THALES



GP–2F M–Type

Annex

ILS 420 SOAC, GP–2F standard

GP Distribution Unit

Ref. No. 120686–0001

Description, Installation and First Alignment

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CHAPTER 1
DESCRIPTION

1.1 GENERAL

See Fig. 1−1.

The optional Distribution Unit (DU) comprises the power distribution and phasing components to divide and combine the CSB, the SBO and the Clearance RF signal to provide the appropriate feeding signals for the GP−2F antennas A1 (CSB+SBO+Clear.), A2 (CSB+SBO) and A3 (SBO+Clear.), which supply the antenna system. It is located between TX cabinet RF output and feeding to the antennas.

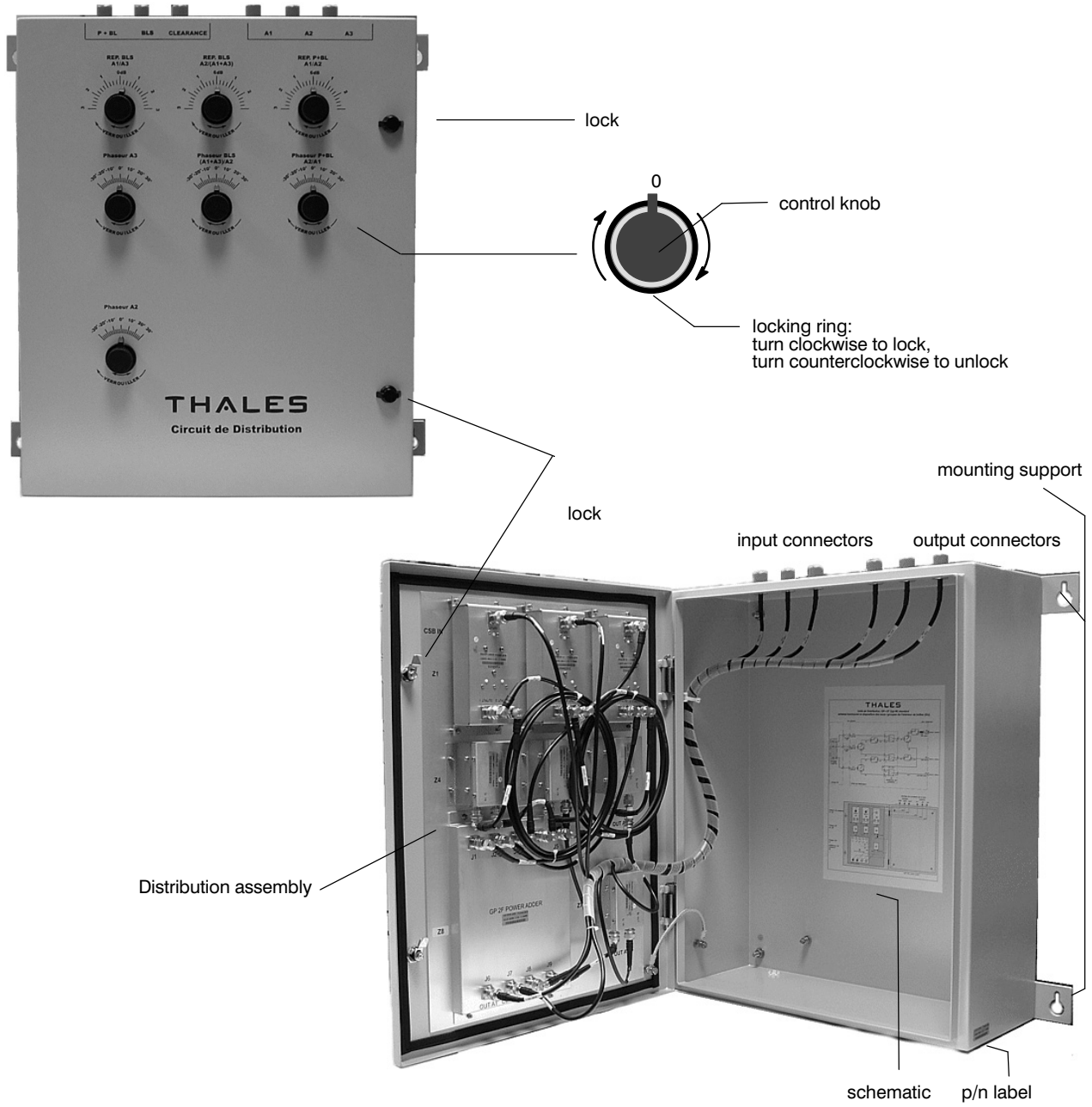


Fig. 1−1 Distribution Unit (DU), GP−2F (M−Type) standard

1.2 FUNCTIONAL OVERVIEW

See Fig. 1−2, 1−3.

The Distribution Unit (DU) divides the Glide Path RF signals into the proper phases and amplitudes and distributes them to each antenna element A1, A2, A3. The signal distribution function is performed by power dividers Z1, Z2, Z3, and the power adder device Z8, phasers Z4 and Z5, and phase shifters Z7 and Z6 in the output lines to the antennas A2, A3.

The CSB signal from the TX cabinet is supplied to the input of power divider Z1. Power divider Z1 establishes the ratio of CSB power levels between the lower antenna element A1 and the middle antenna element A2. Power divider Z1 output1 (CSB signal) is routed to divider *P1* in the power adder device Z8 for the lower antenna. Power divider Z1 output2 (CSB signal) is routed via adjustable phase shifter Z4 to divider *P2* in the power adder device Z8 and fed via the adjustable phase shifter Z7 to the middle antenna.

The SBO signal from the TX cabinet is supplied to the input of power divider Z2. Power divider Z2 establishes the ratio of sideband power levels at the middle antenna A2 with respect to the upper antenna A3 and the lower antenna A1. Power divider Z2 output1 (SBO signal) is routed to divider *P2* in Z8 for the middle antenna. Power divider Z2 output2 (SBO signal) is routed via adjustable phase shifter Z5 to divider *P3* in the power adder device Z8 for the upper antenna.

The combined CLR+SBO signal from divider *P3* in power adder device Z8 is supplied to the input of power divider Z3. Power divider Z3 establishes the ratio of Clearance and SBO power levels at the upper and lower antenna elements. Power divider Z3 output2 (CLR+SBO) is routed to the adjustable phase shifter Z6 and via an attenuator (3 dB) to the upper antenna element. Power divider Z3 output1 (CLR+SBO) is routed to divider *P1* in the power adder device Z8 and, combined with the CSB signal, fed to the lower antenna.

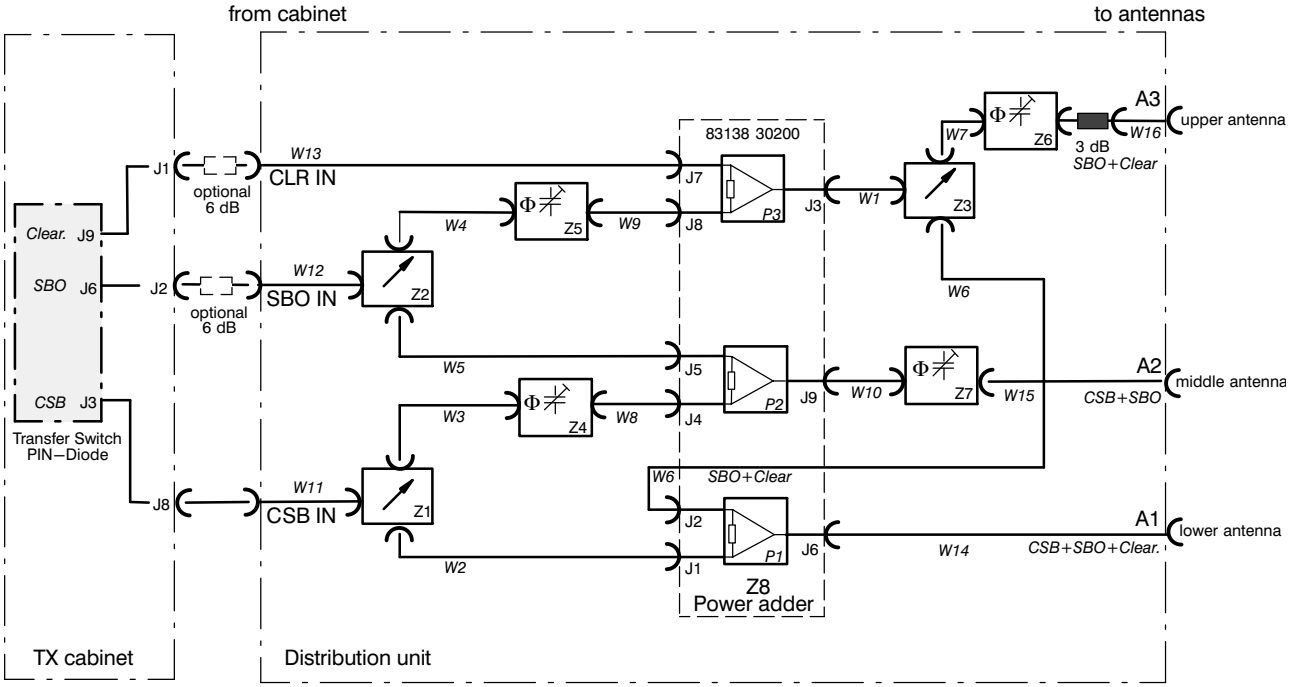


Fig. 1−2 Distribution Unit, GP−2F (M−Type) standard , block diagram

Dividers and phasers within the DU are adjusted with the control knobs at the front panel. The control consists of the control knob itself and a locking ring (see Fig. 1−1). Before use the control knob has to be unlocked first turning the locking ring counterclockwise.

NOTE: After adjustment of a control it has to be locked again to prevent unintentional setting!

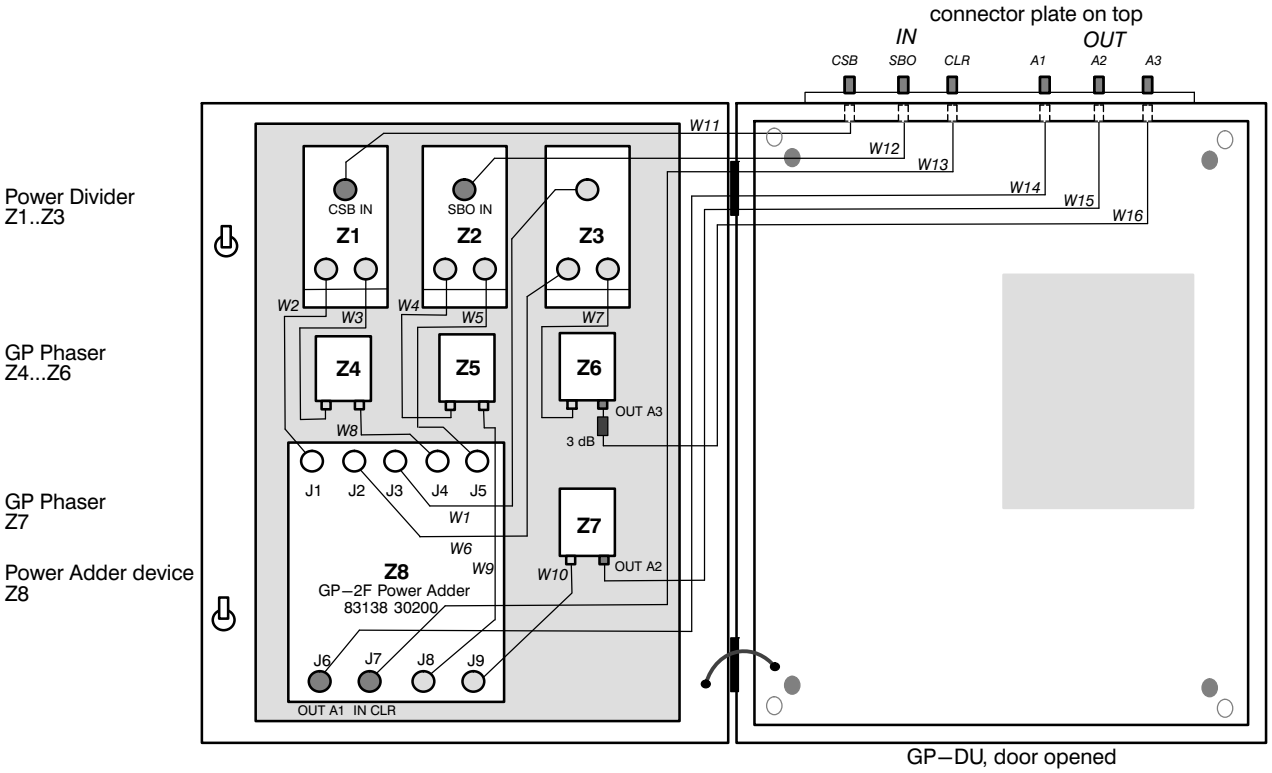


Fig. 1−3 Location of internal components (DU)

