2 SBO output enabled, active GP

Setting for GP–1F and GP–2F standard

JP5 example MODPA1 (CSB/SBO) example MODPA2 (CLR)

JP8 example MODPA1 (CSB/SBO) for internal SBO carrier

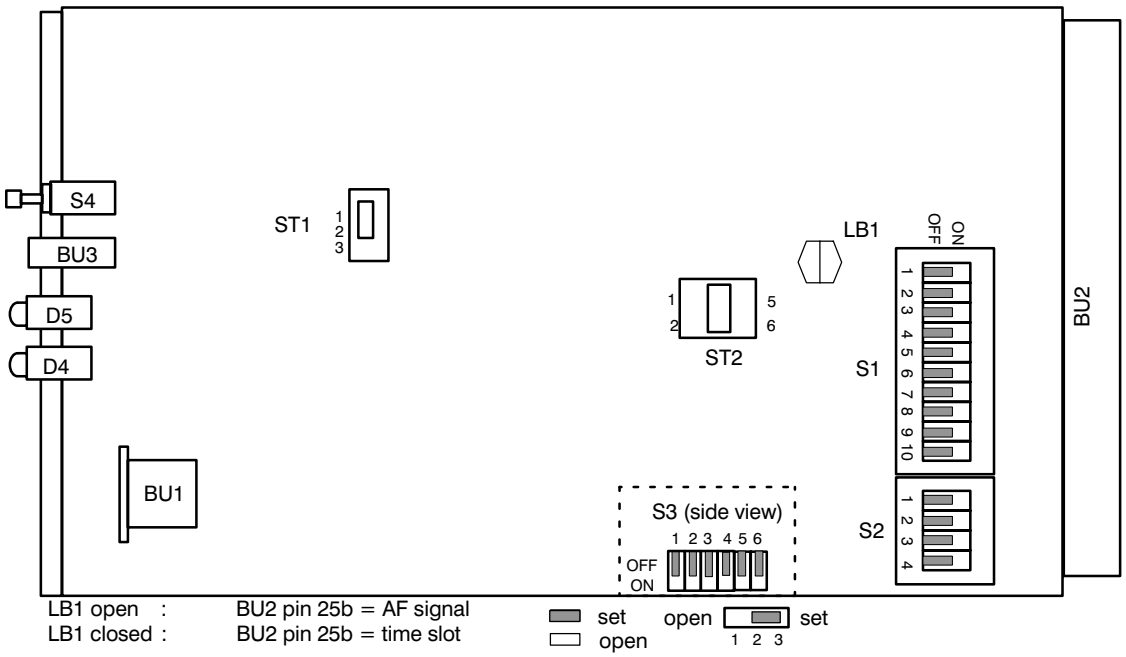
JP10* example MODPA1 (CSB/SBO) SBO output enabled

JP9* example MODPA1 (CSB/SBO)

JP10* example MODPA2 (CLR) SBO output disabled

8b Glide Path Modulator Power Amplifier (MODPA–GP) 120589–0002 2 of 3

JUMPER	POSITION	DEFINITION	REMARKS
GP−2F active, MODPA 1 (CSB1/SBO) and MODPA 2 (CSB2/CLR)			
JP1	1−2 3−4 1−3/2−4	RF path closed RF path open internal RF−Path to ground	default setting service position service position
JP2	1−2 3−4 1−3/2−4	RF path closed RF path open internal RF−Path to ground	default setting service position service position
JP3	1−2 3−4 1−3/2−4	RF path open RF path closed internal RF−Path to ground	service position default setting service position
JP4	1−2 3−4 1−3/2−4	RF path closed RF path open internal RF−Path to ground	default setting service position service position
JP5		RF−path setting for non active or active GP	
	3−1, 5−6, 9−10	Int. SBO, non active GP, connect J7 to load	setting for standard GP, both MODPA1 and MODPA2
	3−4, 5−6, 9−10	Int. SBO out, active GP, PA output to J7	setting for MODPA1 for SBO (and CSB), active GP
	1−3, 4−6, 5−7	Ext. SBO, active GP, input to J7	setting for MODPA2 for CSB2 (and CLR), active GP
JP6	2−4 1−3 1−2/3−4	RF path closed RF path open internal RF−Path to ground	default setting service position service position
JP7	1−2 3−4 1−3/2−4	RF path closed RF path open internal RF−Path to ground	default setting service position service position
JP8		Internal SBO ON/OFF	
	1−3/2−4	for int. SBO carrier, input J1 to internal path	setting for MODPA1 for SBO (and CSB), active GP
	1−2/3−4	for ext. SBO carrier, input J1 to load	setting for MODPA2 for CSB2 (and CLR), active GP
JP9		SBO input capacitor bridging	
	none	standard path	setting for MODPA1 for SBO (and CSB), active GP
	1−2/3−4	SBO, input capacitors bridged	setting for MODPA2 for CSB2 (and CLR), active GP
JP10	1−3 2−4	SBO output enable SBO output disable/shutdown SBO power stage	setting for MODPA1 and 2 for active GP−2F setting for MODPA2 for standard GP−2F (CLR stage only)
8 Glide Path Modulator Power Amplifier (MODPA−GP) 120589−0001/−0002			**3 of 3**



DEFINITION	JUMPER/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:

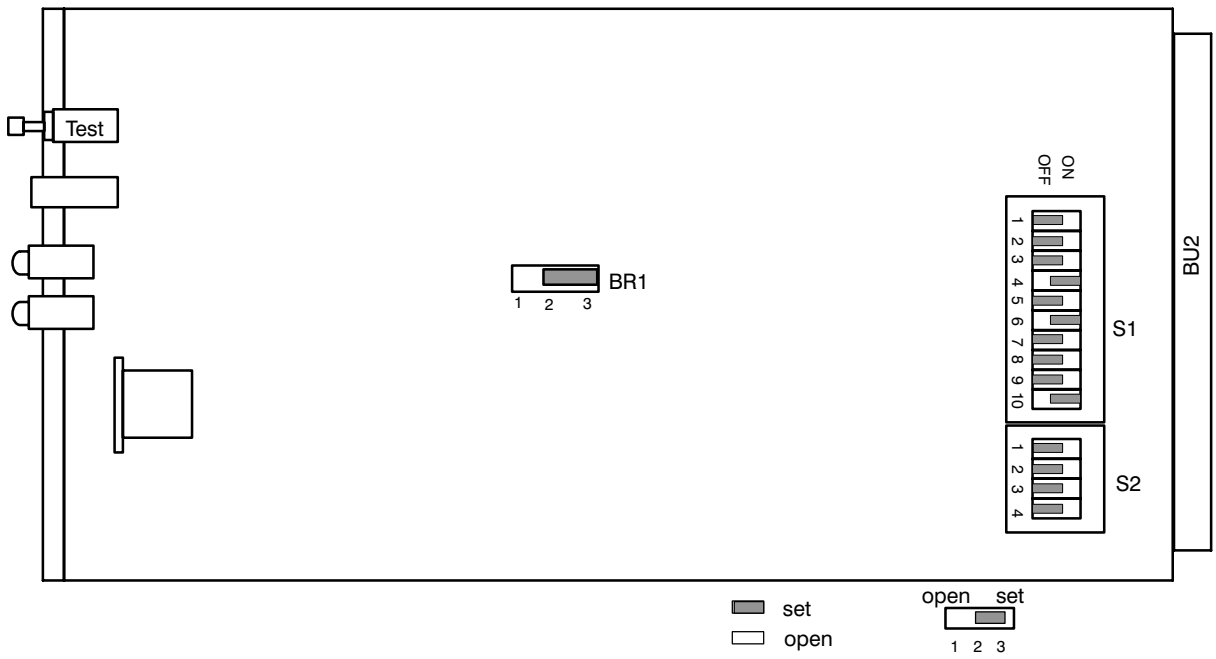
Level at Z	ST1
−43 dBm	1−2 (delivery setting)
−33 dBm	2−3

ST2 Transmit level range:

Switched line at Z	ST2	Dedicated line (600 ohm)	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.

9 Switched or Dedicated line Modem (LGM28.8)	84045 83245	1 of 1



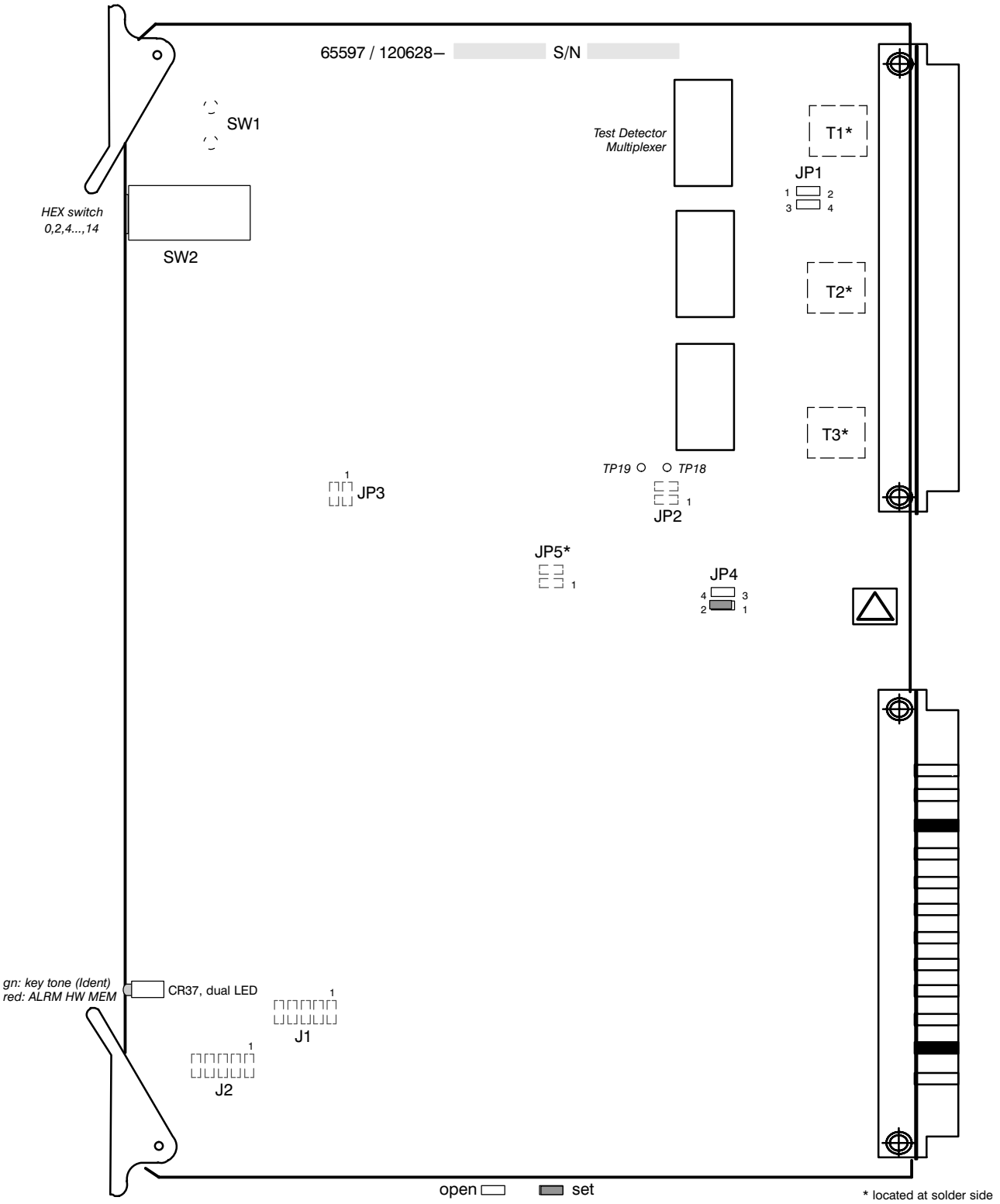
DEFINITION	JUMPER/POSITION		REMARKS
Permanent transmission control	**S2.1**		
on	OFF		default setting
off	ON		–
Operation 1200/600 bit/s	**S2.2**		
1200 bit/s	OFF		default setting
600 bit/s	ON		–
Transmit level	**S1.9**	**S1.10**	
±0 dBm	OFF	OFF	–
–3 dBm	ON	OFF	–
–6 dBm	OFF	ON	default setting
–9 dBm	ON	ON	–

NOTE: Some telephone networks may prohibit alteration of the transmit level.

Impedance during transmission	**S1.8**	
300 ohms	OFF	for remote site (e.g. RCSE)
600 ohms	ON	for station site
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	JUMPER/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

10 Dedicated or Party line Modem (LGM1200MD) **84045 83233** **2 of 2**



11 LLZ/GP Monitor Interface (INTFC) 120628–0001 **1 of 2**

JUMPER	POSITION	DEFINITION	REMARKS
JP1	 1–2 3–4	Hardware Monitor LLZ or GP setup: set for LLZ CLR Width1 monitoring set for GP CLR SDM monitoring	default: no setting optional, used with LLZ optional, used with GP
JP2	1–2, 3–4	not used	not assembled
JP3	1–2, 3–4		not assembled
JP4	 1–2 3–4	Selecting Ident input: on–air Ident standby Ident	 default factory use
JP5	1–2, 3–4	not used	not assembled
J1	–	not used	not assembled
J2	–	not used	not assembled
SWITCH	**POSITION**	**DEFINITION**	**REMARKS**
SW1	–	not used	not assembled
SW2	HEX switch	switch for manual test detector input select	factory use
11 LLZ/GP Monitor Interface (INTFC) 120628–0001			**2 of 2**

CHAPTER 7
ALIGNMENT PROCEDURE GP−2F, M−TYPE (STANDARD)

This chapter describes the alignment procedure for the GP−2F standard version (M−Type or Capture Effect). The procedure of the active GP−2F version is contained in chapter 5. The alignment procedure of a Glide Path system (2F) including prerequisites is described in a step by step manner starting with 7.1. The following list is a summary and also a detailed table of contents.

7.1 GENERAL PREREQUISITES

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

7.1.1 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.

7.1.1.1 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 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 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)

7.1.1.2 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).

7.1.2 Recommended Measuring Equipment

– 1 thruline wattmeter
– 1 oscilloscope (dual trace, trigger delay facility)
– 1 W, 10 W measuring element (330 MHz)
– 1 DDM instrument and field strength meter (portable)
– 3 terminating resistors, 50 ohms, 10 W
– Reducers and phase adapters (TNC and SMA), possibly 90˚ or 180˚ cable (used for phasing)
– 1 RF Test cable: RG 223, ca. 720 mm mechanical length, 435˚ at 328...335 MHz,, TNC/f – TNC/f
– 1 pair of radiotelephones

7.1.3 Status of Installation

Before operation, the system must complete as follows:

– Transmitter cabinet, installed,
– Power supply, installed,
– Batteries, installed,
– Antenna system and
– Nearfield monitor dipole* (option), installed and cabling complete.
(* The exact location and the foundation are usually defined after flight check)
– 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 printed circuit boards (refer also to chapter 6, section 6.6.5) have to be in accordance with the system version. To enable battery backup on specific printed circuit boards and for initial settings on site refer to 7.2.1.1.
– The MCS resp. ADRACS software has been loaded to PC (refer to 7.1.1).

7.1.4 Check of Antenna Installation

The information about this will be found in Part 3, Antenna System Description of the GP Technical Manual.

7.2 FIRST SWITCHING ON

7.2.1 Status of the System

− Mains OFF (mains distribution unit, 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)
− DC−switches TX1 and TX2 on subrack PS (transmitter cabinet) in position OFF

CAUTION

All CSB and SBO RF−outputs must either be terminated with a dummy load or connected to antenna. Otherwise the transmitter may be damaged when switching on the equipment.

7.2.1.1 Special Jumper Settings before Start Up

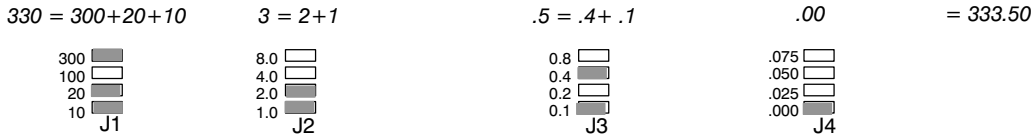
Individual jumpers have to be set before the first switching on. The location of jumpers is shown in section 6.6.5. Perform the following settings:

− LCP: Set jumper X36 (enabling backup battery for RTC).

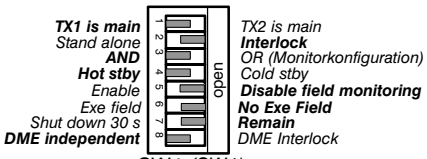
− SYN: Set jumpers J1 to J4 according to the selected operating frequency:

J1:	300 or 100 and tenth	J2:	units
J3:	one tenth	J4:	one hundreds and thousandths

Example: The GP frequency is selected to *333.50* MHz. Perform following settings:



− ECU: Set switch SW4 (*SW1*) according to selected station configuration and jumpers J6, J7, if specific DME operation is required. This setting must correspond to software configuration data. Standard setting of SW4 (*SW1*) is:



Standard setting:	1	closed	Transmitter 1 is main
	2	open	Interlock on (control follows interlock bit)
	3	closed	Monitor AND configuration enabled
	4	closed	Hot Standby set
	5	open	Closed if farfield monitor available (FFM, LLZ)
	6	open	Closed if field monitor available and executive
	7	open	Station remains operable
	8	closed	No DME

7.2.2 Switch On

a) Connect PC serial interface connector (e.g. COM1) to RS232 connector 'Local PC' on top of the cabinet with a 'zero modem cable' (rx/tx crossed).
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.
c) Close battery fuse switches (battery fuse box, inside shelter).
NOTE: Matching the charging voltage of BCPS modules to environmental conditions: Refer to 6.3.3.
d) Set DC switches TX1 and TX2 on subrack PS (transmitter cabinet) to ON.
e) Switch to local control with the key−lock switch on the Local Control Panel (LCP).

7.2.3 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 menus of the user program before performing the first set up procedure. The user program specific actions/procedures, which are:

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

are described in detail in the **ANNEX 'PC User Program−specific Procedures'** of this manual (see Register 8).

7.2.4 Preparing the Installation SITE with PC

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.

7.2.4.1 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 OS.

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 function 'LOGIN' of the MASTER MENU. Enter *REU* as 'UserName' and confirm blank characters in 'Password'.

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

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

f) Select function '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 function 'SET SITE DATE & TIME'. Enter date and time.

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

7.2.4.2 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 start window.

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

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

g) Click 'Reset SITE' of menu 'RC Management' 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 start window.

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

k) Click 'Exit' to close program.

7.2.5 Enter Station Configuration Data

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

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

b) Switch both TX on and Set all monitor bypass on.

c) Open the Station Configuration dialog.

d) Enter all required parameters in the dialog window. Verify that the parameter 'Standby configuration' is set to 'Hot'.

NOTE: Settings in d) must correspond to the settings of the DIP−FIX switch SW4(SW1) on ECU board!

e) Switch both TX off.

NOTE: It is recommended for the first setup procedure to note down all settings and values which have been performed in the individual steps of alignment. This is useful because the values should be remembered in the setup sequence of the procedure.

7.3 CHECK ANTENNA MATCHING

NOTE: Use same power probe for the ratio measurement !

Check the matching of all antennas, one after the other, as described below:

a) Connect cable for A1, coming from transmitter, via wattmeter directly to the supply cable of the antenna which must be measured. Terminate output A2 and A3 with dummy load 50 ohm/10 W.

b) Switch TX1 on. Set TX1 on aerial.

c) Open dialog 'Transmitter1−Waveform Data#1'.

d) Set 'CRS CSB RF−Level' to 1 W. Set 'CLR RF−Level' to 0 W. Set 'SBO RF−Level' to 0 %.

NOTE: If need be set CRS CSB DDM= 0 % and CRS CSB SDM= 0 % (depends on instrument used).

e) Form the ratio between the forward and reverse signals with the wattmeter. The matching value should be >20 dB. If not, examine the antenna and the supply cable.

f) Switch TX1 off.

g) Connect next antenna cable (A2 respectively A3) and repeat steps b), e), f).

h) Connect all the RF cables as normal again at the end of the matching measurements.

7.3.1 Check Power Adder Power Distribution

REMARK: Phase shifters Z1 and Z3 (Fig. 7−1) are set to 0° as default setting. A change of this setting may be performed during flight check measurements.

a) Measurement procedure:
This check entails supplying the CRS CSB signal to the 3 inputs COURSE CSB, COURSE SBO and CLEARANCE, one after the other (see Sections 7.3.1b) to 7.3.1d)). The inputs must be terminated each with a 50 ohm resistor when not in use. The CRS SBO and Clearance power remain set to 0. The power at the outputs to the antennas is measured by the wattmeter, where

A1= lower antenna (L), A2= middle antenna (M) and A3= upper antenna (U).

