THALES

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Description, Installation, Operation, Maintenance Reference: Vol. 1 Code 955 900 031 C

GROUND BEACON

DME 415/435

Technical Manual

VOLUME 1

Equipment description, Installation, Operation, Maintenance and PC user

SECTION 2

INSTALLATION

Vers. D, September 2005

Table of CONTENTS

List of FIGURES

List of TABLES

SECTION 2

INSTALLATION

2.1 GENERAL INSTALLATION INFORMATION

2.1.1 Safety Precautions

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

2.1.1.1 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.

Damage caused by animals is highly improbable. The door of the shelter or equipment room should be locked in the absence of the personnel.

2.2 INSTALLATION PRELIMINARY

The operator must perform the following operations when installing the beacon:

- Select and prepare the site;
- Unpacking, Paging and shipping;
- Typical installation
  - ground the equipment;
  - connect the power supplies;
  - connect the antenna.
  - I/O connections

  The following connections may also be necessary, depending on the beacon configuration selected and the options used:
  - connection the facility with associated equipment;
  - connection with other equipment.

2.3 INSTALLATION SITE SELECTION

The area in which a DME 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 type of obstacle. Also clearance and runway configuration (e.g. overrun, clearway, stopway) in case located in terminal area.

The following site selection guidelines are general recommendation and only guiding values for information. The exact values are locally dependent decisions, which are made during installation. They are computed with formulas, which take in account of terrain, obstacles and other. See Appendix "A – DME Antenna Siting Area Criteria", on this volume.

The installation is determined by means of a site survey at which a surveyor must always be present.
THALES Italia s.p.a. is able to provide engineering consultants on site for this survey.

The DME installation area selection depends on the following using conditions:

1) Terminal Area beacon

   a) DME (substituting or integrating MARKER functions) placed with ILS equipment
   In this case, DME antenna, usually directional antenna, is mounted on Glide Slope antenna mast and the DME equipment is installed into Glide Path shelter.

   b) Stand-alone
   DME with omnidirectional antenna on its own mast and equipment installed into a suitable shelter. The area is dependent on clearance and runway configuration.

2) In route beacon

   (External zone site and normally far away from terminal area), with or without associated VOR equipment: see Appendix "A – DME Antenna Siting Area Criteria", on this volume

2.4 EQUIPMENT SITE LOCATION

The ground beacon may be installed in a control room or inside a shelter, which complies with the environmental temperature, humidity and pressure values listed in Section 4. Bear in mind that the equipment has the following overall dimensions:

- height: 1730 mm,
- width: 580 mm,
- depth: 635 mm cabinet code 297509007or 610 mm cabinet code 297509004

the amount of space around the equipment must be as follows:

- more than a value between the rear part of the beacon and the wall or any other piece of equipment, to allow the operator to open the rear door of the equipment.
  Make it possible support the back part of the cabinet to a wall, in as all the operations of cables and connectors assemblage, could be performed on front.
- a minimum of 30 cm between the top of the beacon and the ceiling of the control room or the shelter to leave space for the external connection cables and to allow access to the antenna connector and to the antenna probes connectors;
- a minimum of 60 cm between the front of the beacon and the wall or any other piece of equipment, to allow the operator to open the front door.

The base must be able to support the total weight of the equipment (approx. 200/230 kg including the optional modules) within the range of dynamic stress envisaged for the equipment.

The beacon does not normally need securing; if it is to be secured to the base, however, four M12 bolts should be used and their fixing holes.

2.5 UNPACKING, PACKING AND SHIPPING;

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 section 4 must be conformed to. The check list is inside the packing to which to refer.

The DME beacon and modules will be packed according to the national and international standards. The packing procedure may be slightly different according to the way of shipping or to the destination country.

2.6 TYPICAL INSTALLATION

Figure 2.8 shows all the connections for beacon installation. Should this use an I/O system provided with the LCSU unit in standard configuration; this figure also illustrates the characteristics of the cables used for installation and provided by the manufacturer, as listed in table 2.1. The main characteristics of installation cables are on figures 2.1 to 2.7. The reference item is shown on figures, internal at a circle.

WARNING

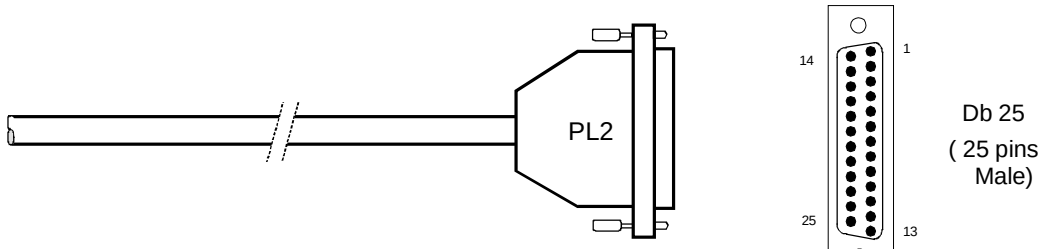
Before connecting the cables check that the mains lead is dead and that the battery is not connected (the breaker of mains and battery, on external electrical switchboard, must be OFF).

2.6.1 Installation cables

. The main characteristics of installation cables are on figures 2.1 to 2.7. and in table 2-1.

Table 2-1 - List of typical installation cables

REF.	CABLE	LENGTH (m)	NOTE
1	GROUND CABLE **(option)**	15	Single wire section:25 mm^2. External wire covering: Ø=11 mm, green/yellow color
2	MAINS POWER SUPPLY CABLE **(option)**	15	Three wires section 2,5mm^2 each – External cable covering Ø=15,2 mm
3	BATTERY CABLE (RO) **(option)**	15	Single wire section:10 mm^2 - External wire covering: Ø=7,6 mm; red color
4	BATTERY CABLE (NE) **(option)**	15	Single wire section:10 mm^2 - External wire covering Ø=7,6 mm; black color
5	AUX OUT I/O CABLE **(option)**	10	see figure 2.1
6	AUX IN I/O CABLE **(option)**	10	see figure 2.2
7	LOCAL PC SERIAL CABLE	3	see figure 2.3
8	RS-232 EXTERNAL MODEM CABLE **(option)**	3	see figure2.4
9	INTERFACE FACILITY CABLE	10	see figure 2.5
10	TELEPHONE CABLE **(option)**	15	Two pair twisted wire telephone cable (screened)
11	LOW LOSS ½" ANTENNA CABLE	25	see figure 2.6.
12	LOW LOSS ½" MONITOR CABLE	25	see figure 2.6.
13	LOW LOSS ½" MONITOR CABLE	25	see figure 2.6.
14	OBSTRUCTION LIGHT CABLE **(option)**	25	see figure 2.7 Three wire 1,5 mm^2 shielded cable



PIN n°	Wire Covering Color
1	White
2	Brown
3	Green bright
4	Yellow
5	Gray
6	Pink
7	Bleu (dark)
8	Red
9	Black

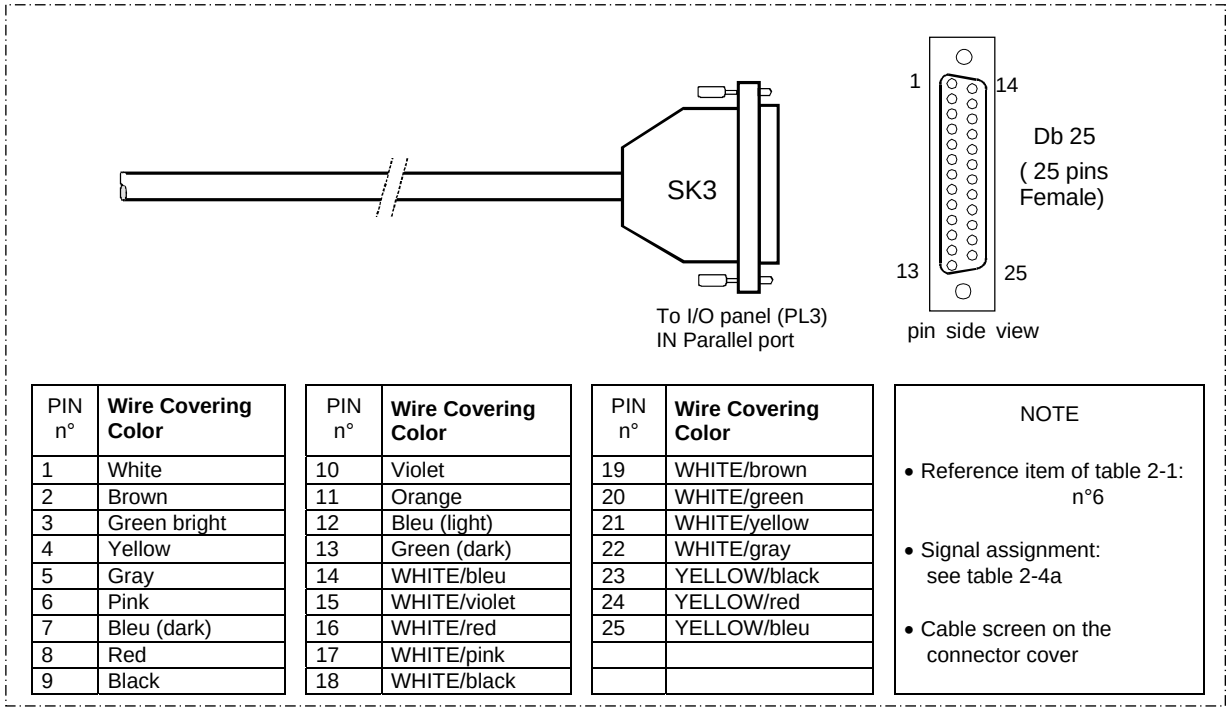
PIN n°	Wire Covering Color
10	Violet
11	Orange
12	Bleu (light)
13	Green (dark)
14	WHITE/bleu
15	WHITE/violet
16	WHITE/red
17	WHITE/pink
18	WHITE/black

PIN n°	Wire Covering Color
19	WHITE/brown
20	WHITE/green
21	WHITE/yellow
22	WHITE/gray
23	YELLOW/black
24	YELLOW/red
25	YELLOW/bleu

NOTE

- Reference item of table 2-1: n°5
- Signal assignment: see table 2-4b
- Cable screen on the connector cover

Figure 2.1. AUX OUT I/O cable



PIN n°	Wire Covering Color
1	White
2	Brown
3	Green bright
4	Yellow
5	Gray
6	Pink
7	Bleu (dark)
8	Red
9	Black