1.3 TECHNICAL CHARACTERISTICS

Location	wall mounted within GP shelter building
Mechanical size of housing (WxHxD)	500 x 600 x 230 [mm], without knobs and connectors
Power divider/adder	Design in accordance to antenna type
Antenna distribution cables (50 ohm)	coaxial

1.4 DISTRIBUTION UNIT (DU), CONTROLS, GP−2F (M−TYPE) STANDARD

Control	Label	Function	adj. Scale
Carrier Power Divider Control Z1	Rep. P+BL A1/A2	Divides carrier (CSB) into two components to *P1* and *P2* of power adder device Z8 for lower and middle antenna.	Ref: 6 dB; ±3 dB
Sideband Only Power Divider Control Z2	Rep. BLS A2/(A1+A3)	Divides sideband (SBO) into two components to *P2* and *P3* of power adder device Z8 for middle and lower/upper antenna.	Ref: 6 dB; ±3 dB
Sideband Only Power Divider Control Z3	Rep. BLS A1/A3	Divides combined signal (SBO+Clear.) into two components for upper and lower antenna.	Ref: 0 dB; ±3 dB
CSB phase control Z4	Phaseur P+BL A1/A2	Adjusts relative phase of CSB input to SBO input at *P2* of power adder device Z8 for middle and lower antenna.	Ref: 180°; ±30°
SBO phase control Z5	Phaseur BLS A2/(A1+A3)	Adjusts relative phase of SBO input at *P3* of power adder device Z8 for middle and lower/upper antenna	Ref: 180°; ±30°
A3 phase control Z6	Phaseur A3	Adjusts relative phase of A3 output signal (SBO+Clear.) to A1 signal.	Ref: 0°; advance: 0...+30 ° delay: 0...−30°
A2 phase control Z7	Phaseur A2	Adjusts relative phase of A2 output signal (CSB+SBO) to A1 signal.	Ref: 0°; advance: 0...+30 ° delay: 0...−30°

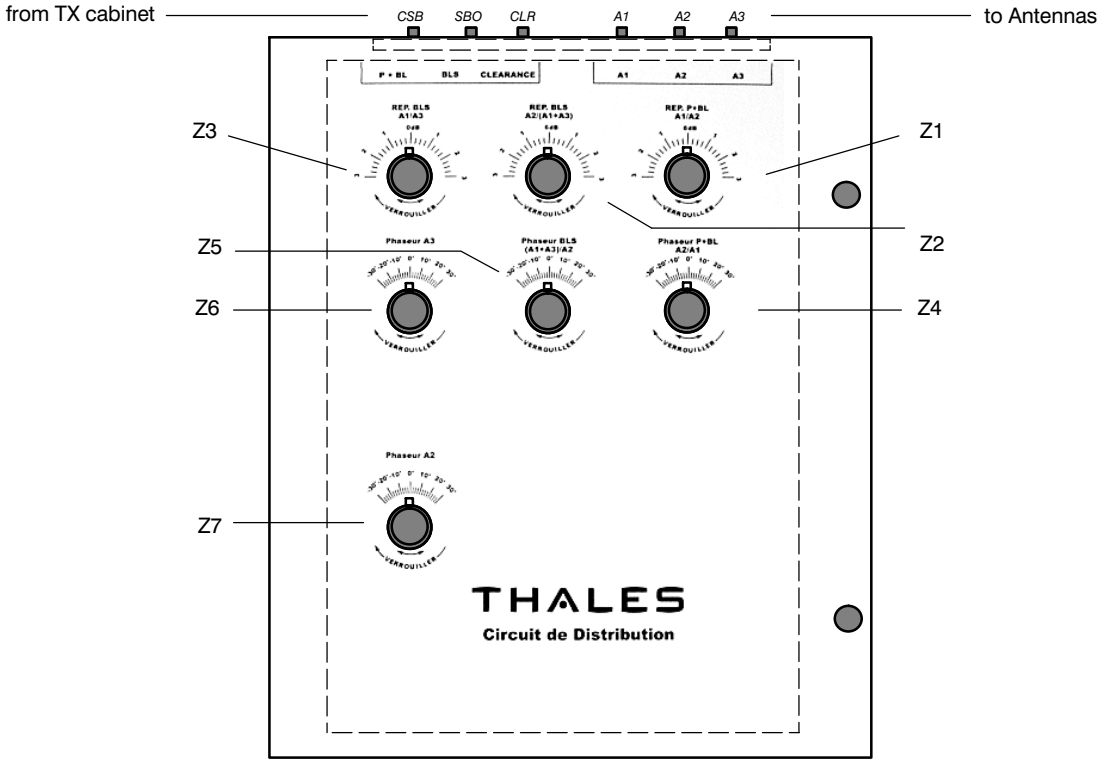
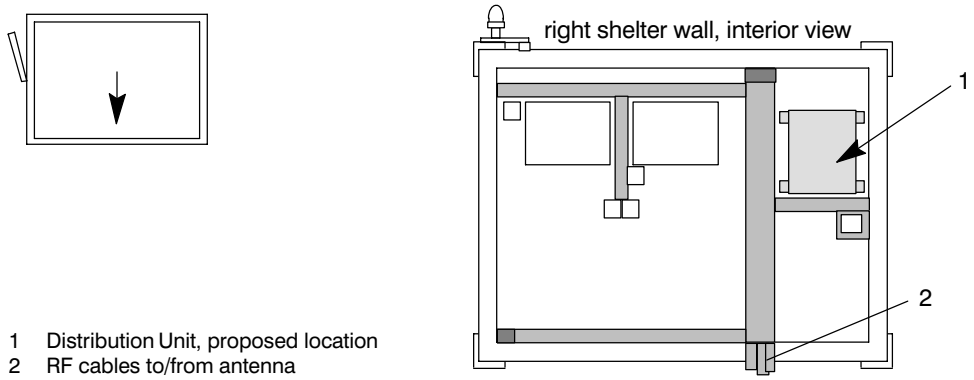


Fig. 1−4 Distribution Unit GP−2F (M−Type), standard, controls

CHAPTER 2
INSTALLATION

Fig. 2−1 shows a proposed location of the Distribution Unit in the shelter, Fig. 2−2 the system cabling. Fig. 2−3 shows the controls and top panel connectors.



1 Distribution Unit, proposed location
2 RF cables to/from antenna

Fig. 2−1 Location of Distribution Unit (DU) in the Shelter (proposal)

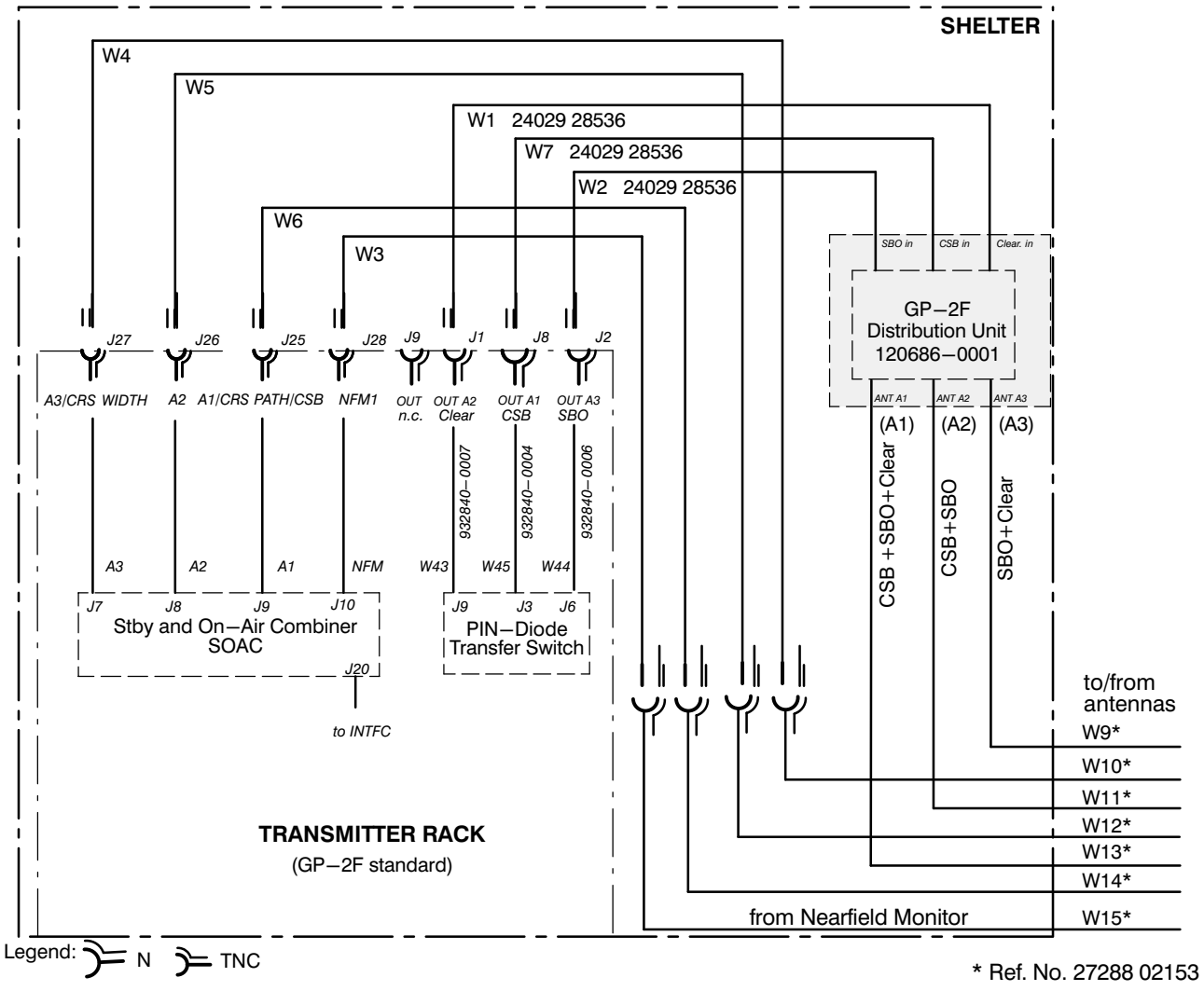


Fig. 2−2 System cabling, Distribution Unit GP−2F (M−Type), standard

The GP−DU can be mounted to the wall using the upper and lower supports.