Connect all RF cables as normal again after the measurements.

b) CSB supplied to input J1 COURSE CSB. Check power ratio: A1 : A2 =+6 dB (±0.3 dB)

NOTE: Corresponds to power ratio 3.6...4.4, note value .....dB

CAUTION

Set CSB to 1 W before supplying to input J2 COURSE SBO. Remove external attenuator if used!

c) Set CRS CSB to 1 W and supply to input J2 COURSE SBO.

d) Check power ratio: A1 : A3 = 0 dB (±0.3 dB)

NOTE: Corresponds to level ratio difference of ±3.5 %. Note value .....dB

e) Check power ratio: A2 : A1/A3 = +6 dB (±0.3 dB)

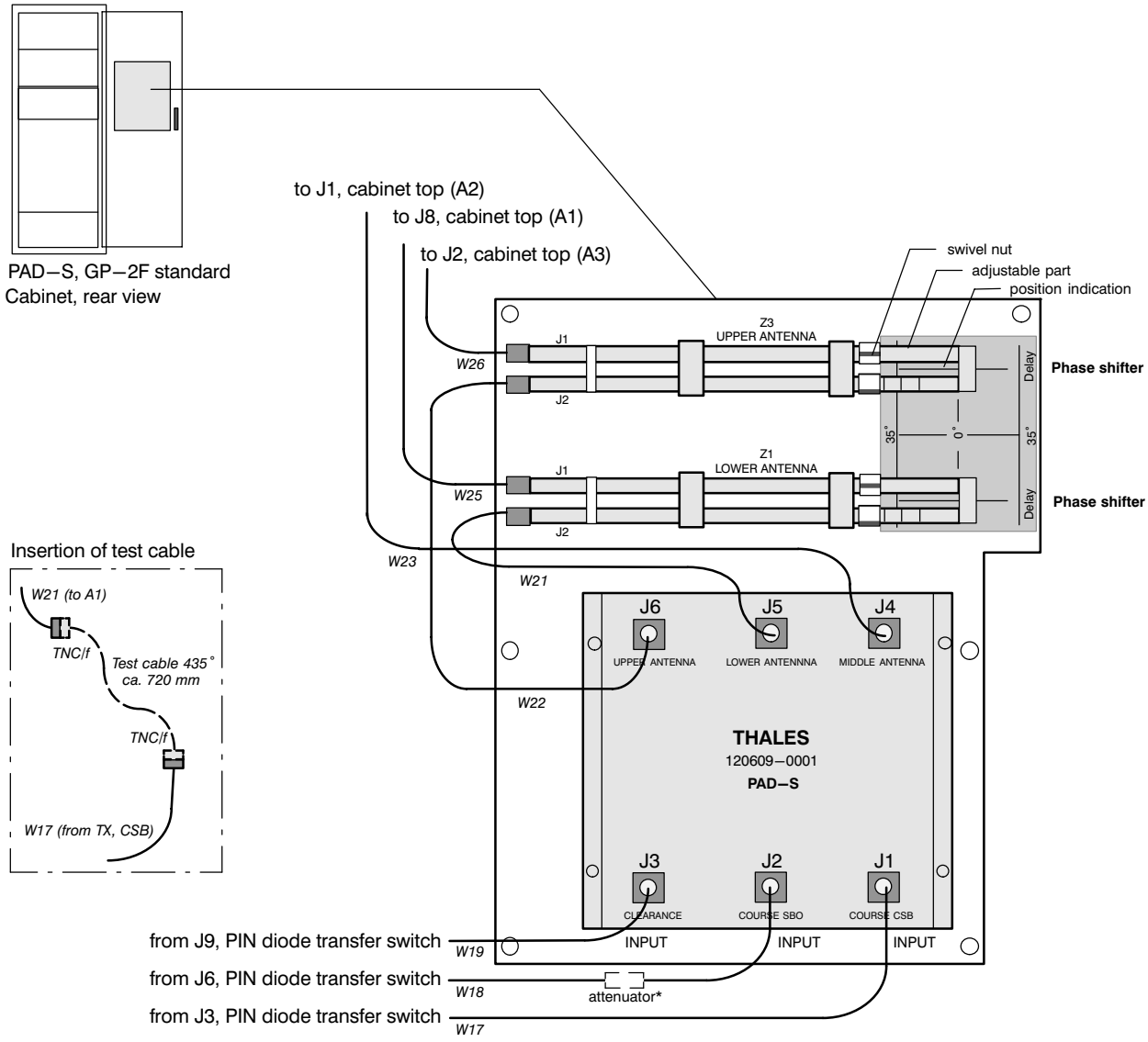
NOTE: Corresponds to power ratio 3.6...4.4. Note value: .....dB

REMARK: Install 6 to 10 dB attenuator at PIN diode transfer switch again if previously removed !

f) CSB supplied to input J3 CLEARANCE. Set CSB to 1 W.

g) Check power ratio: A1 : A3 = 0 dB (±0.3 dB)

NOTE: Corresponds to level ratio difference of ±3.5 %. Note value: .....dB



Mechanical adjustment Z1, Z3:
Loosen swivel nut and adjust by sliding the adjustable part more or less out or in. Finally fix nut again. Note scale position. Default setting is 0° position.

* an attenuator (6 to 10 dB) may be optionally inserted in the SBO supply line.

Fig. 7−1 Power Adder PAD−S

7.4 SETTING THE TRANSMITTER

7.4.1 CRS CSB Power

a) TX1 and TX2 are switched off.

b) Connect cable for A1, coming from transmitter, via wattmeter.

c) Switch both TX on and set TX1 on aerial.

d) Open dialog 'Transmitter1−Waveform Data#1', open dialog 'Transmitter2−Waveform Data#1'.

e) Parameter 'CLR RF−Level' is set to 0 W.

NOTE: If need be set CRS CSB DDM=0 % and CRS CSB SDM=0 % (depends on instrument used).

f) Set 'CRS CSB RF−Level' to achieve an RF level of approx. 1 W at A1 output and note down value.

g) Set TX2 on aerial.

h) Adjust TX2 according to TX1.

i) Switch both TX off.

j) Connect RF cable for A1 as normal again.

7.4.2 Clearance Power

a) TX1 and TX2 are switched off.

b) Connect cable for A3, coming from transmitter, via wattmeter.

c) Switch both TX on and set TX1 on aerial.

d) Open dialog 'Transmitter1−Waveform Data#1', open dialog 'Transmitter2−Waveform Data#1'.

e) Set 'CRS SBO Amplitude' to 0 %. Set 'CLR RF Level' to a value to measure −12 dB of the measured CRS CSB RF level in 7.4.1 f).

NOTE: Measured value should be approx. 0.0625 W. If need be set CLR DDM and CLR SDM=0 % (depends on instrument used).

f) Set TX2 on aerial.

g) Adjust TX2 according to TX1

h) Switch both TX off.

i) Connect cable for A3 as normal again.

7.4.3 SDM and DDM Setting

7.4.3.1 SDM and DDM of CRS CSB (A1)

a) TX1 and TX2 are switched off.

b) Connect Field Receiver to integral monitor cable from A1.

c) Switch TX1 on.

d) Open dialog 'Transmitter1−Waveform Data#1', open dialog 'Transmitter2−Waveform Data#1'.

e) Set 'CLR RF−Level' to 0 and 'CRS SBO Amplitude' to 0 %. Set CRS CSB SDM and DDM value to measure 80 % SDM and 0 % DDM at the receiver.

f) Switch TX2 on.

g) Set TX2 on aerial.

h) Adjust TX2 according to TX1.

i) Switch both TX off.

j) Connect cable for A1 as normal again.

7.4.3.2 SDM and DDM of Clearance (A1,A3)

a) TX1 and TX2 are switched off.

b) Connect Field Receiver to integral monitor cable from A3.

c) Switch TX1 on.

d) Open dialog 'Transmitter1−Waveform Data#1', open dialog 'Transmitter2−Waveform Data#1'.

NOTE: CRS SBO Amplitude is set to 0 %.

e) Set 'CLR RF Level' to original value as determined in 7.4.2. Set CLR SDM and CLR DDM values to measure 80 % SDM and e.g. 30 % DDM (150 Hz>90 Hz) at the receiver.

NOTE: For 150 Hz only scenarios, the DDM is to measure the same as SDM (80 % each).

f) Switch TX2 on.

g) Set TX2 on aerial.

h) Adjust TX2 according to TX1.

i) Switch both TX off.

j) Connect integral monitor cable for A3 as normal again.

7.5 AERIAL RF PHASING

7.5.1 CSB/SBO Phasing via Antenna A2 and CRS SBO Setting

a) Connect outputs of A1 (Lower Antenna) and A3 (Upper Antenna) of the Power Adder PAD−S (see Fig. 7−1) to 50 ohm terminating resistors (instead of the antenna). Connect Field Receiver to integral monitor cable from A2.

NOTE: A2 radiates CSB and SBO

b) Switch TX1 on. Open dialog 'Transmitter1−Waveform Data#1'.

c) Set 'CRS SBO Amplitude' to 50 %.

d) Measure the DDM with the DDM instrument. Set the 'CRS SBO Phase' so that the DDM instrument indicates DDM 0.

NOTE: Range of values: 0...359°.

e) Add or subtract 90° to or from the phase value determined in d) and enter as the new value. The DDM instrument should now indicate a high DDM with predominant 90 Hz (90 >150 Hz). If not, a further 180° must be either added or subtracted.

NOTE: Range of values: 0...359°; note value: .....

f) Adjust CRS SBO Amplitude to measure 46.7 % (90>150 Hz) on DDM instrument for 0° Forward Slope, see table and graph in Fig. 7−7.

g) Switch TX2 on. Set TX2 on aerial.

h) Adjust TX2 according to TX1.

i) Switch both TX off.

j) Connect cable for A2 as normal again.

7.5.2 CSB/SBO Phase via Antenna A1 *(not applicable)*

7.5.3 A1/A2 Phasing

a) The following preliminary steps must be taken at the the Power Adder (see Fig. 7−1):
- Connect output A1 and output A2 on cabinet top to the antennas as normal.
- Terminate output A3 on cabinet top with 50 ohm load.
- Disconnect cable W17 to input J1 COURSE CSB and cable W21 to output J5 from PAD−S.
- Terminate input J1 COURSE CSB and connector J5 of PAD−S with 50 ohm load.
- Insert "Test Cable" for phasing between removed cables W17 and W21.

NOTE: The electrical length (435°) of the test cable represents to the phase response of PAD−S internal path J1 to J5. A1 radiates CSB, A2 radiates SBO

b) Switch TX1 on. Open dialog 'Transmitter1−Waveform Data#1'. Note down value of 'CLR RF Level'. Set parameter 'CLR RF Level' to 0.

c) Add +90° to the phase value determined in 7.5.1 e) and enter.

NOTE: Value of 7.5.1e) = ...°

d) Adjust with e.g. phasing cables, phase plugs or with mechanical Phase Shifter Z1 (Fig. 7−1) so that the DDM instrument indicates DDM 0 at the middle marker.

e) Reset the CRS SBO phase to its original value as in 7.5.1 e) and check that the DDM instrument now indicates a DDM with predominant 150 Hz (150 >90 Hz).

NOTE: If not, insert additional 180° cable at the output of A1.

f) Switch TX1 off.

7.5.4 A1/A3 Phasing

a) The following preliminary steps must be taken at the the Power Adder:
   - Connect output A3 on cabinet top to the antennas as normal.
   - Terminate output A2 on cabinet top with 50 ohm load.
   - ”Test cable” is still connected between W17 and W21.

   NOTE: A1 radiates CSB and A3 radiates SBO.

b) Switch TX1 on. Parameter ’CLR RF Level’ is set to 0. Open dialog ’Transmitter1−Waveform Data#1’.

c) Add +90° to the phase value determined in 7.5.1 e) and enter.

   NOTE: Value of 7.5.1 e) = ...°

d) Adjust with e.g. phasing cables, phase plugs or with mechanical Phase Shifter Z3 (Fig. 7−1) so that the DDM instrument indicates DDM 0 at the middle marker.

e) Reset the SBO phase to its original value as in 7.5.1 e) and check that the DDM instrument now indicates a DDM with predominant 90 Hz (90 >150 Hz).

   NOTE: If not, insert additional 180° cable at the output of A3.

f) Restore ’CLR RF Level’ to noted value of 7.5.3 b).

g) Switch TX1 off.

h) Connect all antenna cables as normal again.

7.6 SETTING THE MONITORS

See Figs. 7−2 to 7−6.

The Stby and On−Air Combiner (SOAC) unit processes the input monitoring signals of the aerial and standby transmitter. It is supposed that the SOAC is factory pre−aligned. However, on site field adjustment is necessary. For correct operation the 7 monitor channels have to be set in a certain manner:

1) The RF input signal of each path on the SOAC is down converted to an 8 kHz IF signal. This signal has to be adjusted to an output signal of approx. 3.6 Vpp. The 8 kHz IF amplitudes are measured with an oscilloscope at the corresponding test points. Coarse adjustment of the input level is performed with attenuators which are inserted or bypassed with the corresponding jumpers (see section 6.6.5), if need be. Figs. 7−3, 7−5 show the signal path, the potentiometers and the corresponding testpoints of each channel on the SOAC. Recommendation: Use a special alignment screw driver with immersed blade for the potentiometers.
   If need be, e.g. phase cannot be adjusted, insert phase adapters or cables to the concerned input.
2) When the signals in the field are set correctly, the input signal to the monitors, the measured values, represent nominal values and have to be entered in the data window (Open dialog 'Monitor1−Nominal Values' or open dialog 'Monitor2−Nominal Values').
3) The monitor has to be supplied with a calibration signal (CRS CSB) adjusted to 80 % SDM and 0 % DDM. This signal is used to calibrate the monitor channel. With a known SDM and DDM, the monitor is able to calculate the third unknown parameter: the RF−LEVEL.
4) Finally, the original signal is supplied to the monitor. With this signal the monitor has to be normalized. The automatic normalization procedure runs only if the actual DDM and SDM values do not vary too much from the Nominal Values !

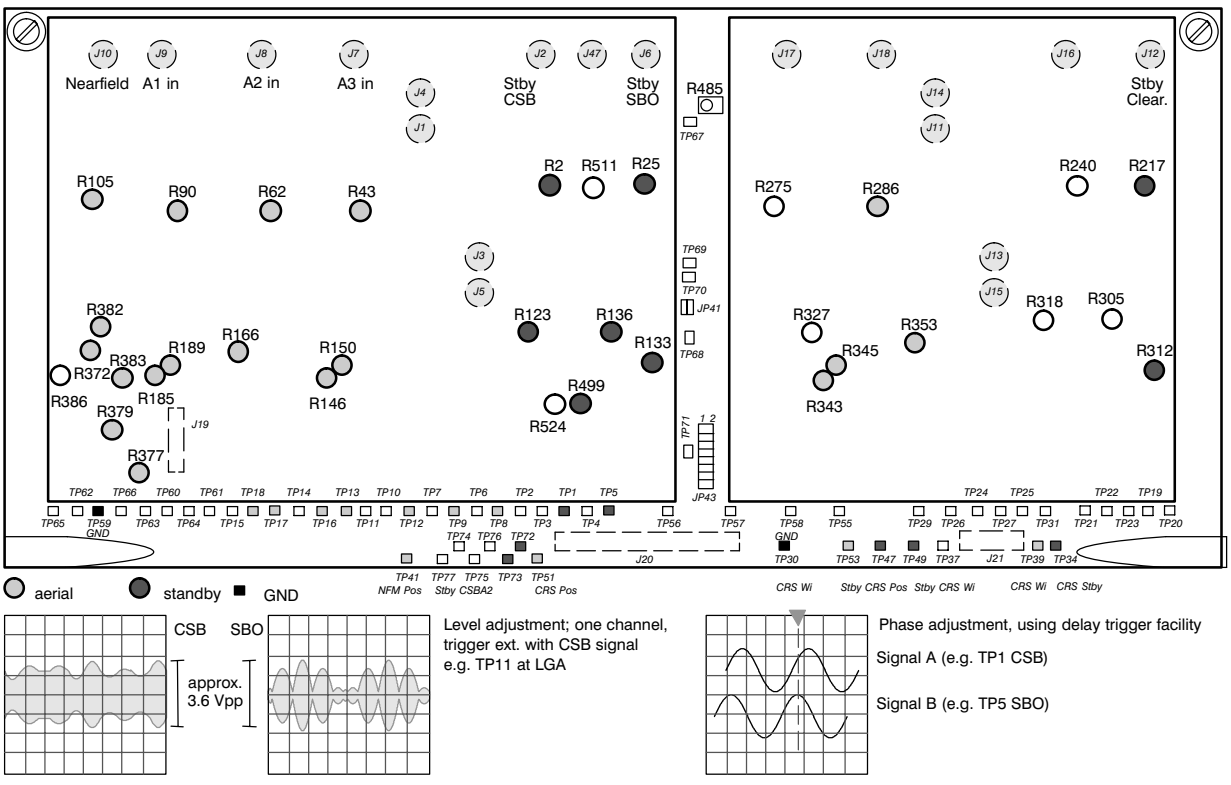


Fig. 7−2 Adjustment controls and test points of SOAC

7.6.1 Adjustment Procedure of Aerial Channels

See Fig. 4−7, 7−2, 7−3, 7−4. The signal path used within the SOAC is set to *3−4* on J19 of SOAC (instead *1−2*). Use amplifier (+15 dB) in the input path only if absolutely necessary.

7.6.1.1 CRS Posn. Channel (Input connector J9 (A1) and J7 (A3))

a) Connect oscilloscope to TP16 (or TP62) and TP59 (GND).
Adjust IF gain of A1 path to measure approx. 6 Vpp at TP16 or TP62: perform first coarse alignment removing or inserting attenuators with JP16,17 or JP18,19; perform fine adjustment with R90.

b) Connect oscilloscope to TP8 and TP59 (GND).
Adjust IF gain of A3 path to measure approx. 1 Vpp at TP8: perform first coarse alignment removing or inserting attenuators with JP7,8 or JP9,10; perform fine adjustment with R43.

c) Check relative A1 − A3 phase with oscilloscope, measure between TP16 (A1) and TP9 (A3), see Fig. 4−7, 7−3, 7−4. Adjust with R146 to 0°. R150 is factory set.

d) Connect oscilloscope to TP62 or TP51 and TP59 (GND).
CRS Posn. DDM is defined by A1 to A3 ratio set with R372, measured at TP62, to cancel the SBO component. Finally adjust output level with R377 to achieve approx. 3.6 Vpp at TP51.

7.6.1.2 CRS Width channel (Input connector J9 (A1), J8 (A2) and J7 (A3))

a) Connect oscilloscope to TP12 and TP59 (GND).
Adjust IF gain of A2 path to measure approx. 4 Vpp at TP12: perform first coarse alignment removing or inserting attenuators with JP12,13 or JP14,15; perform fine adjustment with R62.

NOTE: IF gain for A1 and A3 has been set above for CRS Posn. channel.

b) Check relative A2 − A3 phase with oscilloscope, measure between TP13 (A2) and TP8 (A3), see Fig. 4−7, 7−3, 7−4. Adjust with R166 to 180°.

c) Check relative A1 − A3 phase with oscilloscope, measure between TP17 (A1) and TP8 (A3), see Fig. 4−7, 7−3, 7−4. Adjust with R185 to 0°. R189 factory set.

d) Connect oscilloscope to TP53 and TP59 (GND). Initially adjust output level with R382 to approx. 3.6 Vpp. CRS Width DDM is defined by the A1/A2/A3 ratio set with R386 (A1), R383 (A2) and R379 (A3), measured at the correspondent testpoints. Connect oscilloscope in succession to TP65, TP64, TP63 and finally to TP53 and TP59 (GND). The ratio related to a glide angle of 3° should be: A1=TP65=1.0; A2=TP64=0.74; A3=TP63=0.46 (for other values refer to 7.13).

e) To adjust these ratios, disconnect the supply cable to J7 (A3 in) and J8 (A2 in). Adjust the level at TP65 to 3.0 Vpp with R386 (ref. level). Remove the supply line of A1 (J9) and connect it in succession to J8 (A2 in) and J7 (A3 in). Adjust A2 level (at TP64) and A3 level (at TP63) to the required ratio. Finally adjust output level with R382 to approx. 3.6 Vpp at TP53, after setup of Width DDM.

NOTE: The ratio of A1/A2/A3 may vary according to the actual glide angle.