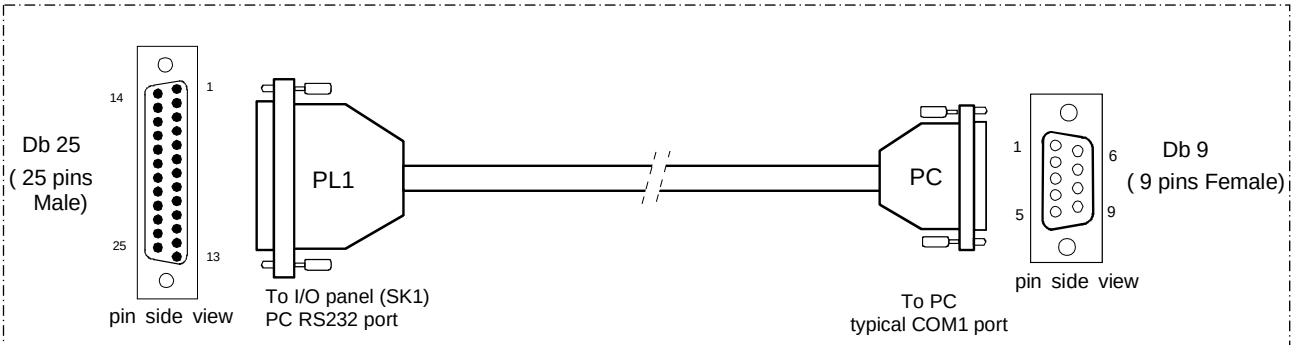
PIN n°	Wire Covering Color
10	Violet
11	Orange
12	Bleu (light)
13	Green (dark)
14	WHITE/bleu
15	WHITE/violet
16	WHITE/red
17	WHITE/pink
18	WHITE/black

PIN n°	Wire Covering Color
19	WHITE/brown
20	WHITE/green
21	WHITE/yellow
22	WHITE/gray
23	YELLOW/black
24	YELLOW/red
25	YELLOW/bleu

NOTE

- Reference item of table 2-1: n°6
- Signal assignment: see table 2-4a
- Cable screen on the connector cover

Figure 2.2. AUX IN I/O cable



PIN n°	PL1 Signal assignment
1	-
2	RXD
3	TXD
4	CTS
5	RTS
6	DTR
7	GND
8	DCD
9	-

PIN n°	PL1 Signal assignment
10	-
11	-
12	-
13	-
14	-
15	-
16	-
17	-
18	-

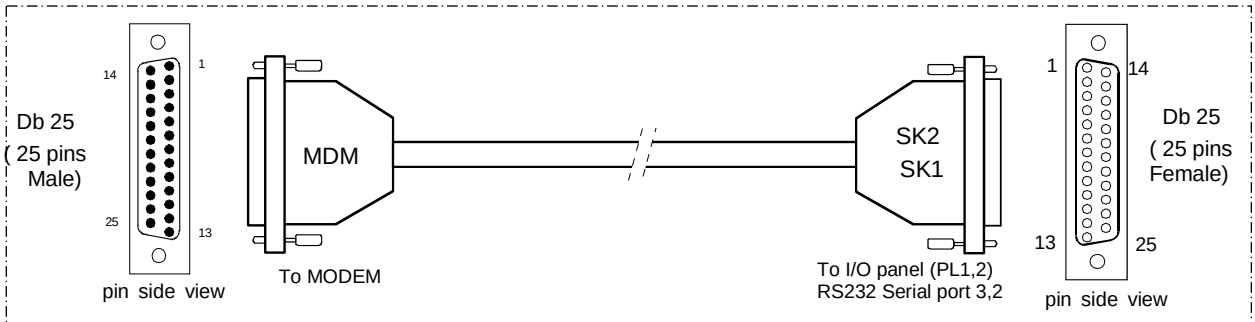
PIN n°	PL1 Signal assignment
19	-
20	DSR
21	-
22	RI
23	-
24	-
25	-

PIN n°	PC Signal assignm.
1	DCD
2	RXD
3	TXD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	RI

NOTE

- Reference item of table 2-1: n°7

Figure 2.3. PC serial cable



PIN n°	Signal assignment
1	-
2	TXD1/2
3	RXD1/2
4	RTS1/2
5	CTS1/2
6	DSR 1/2
7	GND
8	DCD1/2
9	-

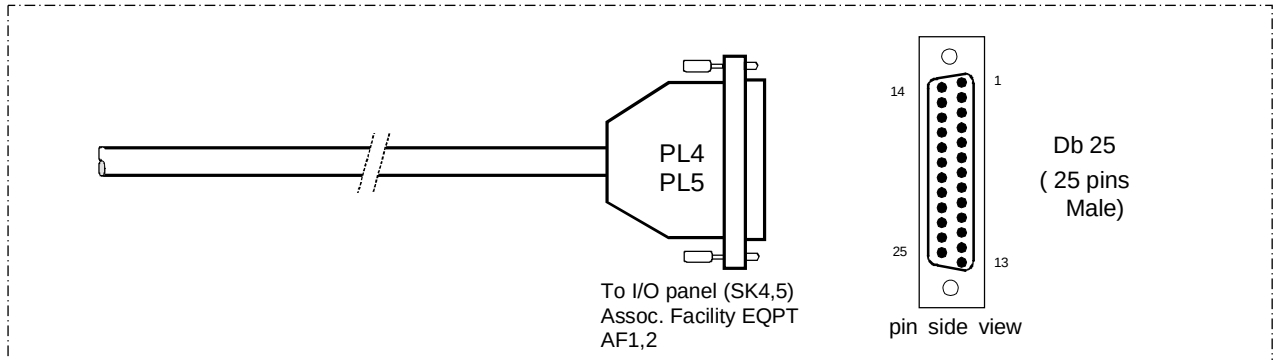
PIN n°	Signal assignment
10	-
11	-
12	-
13	-
14	-
15	TXCK1/2
16	-
17	RXCK1/2
18	-

PIN n°	Signal assignment
19	-
20	DTR1/2
21	-
22	RI 1/2
23	-
24	-
25	-

NOTE

- Reference item of table 2-1: n°8

Figure 2.4. RS232 External Modem cable



PIN n°	Wire Covering Color	
	STD	Alternative
1	White	Black
2	Brown	White
3	Green bright	Red
4	Yellow	Green
5	Gray	Orange
6	Pink	Bleu
7	Bleu (dark)	White/blk
8	Red	Red/black
9	Black	Green/blk

PIN n°	Wire Covering Color	
	STD	Alternative
10	Violet	Oran/blck
11	Orange	Bleu/blk
12	Bleu (light)	Black/whi
13	Green (dark)	Red/white
14	WHITE/bleu	Green/wh
15	WHITE/violet	Bleu/whit
16	WHITE/red	Black/red
17	WHITE/pink	White/red
18	WHITE/black	Oran/blk

PIN n°	Wire Covering Color	
	STD	Alternative
19	WHITE/brown	Bleu/red
20	WHITE/green	Red/gre
21	WHITE/yellow	Oran/gre
22	WHITE/gray	Blk/Wh/rd
23	YELLOW/black	Wh/blk/rd
24	YELLOW/red	Rd/blk/wh
25	YELLOW/bleu	Gr/blk/wh

NOTE

- Reference item of table 2-1: n°9
- Signal assignment: see table 2-6
- Cable screen on the connector cover

Figure 2.5. Interface Facility cable

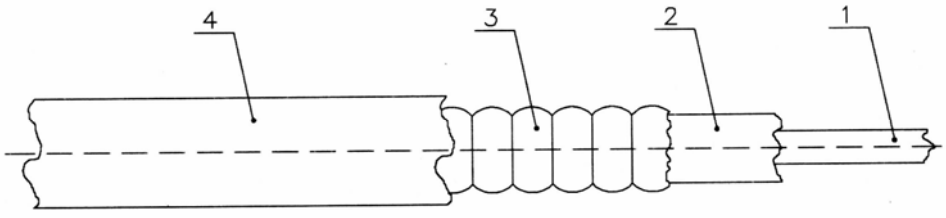
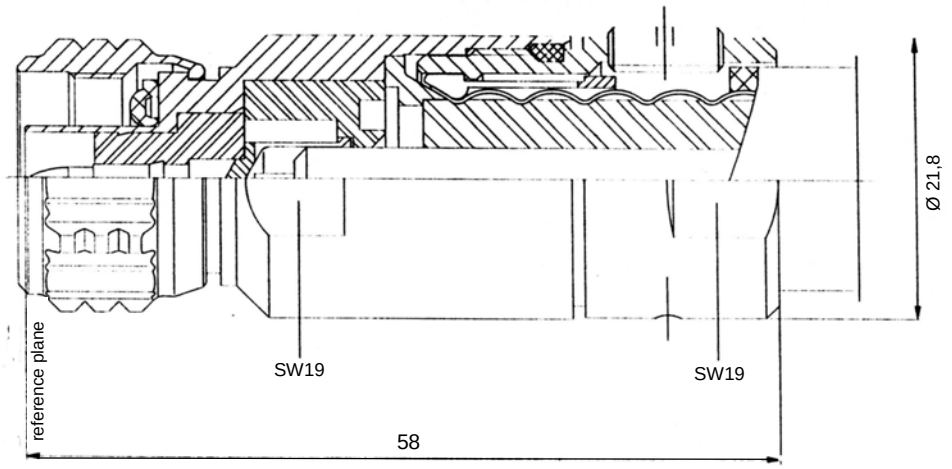


Table 2-2 - RF coax cable LCF 1/2" CU2Y type - Technical specification

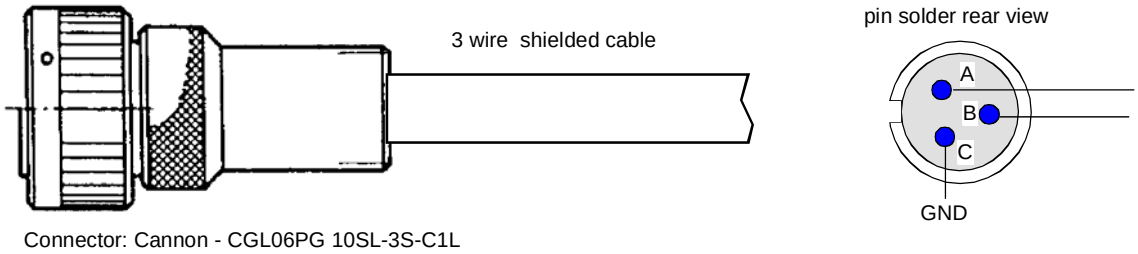
item	Mechanical		Electrical data	
1	Inner conductor	Ø 4,8 mm AL/CU clad	Characteristic impedance	50 ±1Ω
			Relative propagation velocity	88%
2	Dielectric	Ø 11,5 mm Foam PE	Capacity	76 pF/m
3	Outer conductor	Ø 13,8 mm corrugated copper tube	Peak Power rating	23 kW
			Peak RF Voltage rating	1,5 kV
4	Jacket	Ø 16,1 mm PE black	Attenuation @ 20°C	0,073 dB/m
-	Weight	Approx. 0,23 kg/m	Max operating frequency	3000 MHz
-	Minimum bending radius	70 mm: single bending	DC-resistance inner conductor	1,59 Ω/km
		125 mm: repeated bending	DC-resistance outer conductor	2,0 Ω/km
			Typical delay at 1000MHz	0.004 µs/m



Connector N-plug for LCF 1/2" – 50 Ω

Coax cable with connector N-plug

Figure 2.6. RF coax cable - LCF 1/2"



Connector: Cannon - CGL06PG 10SL-3S-C1L

Figure 2.7. Obstruction light cable

2.6.2 Grounding

The ground cable must be laid separately and connected permanently to GND terminal of the "Terminal Board) and to the connecting bolt of the cabinet.