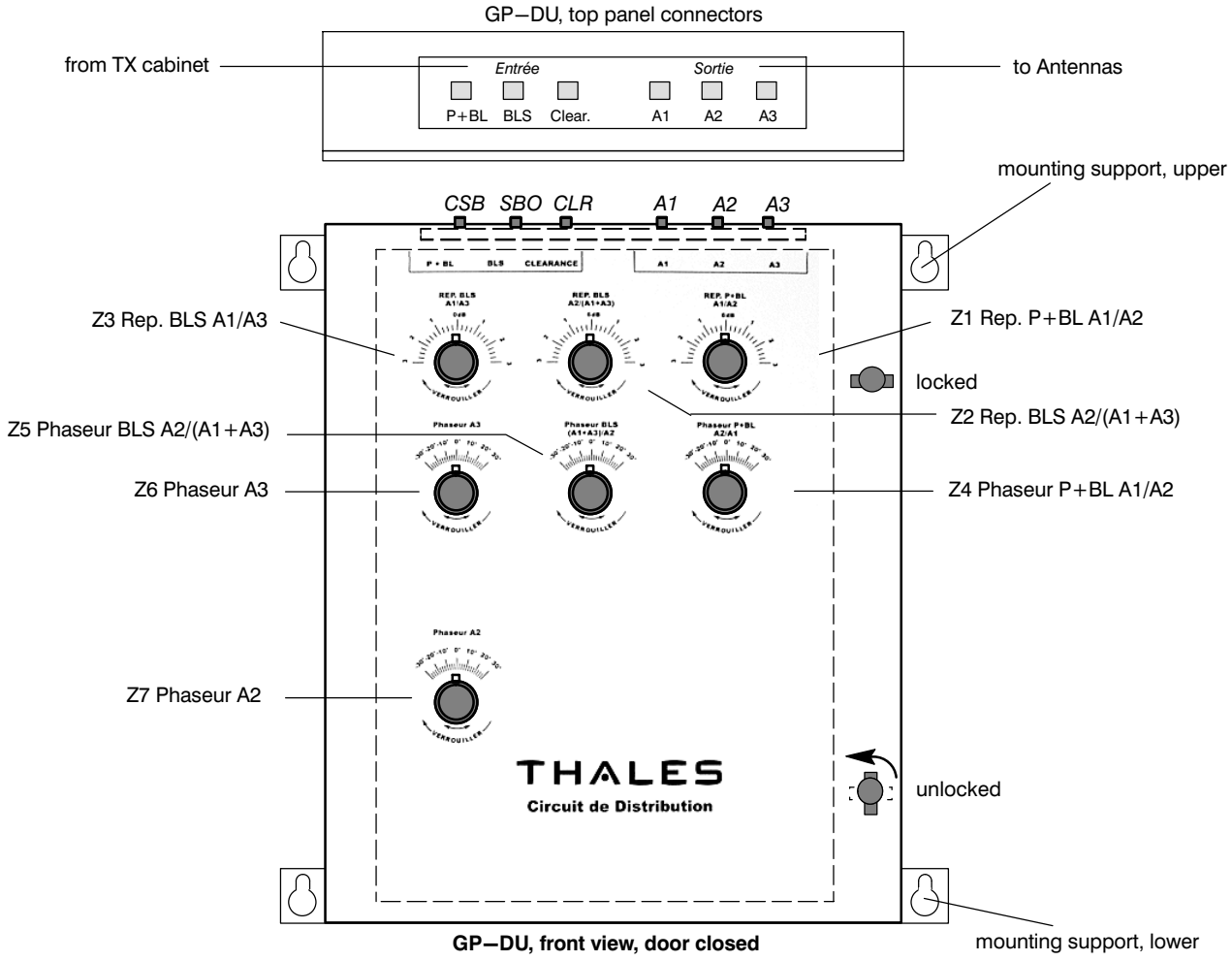


Fig. 2−3 Distribution Unit (DU), top panel connectors and front panel controls

CHAPTER 3

CHAPTER 4

CHAPTER 5

CHAPTER 6

Chapter 3 to 6 as header are only provided for enumeration of chapters to provide the chapter 7 ”First Alignment” matched to the existing manual GP 422, Part 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 of chapter 7.

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7.1.2 Recommended Measuring Equipment
7.1.3 Installation
7.1.4 Check of Antenna Installation
7.1.5 General Information to modified M−Type

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7.2.4 Entering Station Configuration Data

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7.7 BATTERY MONITORING

7.8 NORMAL OPERATION

7.9 FLIGHT CHECK
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7.9.7 Course Alarm
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7.9.9 Miscellaneous

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7.11 MONITOR ALARM LIMITS, COURSE WIDTH CALCULATION

7.12 CONVERSION OF RETURN LOSS TO VSWR VALUES

7.13 RATIO LEVELS A1/A2/A3 FOR WIDTH ADJUSTMENT

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 with ADRACS

A standard or Laptop PC is used to perform locally the first alignment of the installation. The PC should meet the following requirements:

- Processor Pentium 90 or better (IBM PC/AT compatible)
- 32 MB RAM, min. 1 GB HDD, 3.5” FDD (1.44 MB), CD−ROM drive, VGA adapter
- VGA color monitor
- Control via mouse or comparable pointing device
- two serial interface connectors available
- any 32 bit version of Microsoft WINDOWS operating system
- minimum 10 MB free disk space on HDD

Usually suitable PC equipment is already available at site. Otherwise it can be delivered on request as an option. The ADRACS operating software for the different NAV systems must be installed on the PC system. The adjustment of the transmitter and monitor parameters is performed via this terminal using the corresponding menu window. First the ADRACS software should be installed on the available PC. For installation procedure refer to Section 1.4 of Technical Manual **ADRACS** (Code No. 83140 55324).

7.1.2 Recommended Measuring Equipment

- Thruline wattmeter
- Oscilloscope (dual trace, trigger delay facility)
- 1 W, 10 W measuring element (330 MHz)
- DDM instrument (portable)
- 3 terminating resistors, 50 ohm, 10 W
- Reducers and phase adapters (TNC and SMA)
- 1 pair of radiotelephones

7.1.3 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−FIX switches of the pertinent printed circuit boards (refer also to 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 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.

7.1.5 General Information to modified M−Type

Modified M−Type means a special setting and alignment of the standard GP−2F M−Type to fulfil the system requirements for difficult site conditions.

To perform this the standard 6 dB amplitude ratio and the standard 180° phase difference between the CSB signals CSB A1 rel. to A2 and the SBO signals A2 rel. to A1/A3 can be modified to optimize the radiated GP signals. Table 1 illustrates the GP DU parameters for the realization of a standard M−Type.

The necessary setting parameters for a modified M−Type have to be calculated on the base of a qualified site survey and an engineering analysis. Table 2 shows possible variations of the GP DU settings for the realization of a modified M−Type. These values are typical values. The actual setting values have to be calculated for the specific site by the responsible engineer.

Signal	Ant. Lower (A1)		Ant. Middle (A2)		Ant. Upper (A3)		Remark
	dB	Degree	dB	Degree	dB	Degree	
CRS−CSB	0	0°	−6	180	−−	−−	
CRS−SBO	−6	180°	0	0°	−6	180°	
Clearance	0	0°	−−	−−	0	0°	

Table 1 Course (CRS) CSB/SBO− and Clearance Distribution for the Standard M−Type Array

Item	Setting Range (typ.)	Remark
CSB−Amplitude A2 relative to A1	−3 dB to −9 dB	
SBO−Amplitude A1/A3 relative to A2	−3 dB to −9 dB	
SBO−Amplitude A1 relative to A3	−3 db to +3 dB	
CSB−Phase A2 relative to A1	180° ±30°	
SBO−Phase A1/A3 relative to A2	180° ±30°	
A2−Phase	±30°	
A3−Phase	±30°	

Table 2 Possible variations in alignment for realization of a modified M−type (typical values)

7.2 FIRST SWITCHING ON

7.2.1 Status of the System

– Mains off

– Battery fuse switches open (used for emergency battery, battery fuse box, shelter)

– POWER−switches on BCPS (ACC modules, transmitter cabinet) in position OFF

– 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

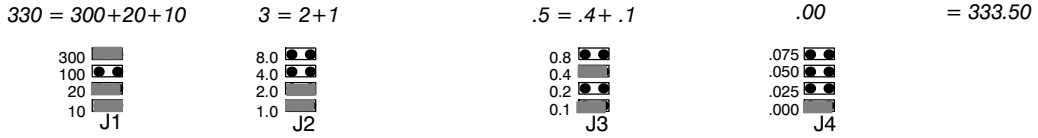
Individual jumpers have to be set before the first switching on. The location of jumpers is shown in section 6.6.5. Perform the following settings:

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

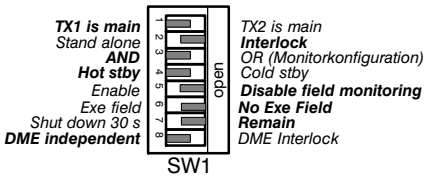
– SYN: Set jumpers J1 to J4 according to the selected operating frequency:

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 SW1 according to selected station configuration and jumpers J6, J7, if specific DME operation is required (LLZ only). This setting must correspond to software configuration data. Standard setting of 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 connector ”PC / RS232” on top of the cabinet using an interface cable (zero modem cable).

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).

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 Preparing the Installation SITE with PC and ADRACS

NOTE: Installation and use of the PC User Program is described in the Technical Manual **ADRACS** (chapter 1, sect. 1.4 Installation, chapter 2, Use). It is recommended to become familiar with the menus of the user program before performing the first set up procedure.

a) Switch on the PC and run WINDOWS.

b) Click 'Start' button, select 'Programs' program group 'Adracs Remote Controlling', 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.

7.2.4 Enter Station Configuration Data

a) Select group 'Adracs Remote Controlling'. Run 'Adracs Remote Controlling Software'.

b) Perform login procedure at the PC (Fig. 7−1).

c) Click screen button 'select' in the GP status field. The Detailed Status window appears.

d) Select menu 'Commands'. Click *Switch both TX ON* and *Set all bypasses ON* (Fig. 7−2).

e) Select *Data* submenu *MON−TX−LRCI Data* (Fig. 7−3). Call function 'Adjust Windows' (see Fig. 7−4). Select data window 'LRCI Station Configuration' in ADJUST WINDOWS (see Fig. 7−5).

f) Enter all required parameters in window 'LRCI − Station Configuration' (Fig. 7−6). Verify that the parameter 'Standby configuration' is set to *Hot*.

NOTE: Settings in f) must correspond to settings of DIP−FIX switch SW1 on ECU board !

g) Select "Click here to accept" and "Send data" to confirm settings.

h) Select menu 'Commands'. Click *Switch both TX OFF* (Fig. 7−2).

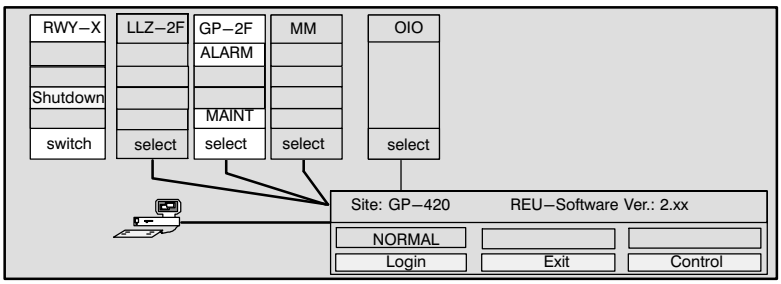


Fig. 7−1 Start window and LOGIN (example)

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.

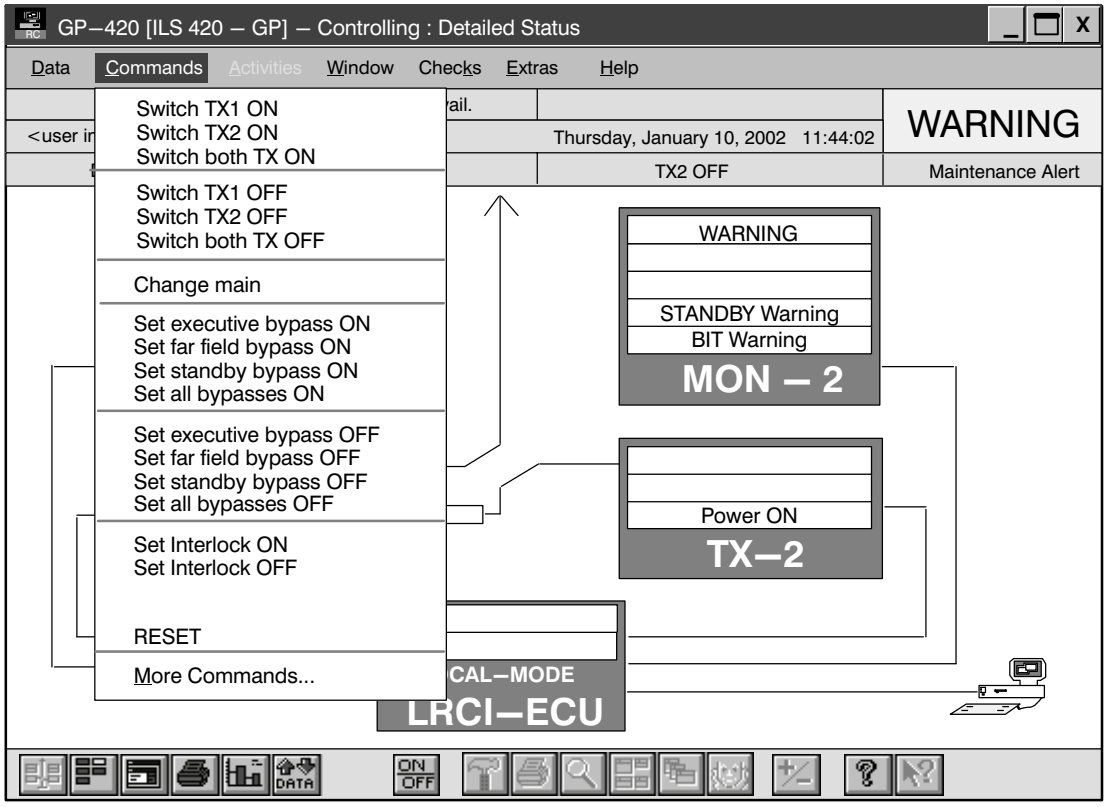


Fig. 7–2 Detailed Status window; menu COMMANDS (example)