7.6.1.3 CLR channel (Input from J7 (A3 in) via JP11 and JP36.

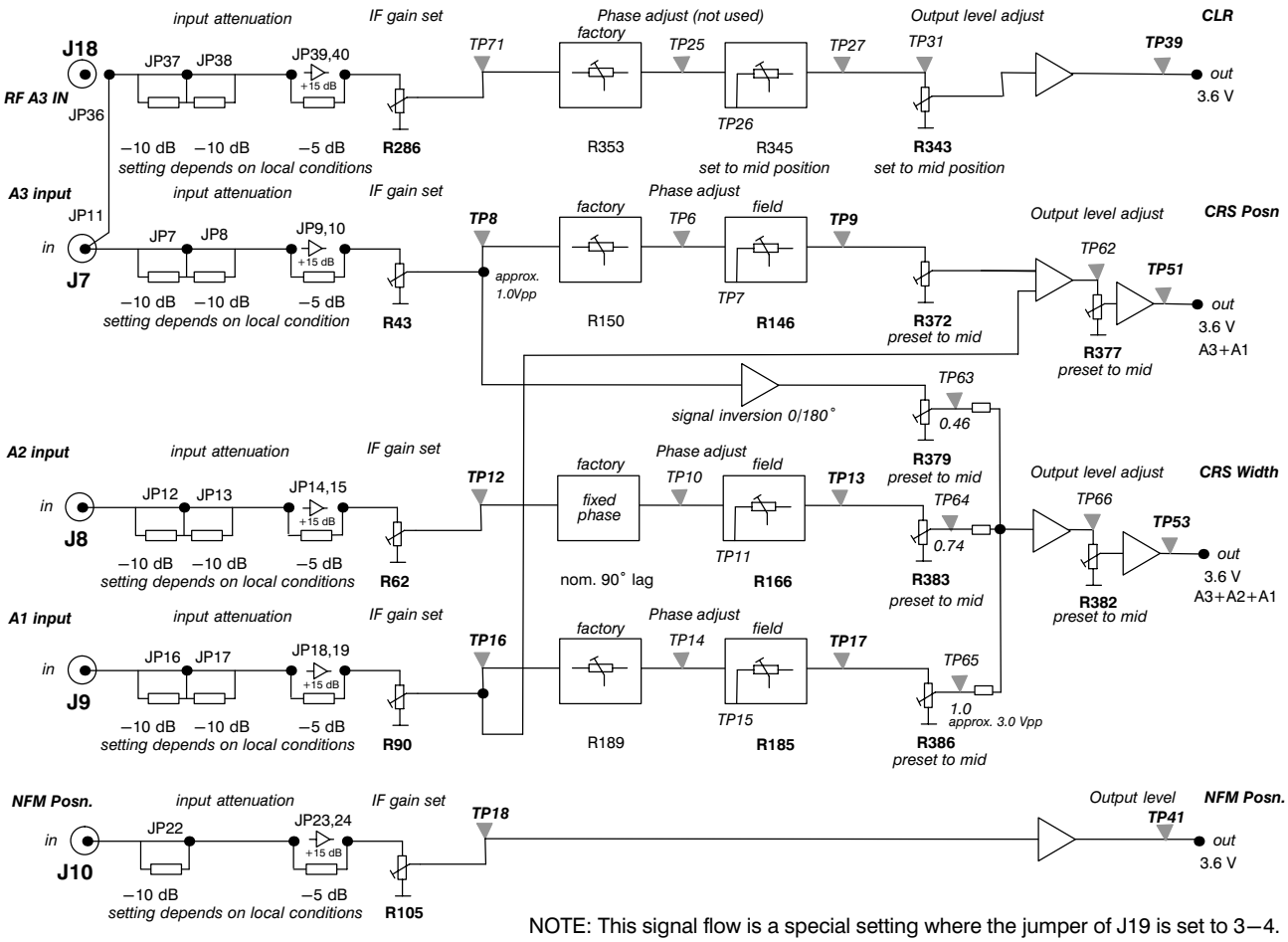
a) Connect oscilloscope to TP39 and TP59 (GND). Measure output level.

b) Adjust IF gain to achieve approx. 3.6 Vpp output: perform first coarse alignment removing or inserting attenuators with JP37,38 or J39,40; perform fine adjustment with R286 and finally R343 to approx. 3.6 Vpp. Phase adjustment with R353 is factory set. R345 remains in mid position.

7.6.1.4 NFM channel (Input connector J10. Refer also to 7.6.3.4.)

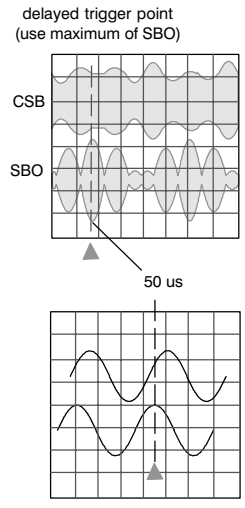
a) Connect oscilloscope to TP41 and TP59 (GND). Measure output level.

b) Adjust IF gain to achieve approx. 3.6 Vpp output: perform first coarse alignment removing or inserting attenuators with JP22 or J23,24; perform fine adjustment with R105 to approx. 3.6 Vpp.



NOTE: This signal flow is a special setting where the jumper of J19 is set to 3−4.

Fig. 7−3 Adjustment of detector channels for aerial monitoring (GP−2F standard)



NOTE:
For more clear representation, the use of an analog oscilloscope is recommended. For the phase alignment procedure, the delayed trigger segment of 50 us has to be in a range of the signals where the amplitudes rise in the same direction to get correct phasing. Check the trigger position of the signal if the result seems to be in the opposite phase range (e.g. 180° rotated); read also monitor result in the PC User Program (ADRACS or MCS) for correct sign. If the phase cannot be adjusted insert phase adapters or phasing cables to achieve a sufficient setting range of the potentiometers.

Recommended measurement procedure:
Adjust the scope so that both signals are equal in amplitude. Turn on the ADD and INVERT functions. Make the signal now created on the scope as flat as possible. This will ensure the signals are within a couple of degrees. It is very important that these two signals are in phase.

Oscilloscope setting:

Channel 1	CSB
Channel 2	SBO, position below or on same line
V/div.	0.5
Trigger	internal, channel 1 (or ext., from LGA, TP11)
Time sweep	0.1 ms; delayed: 50 us
Time delay	Adjust to show a sine curve segment

Fig. 7−4 Relative phase adjustment procedure

7.6.2 Adjustment Procedure of Standby Channels

See Fig. 4−7, 7−2, 7−5, 7−6.

7.6.2.1 **Stby CRS Posn. channel** (Input connector J2)

a) Connect oscilloscope to TP47 and TP59 (GND). Measure output level.

b) Adjust IF gain to achieve approx. 3.6 Vpp output: R499 is set to mid position. Perform first coarse alignment removing or inserting attenuators with JP2,3; perform fine adjustment with R2. Phase adjustment with R123 is factory set and not needed for Posn. channel.

7.6.2.2 **Stby CRS Width channel** (Input connector J2 (CSB), J6 (SBO))

a) Connect oscilloscope to TP4 and TP59 (GND).
Adjust IF gain of SBO path to measure approx. 0.3 Vpp at TP4: perform first coarse alignment removing or inserting attenuators with JP4,5; perform fine adjustment with R25.

NOTE: IF gain for CSB has been set above for Stby CRS Posn. channel.

b) Check relative CSB − SBO phase with oscilloscope, measure between TP1 (CSB) and TP5 (SBO), see Fig. 4−7, 7−5, 7−6. Adjust with R136 to 0°. R123 is factory set. If R136 is not efficient, use also R123 for fine adjustment.

c) Connect oscilloscope in succession to TP72, TP73 and finally to TP49 and TP59 (GND). Initially adjust with R499 to approx. 3 Vpp at TP72.

d) Stby CRS Width DDM is defined by CSB/SBO ratio set with R25 (SBO) and R499 (CSB), measured at the correspondent testpoints. The levels should approximately be:
CSB = TP72 = 3 Vpp; SBO = TP73 = 0.3 Vpp.
Finally adjust output level with R133 to approx. 3.6 Vpp, after setup of Width DDM.

7.6.2.3 **Stby CLR channel** (Input connector J12)

a) Connect oscilloscope in succession to TP19, TP34 and TP59 (GND). Measure output level.

b) Adjust IF gain to achieve approx. 3.6 Vpp output: perform first coarse alignment removing or inserting attenuators with JP26,27. Perform fine adjustment with R217 to achieve 2 Vpp at TP19. Finally adjust output level with R312 to approx. 3.6 Vpp. Phase adjustment with R305 is factory set.

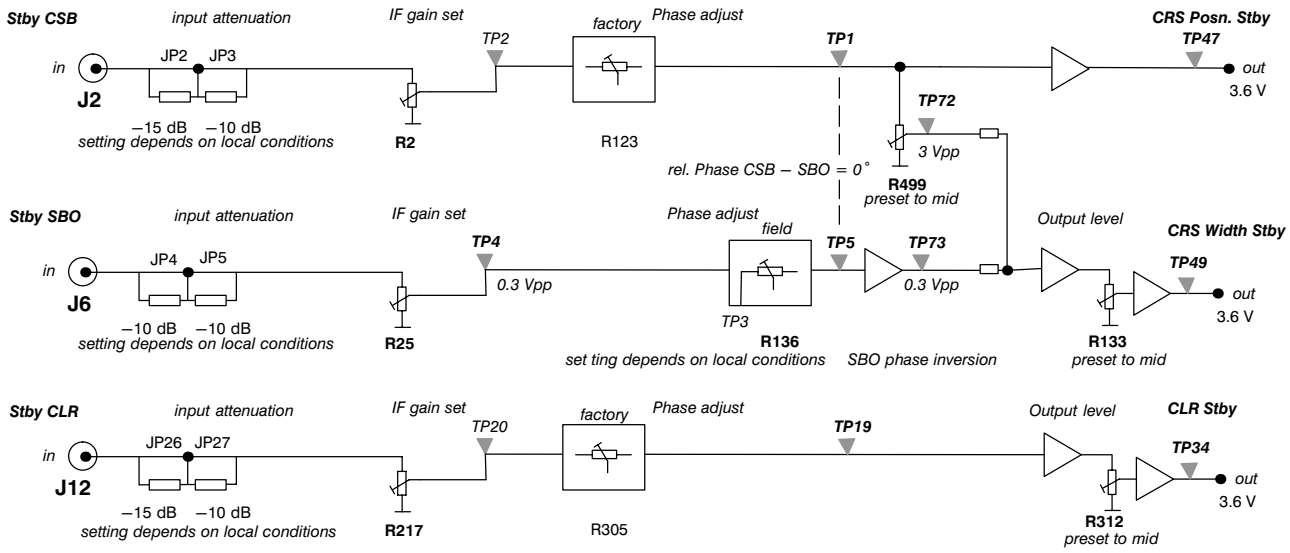
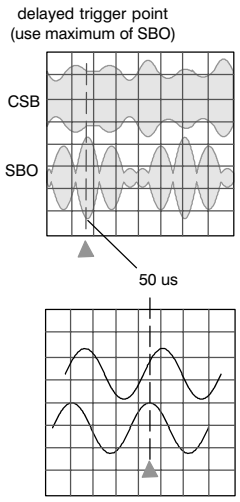


Fig. 7−5 Adjustment of detector channels for standby monitoring (GP−2F standard)



Phase adjustment, using delay trigger option

Signal A (e.g. TP1 CSB)

Signal B (e.g. TP5 SBO)

NOTE:
For more clear representation, the use of an analog oscilloscope is recommended. For the phase alignment procedure, the delayed trigger segment of 50 us has to be in a range of the signals where the amplitudes rise in the same direction to get correct phasing. Check the trigger position of the signal if the result seems to be in the opposite phase range (e.g. 180° rotated); read also monitor in the PC User Program (ADRACS or MCS) result for correct sign. If the phase cannot be adjusted insert phase adapters or phasing cables to achieve a sufficient setting range of the potentiometers.

Recommended measurement procedure:
Adjust the scope so that both signals are equal in amplitude. Turn on the ADD and INVERT functions. Make the signal now created on the scope as flat as possible. This will ensure the signals are within a couple of degrees. It is very important that these two signals are in phase.

Oscilloscope setting:

Channel 1	CSB
Channel 2	SBO, position below or on same line
V/div.	0.5
Trigger	internal, channel 1 (or ext., from LGA, TP11)
Time sweep	0.1 ms; delayed: 50 us
Time delay	Adjust to show a sine curve segment

Fig. 7−6 Relative phase adjustment procedure

7.6.3 Calibration and Normalization of Integral Monitors

NOTE: Before performing this procedure it is recommended to check alarm limits acc. 7.6.5.

a) Switch both TX on and set TX1 on aerial.

7.6.3.1 Integral Monitoring POS (DDM 0 %)

a) RF−level of the corresponding path on the SOAC (Fig. 7−2, 7−3) is set to approx. 3.6 Vpp amplitude as described in 7.6.1.

b) Open dialog 'Monitor1−Nominal Values' and open dialog 'Monitor2−Nominal Values'. Confirm nominal values (DDM 0 %; SDM 80 %) for 'EXEC CRS Position DDM' and 'EXEC CRS Position SDM'.

c) Send to Monitor1/2 the command 'Calibration, Executive CRS Position detector'.

d) Send to Monitor1/2 the command 'Normalization, Executive CRS Position detector'.

NOTE: The automatic normalization procedure runs only if the actual DDM and SDM values do not vary to much from the nominal values !

7.6.3.2 Integral Monitoring Width (DDM 17.5 %)

a) RF−level of the corresponding path on the SOAC (Fig. 7−2, 7−3) is set to approx. 3.6 Vpp amplitude as described in 7.6.1.

b) Open dialog 'Monitor1−Nominal Values' and open dialog 'Monitor2−Nominal Values'. Confirm nominal values (DDM 17.5 %; SDM 80 %) for 'EXEC CRS Width DDM'.

c) Open dialog 'Transmitter1−Waveform Data#1'. Note down the value of 'CRS SBO RF Level'. Set it to 0 %.

d) Send to Monitor1/2 the command 'Calibration, Executive CRS Width detector'.

e) Restore 'CRS SBO RF Level' back to noted value.

NOTE: The procedure enables to calibrate to 17.5 % within a range of about 17 % to 18 %. This is normally achieved by an accurate adjustment of the ratios of the inputs of A1, A2, A3 as performed in 7.6.1.2. If the value is out of range it may be necessary to adjust to a reading of 17.5 % with R383 (this is the A2 path). Check 'Exec. Course Width RF Level' of A2 again and adjust if necessary. Repeat steps c) to e). Proceed with f).

f) Send to Monitor1/2 the command 'Normalization, Executive CRS Width detector'.

7.6.3.3 Integral Monitoring CLR (e.g. DDM 30 %)

NOTE: The CLR monitoring DDM value is a user defined setpoint, which may be defined as e.g. 30 % or 80 %. For 150 Hz only scenarios, the DDM is to measure as 80 %.

a) RF−level of the corresponding path on the SOAC (Fig. 7−2, 7−3) is set to approx. 3.6 Vpp amplitude as described in 7.6.1.

b) Open dialog 'Monitor1−Nominal Values' and open dialog 'Monitor2−Nominal Values'. Confirm nominal values (DDM 30 %; SDM 80 %) for 'EXEC CLR Width DDM' and 'EXEC CLR Width SDM'.

c) Send to Monitor1/2 the command 'Calibration, Executive CLR Width detector'.

d) Send to Monitor1/2 the command 'Normalization, Executive CLR Width detector'.

7.6.3.4 Nearfield Monitor (DDM 0 %), optional (if available)

REMARK: Usually the location of the optional nearfield monitor dipole is exactly determined really during flight check. The check and adjustment described here can be executed either after determination of the location or using a provisionally mounted monitor dipole at the theoretical location (see section 7.10)

a) Set the RF−level of the corresponding path on the SOAC (Fig. 7−2, 7−3) to approx. 3.6 Vpp amplitude as described in 7.6.1.4.

b) Open dialog 'Monitor1−Nominal Values' and open dialog 'Monitor2−Nominal Values'. Confirm nominal values (DDM 0 %, SDM 80 %) for 'Nearfield DDM'.

c) Send to Monitor1/2 the command 'Calibration, Executive Nearfield Pos. detector' (or 'Executive Ch. 4 Width detector').

d) Send to Monitor1/2 the command 'Normalization, Executive Nearfield Pos. detector' (or 'Executive Ch. 4 Width detector').

7.6.4 Calibration and Normalization of Standby Monitors

NOTE: Before performing this procedure it is recommended to check alarm limits acc. 7.6.5.

7.6.4.1 Setting of Standby Monitoring CLR (e.g. DDM 30 %)

NOTE: The CLR monitoring DDM value is a user defined setpoint, which may be defined as e.g. 30 % or 80 %. For 150 Hz only scenarios, the DDM is to measure as 80 %.

a) RF−level of the corresponding path on the SOAC (Fig. 7−2, 7−5) is set to approx. 3.6 Vpp amplitude as described in 7.6.2.

b) Open dialog 'Monitor1−Nominal Values' and open dialog 'Monitor2−Nominal Values'. Confirm nominal values (DDM 30 %; SDM 80 %) for 'Stby CLR Width DDM' and 'Stby CLR Width SDM'.

c) Open dialog 'Transmitter2−Waveform Data#1'. Set 'CLR RF−LEVEL', 'CLR DDM' and 'CLR SDM' of the standby transmitter to the same value as defined in 7.4.3.2.

d) Send to Monitor1/2 the command 'Calibration, Standby CLR Width Detector'.

e) Send to Monitor1/2 the command 'Normalization, Standby CLR Width Detector'.

7.6.4.2 Setting of Standby Monitoring CRS POS (DDM 0 %)

a) RF−level of the corresponding path on the SOAC (Fig. 7−2, 7−5) is set to approx. 3.6 Vpp amplitude as described in 7.6.2.

b) Open dialog 'Monitor1−Nominal Values' and open dialog 'Monitor2−Nominal Values'. Confirm nominal values (DDM 0 %; SDM 80 %) for 'Stby CRS Position DDM' and 'Stby CRS Position SDM'.

c) Send to Monitor1/2 the command 'Calibration, Standby CRS Position Detector'.

d) Send to Monitor1/2 the command 'Normalization, Standby CRS Position Detector'.

7.6.4.3 Setting of Standby Monitoring CRS WIDTH (DDM 17.5 %)

a) RF−level of the corresponding path on the SOAC (Fig. 7−2, 7−5) is set to approx. 3.6 Vpp amplitude as described in 7.6.2.

b) Open dialog 'Monitor1−Nominal Values' and open dialog 'Monitor2−Nominal Values'. Confirm nominal values (DDM 17.5 %; SDM 80 %) for 'Stby CRS Width DDM'.

c) Open dialog 'Transmitter2−Waveform Data#1'. Note down the value of 'CRS SBO RF Level' of standby transmitter. Set it to 0 %.

d) Send to Monitor1/2 the command 'Calibration, Standby CRS Width detector'

e) Restore the value modified in c) back to noted value.

NOTE: The procedure enables to calibrate to 17.5 % within a range of about 17 % to 18 %. This is normally achieved by an accurate adjustment of the ratio of CSB to SBO as performed in 7.6.2.2. If the value is out of range it may be necessary to adjust to a reading of 17.5 % with R25.

f) Send to Monitor1/2 the command 'Normalization, Standby CRS Width detector'.

7.6.5 Check Alarm Limits

NOTE: If upper limit is equal to lower limit, executive monitoring is not available. The alarm limits are recommended values. A part of these will be checked and defined during Flight Check.

7.6.5.1 Executive Alarm Limits

a) Open dialog 'Monitor 1 − Executive Alarm Limits' and open dialog 'Monitor 2 − Executive Alarm Limits' (for MCS: dialogs 'Monitor 1/2 − Limits: Current Executive Data').

b) Check that RF level alarm limits for all monitors are set to:
90 % (lower limit) and 110 % (upper limit); also used: 120 % (upper limit).

c) Check that SDM alarm limits for all monitors are set to:
76 % (lower limit) and 84 % (upper limit).

d) Check that POS DDM alarm limits for all monitors are set to:
−5.4 % (lower limit) and +5.4 % (upper limit) (CAT I to III).

e) Check that CRS WIDTH DDM alarm limits for all monitors are set to:
−4.3 % (lower limit) and +4.3 % (upper limit) of the actual value;
example for 17.5 %: 13.2 % (lower limit) and 21.8 % (upper limit).

NOTE: CAT II and III only !

f) Check that CLR WIDTH DDM alarm limits for all monitors are set to:
−4 % (lower limit) and +4 % (upper limit) of the actual measured value.

g) Check that RF level alarm limit for the monitors is set to:
71 % (lower limit) and 129 % (upper limit).

h) Check that SDM alarm limit for the monitors is set to:
76 % (lower limit) and 84 % (upper limit).

i) Check that POS DDM alarm limit for the monitors are set to:
−5.4 % (lower limit) and +5.4 % (upper limit) (CAT I to III).

j) Check that Alarm delay time is set to: CAT I: 10 s; CAT II: 5 s; CAT III: 2 s (prefer. 1 s); NF: 20 s.

NOTE: Values of g) to i) are the alarm limits for the optional nearfield monitor.