A ground fault external interrupter it is suggested for a rated fault leakage current of 30 mA.

The copper cable, with cross-section 25 mm^2, and fitted with a lug for attaching to the ground bolt, is provided for grounding the beacon. Figures 2.10 and figure 2.12 illustrate how the beacon is grounded.

One end of the cable is inserted in the lug terminal and the other end is connected to the local ground network, which must comply with the safety regulations stipulated in the specifications.

2.6.3 Power supply connection

The equipment can be powered from either mains, or battery, or both.
The standard version can be powered from a external 48 Vdc. The BCPS rack must be added for VAC operation and it can either be housed inside the equipment or installed externally as well.

Cabling connections are shown in figures 2.11 and 2.12.

The BCPS unit will have a different structure depending on the type of power supply used. Furthermore, since the beacon is not provided with any on/off breakers. It will be provided from optional breaker AC and DC recommended with independent switch for the two power supplies.

When collocated with a System 400 (D)VOR, NDB or ILS Systems a common power supply and battery will be implemented.
The equipment may be supplied by the mains with a 194 to 260 Vac voltage, 48 to 64 Hz, single phase, or by an source providing a rated 48 Vdc (external source or 48Vdc battery back-up) direct power supply (40 Vdc to 60 Vdc). Equipment consumption: refer to para. 4.10.1 section 4 on this volume

Connect the mains leads (L= mains phase; N = Neutral; Mains Ground = typical green-yellow color) and battery leads (+polarity = red cable and negative polarity = black cable) to terminals on "terminal board" as shown in figure 2.11 or 2.13.

CAUTION

When connecting the DC supply observe the correct polarity ("+ positive" and "- negative")

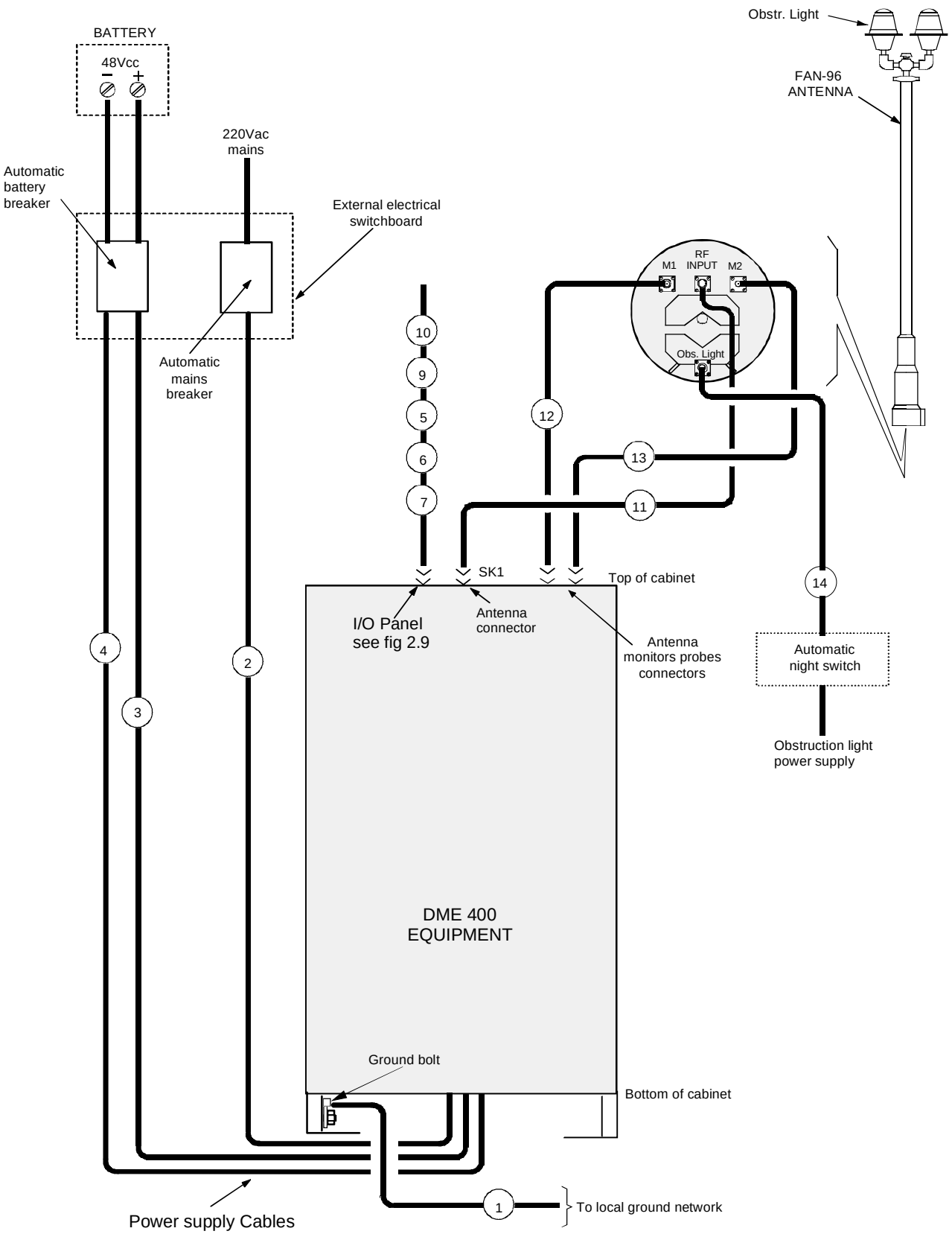
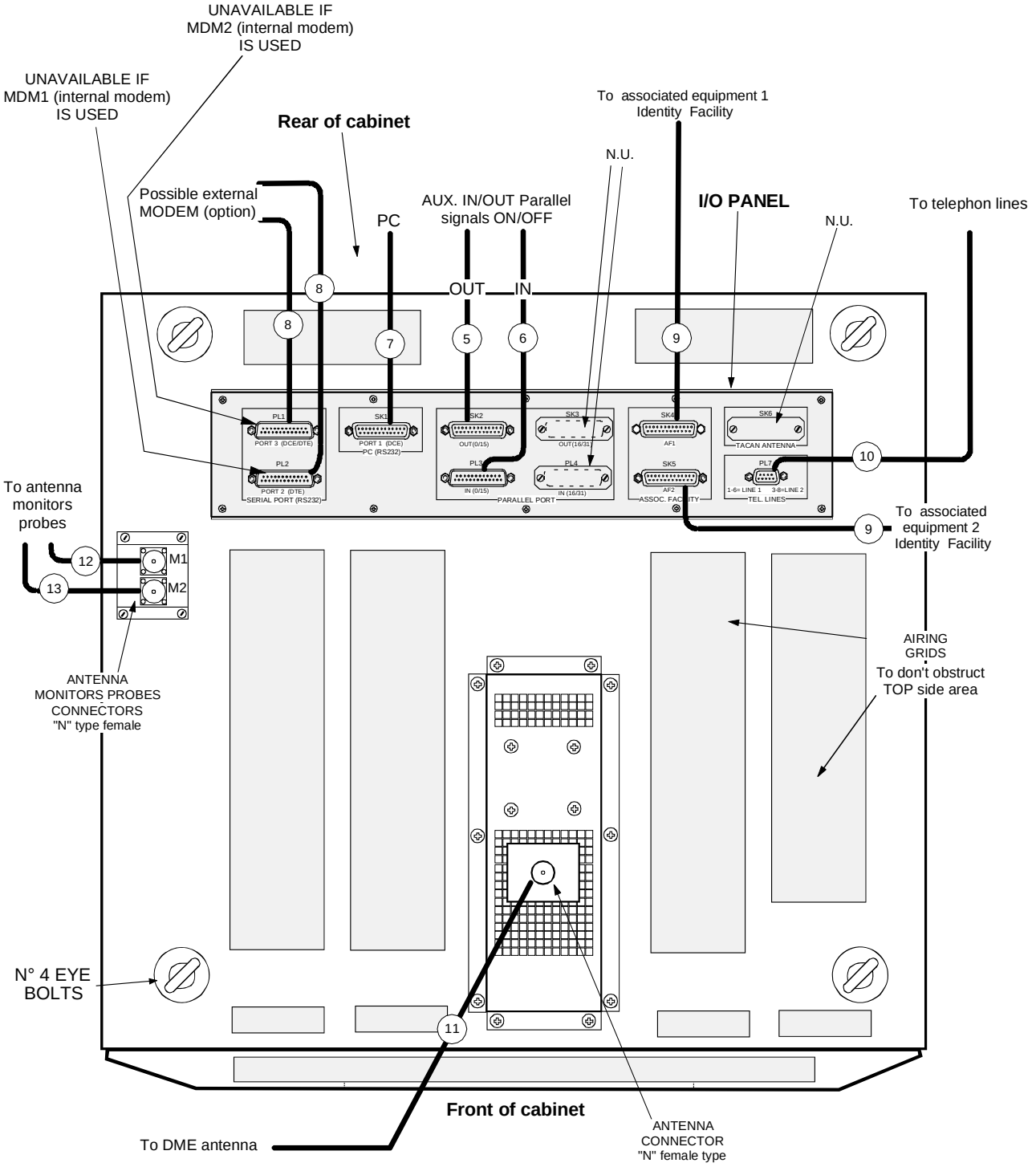


Figure 2.8. Installation connections (typical)