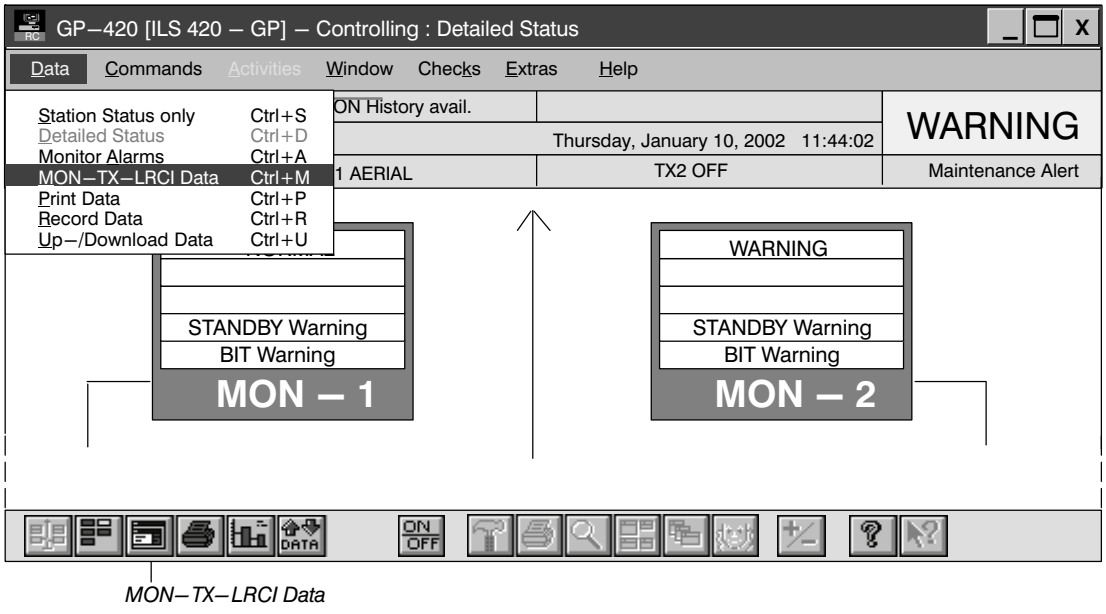


Fig. 7–3 Detailed Status window; menu DATA (example)

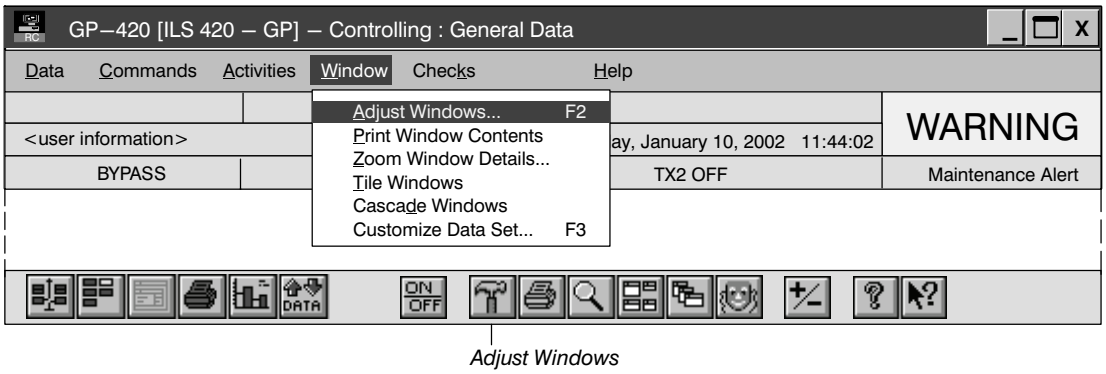


Fig. 7−4 General Data window; menu WINDOW (example)

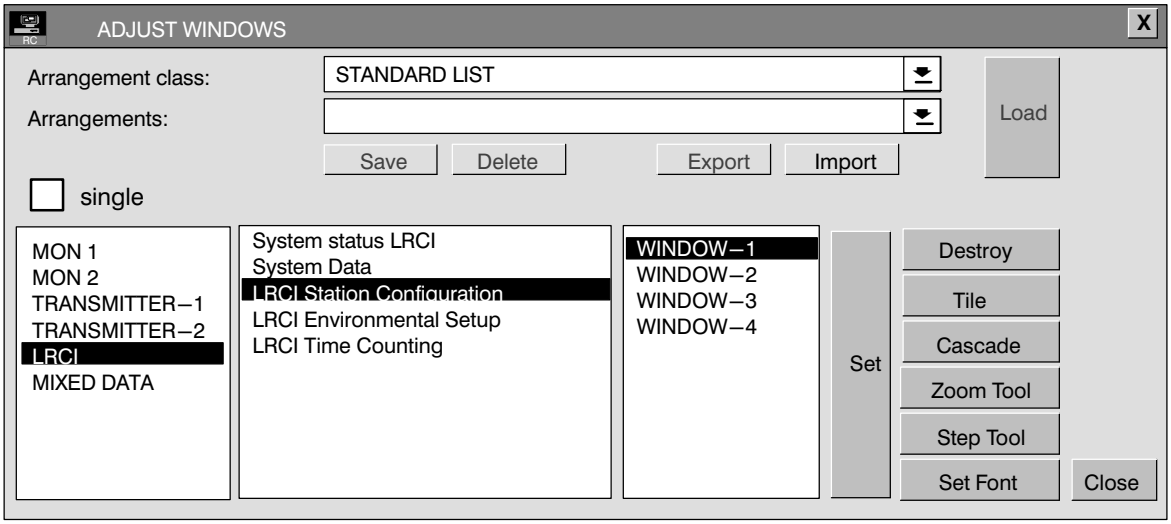


Fig. 7−5 ADJUST WINDOWS dialog window (example)

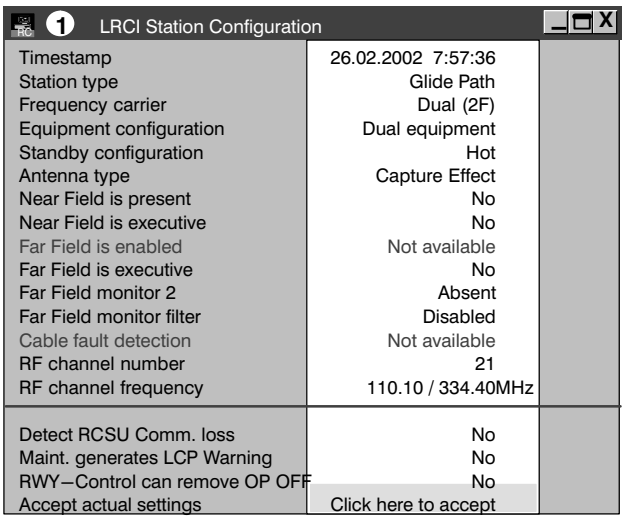


Fig. 7−6 LRCI Station Configuration window for parameter setting (example)

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 on TX1. Set TX1 on aerial.

c) Select TX1 Waveform Data #1 (use ADJUST WINDOWS), see Fig. 7−8.

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 off TX1.

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 Distribution of Distribution Unit (DU)

NOTE: As starting point it is assumed that all controls of the DU are set to mid position.

Measuring procedure:

– This check entails supplying the CRS CSB signal to the 3 inputs CSB, SBO and Clear of the DU, one after the other (see Sections 7.3.1b to 7.3.1d).

– 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).

– Switch off TX1 **before** connecting or disconnecting the CSB RF supply cable to individual inputs!

– 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.

– After the measurements, connect all RF cables as normal again.

a) Switch on TX1. Set TX1 on aerial.

b) CSB is supplied to input CSB (P+BL) of DU. Check power ratio: A1 : A2 =+6 dB (±0.2 dB)

NOTE: Corresponds to power ratio 3.6...4.4, note value .....dB

Correct with *Z1* of DU (Fig. 7−7) the ratio CSB A1/A2, if necessary.

NOTE: Note scale value.

CAUTION

Set CSB to 1 W before supplying to input SBO. Remove external attenuator if used!

c) Set CRS CSB to 1 W and supply to input SBO (BLS) of DU.

Check power ratio: A1 : A3 = 0 dB (±0.1 dB)

NOTE: Corresponds to power difference of ±2.3 %. Note value .....dB

Correct with *Z3* of DU (Fig. 7−7) the ratio SBO A1/A3, if necessary.

NOTE: Note scale value.

Check power ratio: A2 : A1/A3 = +6 dB (±0.2 dB)

NOTE: Corresponds to power ratio 3.6...4.4. Note value: .....dB

Verify the ratio SBO A2/(A1+A3) and correct with *Z2* of DU (Fig. 7−7), if necessary. Note scale value.

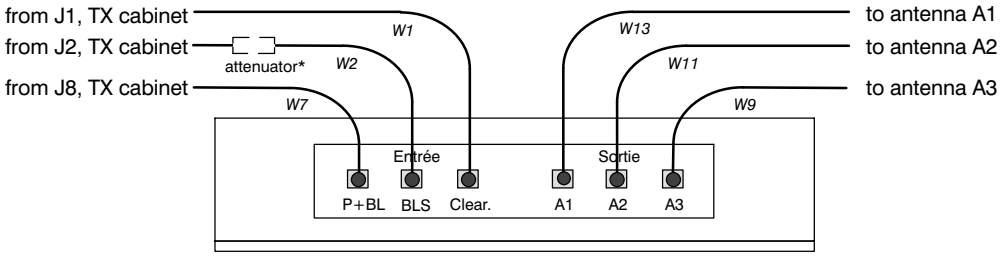
REMARK: Install 6 to 10 dB attenuator at PIN−diode transfer switch again if previously removed !

d) CSB supplied to input Clear of DU. Set CSB to 1 W.

Check power ratio: A1 : A3 = 0 dB (±0.2 dB)

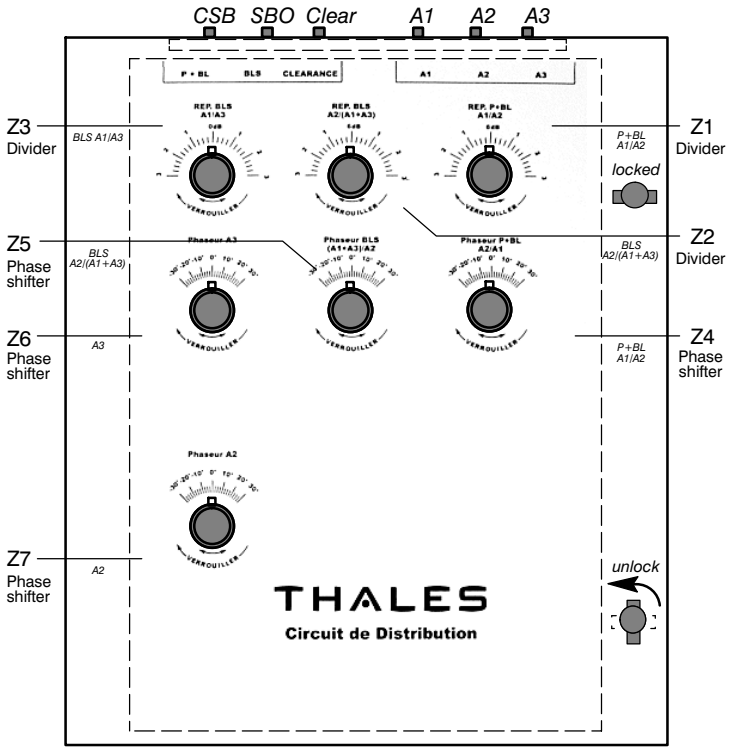
NOTE: Corresponds to power ratio difference of ±2.3 %. Note value: .....dB

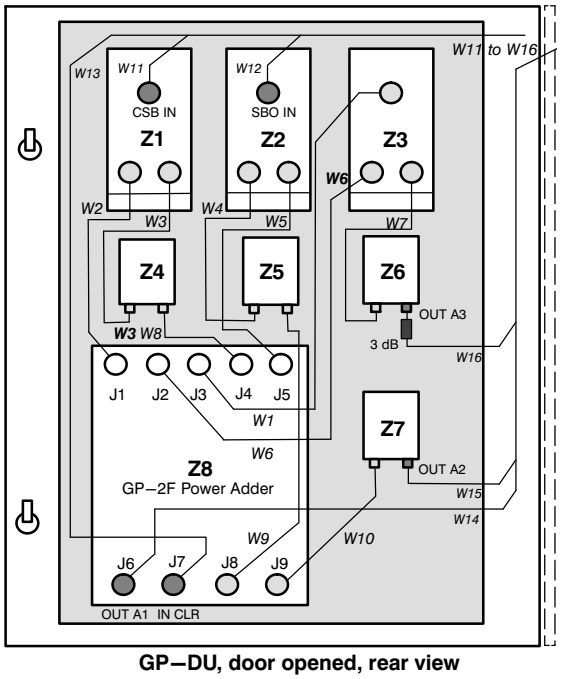
If not, the Distribution Unit GP−2F must be examined together with the measuring elements.