7.6.5.2 Standby Alarm Limits

a) Open dialog 'Monitor 1 − Standby Alarm Limits' and dialog 'Monitor 2 − Standby Alarm Limits' (for MCS: dialogs 'Monitor 1/2 − Limits: Current Standby Data').

b) Check that RF level alarm limits for all monitors are set to:
90 % (lower limit) and 110 % (upper limit); also used: 120 % (upper limit).

c) Check that SDM alarm limits for all monitors are set to:
76 % (lower limit) and 84 % (upper limit).

d) Check that POS DDM alarm limits for all monitors are set to:
−5.4 % (lower limit) and +5.4 % (upper limit) (CAT I to III).

e) Check that CRS WIDTH DDM alarm limits for all monitors are set to:
−4.3 % (lower limit) and +4.3 % (upper limit) of the actual value;
example for 17.5 %: 13.2 % (lower limit) and 21.8 % (upper limit).

NOTE: CAT II and III only !

f) Check that CLR WIDTH DDM alarm limits for all monitors are set to:
−4 % (lower limit) and +4 % (upper limit) of the actual measured value.

REMARK: Check pre−alarm limits. If need be adjust to 80 % of alarm limit value (recommended).

7.7 BATTERY MONITORING

If emergency batteries are available, the battery voltage can be monitored to avoid over discharge of batteries. For this purpose, a warning level can be set and a low level limit can be set.

NOTE: A battery switch off to avoid deep discharge is executed via the separate LVS−circuit and the relay located on the BP−PS subrack.

a) Open dialog 'LRCI − Environmental Setup'.

b) Enable 'Battery Low Monitoring' by selecting 'Alarm Maint. Alert' or 'Alarm Degradation'.

NOTE: 'Alarm Maint. Alert' means indication only, 'Alarm Degradation' means action.

c) Set 'Battery Warning Level' to e.g. 46.0 V.

NOTE: Setting range: 40 to 50 V.

d) Set 'TX off if battery lower than' to e.g. 44.0 V.

NOTE: Setting range: 40 to 50 V.

7.8 NORMAL OPERATION

a) Switch both TX on and set TX1 on aerial.

b) Check that no MONITOR ALARM or TX WARNING is on, otherwise locate and eliminate the fault.

c) Set TX2 on aerial.

d) Check that no MONITOR ALARM or TX WARNING is on, otherwise locate and eliminate the fault.

e) Set TX1 on aerial.

f) Set all Monitor Bypass off.

NOTE: NORMAL should light up in MAIN STATUS field.

7.9 FLIGHT CHECK

The following describes procedures for flight check. However, scope and sequence of this procedures may vary depending on the individual flight check crew. It is assumed that TX1 is used as aerial transmitter. Set to monitor bypass mode during flight check procedure.

NOTE: A local LCP menu "FLIGHT CHECK ADJUSTMENT is available for some level or phase adjustments during flight check, e.g. for CSB and SBO and clearance. This menu item is only available in *'Local'* mode position of the key switch on the LCP.

7.9.1 Antenna Height Check

The height of each antenna must be checked separately by measuring the field strength null.

NOTE: These measurements are complex. Either fly along the null, which is however almost impossible and makes no sense in critical terrain, where usually a M type is required, or fly horizontally and evaluate the nulls. It is important during a level flight that A1 and A3 are cancelled out on the glide angle.

The following null requirements must be fulfilled:

- *A1 = 2x glide angle*
- *A2 = Glide angle (most important null)*
- *A3 = 2/3 or 4/3 or 6/3 etc. • glide angle*

If not, correct the antenna heights individually: $h_{new} = h_{old}$ • *(actual angle : setpoint)*

If, however, flights along the null are made, the following steps must be taken prior to the flight check:

a) Switch TX1 off.

b) Loosen antenna cables for A1, A2, A3 on top of the cabinet. Terminate outputs on cabinet for A2, A3 with 50 ohms/10 W.

c) Connect the antenna to be checked directly to output for A1 (CSB out).

REMARK: Before connecting the next antenna, switch off TX each time !

d) Switch TX1 on. Let the flight check perform a level run.

e) Switch TX1 off.

f) Interconnect equipment as normal.

7.9.2 SDM and DDM 0 Check (TX1)

a) CRS CSB radiates as normal. Set CRS SBO and CLR to 0.

b) Correct SDM if necessary.

NOTE: Range of values: 0...99.9 %, note value: .....

c) Correct DDM 0 if necessary.

NOTE: Range of values: 0...±49.9 %, note value .....

REMARK: This should not normally be necessary however.

7.9.3 Phasing A1 — A3

REMARK: This check is only necessary for first flight check and if required main flight check.

a) Switch TX1 off. Perform the same setup as described in section 7.5.4 a) to d).

b) Approach at 3° elevation (nominal glide angle).

c) Change the CRS SBO Phase (normal phase + 90˚) until indication is 0 % DDM in the aircraft. If there is 150 Hz >90 Hz at the measured DDM value, the required phase change for quadrature phasing must be >90° related to the normal phase determined during the ground phasing. The other way round if 90 Hz >150 Hz the phasing must be <90°.

d) CRS SBO Phase (normal phase) = *determined value* − 90 °

e) If phase has changed, repeat phase adjustment (see section 7.6.1).

f) Set TX2 on aerial.

g) Same parameter variation as for TX1. Correct CRS SBO Phase until 'DDM Course Pos. Integral' indicates 0 %.

h) Switch both TX off.

7.9.4 Glide Angle Check

If the measured glide angle deviates too much from the nominal glide angle, the heights of antennas A1, A2, A3 must be corrected. Refer also to Part 3 Technical Manual, GP Antenna Systems.

7.9.5 Width Setting

a) Switch TX1 on.

b) According to the announcement of the flight check crew, the transmitter parameter CRS SBO Amplitude must be corrected in proportion to the determined offset.

7.9.6 Monitor Readjustment

The settings made during the flight check make it necessary to readjust some of the monitor parameters. Repeat the appropriate steps in Sections 7.6.

7.9.7 Course Alarm

NOTE: See also section 7.11 Alarm Limits and Width Calculation.

a) Open dialog 'Monitor 1 − Current Executive Data' (for MCS: dialog 'Monitor 1 − Measurements/ Limits: Current Executive Data'). Select indication 'Exec. CRS Pos. DDM'.

b) Open dialog 'Transmitter 1 − Waveform Data #1'. Change 'CRS CSB DDM' (e.g. ±5.4 %) to reach the preset alarm limits. If necessary, restrict or enlarge as specified by the flight check crew.

7.9.8 Width Alarm

a) Open dialog 'Monitor 1 − Current Executive Data' (for MCS: dialog 'Monitor 1 − Measurements/ Limits: Current Executive Data'). Select indication 'Exec. CRS Width DDM'.

b) Change course width with command 'Width Adjustment'' (in ADRACS: menu 'Extras', function 'Tools') to reach the preset alarm limits.

NOTE: The command 'Width Adjustment' is currently not available in the MCS user program.

c) If necessary, restrict or enlarge the alarm limits as specified by the flight check crew.

7.9.9 Miscellaneous

Some other parameters must also be checked, e.g. the range. No further settings must be made with the transmitter or monitor however.

Finally, the system has to be set to normal operation, i.e. monitor bypass is removed, TX1 is aerial and the key−lock switch at the LCP is set to "Remote".

7.10 DETERMINING THE MONITOR LOCATION

a) Calculate the theoretical location with the approximate equation:

$$D_{MON} = \frac{(h_3^{\,2} - h_1^{\,2}) \times f}{2 \times 300}$$

NOTE: h = antenna height in m; f in MHz.

b) Calculate monitor height:

$H_{Mon} = D_{Mon} \times \tan \theta_0$

c) To optimize the calculated distance with the aid of measuring technique, A1 should radiate CSB only and A3 should radiate SBO only.

d) Switch both TX off.

e) Remove supply cable for A2 on top of transmitter cabinet. Terminate output of cabinet for A2 with 50 ohm/10 W.
Disconnect cable W17 to input J1 COURSE CSB and cable W21 to output J5 from PAD−S. Terminate input J1 COURSE CSB and connector J5 of PAD−S with 50 ohm load. Insert ”Test Cable” between removed cable W17 to J1 COURSE CSB and cable W21 to J5.

NOTE: The electrical length (435°) of the test cable represents to the phase response of PAD−S internal path J1 to J5. A1 radiates CSB, A3 radiates SBO.

f) Switch TX1 on.

g) Setting of transmitter:

- Set CRS CSB DDM to 0 %
- Add +90° to CRS SBO Phase (quadrature)
- Set CLR RF−Level to 0 W

h) Using the portable DDM instrument and an auxiliary mast measure DDM at the calculated monitor point (D_{Mon} , H_{Mon}). If the measured DDM deviates from 0 %, alter the distance until a DDM=0 % is achieved.

i) Switch TX1 off.

j) Interconnect equipment as normal, connect cable of A2 and cable W17 respectively W21 again.

k) Switch TX1 on.

l) Setting of transmitter:

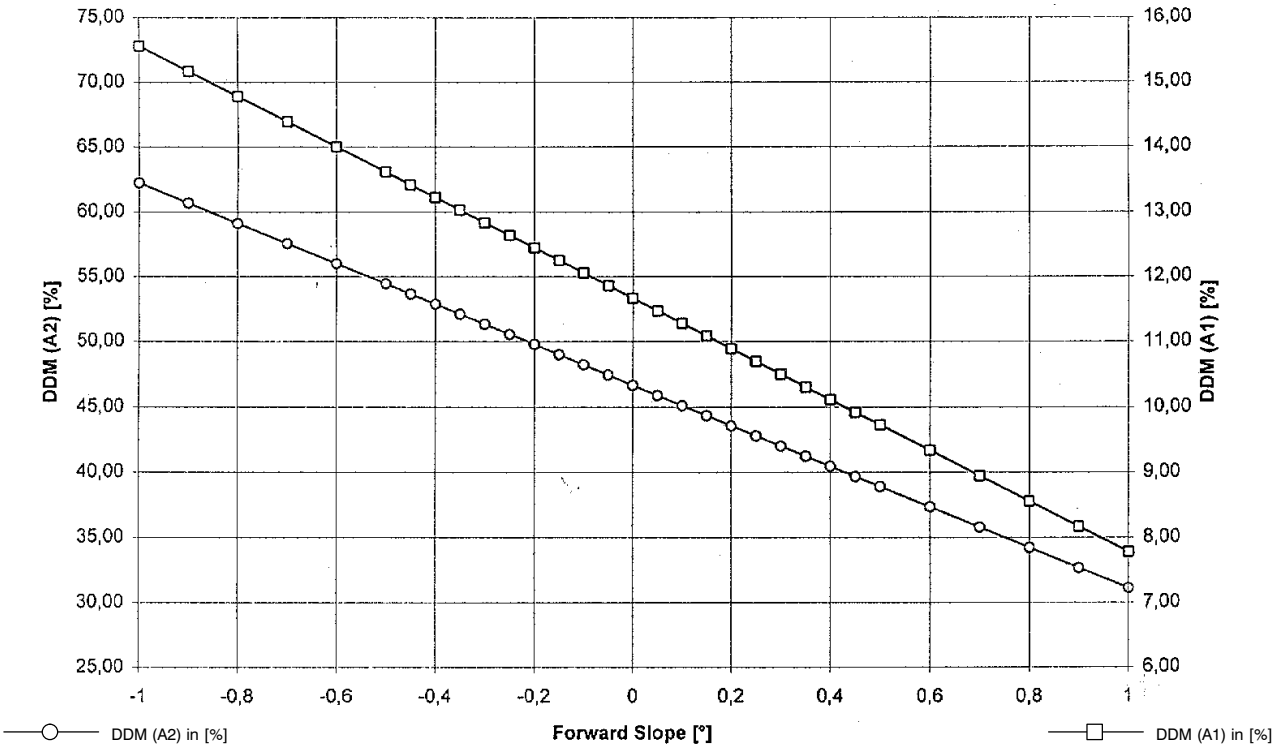
- Set CRS CSB DDM and CRS SBO Phase back to original values.
- Set CLR RF−Level to 0 W.

m) Alter the height of the receiving antenna at the determined optimal distance point until DDM=0 % is achieved.

NOTE: When altering the monitor antenna height, two nulls may occur. The monitor is to adjust in a way that the DDM is reversed in comparison to the farfield with altering the height: height lower, 90 Hz > 150 Hz at the nearfield monitor.

n) Set CLR RF−Level back to original value. This must not lead to any change in the course position (< ±0.1 %).

o) Finally switch TX2 on. TX1 is set to aerial.



NOTE: DDM adjustment values of antennas A1 and A2 of the Glide Path in dependence upon the Forward Slope. In normal case the GP width is determined by the antenna height and the default DDM values. With rising or falling terrain a smaller or greater glide angle as e.g. 3° has to be realized, whereby the width must not be altered for the nominal angle (3°).

Forward Slope [°]	Res. Glide Angle [°]	DDM (A2) [µA]	DDM (A1) [µA]	DDM (A2) [%]	DDM (A1) [%]
−1	4	533,5	133,4	62,24	15,56
−0,9	3,9	520,1	130,0	60,68	15,17
−0,8	3,8	506,8	126,7	59,13	14,78
−0,7	3,7	493,4	123,4	57,56	14,39
−0,6	3,6	480,1	120,0	56,01	14,00
−0,5	3,5	466,8	116,7	54,46	13,62
−0,45	3,45	460,1	115,0	53,68	13,42
−0,4	3,4	453,4	113,4	52,90	13,22
−0,35	3,35	446,8	111,7	52,13	13,03
−0,3	3,3	440,1	110,0	51,35	12,84
−0,25	3,25	433,4	108,4	50,56	12,64
−0,2	3,2	426,8	106,7	49,79	12,45
−0,15	3,15	420,1	105,0	49,01	12,25
−0, 1	3,1	413,4	103,4	48,23	12,06
−0,05	3,05	406,8	101,7	47,46	11,87
0	**3**	**400**	**100,0**	**46,67**	**11,67**
+0,05	2,95	393,4	98,4	45,90	11,47
+0,1	2,9	386,8	96,7	45,13	11,28
+0,15	2,85	380,1	95,0	44,35	11,09
+0,2	2,8	373,4	93,4	43,56	10,89
+0,25	2,75	366,8	91,7	42,79	10,70
+0,3	2,7	360,1	90,0	42,01	10,50
+0,35	2,65	353,4	88,4	41,23	10,31
+0,4	2,6	346,8	86,7	40,46	10,12
+0,45	2,55	340,1	85,0	39,68	9,92
+0,5	2,5	333,5	83,4	38,91	9,73
+0,6	2,4	320,1	80,0	37,35	9,34
+0,7	2,3	306,8	76,7	35,79	8,95
+0,8	2,2	293,5	73,4	34,24	8,56
+0,9	2,1	280,1	70,0	32,68	8,17
+1	2	266,8	66,7	31,13	7,78

Nominal glide angle: 3°

Fig. 7−7 DDM settings for A1, A2 of the standard GP

7.11 MONITOR ALARM LIMITS, COURSE WIDTH CALCULATION

– ILS, Glide Path monitor alarm limits

Parameter	ICAO Annex 10	Reference−§ Annex 10	Standard setting for GP 422 (DDM)	Nom. values for flight check glideangle:3 °;coursewidth:1.44 °
90 Hz−Mod. depth	40 % ± 2.5 %	(3.1.5.5.1)		
150 Hz−Mod. depth	40 % ± 2.5 %	(3.1.5.5.1)		
SDM	80 % ± 5 %		80 % ± 4 %	
Alarm low (CAT I...III)	−7.5 % of nom. glide angle	(3.1.5.7.1)	−5.50 %	2.78°
Alarm up (CAT I...III)	+10 % of nom. glide angle		+7.30 %	3.3°
Width alarm Course CAT I	±31 % of nom. width (± 5.43 % DDM)	(3.1.5.7.1)	12.1 % ... 22.9 %	
Width alarm Course CAT II/III	±25 % of nom. width (±4.37 % DDM)	(3.1.5.7.1)	13.2 % ... 21.8 %	wide: 1.92° / narrow: 1.15°
Width alarm Clearance	>22 % DDM (>0.3 Θ)	(3.1.5.6.4)	4 % of nom. value	Fly up: >190 µA
RF Level (Integr., Intern.)	2F: 90 % (71 % possible)	(3.1.5.7.1)	71 % ... 129 % *	
RF Level (Nearfield)			71 % ... 129 % *	
Alarm delay time	CAT I: 10 s; CAT II: 5 s; CAT III: 2 s (preferably 1 s); Nearfield: 20 s.			

* also possible: 90 ... 110 % (or 120 %)

– Calculation of resulting course width on change of the ”Displacement Sensitivity” according ICAO ANNEX 10 for *x* %:

Resulting Width = Nominal Width / [(100−x) / 100] ==> for 3˚ glide angle:

Width wide = 1.44˚ / [(100−25) / 100] = 1.92˚;
Width narrow = 1.44˚ / [(100+25) / 100] = 1.15˚

Nominal DDM at course width:

±17.5 % ==> DDM [%] = (DDM [µA] /150) • 17.5
and
±150 µA ==> DDM [µA] = (DDM [%] /17.5) • 150

7.12 CONVERSION OF RETURN LOSS TO VSWR VALUES

The following table shows the return loss in dB and the correspondent VSWR value.

Return Loss [dB]	Reflection Coefficient	VSWR
1	0.891	17.391
2	0.794	8.724
3	0.708	5.848
4	0.631	4.419
5	0.562	3.570
6	0.501	3.010
7	0.447	2.615
8	0.398	2.323
9	0.355	2.100
10	0.316	1.925
11	0.282	1.785
12	0.251	1.671
13	0.224	1.577
14	0.200	1.499
15	0.178	1.433
16	0.158	1.377
17	0.141	1.329
18	0.126	1.288
19	0.112	1.253
20	0.100	1.222

Return Loss [dB]	Reflection Coefficient	VSWR
21	0.089	1.196
22	0.079	1.173
23	0.071	1.152
24	0.063	1.135
25	0.056	1.119
26	0.050	1.106
27	0.045	1.094
28	0.040	1.083
29	0.035	1.074
30	0.032	1.065
31	0.028	1.058
32	0.025	1.052
33	0.022	1.046
34	0.020	1.041
35	0.018	1.036
36	0.016	1.032
37	0.014	1.029
38	0.013	1.025
39	0.011	1.023
40	0.010	1.020

7.13 RATIO LEVELS A1/A2/A3 FOR WIDTH ADJUSTMENT

The following table lists the normalized ratio levels A1/A2/A3 used for the integral monitoring width adjustment, depending on a forward slope of terrain which deviates from 0°.

Apron (Fwd. Slope) Setting value	Physical glide angle	A1 normalized	A2 normalized	A3 normalized
− 1,000	4,00	1,00	0,56	0,69
− 0,900	3,90	1,00	0,57	0,67
− 0,800	3,80	1,00	0,59	0,66
− 0,700	3,70	1,00	0,60	0,64
− 0,600	3,60	1,00	0,62	0,62
− 0,500	3,50	1,00	0,64	0,60
− 0,400	3,40	1,00	0,65	0,57
− 0,300	3,30	1,00	0,67	0,55
− 0,200	3,20	1,00	0,69	0,52
− 0,100	3,10	1,00	0,71	0,49
0,000	**3,00**	**1,00**	**0,74**	**0,46**
+ 0,100	2,90	1,00	0,76	0,42
+ 0,200	2,80	1,00	0,79	0,38
+ 0,300	2,70	1,00	0,81	0,34
+ 0,400	2,60	1,00	0,84	0,29
+ 0,500	2,50	1,00	0,87	0,24
+ 0,600	2,40	1,00	0,91	0,18
+ 0,700	2,30	1,00	0,94	0,11
+ 0,800	2,20	1,00	0,98	0,03
+ 0,900	2,10	0,97	1,00	0,05
+ 1,000	2,00	0,93	1,00	0,14

Nominal Glide Angle = 3°

Annex

PC User Program—specific Procedures

Used in Navaids

Alignment Procedure

ANNEX
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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.

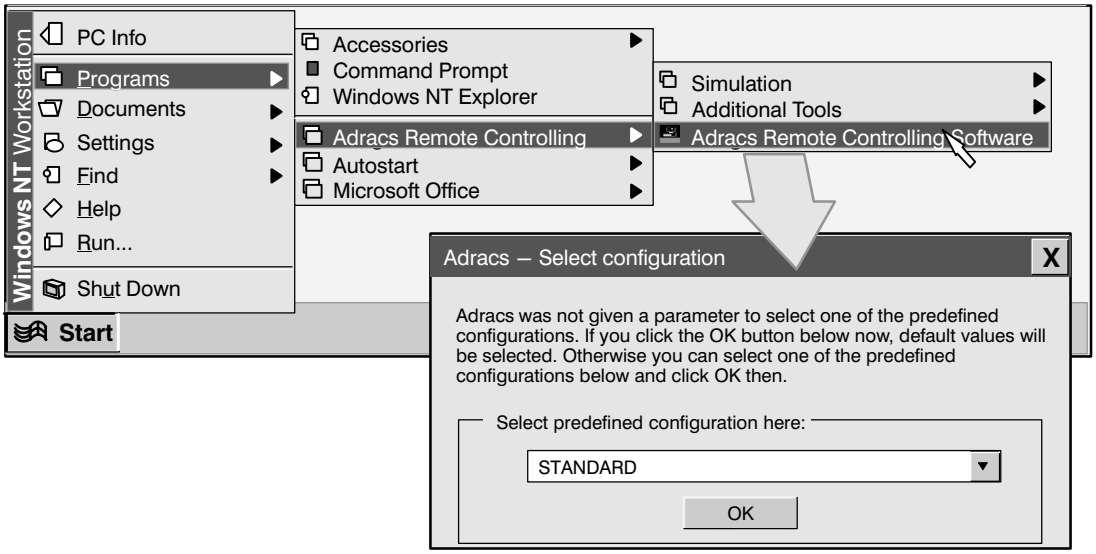


Fig. A–1 Starting 'Adracs Remote Controlling Software' on PC (example)

– The Main Status window of ADRACS is generated (see Fig. A–2).