NOTE: Valid for both cabinets type

Figure 2.9. Installation - Cables connections (typical) on top end of equipment

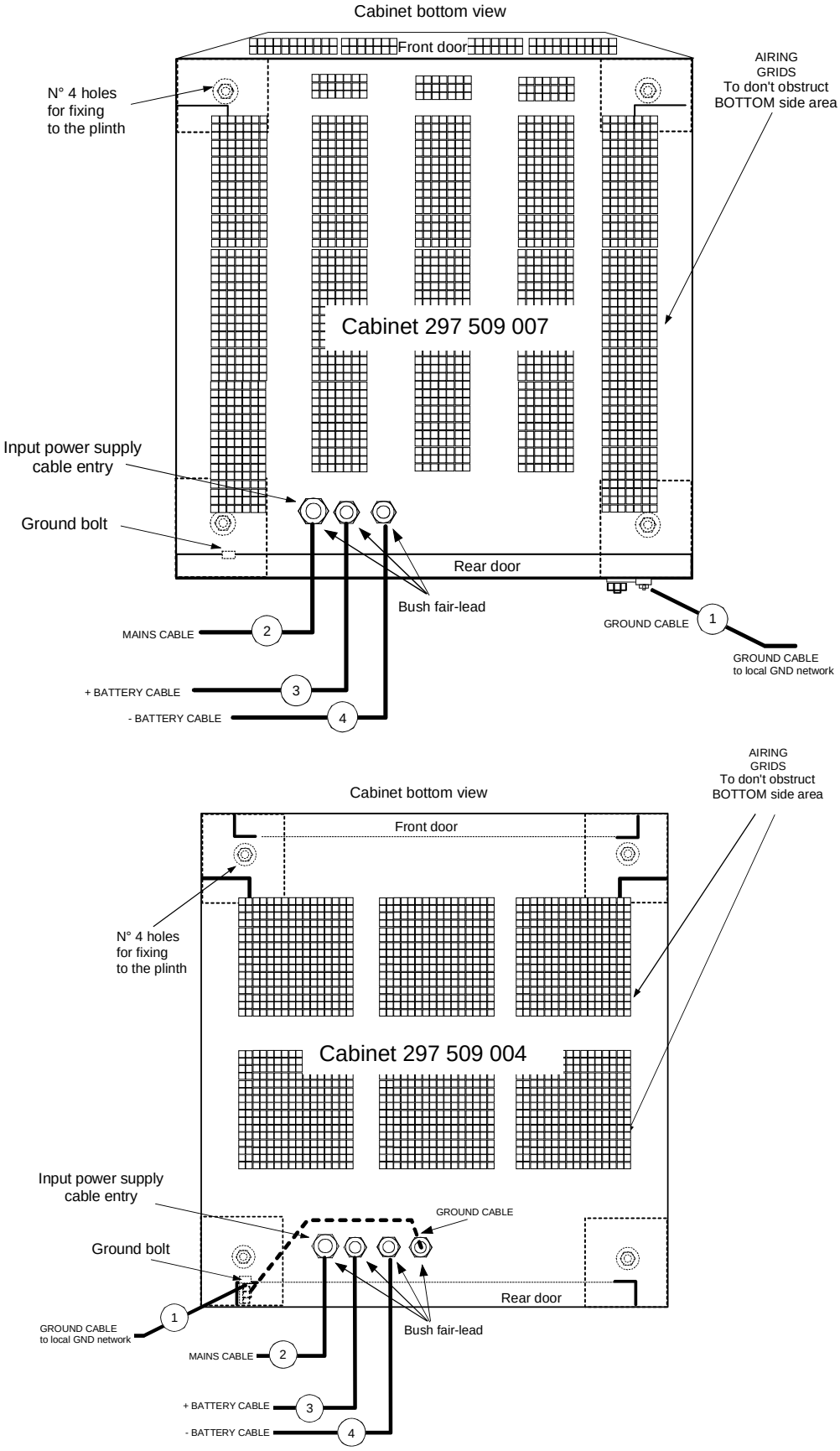


Figure 2.10. Installation - Cables connections (typical) on bottom of cabinet

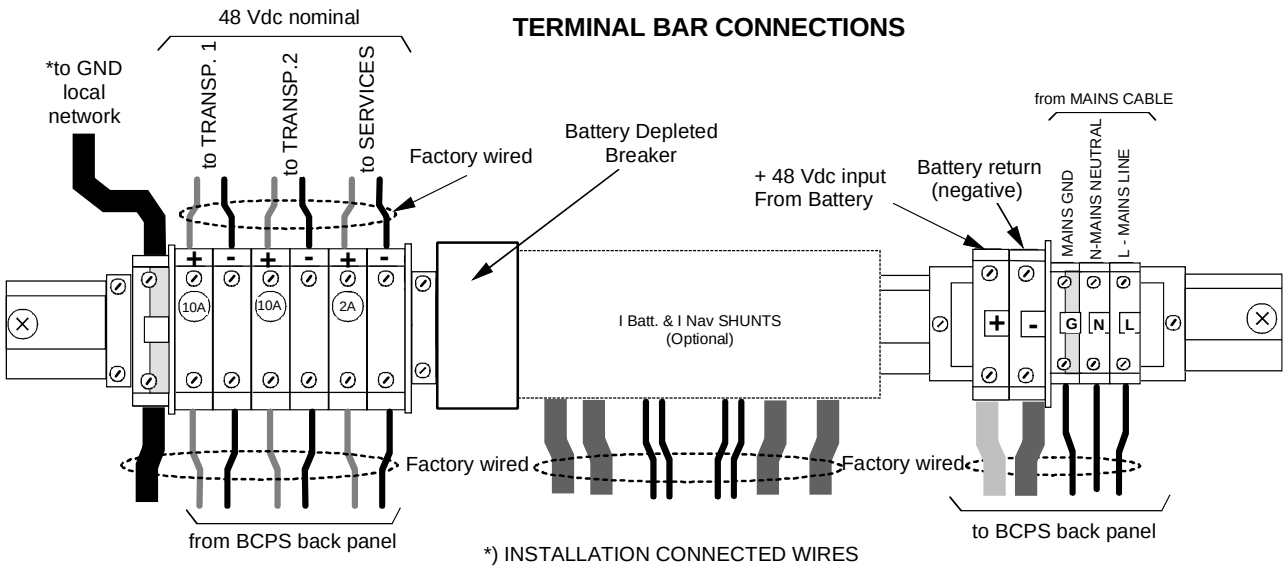
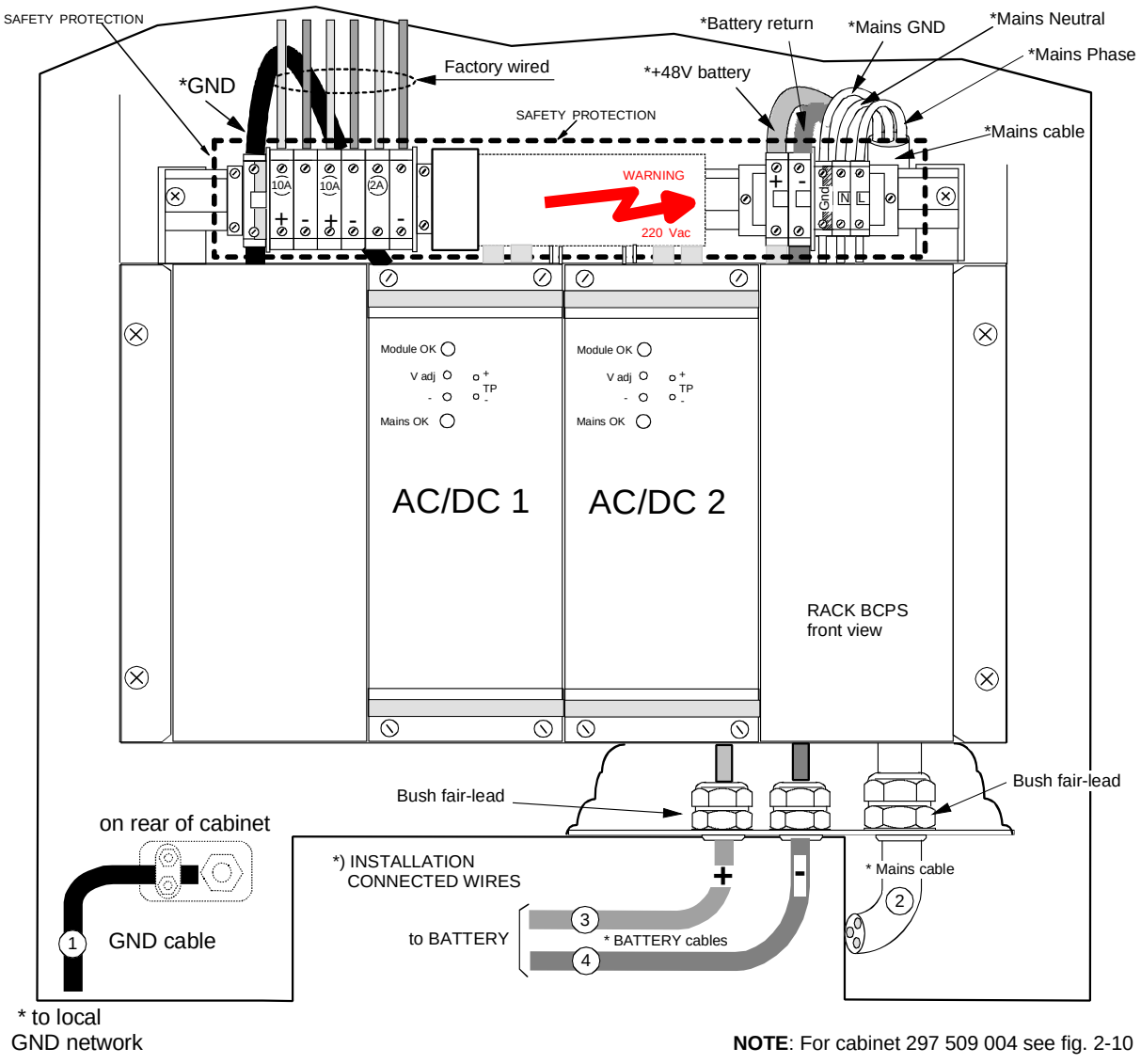


Figure 2.11. Cable connection - Grounding and AC power supply of the Terminal Bar



NOTE: For cabinet 297 509 004 see fig. 2-10

Figure 2.12. Cables connection - Grounding and AC power supply

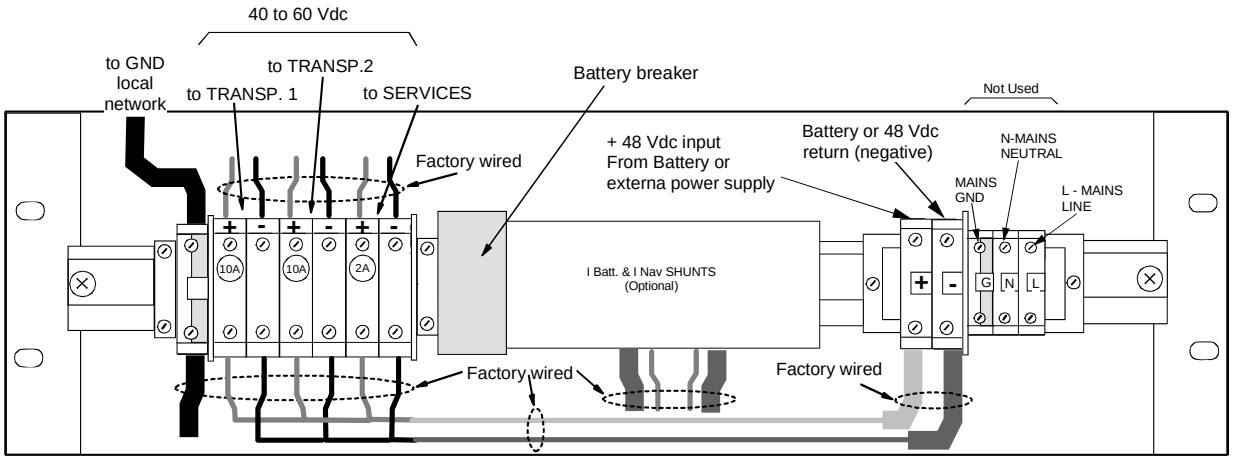


Figure 2.13. Grounding and external 48 Vdc power supply - Cables connection

2.6.3.1 Batteries

The battery of back up is used in case of blackout, to allow the beacon to keep working without interruption.