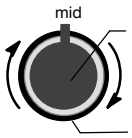
* an attenuator (6 to 10 dB) may be optionally inserted in SBO supply line

GP−DU, top panel connectors





GP−DU, door opened, rear view



Mechanical adjustment control knobs:
− Loosen locking ring.
− Adjust with control knob.
− Note scale position.
Default setting is mid position .

NOTE:
After adjustment of a control it has to be locked again to prevent unintentional setting!

Fig. 7−7 Distribution Unit (DU), GP−2F, standard

7.4 SETTING THE TRANSMITTER

7.4.1 CRS CSB Power

a) TX1 and TX2 switched off.

b) Connect cable to A1, coming from Distribution Unit, via wattmeter.

c) Switch both TX on and TX1 on aerial.

d) Select TX1 and TX2 Waveform Data #1 (use ADJUST WINDOWS), see Fig. 7−8.

e) 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) Switch TX2 on aerial.

h) Adjust TX2 according to TX1.

i) Switch TX1 and TX2 off.

j) Connect RF cable for A1 as normal again.

7.4.2 Clearance Power

a) TX1 and TX2 switched off.

b) Connect cable to A3, coming from Distribution Unit, via wattmeter.

c) Switch both TX on and TX1 on aerial.

d) Select TX1 and TX2 Waveform Data #1 (use ADJUST WINDOWS), see Fig. 7−8.

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) Select TX2 on aerial.

g) Adjust TX2 according to TX1

h) Switch TX1 and TX2 off.

i) Connect cable for A3 as normal again.

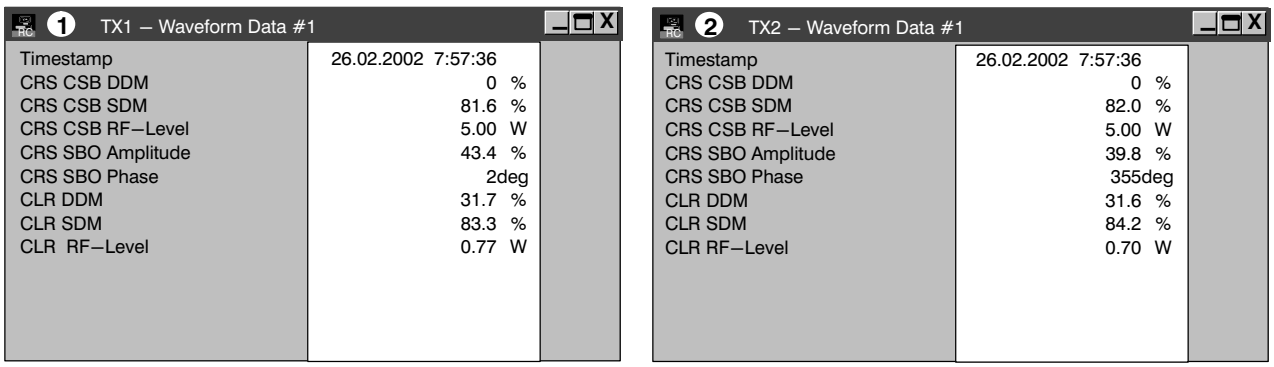


Fig. 7−8 ADJUST WINDOWS, window TX1 and TX2 Waveform Data #1 (example)

7.4.3 SDM and DDM Setting

7.4.3.1 SDM and DDM of CRS CSB (A1)

a) TX1 and TX2 switched off.

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

c) Switch on TX1.

d) Select TX1 and TX2 Waveform Data #1 (use ADJUST WINDOWS), see Fig. 7−8.

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

NOTE: CRS SBO Amplitude is set to 0 %.

f) Adjust CRS CSB DDM value to 0.0 % (90 > 150 Hz) on DDM instrument for 0° Forward Slope).

g) Switch on TX2.

h) Select TX2 as main transmitter (aerial).

i) Adjust TX2 according to TX1.

j) Switch both TX off.

k) Connect cable for A1 as normal again.

7.4.3.2 SDM and DDM of Clearance (A1,A3)

a) TX1 and TX2 switched off.

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

c) Switch on TX1.

d) Select TX1 and TX2 Waveform Data #1 (use ADJUST WINDOWS), see Fig. 7−8.

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 on TX2.

g) Select TX2 as main transmitter (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

NOTE: Phase shifter *Z4* of DU is normally not used for the first setup and remains in mid position.

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 DU (Fig. 7−7) 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 on TX1. Select TX1 Waveform Data #1 (use ADJUST WINDOWS), see Fig. 7−8.

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. 7−20.

g) Switch on TX2. Select TX2 as main transmitter (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

a) The following preliminary steps must be taken at the Distribution Unit (see Fig. 7−7):
- Connect output of A2 as normal again.
- Connect outputs A2 and A3 of the Distribution Unit to 50 ohm terminating resistors.
- Connect Field Receiver to integral monitor cable from A1.

NOTE: A1 radiates CSB and SBO.

b) Switch on TX1. Select TX1 Waveform Data #1 (use ADJUST WINDOWS), see Fig. 7−8.

c) Add +90° to the phase value determined in 7.5.1 e) and enter.

NOTE: Value of 7.5.1e) = ...°

d) If the DDM instrument does not indicate DDM 0, correct the CRS SBO phase with *Z5* of the Distribution Unit (Fig. 7−7) so that the DDM instrument indicates 0; the DDM instrument should indicate DDM with predominant 90 Hz (90 > 150 Hz).

NOTE: For normal M−Type operation the DDM is 0.25 in magnitude than the DDM of A2.

e) Switch off TX1.

7.5.3 A1/A2 Phasing

a) The following preliminary steps must be taken at the the Distribution Unit (see Fig. 7−7):
   - Connect output A1 and output A2 on Distribution Unit to the antennas as normal.
   - Terminate output A3 on Distribution Unit with 50 ohm load.
   - Disconnect cable *W3* at *Z4* and *W6* at *Z3* within Distribution Unit and terminate open connectors with 50 ohm load.

   NOTE: A1 radiates CSB and A2 radiates SBO.

b) Switch on TX1. Select TX1 Waveform Data #1 (use ADJUST WINDOWS), see Fig. 7−8.

c) Add +90° to the phase value determined in 7.5.1 e) and enter.

   NOTE: Value of 7.5.1e) = ...°

d) Set phase shifter *Z7* in the Distribution Unit (Fig. 7−7) 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 off TX1.

7.5.4 A1/A3 Phasing

a) The following preliminary steps must be taken at the the Distribution Unit (see Fig. 7−7):
   - Connect output A1 and output A3 on Distribution Unit to the antennas as normal.
   - Terminate output A2 on Distribution Unit with 50 ohm load.
   - Disconnect cable *W3* at *Z4* and *W6* at *Z3* within Distribution Unit and terminate open connectors with 50 ohm load.

   NOTE: A1 radiates CSB and A3 radiates SBO.

b) Switch on TX1. Select TX1 Waveform Data #1 (use ADJUST WINDOWS), see Fig. 7−8.

c) Add +90° to the phase value determined in 7.5.1 e) and enter.

   NOTE: Value of 7.5.1 e) = ...°

d) Set phase shifter *Z6* of the Distribution Unit (Fig. 7−7) 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) Switch off TX1.

g) Connect all antenna cables and cables within Distribution Unit as normal again.

7.6 SETTING THE MONITORS

See Figs. 7−9 to 7−13.

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. 7−10, 7−12 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 window ”MON1 − Nominal Values” (or ”MON2 − 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 !

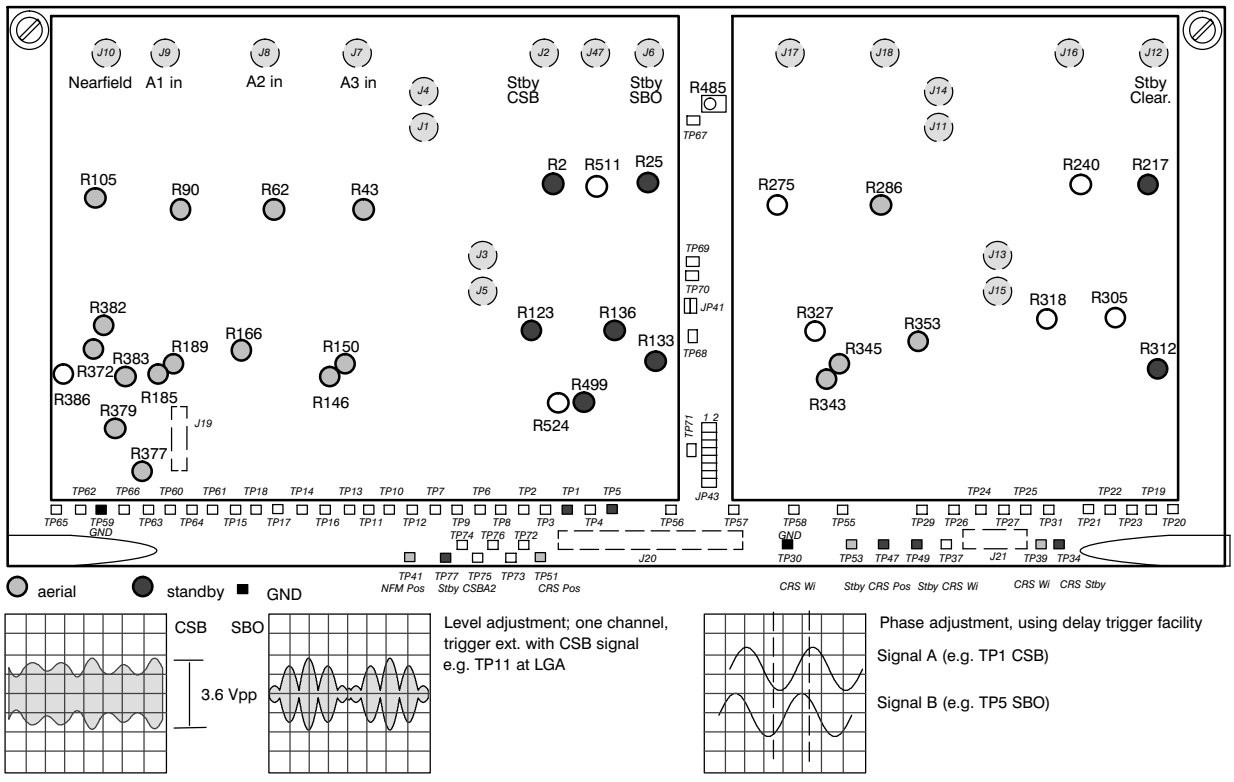


Fig. 7−9 Adjustment controls and test points of SOAC

7.6.1 Adjustment Procedure of Aerial Channels

See Fig. 7−9, 7−10, 7−11. 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))

– 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.

– 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.

– Check relative A1 − A3 phase with oscilloscope, measure between TP16 (A1) and TP9 (A3), see Fig. 7−10, 7−11. Adjust with R146 to 0°. R150 is factory set.

– 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.

7.6.1.2 **CRS Width channel** (Input connector J9 (A1), J8 (A2) and J7 (A3))

– Connect oscilloscope to TP12 and TP59 (GND).
Adjust IF gain of A2 path to measure approx. 6 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.