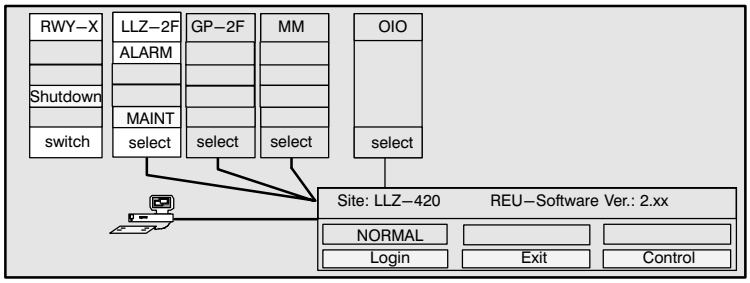


Fig. A–2 ADRACS Main Status window (example)

– 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'.

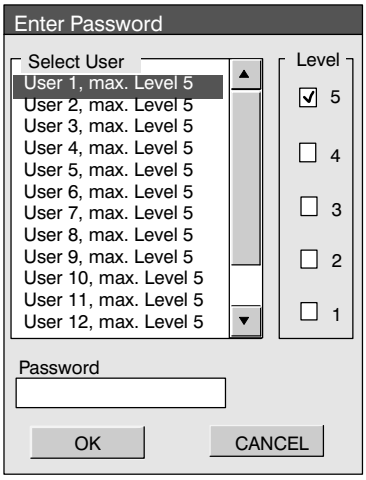


Fig. A–3 ADRACS login function using 'Enter Password' window (example)

– 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).

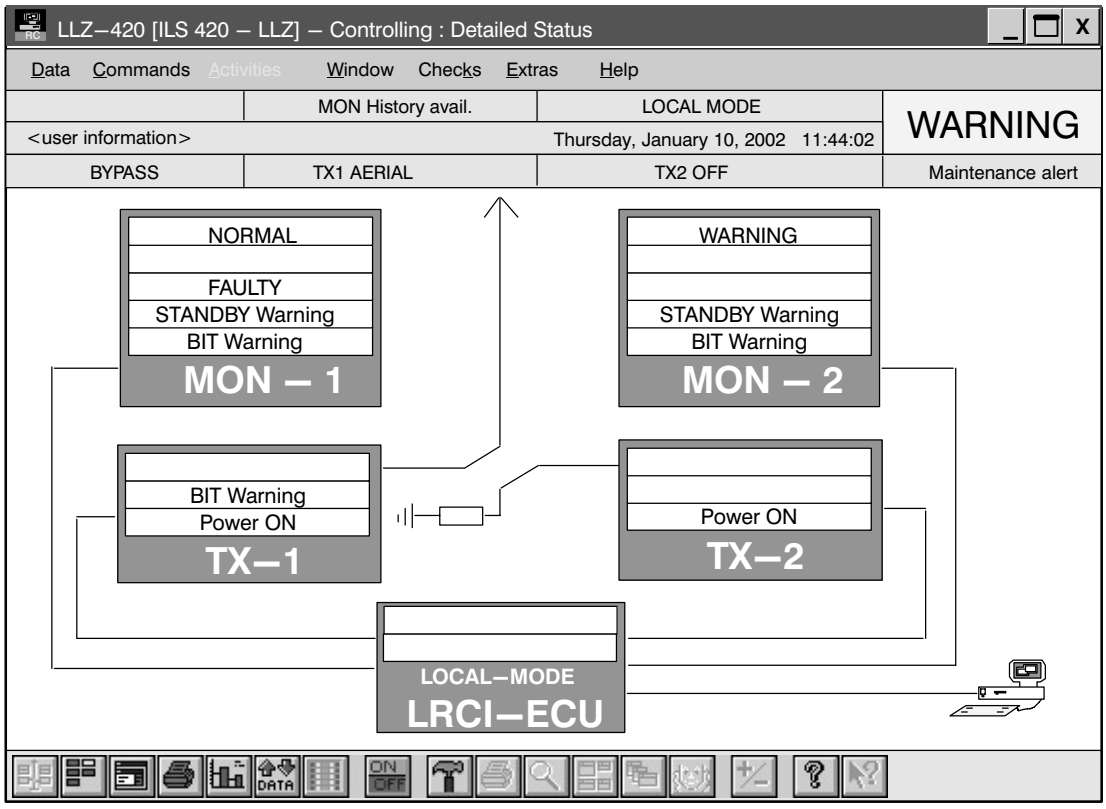


Fig. A–4 ADRACS Detailed Status window of the Navaids equipment (example)

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).

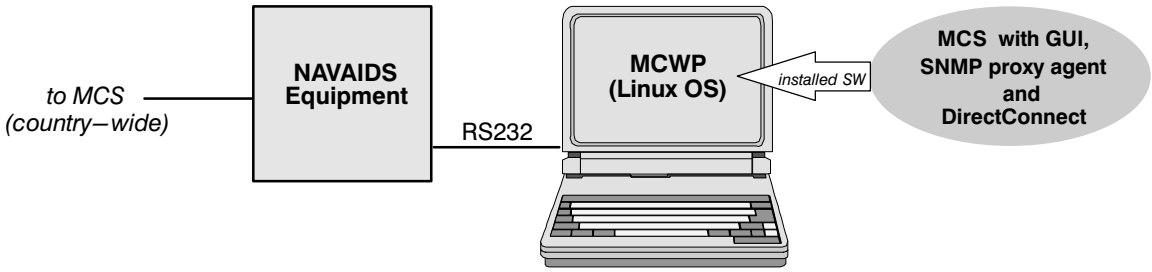


Fig. A−5 Direct connection to a Navaids equipment via serial interface

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).

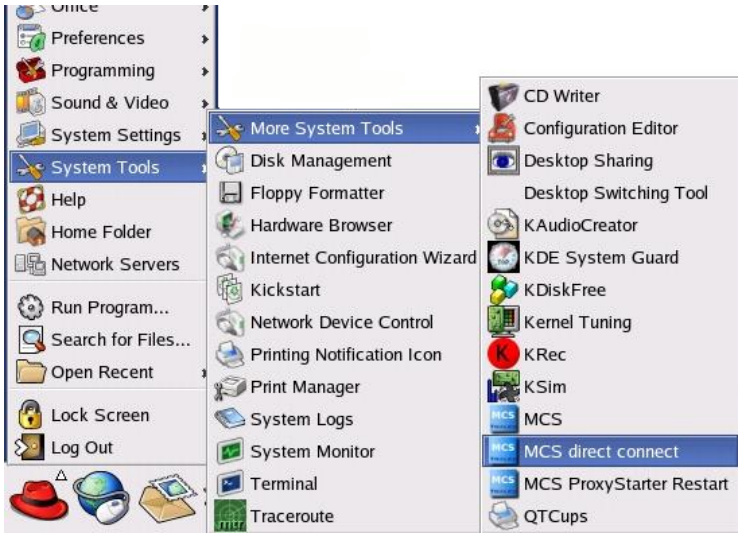


Fig. A−6 Linux desktop start menu with 'MCS direct connect' tool (example)

– 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'.

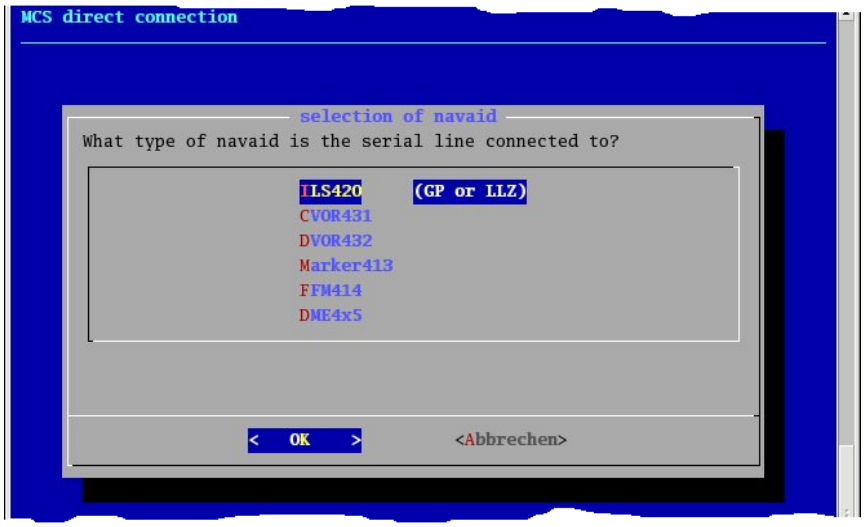


Fig. A–7 Start window of 'MCS direct connection' tool (example)

– 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).

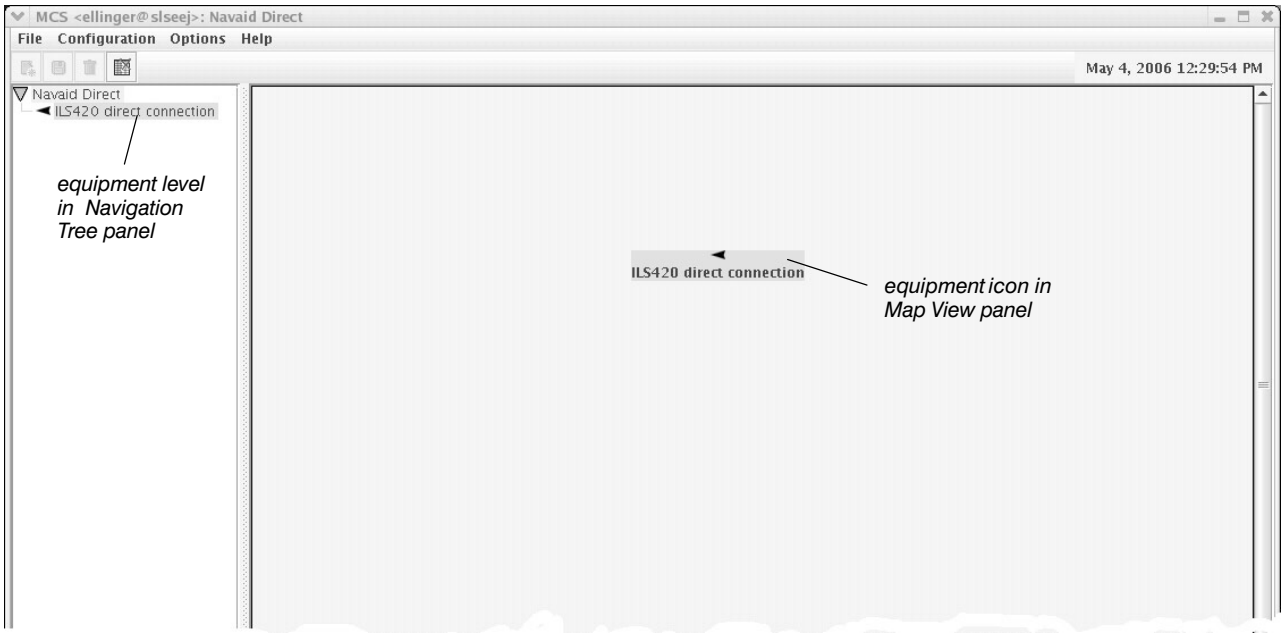


Fig. A–8 MCS Main window after setting up the direct connection to the station (example)

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.

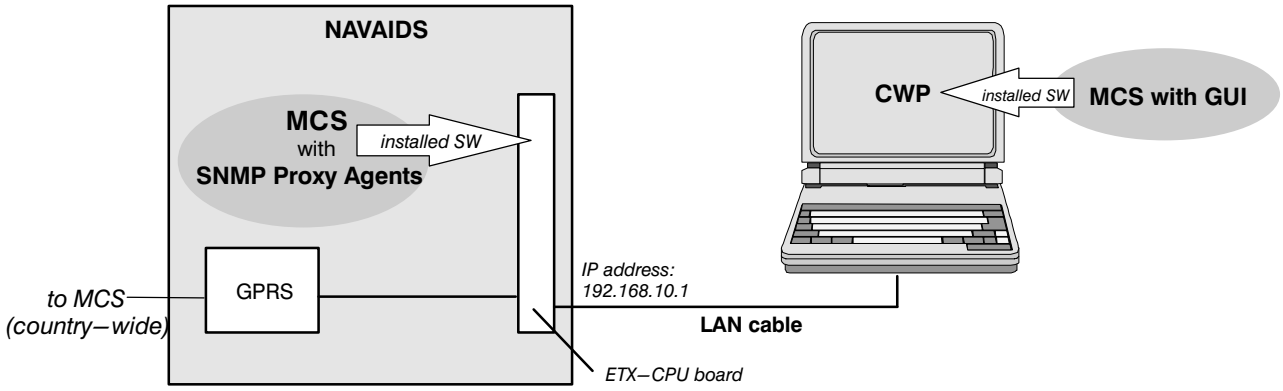


Fig. A–9 Direct connection to a Navaids equipment via Ethernet interface (example)

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).

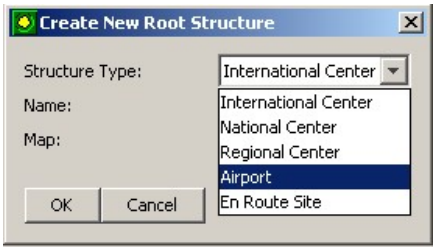


Fig. A–11 Create New Root Structure in the MCS Main window (example)

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).

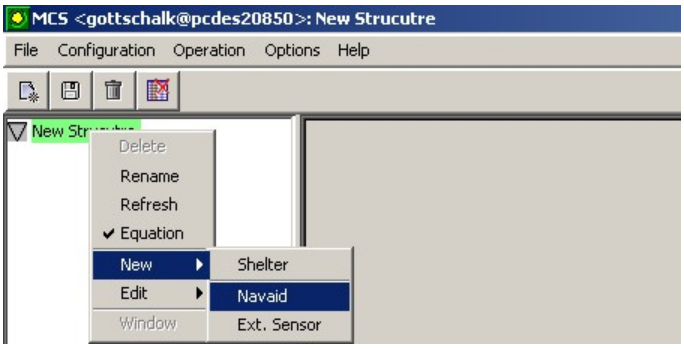


Fig. A−12 Start procedure to create a new Navaid equipment level (example)

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'.

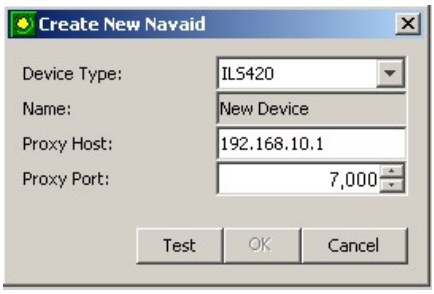


Fig. A−13 Dialog 'Create New Navaid' (example)

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).

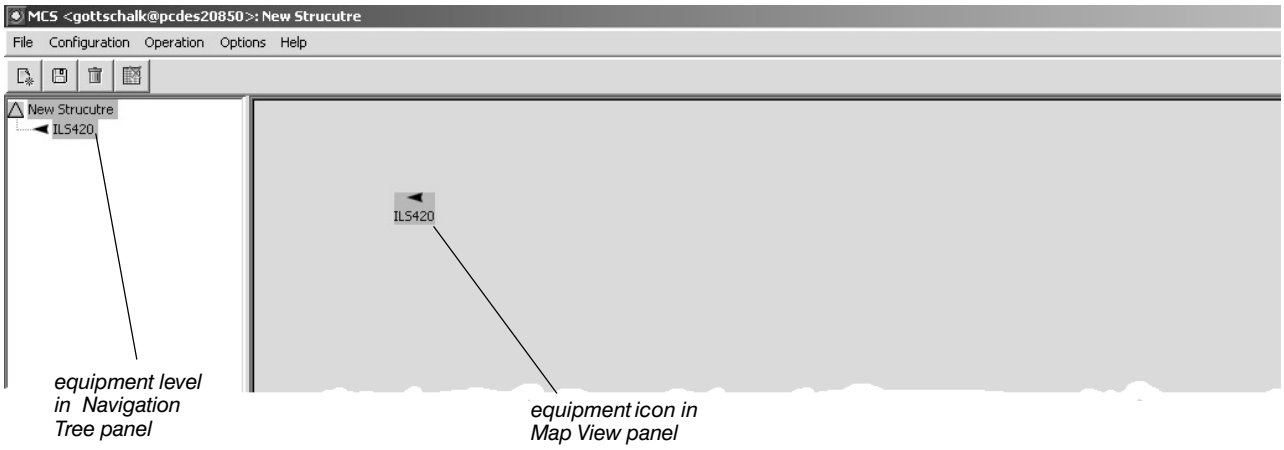


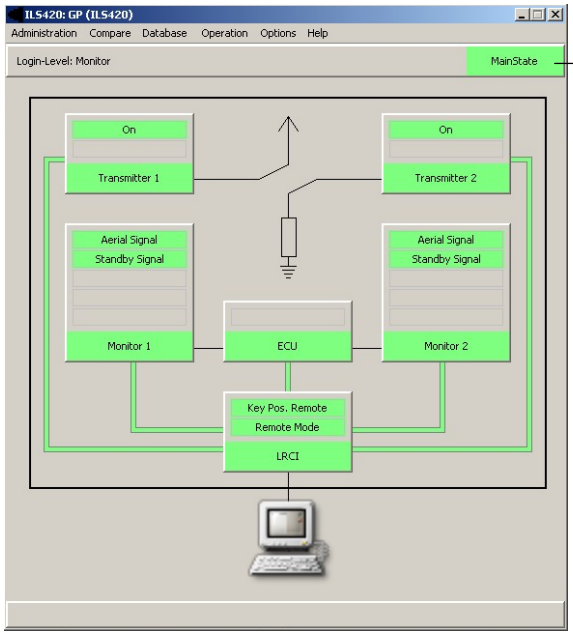
Fig. A−14 MCS Main window after creating a Navaid station in the root structure (example)

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'

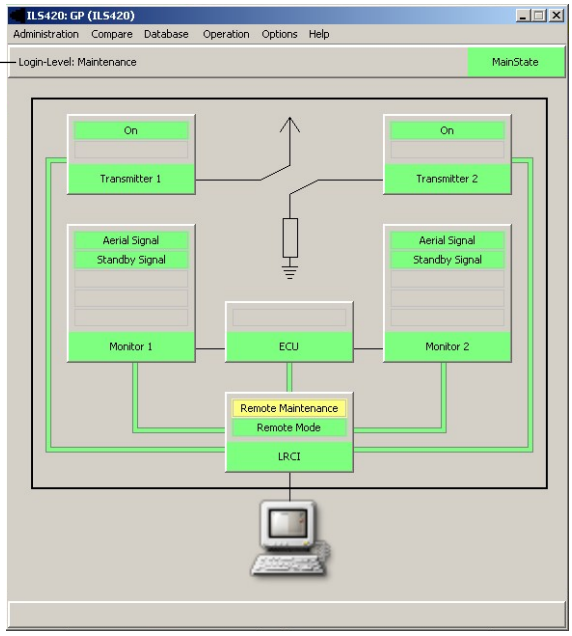


Fig. A–15 MCS 1st Equipment Level window of the Navaids station (examples a and b)

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').