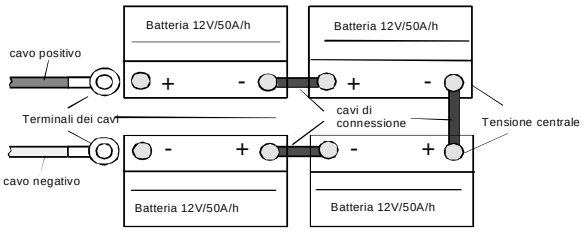


Figure 2.14. Battery connections typical

Battery type and size depend on requirements.

Suggested batteries for back-up power supply must have the following characteristics:

- Output voltage: 48 V nominal (four 12 V unit serially connected: see fig. 2.14);
- Nominal discharge capacity: 50 A/h (this capacity ensures a time duration as at para. 4.10 of section 4);
- Low maintenance types or sealed types;
- Low self-discharge;
- Long life: >4 to 5 years;
- Temperature range: -20 to +50 °C;
- The charge from the equipment, at constant voltage, is typically: 2.25 V/element.

These required characteristics should be completed by technical information from the battery constructor.

CAUTION

The low maintenance battery group must be placed in a low-ventilated environment, while the other sealed types, may be installed everywhere. In any case, follow the battery constructor's instructions.

2.6.3.1.1 *Battery duration time (on 230Vac black-out)*

The battery 50A/h (at end of 42V voltage), are the following:

DME415=**20h** - DME435=**12h** for TX2 stby, TX1 en service, and radiate 800 pps

DME415=**18h** - DME435=**10h** for TX2 stby, TX1 en service, and radiate 2700 pps

DME415=**17h** - DME435=**7h** pour TX2 stby, TX1 en service and radiate 4800 pps

NOTE: With battery 12 mounts old the back up period duration is typical degraded of 10/15% (see also the technical information from the battery constructor)

2.6.4 ANTENNA CONNECTION

Mechanical antenna collocation is simple and straightforward with any type of existing VOR, DVOR or ILS antenna.
Figure 2.15 shows the connections to be performed upon antenna installation and the identification of the cables supplied.
Characteristics and dimensions: see para. 4.9 on section 4 of this volume (FAN 96 type dimensions are in figure 2.15)

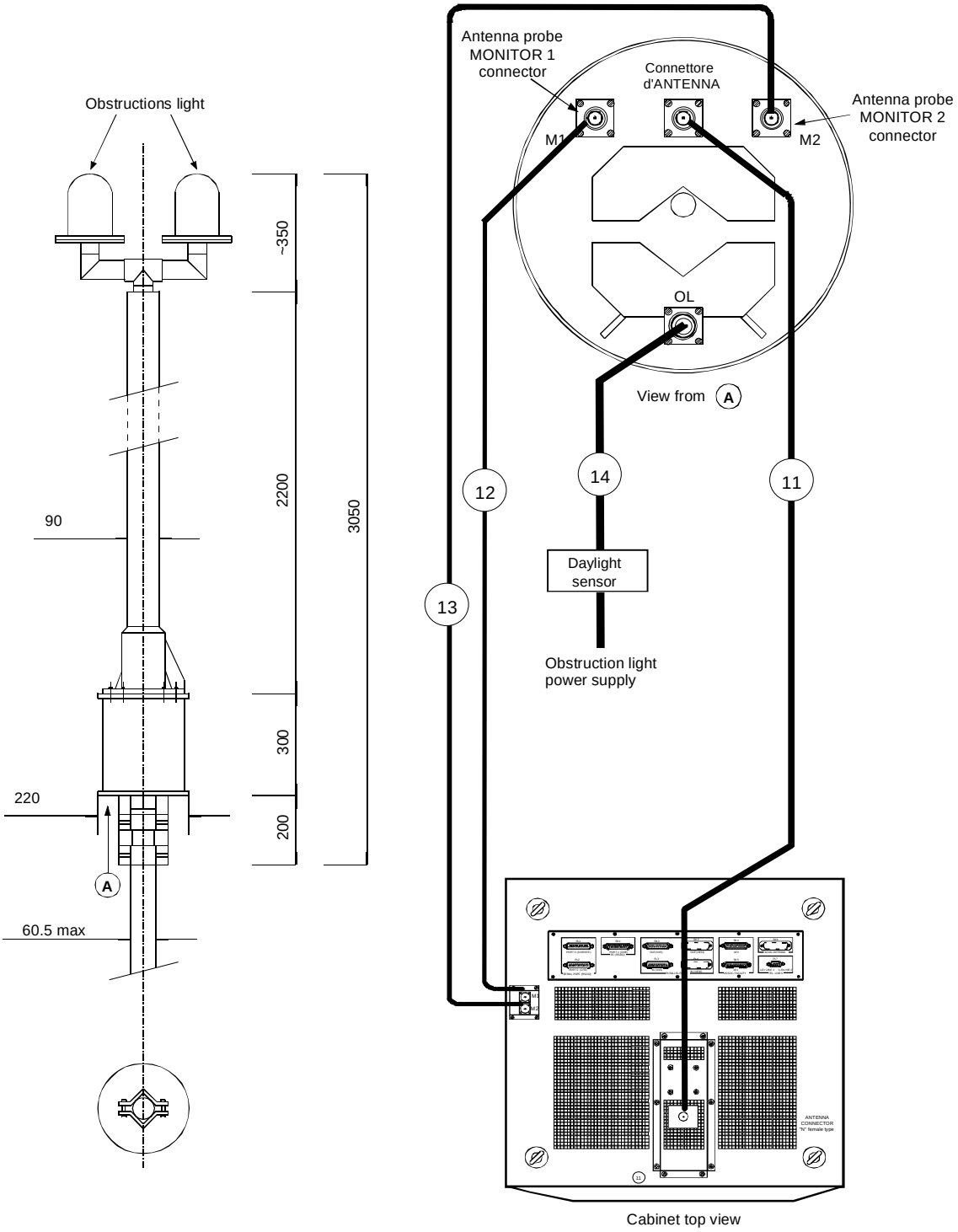


Figure 2.15. Cable connections to FAN 96 antenna

2.6.4.1 Antenna coax cables-Attenuations and delays

The interrogating signal from the aircraft received on the beacon antenna, comes the antenna connector SK1 (equipment input/output RF) with a delay Δt_{RF} which depends on the antenna coax cable.

This delay, indicated in μs, is given through the following relation:

$$\Delta t_{RF} = \frac{L}{P \times c}$$

where:

- L: Cable length expressed in m
- P: Relative propagation velocity (for LCF 1/2" cable, typical value: 88%)
- c: Light velocity (300 m/μs)

The low loss "LCF 1/2 inch" standard cable, has a delay of about 0.004 μs/m and an attenuation of about 0.073 dB/m.

The signal received in antenna comes the beacon receiver after a Δt_{RF} delay, is processed and, after the reply delay (introduced by the transponder), returns to the antenna from where it is transmitted with an additional delay Δt_{RF} (introduced by the antenna coax cable). If it is supposed that the beacon uses a "**X"** channel mode (50 μs reply delay), the total delay of the reply signal, generated by the antenna output system, will be:

$$\textbf{Rvel.} = \Delta t_{RF} + 50\ \mu s + \Delta t_{RF} = 2\Delta t_{RF} + 50\ \mu s$$

The measurement of the reply delay value and its automatic compensation, in 25ns steps compared to the fixed value, is performed by the monitors through interrogating pulses (Pilot pulse) sent by the transponder receiver.

The calculated value of the delay and the cables loss according to their length is shown as an example in the following table 2-3):

Table 2-3 - STD Coax cables

Parameter	Description	Coax. cable		Value
		Type	Length	
Monitor Cable Loss	Loss of monitor coax. cables probes for monitoring	LCF 1/2"	25 m	Approx. 2dB
Antenna Cable Loss	Loss of antenna coax. cable	LCF 1/2"	25 m	Approx. 2dB
Delay time	Delay of antenna coax. cable	LCF 1/2"	25 m	Approx. 100 ns

2.6.4.2 *Data entry calibration procedure for "EXTENDED CONFIGURATION"*

Figure 2.16a) shows an example of typical installation with equipped standard cables.

For calibration and check of the correctness of the power parameters measurement displayed on windows of the "CHECK", preset the configuration "EXTENDED CONFIGURATION" (fig. 2.16b) with the procedures here below (also see in this volume, Appendix "D" PC user EQPT Manager on paragraphs: "Executive Monitoring on Antenna", "STD measurements & Routine Check on Antenna" and "UTILITY – DME Configuration").

Remark: *The peak power output calibration procedure of the TX100 ad TKW modules is described on section 5 -MAINTENANCE- para. 5.3.4 and 5.3.5 of this volume. This procedure must be carried out during the installation, in the event of substitution of module TX100 or/and TKW and also in case the channel change*.