– Check relative A2 − A3 phase with oscilloscope, measure between TP13 (A2) and TP8 (A3), see Fig. 7−10, 7−11. Adjust with R166 to 180°.

– Check relative A1 − A3 phase with oscilloscope, measure between TP17 (A1) and TP8 (A3), see Fig. 7−10, 7−11. Adjust with R185 to 0°. R189 factory set.

– 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).

– 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.

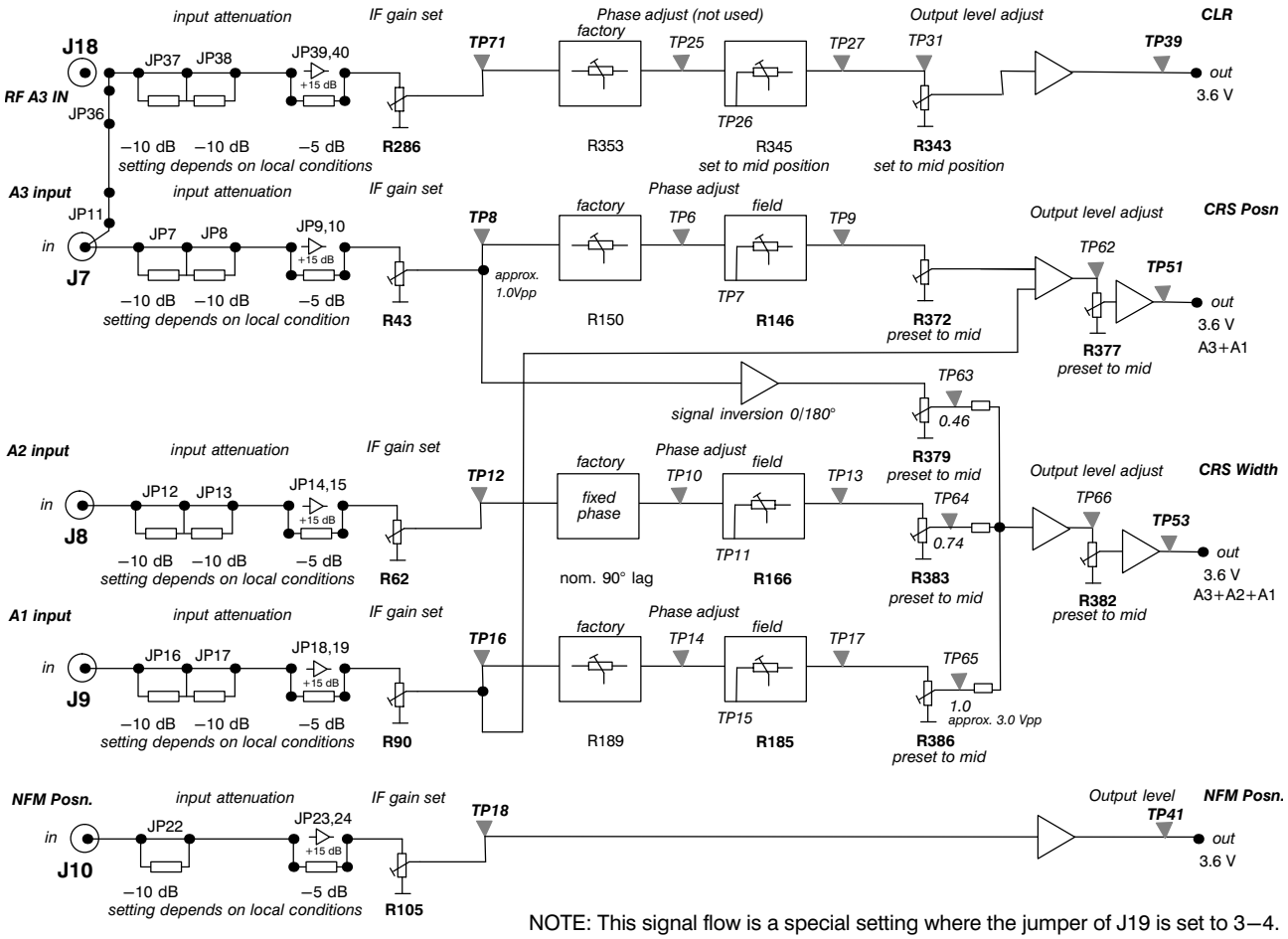
– Connect oscilloscope to TP39 and TP59 (GND). Measure output level.

– 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.)

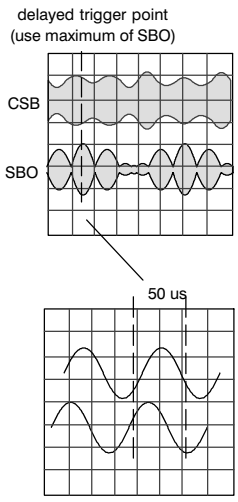
– Connect oscilloscope to TP41 and TP59 (GND). Measure output level.

– 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. 7−10 Adjustment of detector channels for aerial monitoring (GP−2F standard)



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 ADRACS 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. 7−11 Relative phase adjustment procedure

7.6.2 Adjustment Procedure of Standby Channels

See Fig. 7−9, 7−12, 7−13.

7.6.2.1 **StbyCRS Posn. channel** (Input connector J2)

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

– 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))

– 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.

– Check relative CSB − SBO phase with oscilloscope, measure between TP1 (CSB) and TP5 (SBO), see Fig. 7−13. Adjust with R136 to 0°. R123 is factory set. If R136 is not efficient, use also R123 for fine adjustment.

– 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.

7.6.2.3 **Stby CLR channel** (Input connector J12)

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

– 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.

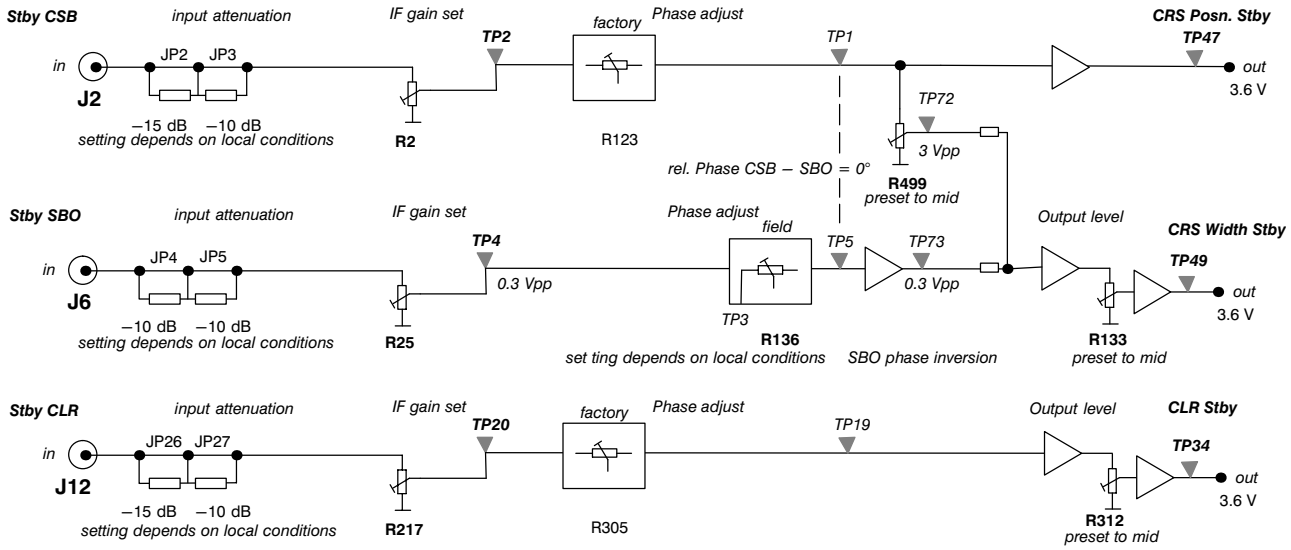
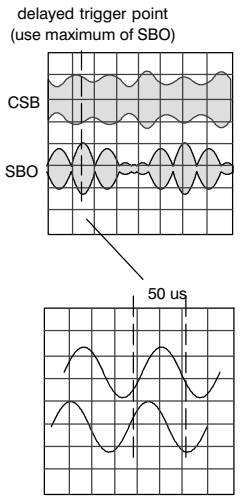


Fig. 7−12 Adjustment of detector channels for standby monitoring (GP−2F standard)



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 ADRACS 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. 7−13 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 TX1 on aerial.

7.6.3.1 Integral Monitoring POS (DDM 0 %)

a) RF−level of the corresponding path on the SOAC (Fig. 7−9, 7−10) is set to approx. 3.6 Vpp amplitude as described in 7.6.1.

b) Select window ”Nominal Values” (use ADJUST WINDOWS, see Fig. 7−5). Confirm nominal values (DDM 0 %; SDM 80 %) for EXEC CRS Position DDM and EXEC CRS Position SDM, see example Fig. 7−14.

c) Select in the tool bar ”Commands” and the window ”Monitor Calibration” (see Fig. 7−15).

d) Choose ”Executive CRS Pos. detector” and program MON1/2.

e) Select window ”Monitor Normalization” (Fig. 7−16).

f) Choose ”Executive CRS Pos. detector” and program MON1/2.

NOTE: The automatic normalisation 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. 7−9, 7−10) is set to approx. 3.6 Vpp amplitude as described in 7.6.1.

b) Select window ”Nominal Values” (use ADJUST WINDOWS, see Fig. 7−5). Confirm nominal values (DDM 17.5 %; SDM 80 %) for EXEC CRS Width DDM, see example Fig. 7−14.

c) Select TX1 Waveform Data #1. Note down values. Set CRS SBO RF Level to 0 %.

d) Select in the tool bar ”Commands” and the window ”Monitor Calibration” (see Fig. 7−15).

e) Choose ”Executive CRS Width detector” and program MON1/2.

f) 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 f). Proceed with g).

g) Select window ”Monitor Normalization” (Fig. 7−16).

h) Choose ”Executive CRS Width detector” and program MON1/2.

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. 7−9, 7−10) is set to approx. 3.6 Vpp amplitude as described in 7.6.1.

b) Select window ”Nominal Values” (use ADJUST WINDOWS, see Fig. 7−5). Confirm nominal values (DDM 30 %; SDM 80 %) for EXEC CLR Width DDM and EXEC CLR Width SDM, see example Fig. 7−14.

c) Select in the tool bar ”Commands” and the window ”Monitor Calibration” (see Fig. 7−15).

d) Choose ”Executive CLR Width detector” and program MON1/2.

e) Select window ”Monitor Normalization” (Fig. 7−16).

f) Choose ”Executive CLR Width detector” and program MON1/2.

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. 7−9, 7−10) to approx. 3.6 Vpp amplitude as described in 7.6.1.4.

b) Select window Nominal Values (use ADJUST WINDOWS, see Fig. 7−5). Confirm nominal values (DDM 0 %, SDM 80 %) for Nearfield DDM, see example Fig. 7−14.

c) Select in the tool bar ”Commands” and the window ”Monitor Calibration” (see Fig. 7−15).

d) Choose ”Executive Nearfield Pos. detector” (or ”Executive 4 detector”) and program MON1/2.

e) Select window ”Monitor Normalization” (Fig. 7−16).

f) Choose ”Executive Nearfield Pos. detector” (or ”Executive 4 detector”) and program MON1/2.