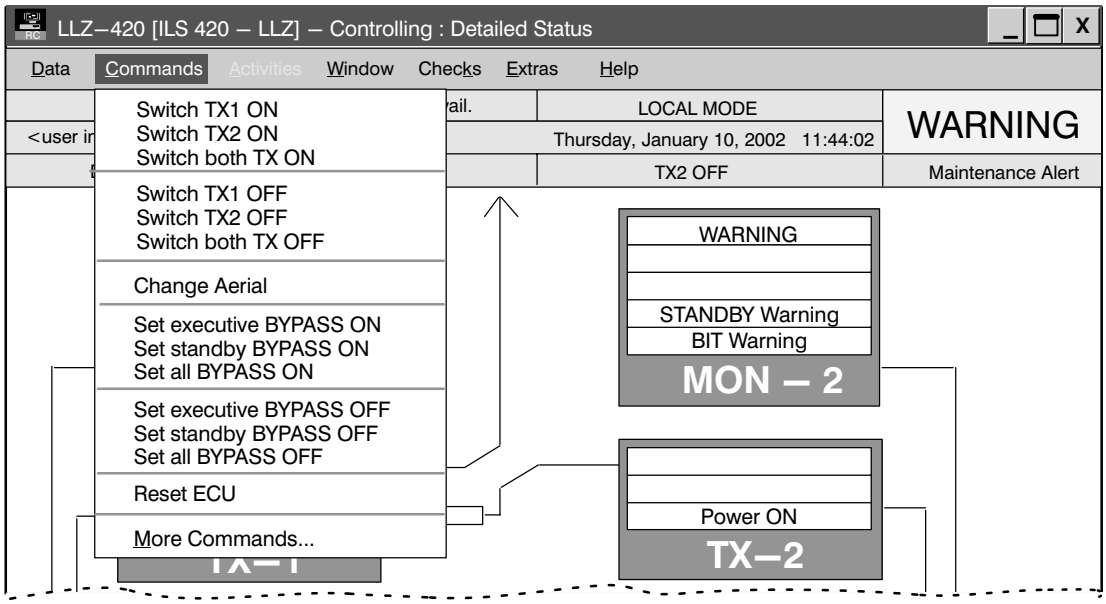


Fig. A–16 ADRACS Detailed Status window with pulldown menu 'Commands' (example)

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).

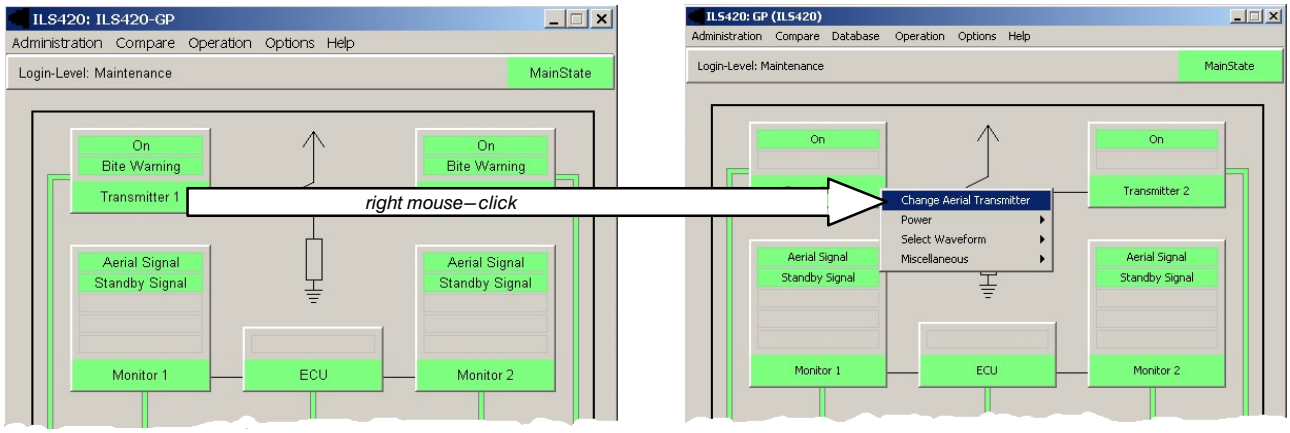


Fig. A–17 MCS 1st Equipment Level window with pull–down menu of transmitter commands (example)

– Open the commands submenu 'Power' by moving the cursor onto the submenu item 'Power' (see Fig. A–18).

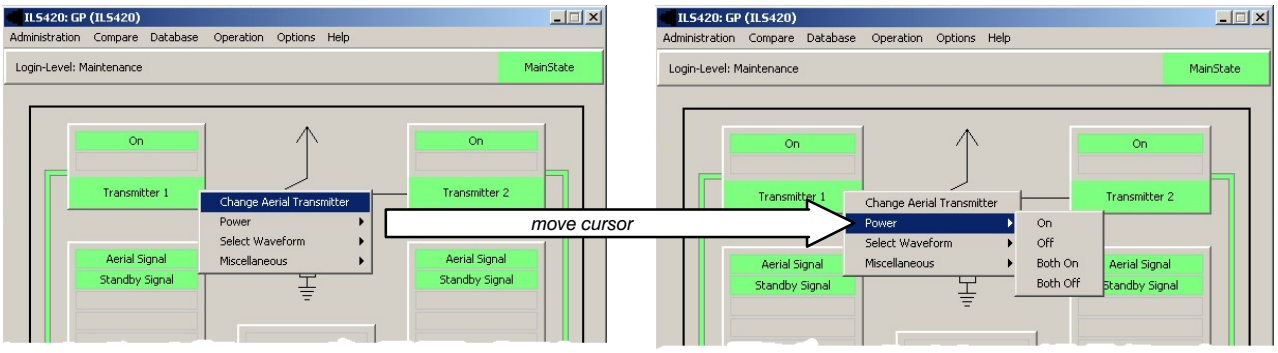


Fig. A–18 Open transmitter commands submenu 'Power' (example)

– 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).

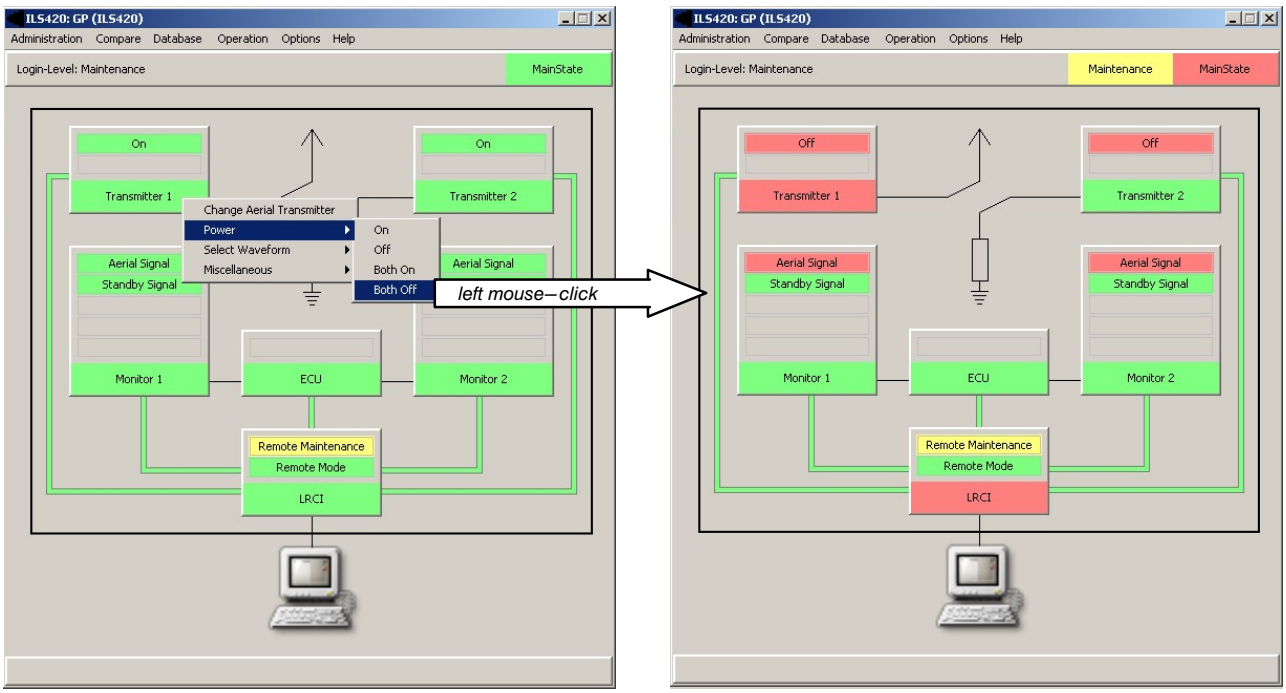


Fig. A–19 Send command 'Power, Both off' to the equipment, state indication is actualized (example)

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'.

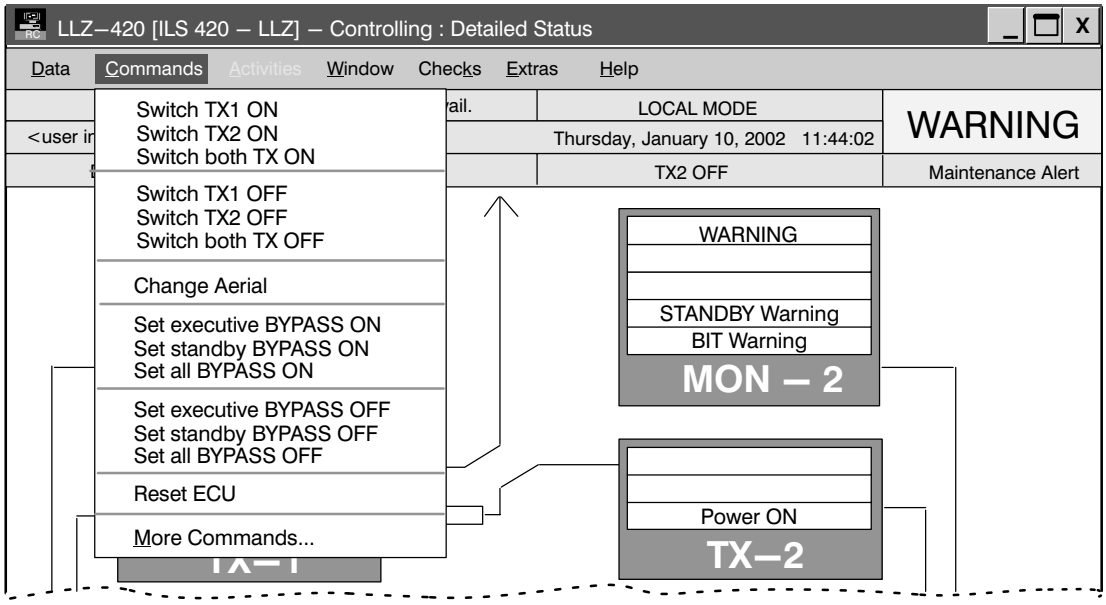


Fig. A–20 ADRACS Detailed Status window with pulldown menu 'Commands' (example)

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).

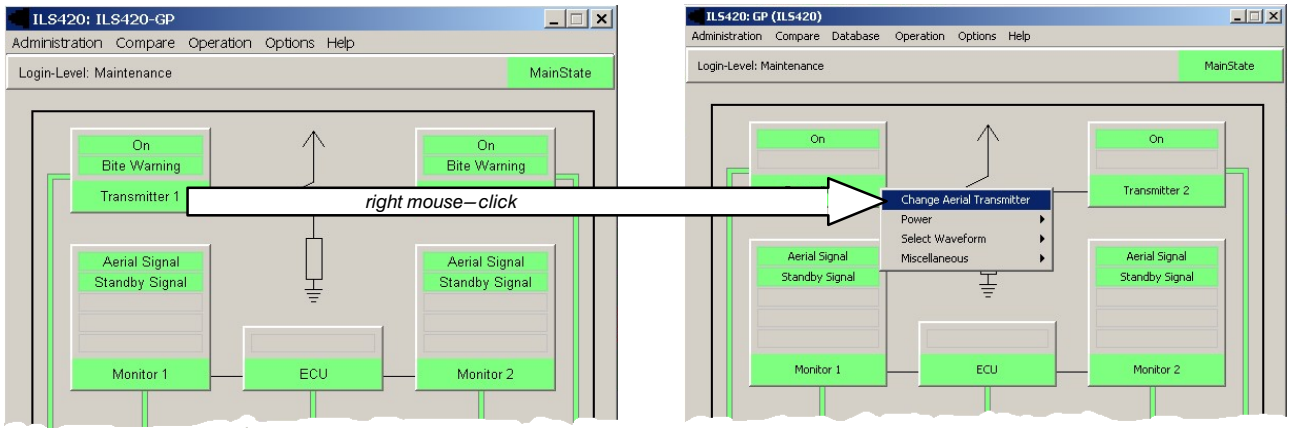


Fig. A–21 MCS 1st Equipment Level window with pull–down menu of transmitter commands (example)

– Open the commands submenu 'Power' by moving the cursor onto the submenu item 'Power' (see Fig. A–22).

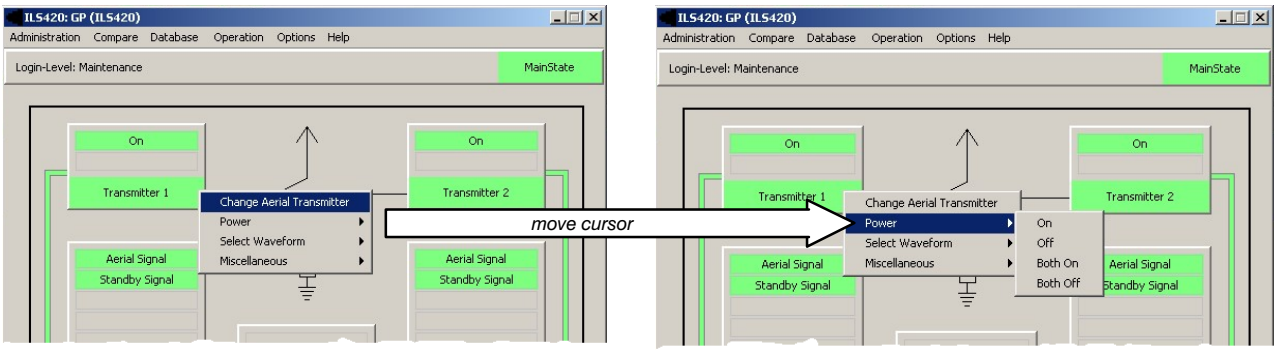


Fig. A–22 Open transmitter commands submenu 'Power' (example)

– 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.

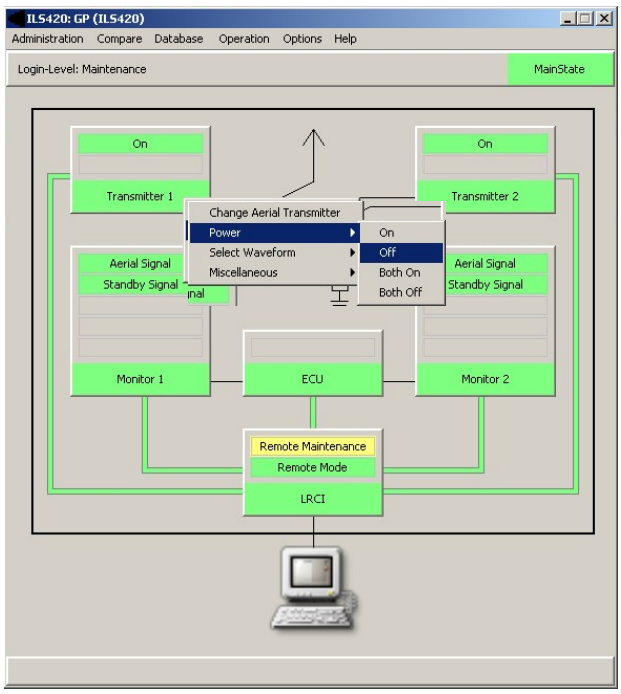


Fig. A–23 Send command 'Power, Off' to the station (example)

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).

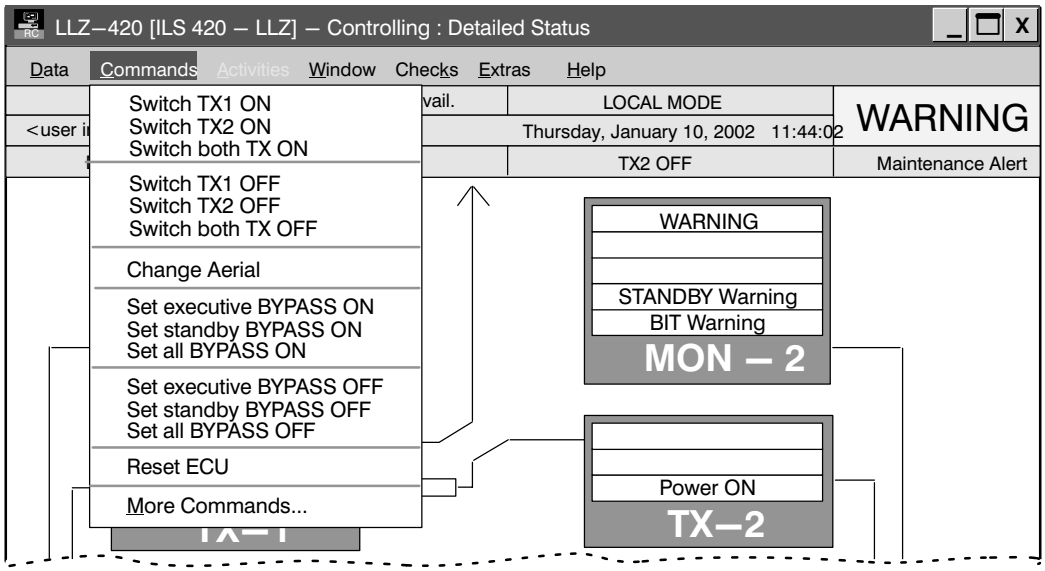


Fig. A–24 ADRACS Detailed Status window; menu 'Commands' (example)

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).

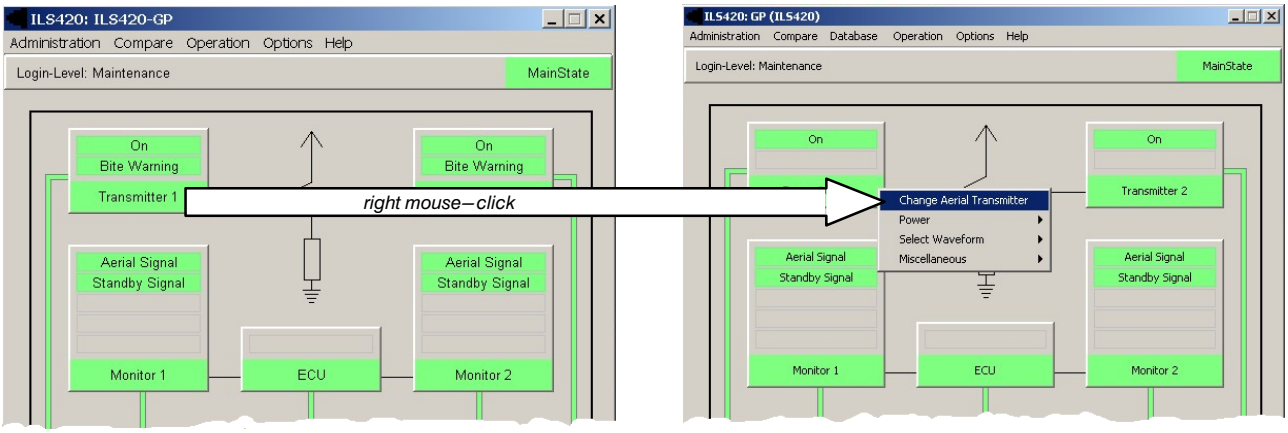


Fig. A–25 MCS 1st Equipment Level window with transmitter command 'Change Aerial' (example)

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').

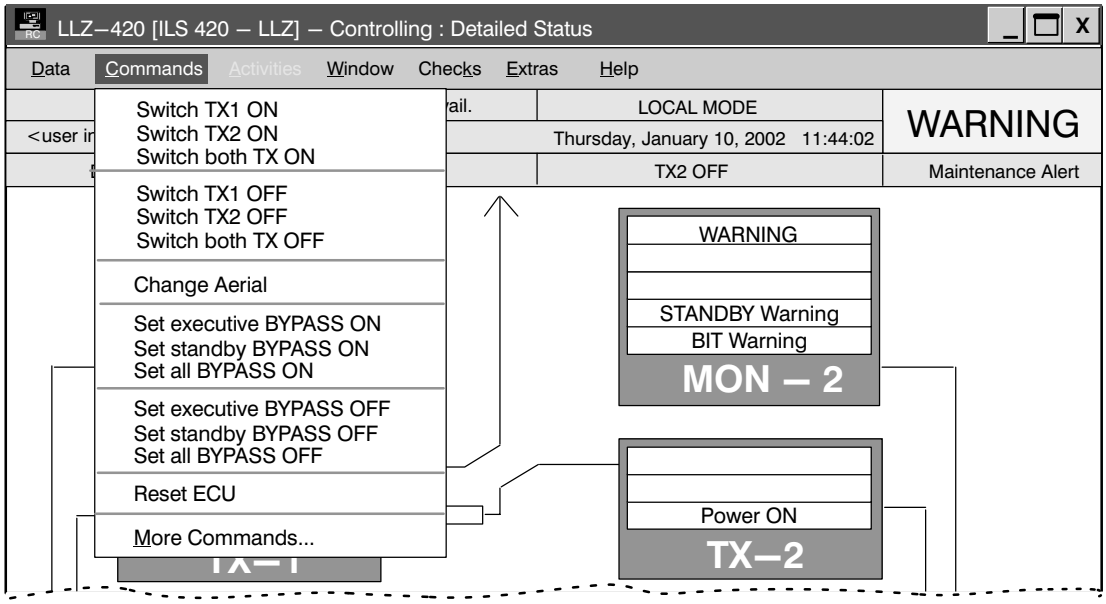


Fig. A–26 ADRACS Detailed Status window; menu 'Commands' (example)

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.