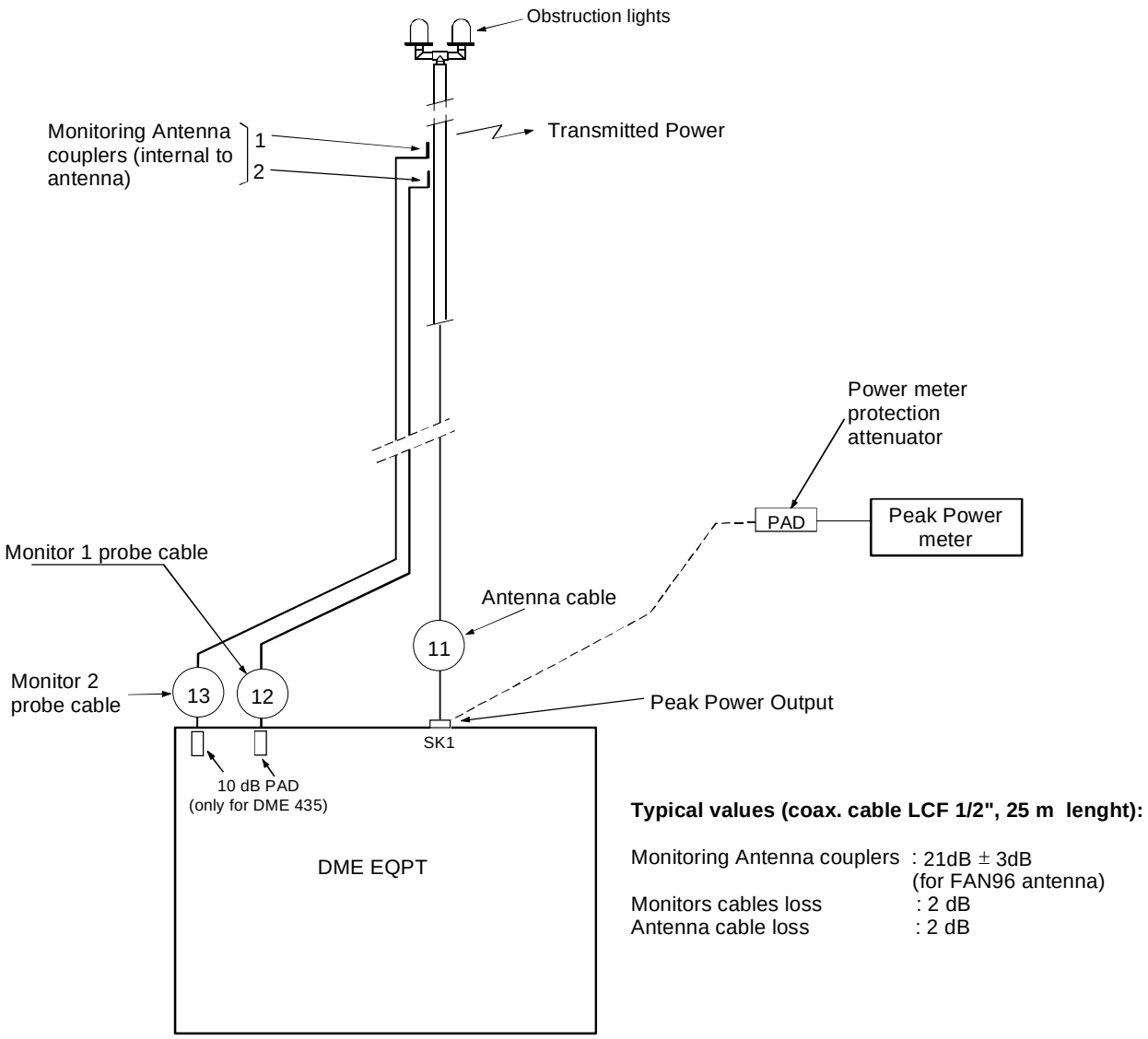


Figure 2.16a. Simplified diagram of Antenna coax cables

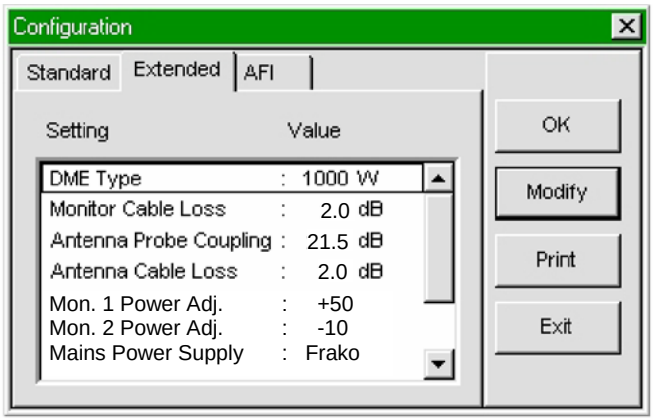


Figure 2.16b. "EXTENDED CONFIGURATION" – Example of data entry

2.6.4.2.1 Check of the OUTPUT POWER measurement on transponder

a) Preset the equipment in "Maintenance" mode (TX in STBY). Unplug the antenna cable and to connect the "peak power meter", as in fig. 2.16a, to the antenna connector. Switch to “OPERATING” mode, take notes of the reading of the power peak meter.

b) Restore the connections of the antenna cables. With TX main in OPERATING and on window “*EXTENDED CONFIGURATION* – **Mon. 1 Power Adj**.” Enter, if necessary, a preset value from -100, 99, -98 .....to ..... +98,+99,+100 (Nr. 1 step by step), in order for the measurement reading on “*Executive monitoring*: **Peak Power Output**” to be the same (±2%) as the one indicated on the external “Peak Power Meter”, previously noted.

c) Repeat point b) for “**Mon. 2 Power Adj**." on window “EXTENDED CONFIGURATION

2.6.4.2.2 Measurement calibration of the TRANSMITTED POWER (radiated)

a) TX main on antenna in OPERATING. On window “EXTENDED CONFIGURATION – **Monitor Cable loss**” enter the value, measured or calculated, of the monitor probe cable loss (for standard cable see table in previous para. 2.6.4.1)

b) On “EXTENDED CONFIGURATION – **Monitor Probe Coupling**” enter the value of the coupler at the operating frequency, a detail that is pointed out on the antenna features. For the model FAN 96 and FAN 88 the coupling values of the probes are shown on a table enclosed to the package of the antenna (for antenna FAN 96: typical value 20dB ± 3dB)

c) On “EXTENDED CONFIGURATION – **Antenna cable loss**” enter the value, measured or calculated, of the antenna cable loss (for standard cable see table in previous para. 2.6.4.1)

d) The measure indicated in “**Transmitted Power**”, in theory, should be:

[“Peak Power Output” – Antenna cable loss] in Watt

Some significant power ratios and loss percentage are calculated as per the following table 2-4 :

Table 2-4 - Loss of STD coax cables

Ant. cable loss: dB	Ratio	Loss %
-3	0,5	50
-2	0,63	37
-1,5	0,708	29,2
-1	0,78	22
-0,5	0,89	11
-0,1	0,9772	2,28

Example: with STD cable (25m – LCF ½”) the reading in “**Transmitted Power**” must be:

1) for DME 415 with 110 W in Peak Power Output: *110 – (110 * 0,347) = 71,83 W*
2) for DME 435 with 1050 W in Peak Power Output: *1050 – (1050 * 0,347) = 685.6 W*

e) if the reading in “**Transmitted Power**” is over ± 2% compared to the value mentioned in point d), vary, step by 0,1dB step , the data on window “EXTENDED CONFIGURATION – **Monitor Probe Coupling**” (or in “**Monitor cable loss**”) up to the limit of ± 2%.

NOTE 1: The sum of the values in dB [**Monitor Cable Loss + Antenna Probe Coupling + Antenna Cable Loss**] must be >20 dB and <33 dB, otherwise the data will refused.

NOTE 2: Values in “**Transmitted Power**” of each monitor can be adjusted within ±10%.

Difference of measure of the values in "Transmitted Power" between the two monitors due to different attenuations of the coaxial cables, couplers and internal coax cabling, can be corrected with the trimmer P6 mounted on module MON (shown in fig. 2.17), in order for each monitor to read measurements that are as equivalent as possible.

f) The power alarm thresholds of the monitors are programmed for fixed ratios, as data "SETTING" preset and the monitors also, automatically counts the loss of the coax cables predisposed in "Extended Configuration".

Examples are shown in table 2-5) for standard cables and with data "SETTING" of *monitors power alarm* preset = -3dB:

Table 2-5 - Monitors power alarm threshold examples

EQPT	Peak power output	Ant. Cable loss	Transmitted power	***Monitors Power Alarm threshold***	
				Peak Power out	*Transmitt. power*
DME AN 415	120 Wp	-1,85 dB	78 Wp	60 Wp	39 Wp
DME AN 435	1050 Wp	-1,85 dB	686 Wp	525 Wp	343 Wp

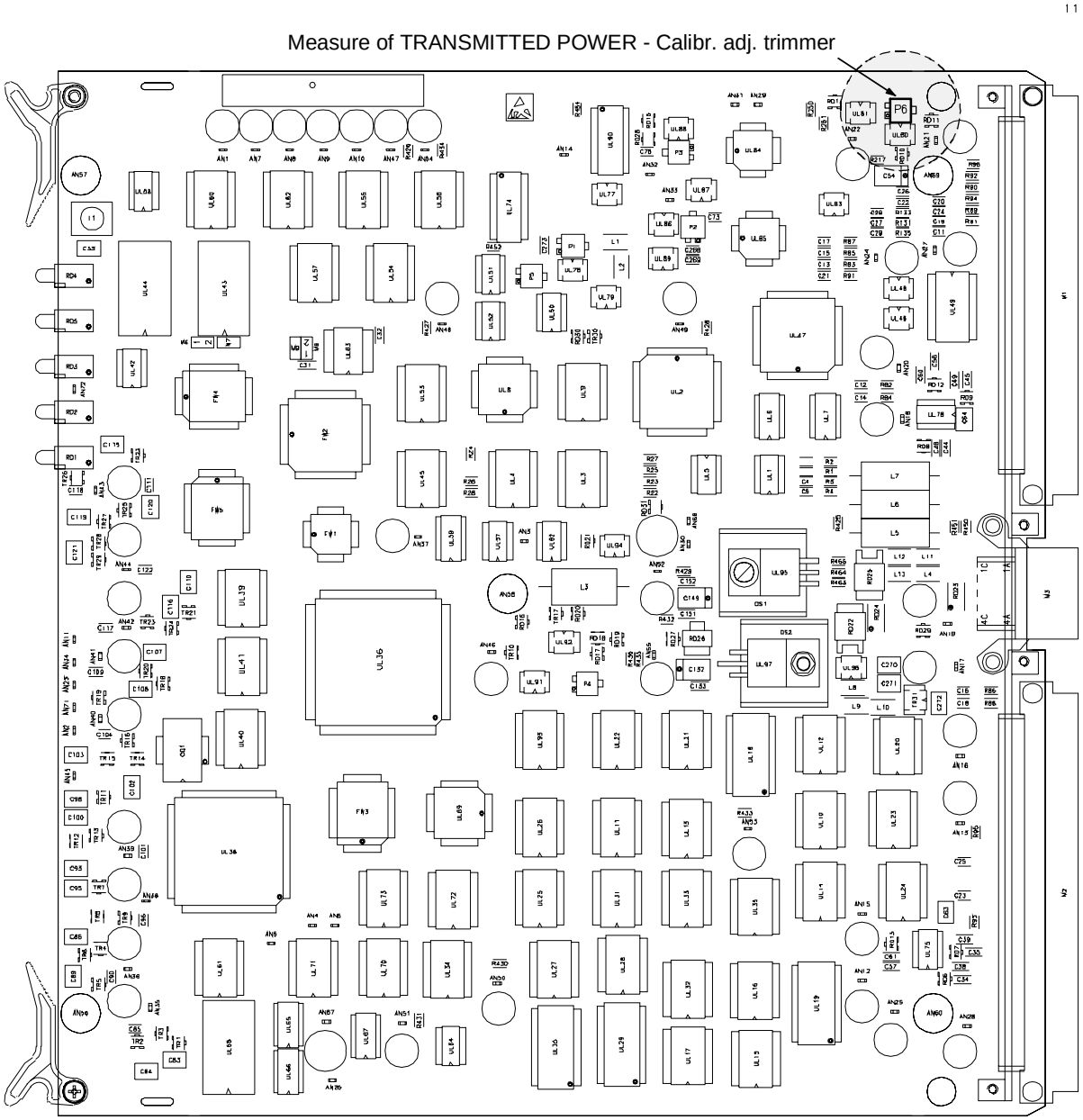


Figure 2.17. MON module – Trimmer adj. position of the "Transmitted Power" measurement