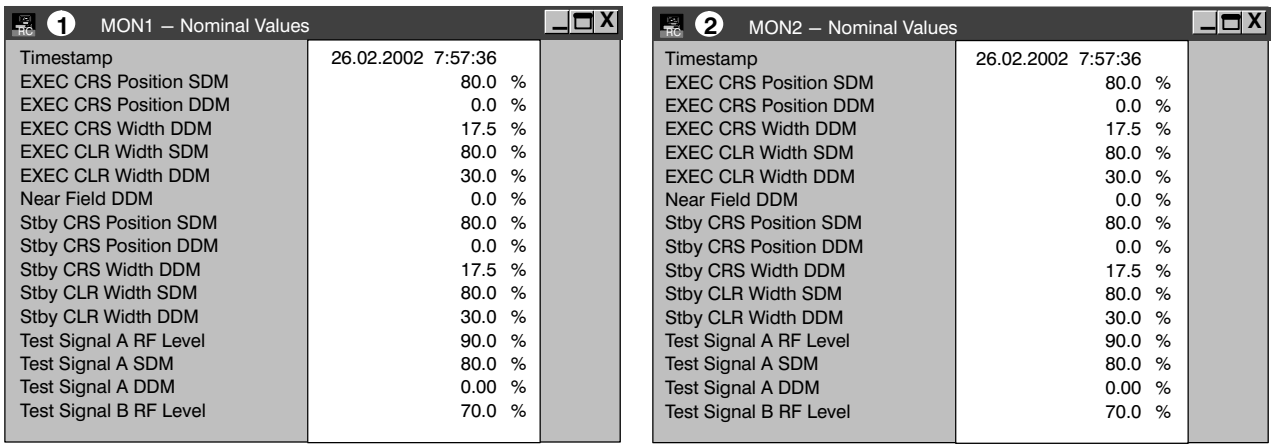


Fig. 7−14 ADJUST WINDOWS, selection of MON1 and MON2 Nominal Values (example)

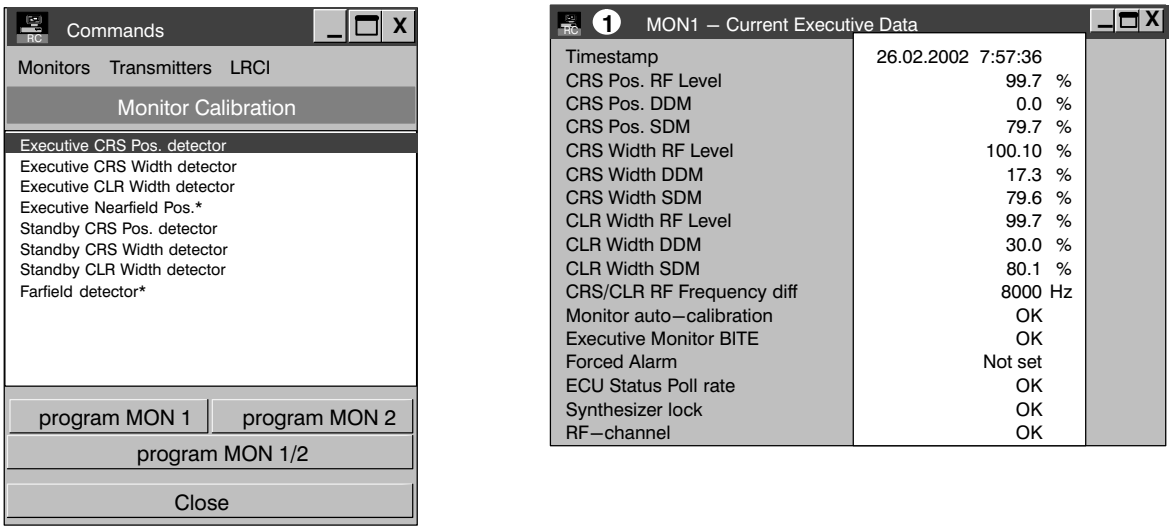
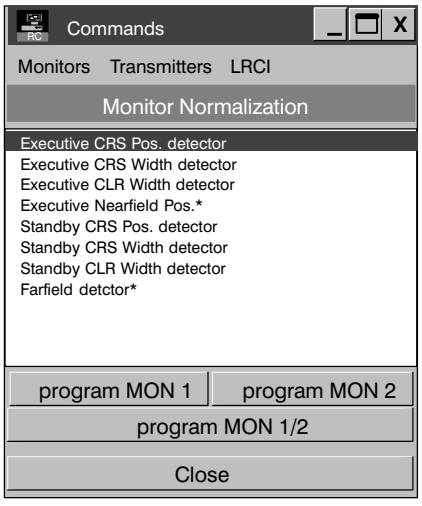


Fig. 7−15 Monitor Calibration commands, MON1 Current Executive Data (examples)



* NOTE:
Executive Nearfield Pos. = Executive 4 detector
Farfield detector = All Field detectors
Will be defined in LRCI Configuration window.

Fig. 7−16 Monitor Normalization commands (example)

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 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. 7−9, 7−12) is set to approx. 3.6 Vpp amplitude as described in 7.6.2.

b) Select window Nominal Values (use ADJUST WINDOWS, see Fig. 7−5). Confirm nominal values (DDM 30 %; SDM 80 %) for STBY CLR Width DDM and STBY CLR Width SDM, see example Fig. 7−14.

c) Select TX2 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) Select in the tool bar ”Commands” and the window ”Monitor Calibration” (see Fig. 7−15).

e) Choose ”Standby CLR Width detector” and program MON1/2.

f) Select window ”Monitor Normalization” (Fig. 7−16).

g) Choose ”Standby CLR Width detector” and program MON1/2.

7.6.4.2 Standby Monitoring CRS POS (DDM 0 %)

a) RF−level of the corresponding path on the SOAC (Fig. 7−9, 7−12) is set to approx. 3.6 Vpp amplitude as described in 7.6.2.

b) Select window Alarm Nominals (use ADJUST WINDOWS, see Fig. 7−8). Confirm nominal values (DDM 0 %; SDM 80 %) for STBY CRS Position DDM and STBY CRS Position SDM, see example Fig. 7−14.

c) Select in the tool bar ”Commands” and the window ”Monitor Calibration” (see Fig. 7−15).

d) Choose ”Standby CRS Pos. detector” and program MON1/2.

e) Select window ”Monitor Normalization” (Fig. 7−16).

f) Choose ”Standby CRS Pos. detector” and program MON1/2.

7.6.4.3 Standby Monitoring CRS WIDTH (DDM 17.5 %)

a) RF−level of the corresponding path on the SOAC (Fig. 7−9, 7−12) is set to approx. 3.6 Vpp amplitude as described in 7.6.2.

b) Select window Nominal Values (use ADJUST WINDOWS, see Fig. 7−5). Confirm nominal values (DDM 17.5 %; SDM 80 %) for STBY CRS Width DDM, see example Fig. 7−14.

c) Select TX2 Waveform Data #1. Note down values. Set CRS SBO RF Level of standby transmitter to 0 %.

d) Select in the tool bar ”Commands” and the window ”Monitor Calibration” (see Fig. 7−15).

e) Choose ”Standby CRS Width detector” and program MON1/2.

f) Restore value of CRS SBO RF Level back to noted down 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.

g) Select window ”Monitor Normalization” (Fig. 7−16).

h) Choose ”Standby CRS Width detector” and program MON1/2.

7.6.5 Check Alarm Limits

See Figs. 7−17, 7−18.

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) Select window MON 1 and MON 2 Executive Alarm Limits (use ADJUST WINDOWS, Figs. 7−5, 7−17).

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).

NOTE: Values of g) to i) are the alarm limits for the optional nearfield monitor.

7.6.5.2 Standby Alarm Limits

a) Select window MON 1 and MON 2 Standby Alarm Limits (use ADJUST WINDOWS, Figs. 7−5, 7−18).

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).

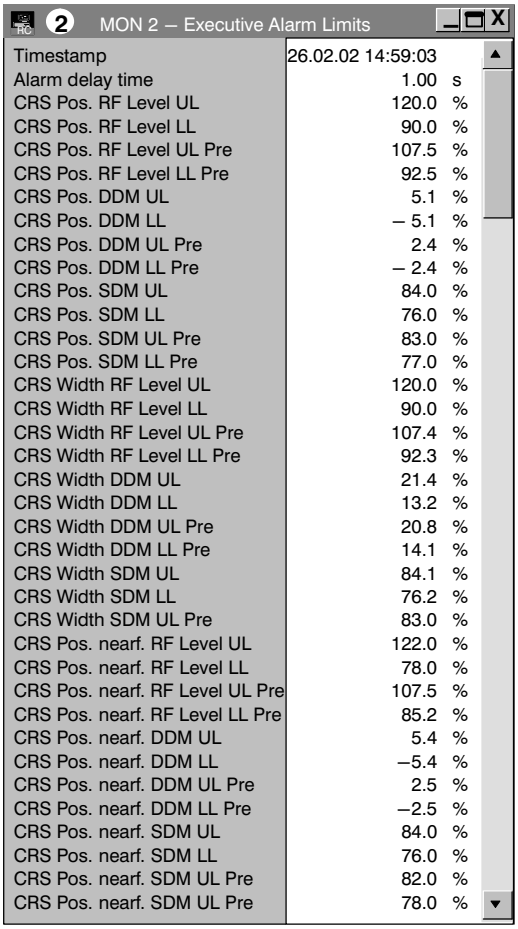
d) Check that POS DDM alarm limits for all monitors are set to:
−5.4 % (lower limit) and +5.4 % (upper limit) (CAT I to III).

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 !

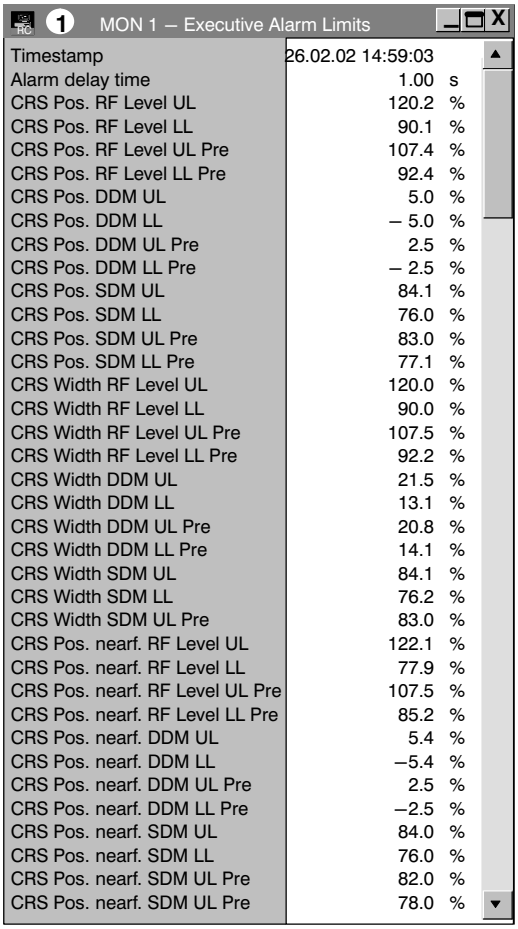
f) Check that CLR WIDTH DDM alarm limits for all monitors are set to:
−4 % (lower limit) and +4 % (upper limit) of the actual measured value.

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



2 MON 2 – Executive Alarm Limits

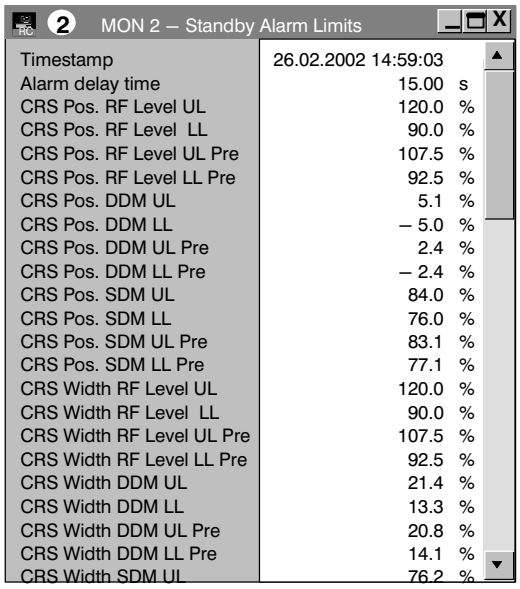
Timestamp	26.02.02 14:59:03	
Alarm delay time	1.00	s
CRS Pos. RF Level UL	120.0	%
CRS Pos. RF Level LL	90.0	%
CRS Pos. RF Level UL Pre	107.5	%
CRS Pos. RF Level LL Pre	92.5	%
CRS Pos. DDM UL	5.1	%
CRS Pos. DDM LL	– 5.1	%
CRS Pos. DDM UL Pre	2.4	%
CRS Pos. DDM LL Pre	– 2.4	%
CRS Pos. SDM UL	84.0	%
CRS Pos. SDM LL	76.0	%
CRS Pos. SDM UL Pre	83.0	%
CRS Pos. SDM LL Pre	77.0	%
CRS Width RF Level UL	120.0	%
CRS Width RF Level LL	90.0	%
CRS Width RF Level UL Pre	107.4	%
CRS Width RF Level LL Pre	92.3	%
CRS Width DDM UL	21.4	%
CRS Width DDM LL	13.2	%
CRS Width DDM UL Pre	20.8	%
CRS Width DDM LL Pre	14.1	%
CRS Width SDM UL	84.1	%
CRS Width SDM LL	76.2	%
CRS Width SDM UL Pre	83.0	%
CRS Pos. nearf. RF Level UL	122.0	%
CRS Pos. nearf. RF Level LL	78.0	%
CRS Pos. nearf. RF Level UL Pre	107.5	%
CRS Pos. nearf. RF Level LL Pre	85.2	%
CRS Pos. nearf. DDM UL	5.4	%
CRS Pos. nearf. DDM LL	–5.4	%
CRS Pos. nearf. DDM UL Pre	2.5	%
CRS Pos. nearf. DDM LL Pre	–2.5	%
CRS Pos. nearf. SDM UL	84.0	%
CRS Pos. nearf. SDM LL	76.0	%
CRS Pos. nearf. SDM UL Pre	82.0	%
CRS Pos. nearf. SDM UL Pre	78.0	%