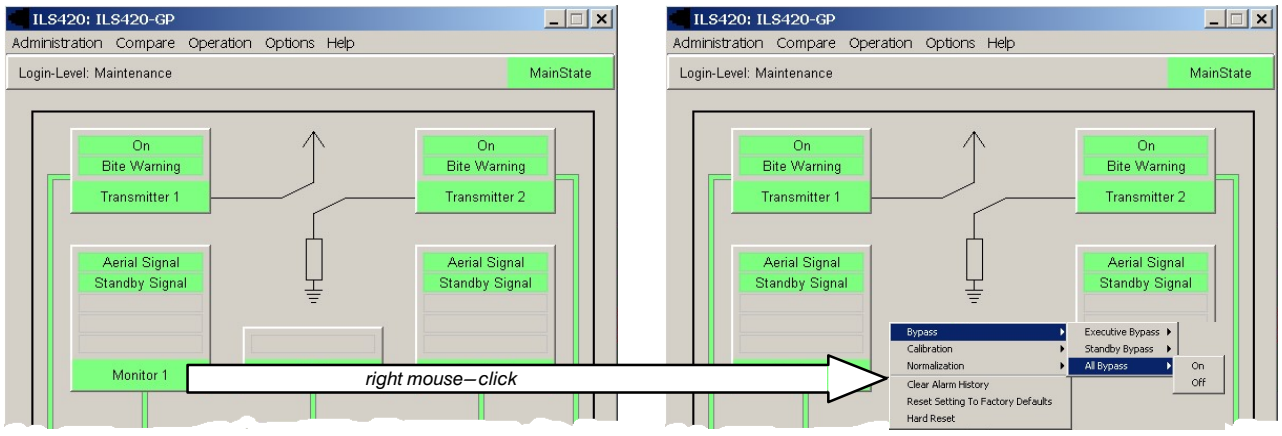


Fig. A–27 MCS 1st Equipment Level window with monitor bypass commands (example)

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.

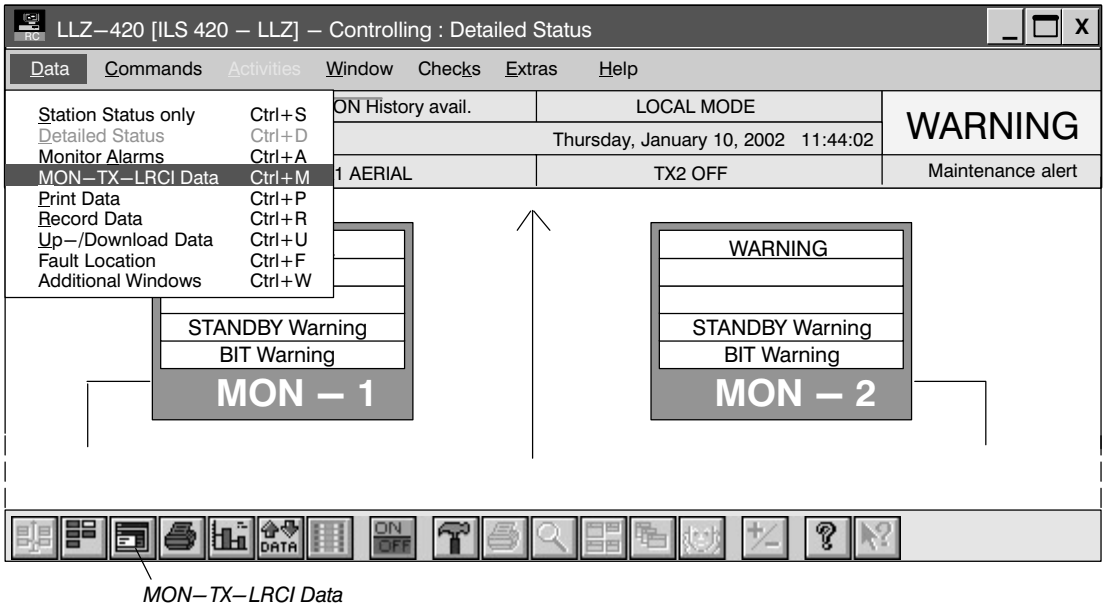


Fig. A–28 ADRACS Detailed Status window; menu ’Data’ (example)

– 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).

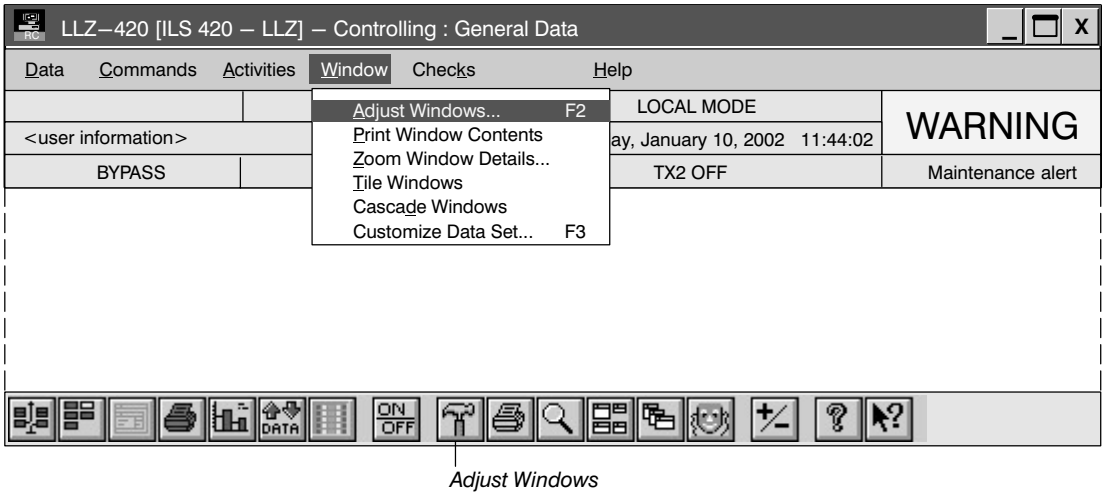


Fig. A–29 ADRACS General Data window; menu ’Window’ (example)

– The 'ADJUST WINDOWS' dialog appears (see Fig. A–30).

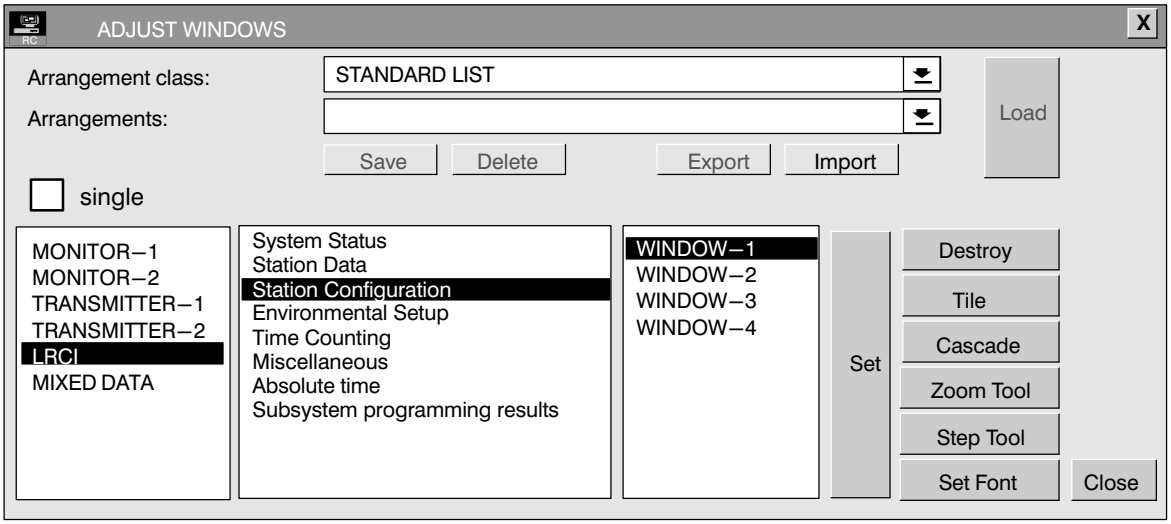


Fig. A–30 ADRACS dialog 'ADJUST WINDOWS' (example)

– 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.

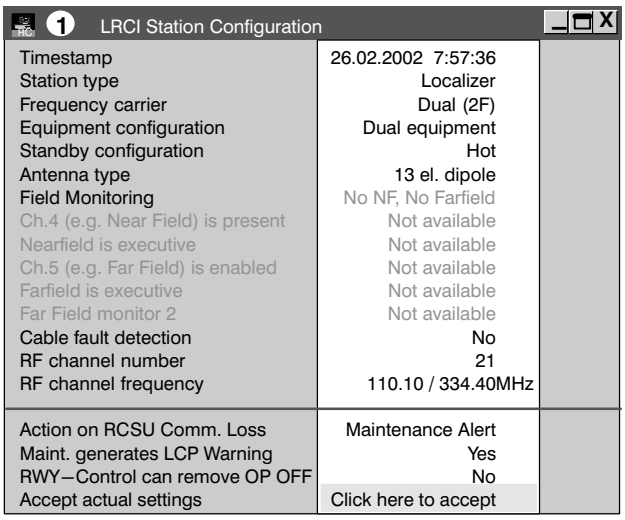


Fig. A–31 ADRACS 'LRCI Station Configuration' window for parameter setting (example)

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)

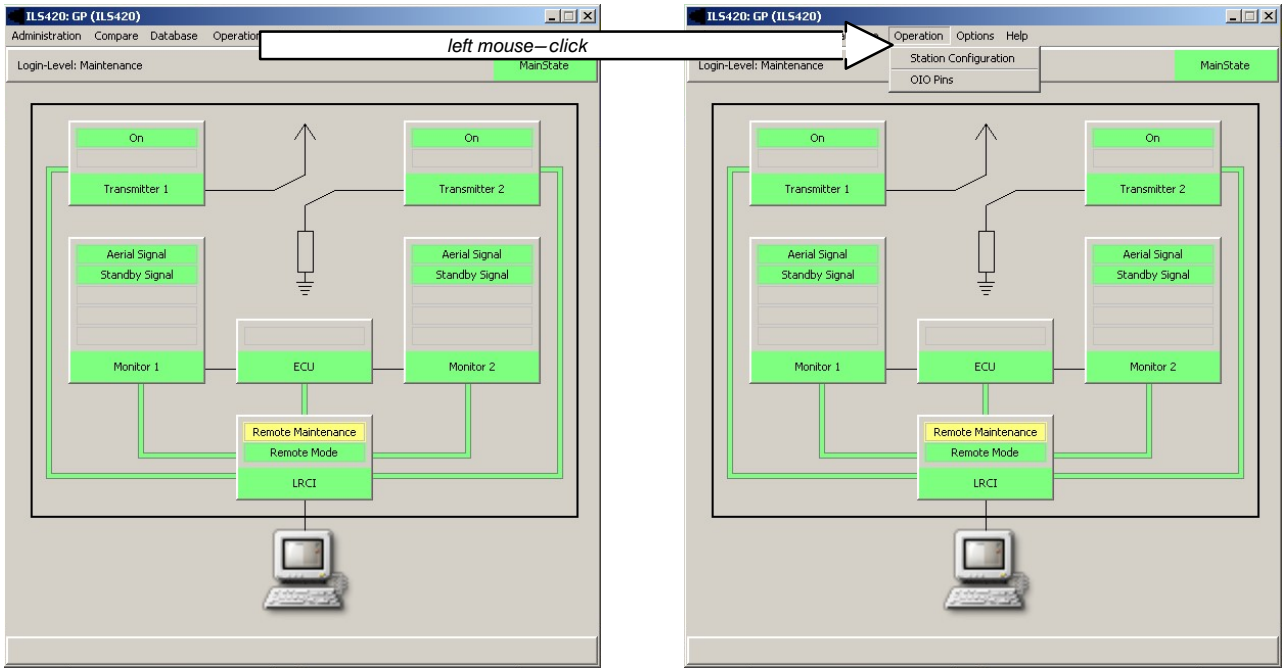


Fig. A–32 MCS 1st Equipment Level window with submenu 'Station Configuration' (example)

– 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.

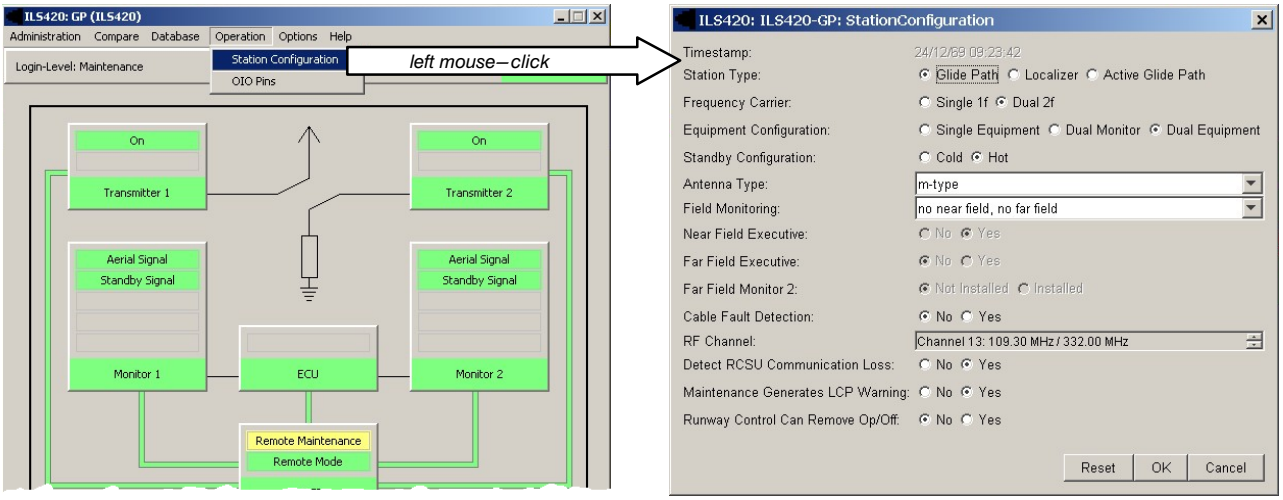


Fig. A–33 Select MCS 'Operation' submenu 'Station Configuration' (example)

– 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).

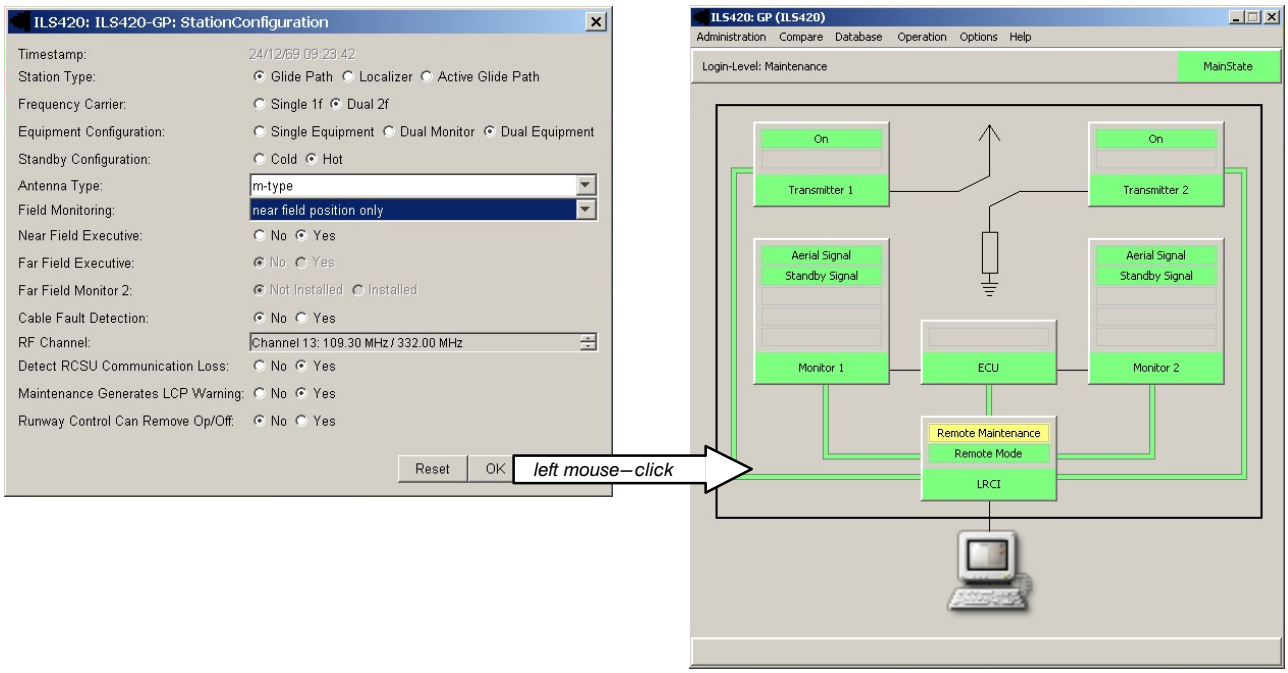


Fig. A–34 Parameter setting in the MCS '<equipment> Station Configuration' dialog (example)

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.

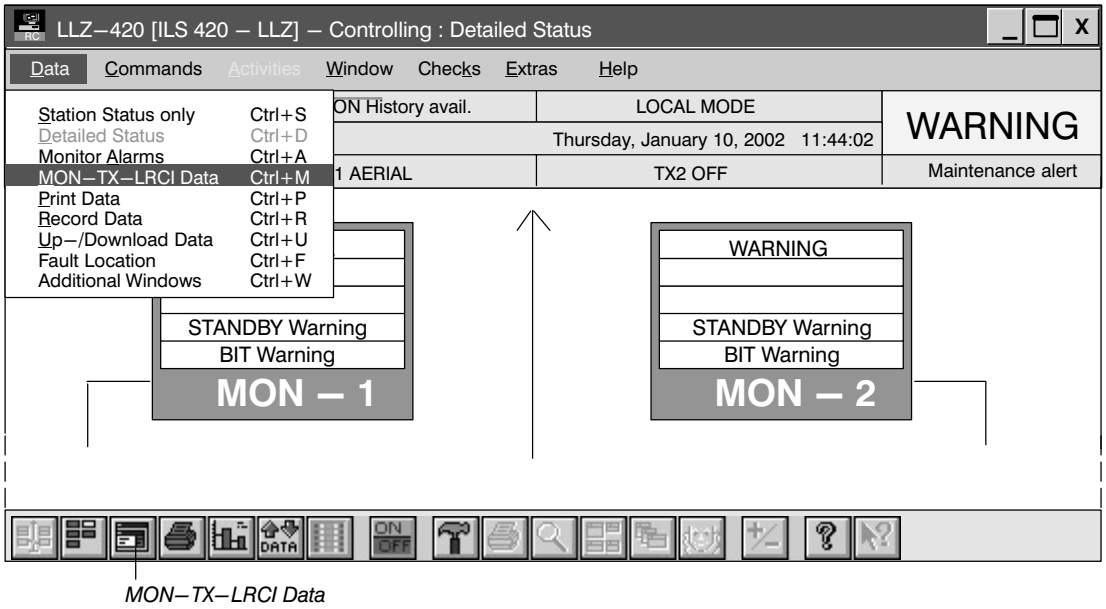


Fig. A–35 ADRACS Detailed Status window; menu 'Data' (example)

– 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).

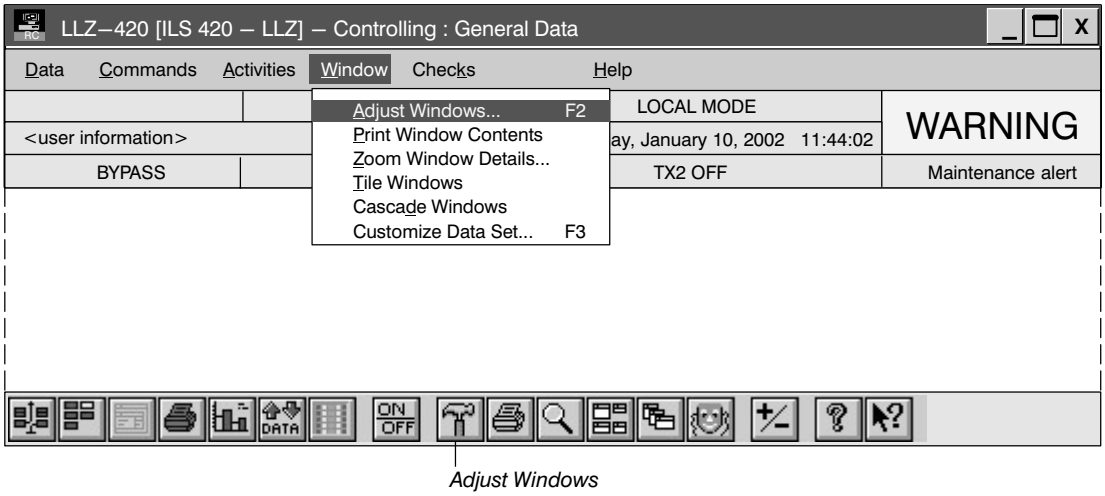


Fig. A–36 ADRACS General Data window; menu 'Window' (example)

– The 'ADJUST WINDOWS' dialog appears (see Fig. A–37).