2.6.5 Adjustment Power Reading by monitor

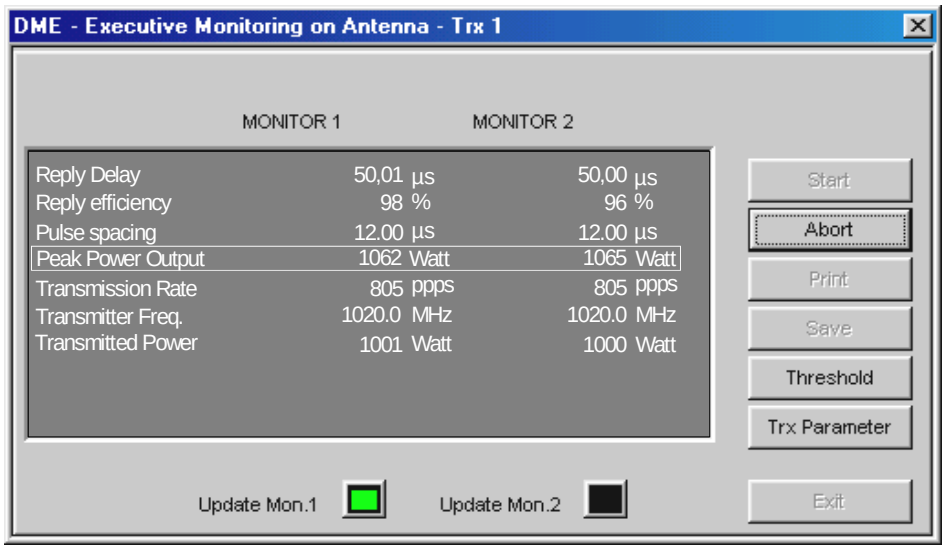


Figure 2.18 Screen of correct measurement by Monitor 1 & 2

To adjust value of **Peak Power Output** (see figure 2.18**)** you have to change the following value of preset**:**

- MON1 Power Adj

- MON2 Power Adj

The range value is from –100 to +100. See figure 2.19**.**

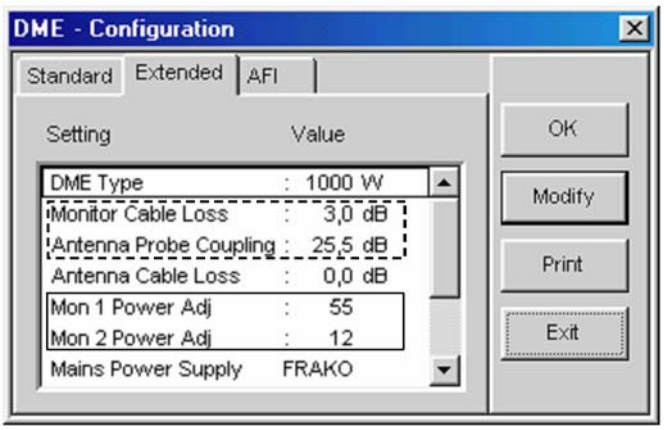


Figure 2.19 Screen of configuration for power reading adjustment

To adjust value of **Transmitted Power** for both monitors, you have to change the values of preset. See figure 2.19

- Monitor Cable Loss

- Antenna Probe Coupling

There is also a possibility to adjust value of power for each monitor, so you can align monitor1 with monitor2 by **TRIMMER P6** on monitor board**.**

NOTE: Be careful !!!! Don't touch any other TRIMMER on monitor board

Remark: *The peak power output calibration procedure of the TX100 ad TKW modules is described on section 5 -MAINTENANCE- para. 5.3.4 and 5.3.5 of this volume.*

2.6.6 I/O and external interface connections

The following I/O connectors (figure 2.15) are available on the top of the cabinet:

- PL1 - SERIAL PORT 3 (standard DTE) – 25 pin Sub D male connector
- PL2 - SERIAL PORT 2 (DTE) – 25 pin Sub D male connector
- SK1 - PC local operation (reciprocally exclusive to SK1 front panel LCSU) – 25 pin Sub D female connector
- SK2 - PARALLEL PORT n° 16 out ON/OFF solid state relay lines – 25 pin Sub D female connector
- PL3 - PARALLEL PORT n° 16 in ON/OFF optocoupled lines – 25 pin Sub D male connector
- SK3 - N.U.
- PL4 - N.U.
- SK4 - ASSOCIATED FACILITY (AF1) interface – 25 pin Sub D female connector
- SK5 - ASSOCIATED FACILITY (AF2) interface – 25 pin Sub D female connector
- PL7 - Telephone lines PSTN or dedicated line connection -9 pin Sub D male connector

Figure 2.9 shows all the connections on I/O panel and figure 2.20 shows the connectors of I/O panel on top end of cabinet.

Tables 2-6a) and 2-6b , (serial ports) and tables 2-7a ,b,c,d (parallel ports), list the pin-out connector signals. On table 2-8 and table 2-9 are listed the pin-out of the connectors of the telephone line and Associated.

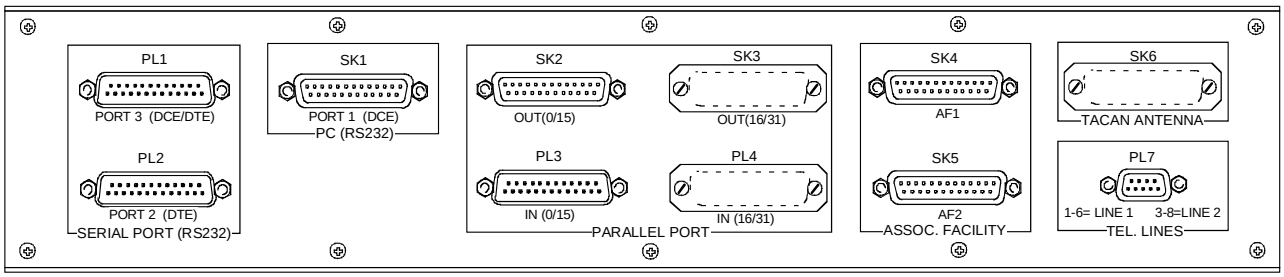
Figure 2.21 shows typical examples of electrical connections related to parallel input lines, user configurable, for the PL3 connector - PARALLEL IN - of the I/O panel.
The block a) shows the drive connection with the contact to ground of the input signal on Nr. 8 lines. The blocks b) and c) show the possibility to drive separately, every input line of the allowable ones (eight). Every line can be driven with a high or low level signal which configurable links (M49, M50, M51, M52) as shown in figure 2.23 .

On table, 2-7a is shown the parallel input line used by equipment for flag indication of AC/DC power supply

Typical examples of how to use the parallel OUTPUT lines are shown in figure 2.22 where:

- in block **b**) a single line external connection for a configuration with a distinct common is shown;
- in block **c**) a four lines connection with only a user power supply (Vg) is shown;
- in block **d**) a four lines connection with a distinct power supply is shown;
- in block **e**) a solution with a power supply (5VDC), picked up from the pin 25 of SK2 connector of the I/O panel is shown.

The commons are arranged in four lines groups, as shown in table 2-7b and in figure 2.22.



PL1 = UNAVAILABLE if MDM 2 IS USED
PL2 = UNAVAILABLE if MDM 1 IS USED
SK1 = PC connection: UNAVAILABLE if PC connector on FRONT PANEL is USED
SK4 = Associated Facility EQPT 1
SK5 = Associated Facility EQPT 2

SK2 = N° 16 AUXILIARY ON/OFF OUT SIGNALS (standard)
PL3 = N° 16 AUXILIARY ON/OFF IN SIGNALS (standard)
(e.g. possible Site Status Indication)
SK3 = N° 16 AUXILIARY ON/OFF OUT SIGNALS (optional)
PL4 = N° 16 AUXILIARY ON/OFF IN SIGNALS (optional)

SK6 = N.U.
PL7 = N° 2 Telephon Line
Internal MODEM connected

Figure 2.20. I/O panel, top view

Table 2-6a - SK1 on I/O panel and front panel - Serial Ports PC connector pin-out signals

SIGNAL	CONNECTOR ON CSB MODULE	SERIAL DCE	PC CONNECTOR on I/O PANEL and on LCSU Front panel	NOTE
	M22-PIN Nr.	Port Nr.	PC-SK1- PIN Nr	
(Spare)	1		1	
(Spare)	2	-	14	
RXD	3	1	2	
(Spare)	4	-	15	
TXD	5	1	3	
(Spare)	6		16	
CTS~	7	1	4	
(Spare)	8		17	
RTS~	9	1	5	
(Spare)	10		18	
(Spare)	11		6	
(Spare)	12		19	
GND	13	1	7	
DCD~	14	1	20	
DTR~	15	1	8	
(Spare)	16		21*)	*) pin from 9 to 13 and 22 to 25: N.U.

Table 2-6b - PL1 and PL2 on I/O panel - Serial Ports MDM connector pin-out signals

SIGNAL	CONNECTOR ON CSB MODULE	SERIAL DTE	CONNECTOR on I/O PANEL	NOTE
	M22-PIN Nr.	Port Nr.	MDM1-PL2 -PIN Nr	
(Spare)	17		1	
(Spare)	18		14	
TXD1	19	2	2	
TXCK1	20	2	15	
RXD1	21	2	3	
(Spare)	22		16	
RTS~1	23	2	4	
RXCK1	24	2	17	
CTS~1	25	2	5	
(Spare)	26		18	
DSR1-386	27		6	
(Spare)	28		19	
PGND	29	2	7	
DTR~1	30	2	20	
DCD~1	31	2	8	
(Spare)	32		21*)	*) pin from 9 to 13 and 22 to 25: N.U.
	M22-PIN Nr		MDM2-PL1- PIN Nr	
(Spare)	33		1	
(Spare)	34		14	
TXD2	35	3	2	
TXCK2	36	3	15	
RXD2	37	3	3	
(Spare)	38		16	
RTS~2	39	3	4	
RXCK2	40	3	17	
CTS~2	41	3	5	
(Spare)	42		18	
DSR2-386	43		6	
(Spare)	44		19	
PGND	45	3	7	
DTR~2	46	3	20	
DCD~2	47	3	8	
(Spare)	48		21*)	*) pin from 9 to 13 and 22 to 25: N.U.

Pin 49 to 64 on M22 (CSB) : N.A.