1 MON 1 – Executive Alarm Limits

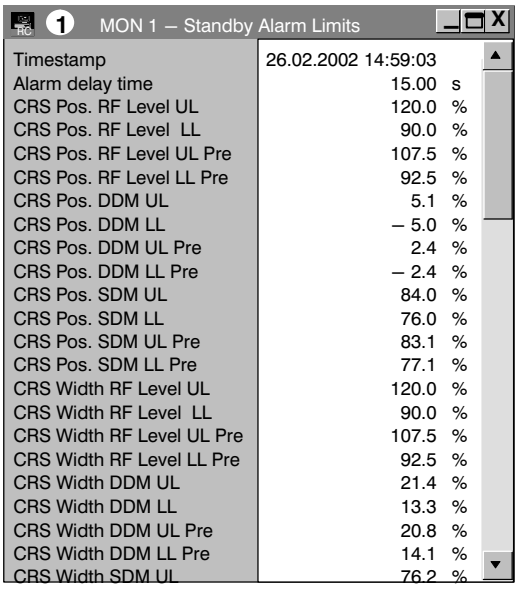
Timestamp	26.02.02 14:59:03	
Alarm delay time	1.00	s
CRS Pos. RF Level UL	120.2	%
CRS Pos. RF Level LL	90.1	%
CRS Pos. RF Level UL Pre	107.4	%
CRS Pos. RF Level LL Pre	92.4	%
CRS Pos. DDM UL	5.0	%
CRS Pos. DDM LL	– 5.0	%
CRS Pos. DDM UL Pre	2.5	%
CRS Pos. DDM LL Pre	– 2.5	%
CRS Pos. SDM UL	84.1	%
CRS Pos. SDM LL	76.0	%
CRS Pos. SDM UL Pre	83.0	%
CRS Pos. SDM LL Pre	77.1	%
CRS Width RF Level UL	120.0	%
CRS Width RF Level LL	90.0	%
CRS Width RF Level UL Pre	107.5	%
CRS Width RF Level LL Pre	92.2	%
CRS Width DDM UL	21.5	%
CRS Width DDM LL	13.1	%
CRS Width DDM UL Pre	20.8	%
CRS Width DDM LL Pre	14.1	%
CRS Width SDM UL	84.1	%
CRS Width SDM LL	76.2	%
CRS Width SDM UL Pre	83.0	%
CRS Pos. nearf. RF Level UL	122.1	%
CRS Pos. nearf. RF Level LL	77.9	%
CRS Pos. nearf. RF Level UL Pre	107.5	%
CRS Pos. nearf. RF Level LL Pre	85.2	%
CRS Pos. nearf. DDM UL	5.4	%
CRS Pos. nearf. DDM LL	–5.4	%
CRS Pos. nearf. DDM UL Pre	2.5	%
CRS Pos. nearf. DDM LL Pre	–2.5	%
CRS Pos. nearf. SDM UL	84.0	%
CRS Pos. nearf. SDM LL	76.0	%
CRS Pos. nearf. SDM UL Pre	82.0	%
CRS Pos. nearf. SDM UL Pre	78.0	%

Fig. 7–17 Window Executive Alarm Limits (example)



2 MON 2 – Standby Alarm Limits

Timestamp	26.02.2002 14:59:03	
Alarm delay time	15.00	s
CRS Pos. RF Level UL	120.0	%
CRS Pos. RF Level LL	90.0	%
CRS Pos. RF Level UL Pre	107.5	%
CRS Pos. RF Level LL Pre	92.5	%
CRS Pos. DDM UL	5.1	%
CRS Pos. DDM LL	– 5.0	%
CRS Pos. DDM UL Pre	2.4	%
CRS Pos. DDM LL Pre	– 2.4	%
CRS Pos. SDM UL	84.0	%
CRS Pos. SDM LL	76.0	%
CRS Pos. SDM UL Pre	83.1	%
CRS Pos. SDM LL Pre	77.1	%
CRS Width RF Level UL	120.0	%
CRS Width RF Level LL	90.0	%
CRS Width RF Level UL Pre	107.5	%
CRS Width RF Level LL Pre	92.5	%
CRS Width DDM UL	21.4	%
CRS Width DDM LL	13.3	%
CRS Width DDM UL Pre	20.8	%
CRS Width DDM LL Pre	14.1	%
CRS Width SDM UL	76.2	%



1 MON 1 – Standby Alarm Limits

Timestamp	26.02.2002 14:59:03	
Alarm delay time	15.00	s
CRS Pos. RF Level UL	120.0	%
CRS Pos. RF Level LL	90.0	%
CRS Pos. RF Level UL Pre	107.5	%
CRS Pos. RF Level LL Pre	92.5	%
CRS Pos. DDM UL	5.1	%
CRS Pos. DDM LL	– 5.0	%
CRS Pos. DDM UL Pre	2.4	%
CRS Pos. DDM LL Pre	– 2.4	%
CRS Pos. SDM UL	84.0	%
CRS Pos. SDM LL	76.0	%
CRS Pos. SDM UL Pre	83.1	%
CRS Pos. SDM LL Pre	77.1	%
CRS Width RF Level UL	120.0	%
CRS Width RF Level LL	90.0	%
CRS Width RF Level UL Pre	107.5	%
CRS Width RF Level LL Pre	92.5	%
CRS Width DDM UL	21.4	%
CRS Width DDM LL	13.3	%
CRS Width DDM UL Pre	20.8	%
CRS Width DDM LL Pre	14.1	%
CRS Width SDM UL	76.2	%

Fig. 7–18 Window Standby Alarm Limits (example)

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 relais located on the BP—PS subrack.

a) Select window ”LRCI — Environmental Setup” (use ADJUST WINDOWS, see Fig. 7—5 and example Fig. 7—19).

b) Enable ”Battery Low Monitoring” 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.

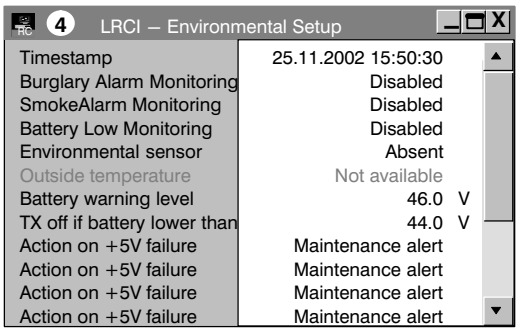


Fig. 7—19 Window LRCI — Environmental Setup (example)

7.8 NORMAL OPERATION

a) Switch on both TX 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) Deactivate bypass for Monitor 1 and Monitor 2.

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.

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 off TX1.

b) Loosen antenna cables for A1, A2, A3 at connector panel on top of the Distribution Unit. Terminate outputs of the Distribution Unit for A2, A3 with 50 ohm/10 W.

c) Connect the antenna to be checked directly to output for A1 at connector panel of the Distribution Unit.

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

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

e) Switch off TX1.

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 normally not 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 'Course Position Integral' in 7.6.3.1.

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 TX1/TX2 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 on TX1.

b) According to the announcement of the flight check crew the transmitter parameter CRS CSB DDM and the CRS SBO Amplitude must be corrected in proportion to the determined offset. Use command 'Width adjustment' to correct all three parameters in the same percentage.

NOTE: The altering correspond to the SBO altering for the standard Glide Path.

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) Select indication 'Exec. CRS Pos. DDM" in "Current Exec. Data".

b) Change CRS CSB DDM in "Waveform Data #1" (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) Select indication 'Exec. CRS Width DDM" in "Current Exec. Data"..

b) Change course width with command 'Width Adjustment' to reach the preset alarm limits.

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.

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:

$H_{Mon} = D_{Mon} \ x \ \tan \theta_0$

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 TX1 off.

e) Remove supply cable for A2 on top of transmitter cabinet. Terminate output of cabinet for A2 with 50 ohm/10 W.
Remove cable *W6* at *Z3* within Distribution Unit (see Fig. 7−7) and terminate open connectors with 50 ohm load.

NOTE: A1 radiates CSB and A3 radiates SBO.

f) Switch on TX1.

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 *W6* to *Z3* within Distribution Unit again.

k) Switch on TX1.

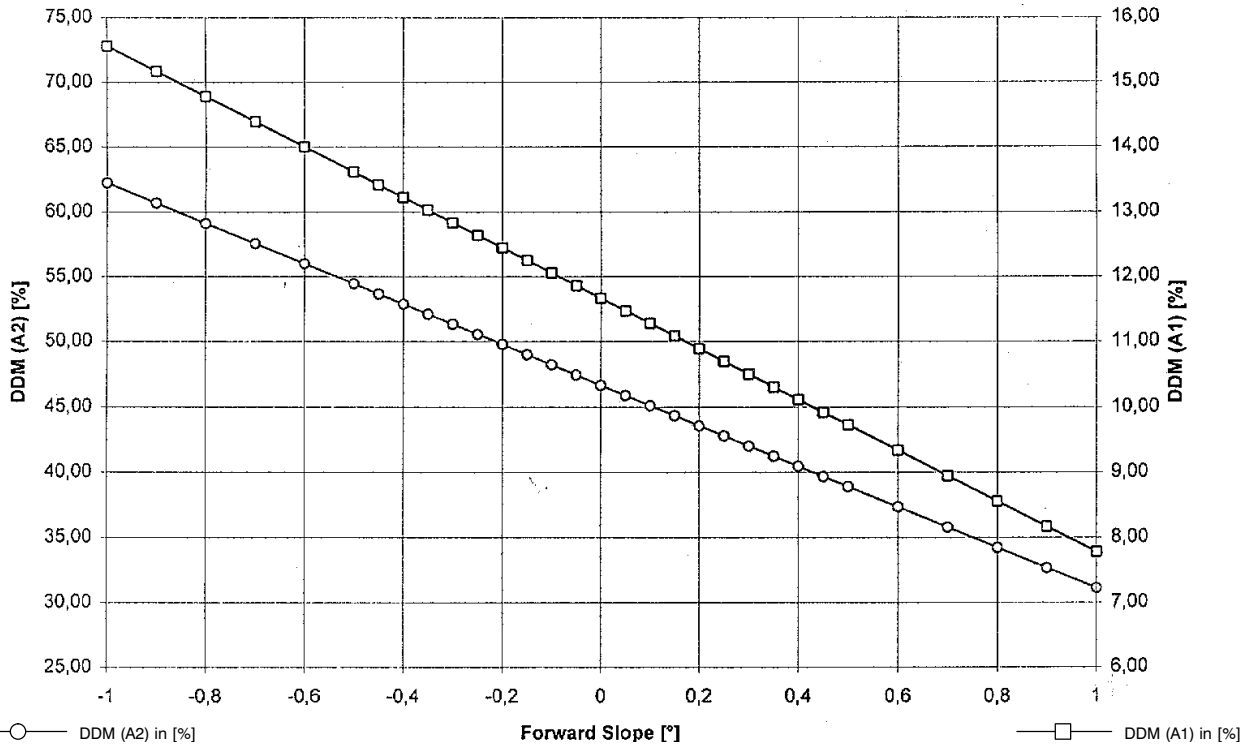
l) Setting of transmitter:

- 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 %).



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. 7−20 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 % (70 % possible)	(3.1.5.7.1)	71 % ... 129 % *	
RF Level (Nearfield)			71 % ... 129 % *	

* 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°