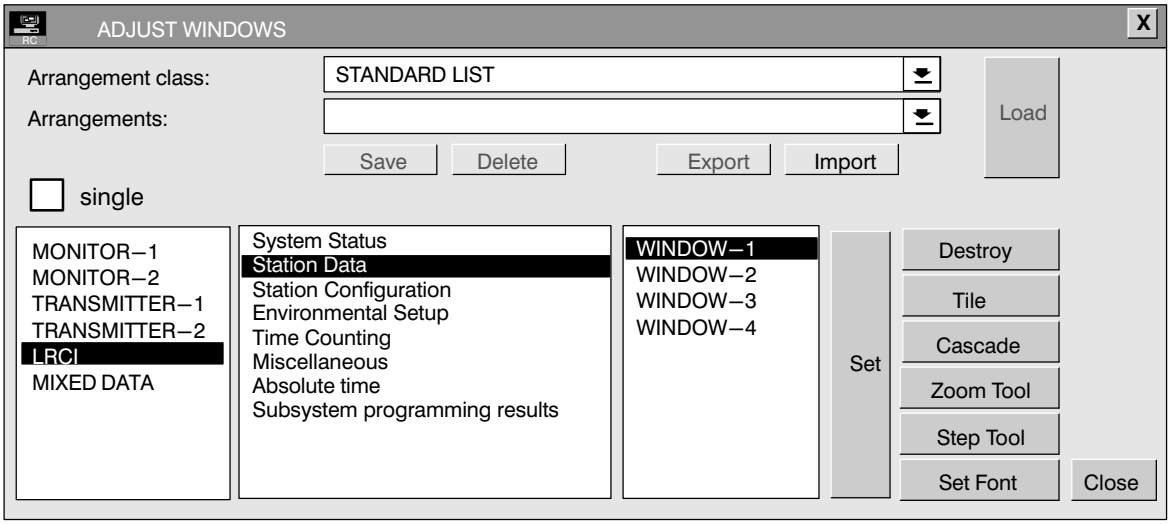


Fig. A–37 ADRACS dialog 'ADJUST WINDOWS', selection of <subsystem> and <data set> (example)

– 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).

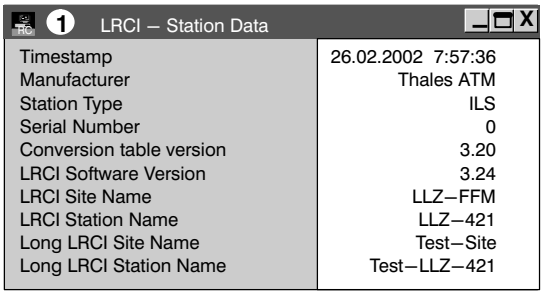


Fig. A–38 ADRACS data window with <data set> for parameter setting (example)

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).

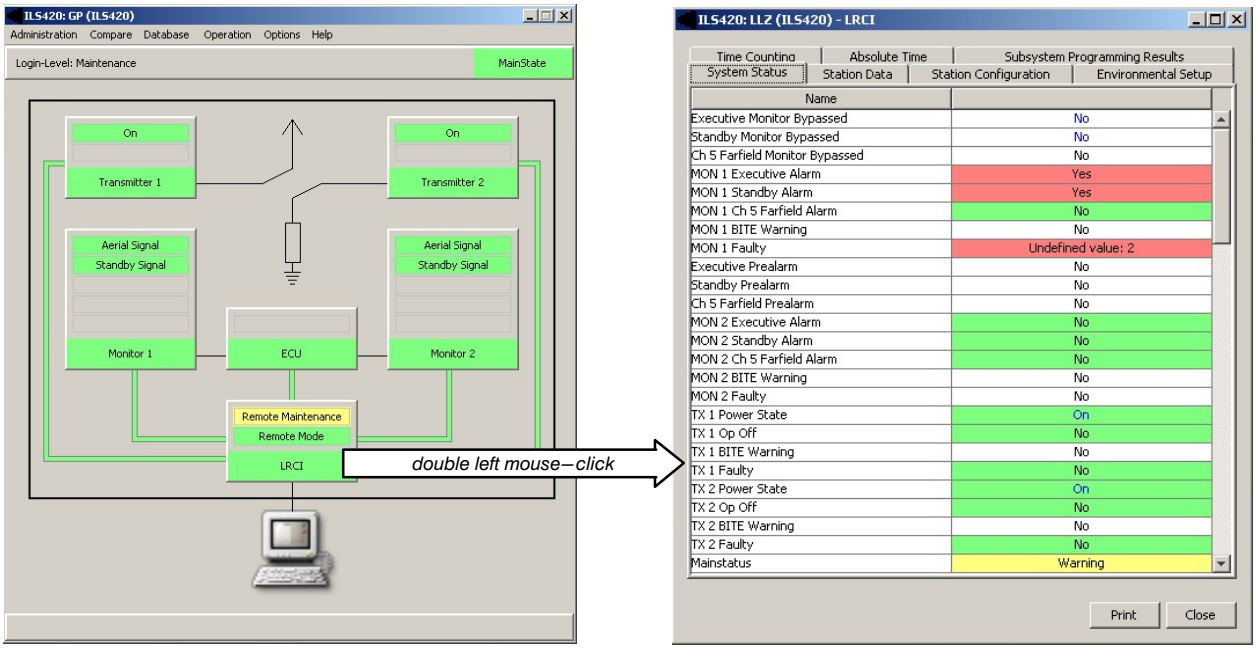


Fig. A–39 MCS <subsystem> 2nd Equipment Level window for parameter setting (example)

– Select the parameter list of the <data set> via left mouse–click on the corresponding file tab (see Fig. A–40).

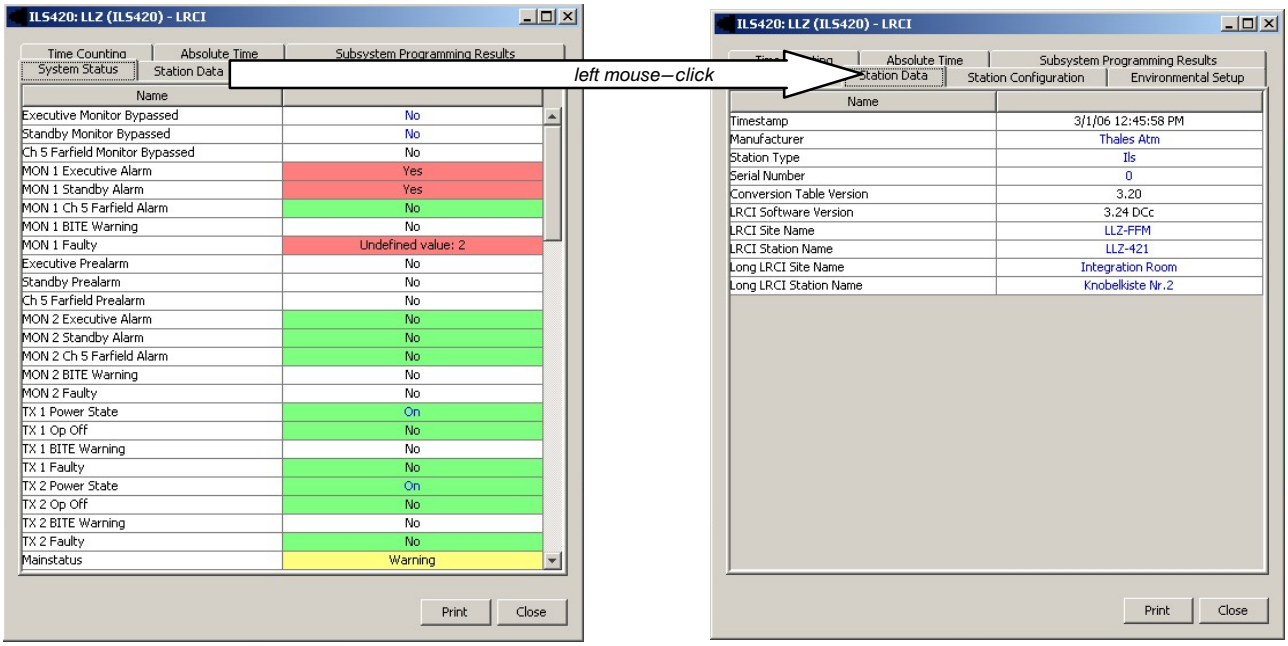


Fig. A–40 Select the <data set> for parameter setting (example)

– 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'.

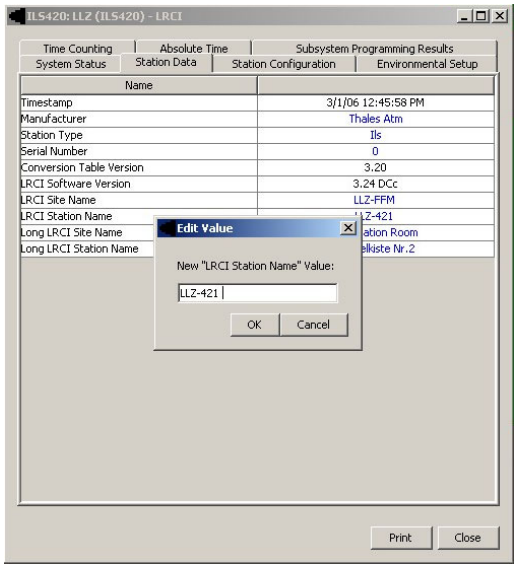


Fig. A–41 'Edit Value' dialog for modifying parameter value (example)

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".

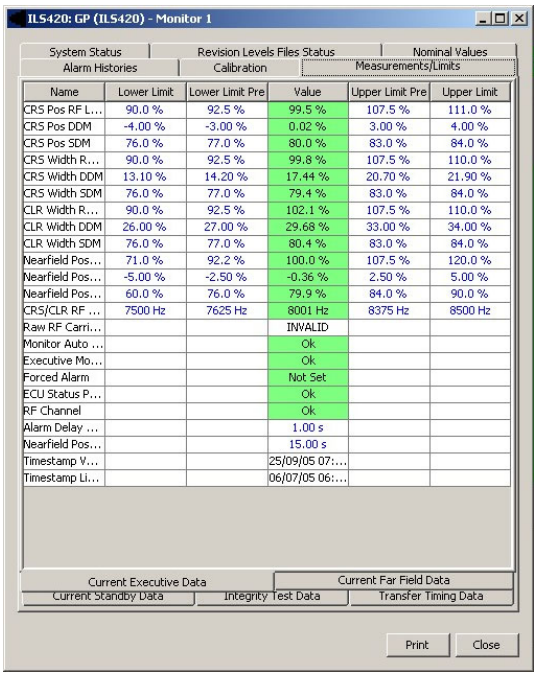


Fig. A–42 2nd Equipment Level window with a <sub–set> of a parameter <data set> (example)

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.

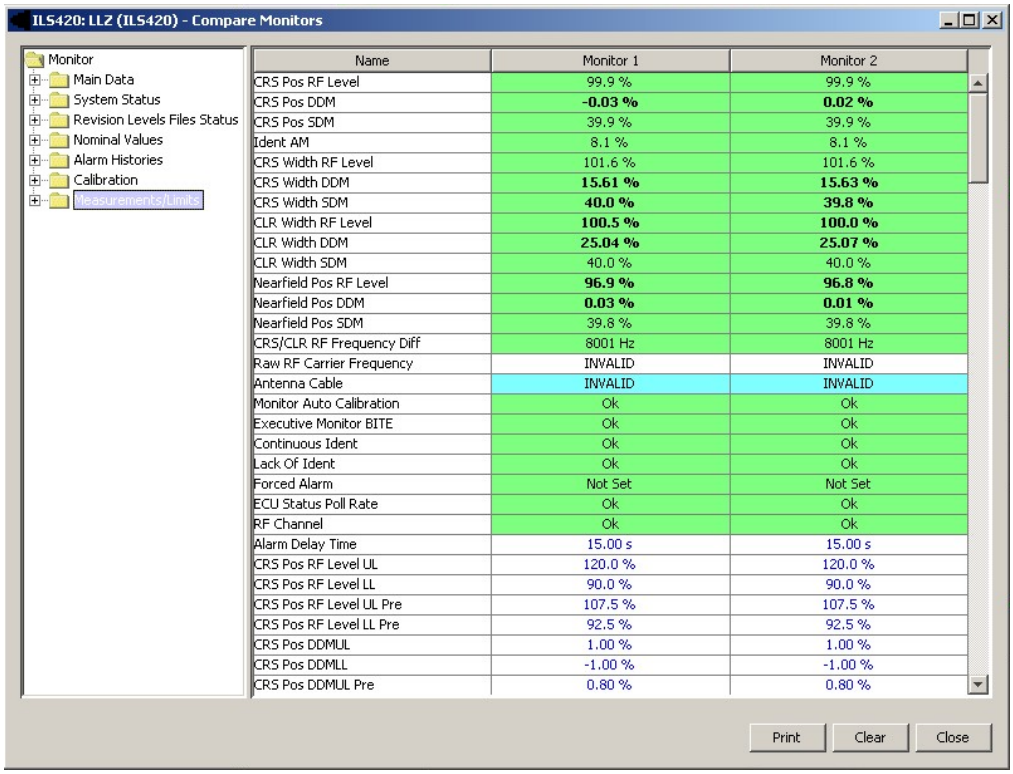


Fig. A−44 'Compare' function in the 1st Equipment Level window (example)

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).

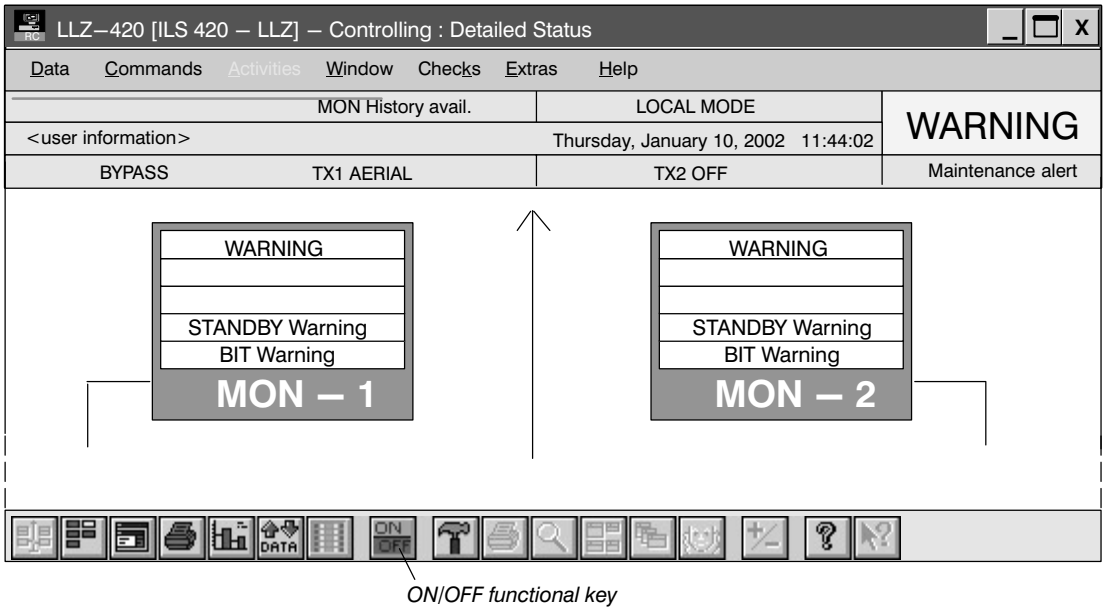


Fig. A–45 ADRACS functional key 'ON/OFF' (example)

– 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.

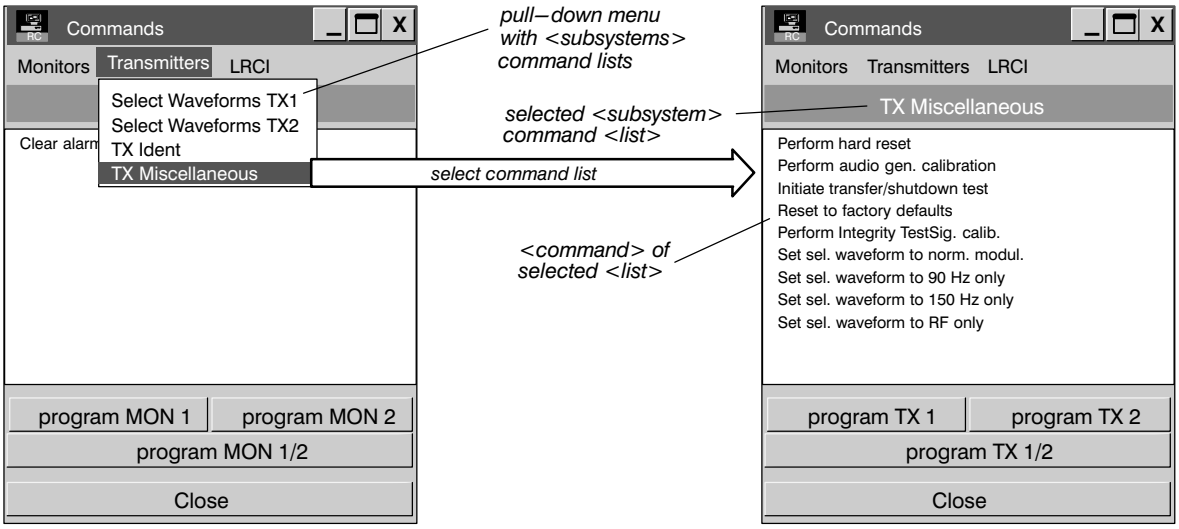


Fig. A–46 ADRACS 'Commands' window after opening the window (example)

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).

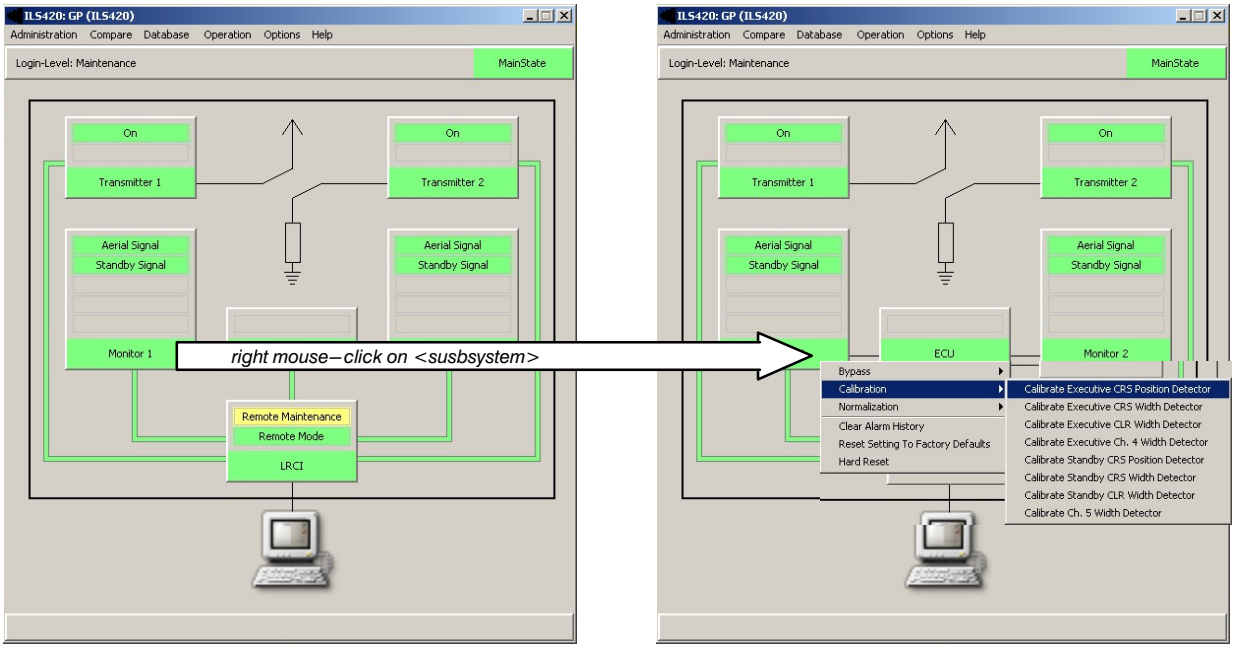


Fig. A–47 MCS 1st Equipment Level window with <subsystem> commands (example)

– 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>.