Table 2-7a - PL3 on I/O panel - INPUT Parallel Port Connector pin-out signals

SIGNAL	CONNECTOR ON CSB MODULE	IN Parallel line ON/OFF Pin function	CONNECTOR on I/O PANEL	NOTE
	M32-PIN Nr.		IN-PL3-PIN Nr	
GND	1	PGND	1	
VCC	2	+5 VDC	14	
OUT3	3	TTL output	2	
IAUX0	4	Opto-coupled input	15	b)
IAUX1	5	Opto-coupled input	3	b)
IAUX2	6	Opto-coupled input	16	b)
IAUX3	7	Opto-coupled input	4	b)
IAUX4	8	Opto-coupled input	17	b)
IAUX5	9	Opto-coupled input	5	b)
IAUX6	10	Opto-coupled input	18	b)
IAUX7	11	Opto-coupled input	6	b)
IAUX8	12	Opto-coupled input	19	a) H+5 FTY1 - Indication TRX1 5Vdc faulty
IAUX9	13	Opto-coupled input	7	a) H+5 FTY2 - Indication TRX2 5Vdc faulty
IAUX10	14	Opto-coupled input	20	a) LMNS1 - Mains input found faulty from AC/DC 1
IAUX11	15	Opto-coupled input	8	a) LMNS2 - Mains input found faulty from AC/DC 2
IAUX12	16	Opto-coupled input	21	a) HBDISC – Battery disconnected
IAUX13	17	Opto-coupled input	9	a) LMNS3 - Mains input found faulty from AC/DC 3
IAUX14	18	Opto-coupled input	22	a) HBPDPL – Battery Predepleted
IAUX15	19	Opto-coupled input	10	a) LMNS4 - Mains input found faulty from AC/DC 4
IN0	20	TTL input	23	a) HBCPFTY1 - AC/DC 1 found faulty
IN1	21	TTL input	11	a) HBCPFTY2 - AC/DC 2 found faulty
IN2	22	TTL input	24	a) HBCPFTY3 - AC/DC 3 found faulty
OUT4	23	TTL output	12	a) HBDPOFF – Non active signal
IN3	24	TTL input	25	a) HBCPFTY4 - AC/DC 4 found faulty
PGND	25	GND	13	

NOTE

a) Internal use. These signals are used in the equipment for the interconnections of the BCPS unit and cannot be used for other purposes. Definitions used are contained in the “NOTE” column.

b) Nr. 8 INPUT parallel auxiliary I/O lines, driven by a free contact ON/OFF (closing to ground) (see figure 2.21 block a).

Table 2-7b - SK2 on I/O panel - OUTPUT Parallel Port Connector pin-out signals

SIGNAL	CONNECTOR ON CSB MODULE	OUT Parallel line ON/OFF Pin function	CONNECTOR on I/O PANEL	NOTE
	M32-PIN Nr.		OUT-SK2-PIN Nr	
COM3	26	Relays common for OAUX4, OAUX5, OAUX6, OAUX7	1	
COM4	27	Relays common for OAUX8, OAUX9, OAUX10, OAUX11	14	
OUT2	28	TTL output	2	
OAUX0	29	Solid state relay output	15	c)
OAUX1	30	Solid state relay output	3	c)
OAUX2	31	Solid state relay output	16	c)
OAUX3	32	Solid state relay output	4	c)
OAUX4	33	Solid state relay output	17	c)
OAUX5	34	Solid state relay output	5	c)
OAUX6	35	Solid state relay output	18	c)
OAUX7	36	Solid state relay output	6	c)
COM1	37	Relays common for OAUX0, OAUX1, OAUX2, OAUX3	19	
OAUX8	38	Solid state relay output	7	c)
OAUX9	39	Solid state relay output	20	c)
OAUX10	40	Solid state relay output	8	c)
OAUX11	41	Solid state relay output	21	c)
OAUX12	42	Solid state relay output	9	c)
OAUX13	43	Solid state relay output	22	c)
OAUX14	44	Solid state relay output	10	c)
OAUX15	45	Solid state relay output	23	c)
COM2	46	Relays common for OAUX12, OAUX13, OAUX14, OAUX15	11	
OUT0	47	TTL output	24	
OUT1	48	TTL output	12	
VCC	49	+5 VDC	25	
PGND	50	GND	13	

NOTE

c) Nr. 16 OUTPUT parallel auxiliary I/O lines (for application examples: see figure 2.22).

Table 2-7c - PL4 on I/O panel (optional) - INPUT Parallel Port connector pin-out signals

SIGNAL	CONNECTOR ON CSB MODULE	IN Parallel line ON/OFF Pin function	CONNECTOR on I/O PANEL	NOTE
	PIN Nr.		IN-PL4-PIN Nr	
PGND	1	PGND	1	
VCC	2	+5 VDC	14	
(Spare)	3		2	
IAUX16	4	Opto-coupled input	15	
IAUX17	5	Opto-coupled input	3	
IAUX18	6	Opto-coupled input	16	
IAUX19	7	Opto-coupled input	4	
IAUX20	8	Opto-coupled input	17	
IAUX21	9	Opto-coupled input	5	
IAUX22	10	Opto-coupled input	18	
IAUX23	11	Opto-coupled input	6	
IAUX24	12	Opto-coupled input	19	
IAUX25	13	Opto-coupled input	7	
IAUX26	14	Opto-coupled input	20	
IAUX27	15	Opto-coupled input	8	
IAUX28	16	Opto-coupled input	21	
IAUX29	17	Opto-coupled input	9	
IAUX30	18	Opto-coupled input	22	
IAUX31	19	Opto-coupled input	10	
(Spare)	20		23	
(Spare)	21		11	
(Spare)	22		24	
(Spare)	23		12	
(Spare)	24		25	
PGND	25	GND	13	

Table 2-7d - SK3 on I/O panel (optional) - OUTPUT Parallel Port Connector pin-out Signals

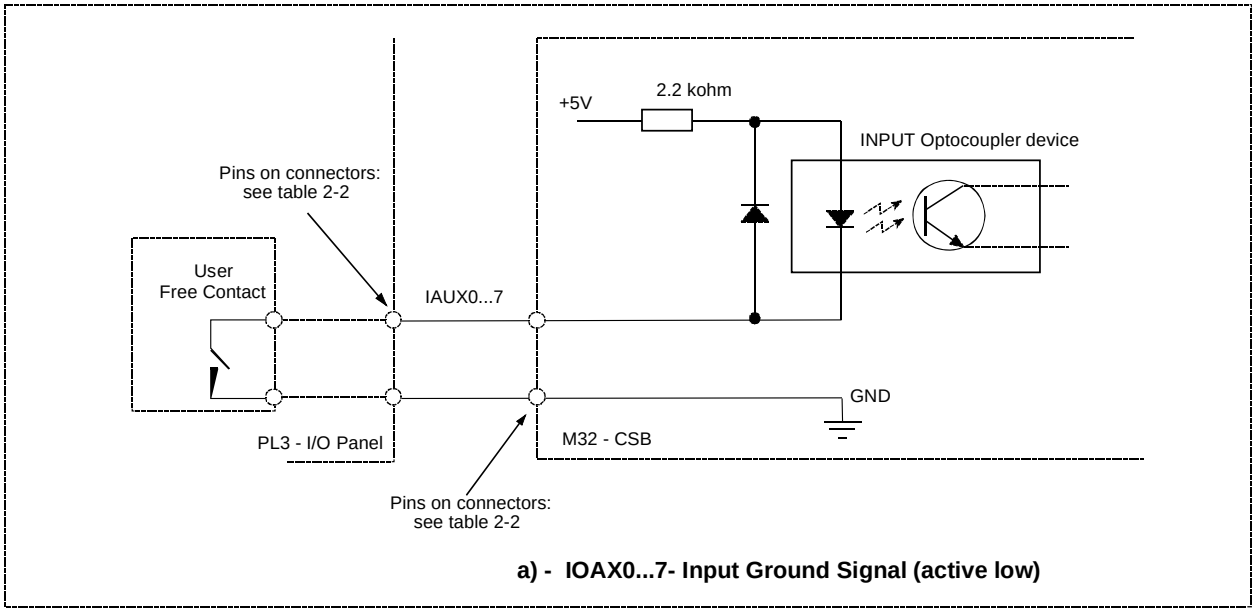
SIGNAL	CONNECTOR ON CSB MODULE	OUT Parallel line ON/OFF Pin function	CONNECTOR on I/O PANEL	NOTE
	PIN Nr.		OUT-SK2-PIN Nr	
COM7	26	Relays common for OAUX4, OAUX5, OAUX6, OAUX7	1	
COM8	27	Relays common for OAUX8, OAUX9, OAUX10, OAUX11	14	
(Spare)	28		2	
OAUX16	29	Solid state relay output	15	
OAUX17	30	Solid state relay output	3	
OAUX18	31	Solid state relay output	16	
OAUX19	32	Solid state relay output	4	
OAUX20	33	Solid state relay output	17	
OAUX21	34	Solid state relay output	5	
OAUX22	35	Solid state relay output	18	
OAUX23	36	Solid state relay output	6	
COM5	37	Relays common for OAUX0, OAUX1, OAUX2, OAUX3	19	
OAUX24	38	Solid state relay output	7	
OAUX25	39	Solid state relay output	20	
OAUX26	40	Solid state relay output	8	
OAUX27	41	Solid state relay output	21	
OAUX28	42	Solid state relay output	9	
OAUX29	43	Solid state relay output	22	
OAUX30	44	Solid state relay output	10	
OAUX31	45	Solid state relay output	23	
COM6	46	Relays common for OAUX12, OAUX13, OAUX14, OAUX15	11	
(Spare)	47		24	
(Spare)	48		12	
VCC	49	+5 VDC	25	
PGND	50	GND	13	

Table 2-8 - PL7 on I/O Panel - Telephone line Connector pin-out signals

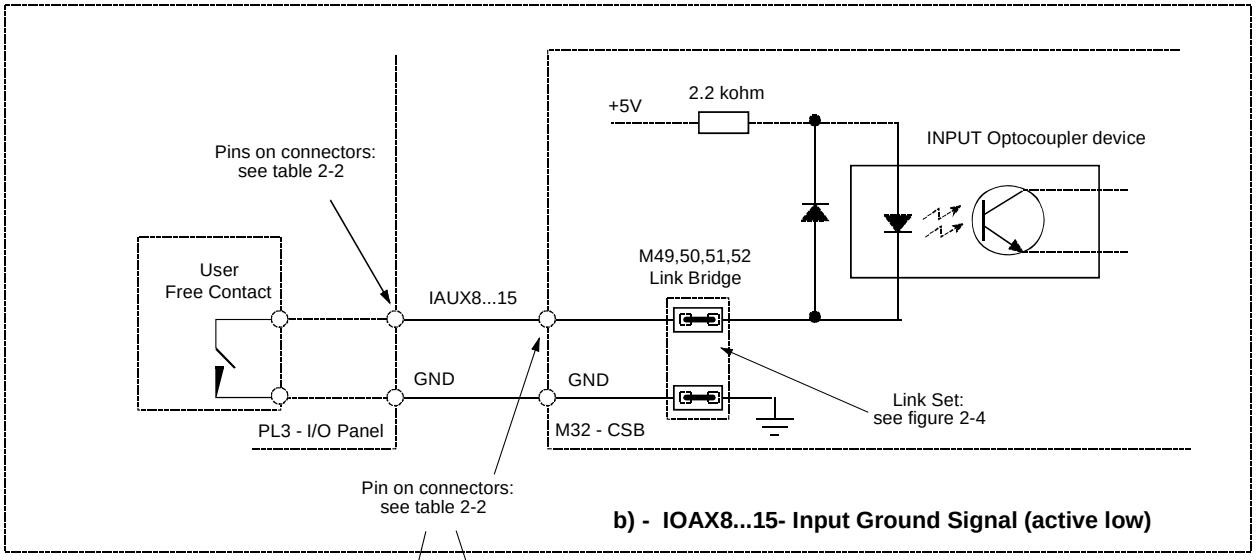
PIN	Signal	Line
1	Tla1	1
6	TLb1	1
3	Tla2	2
8	TLb2	2
PIN 2,4,5,9 spares		

Table 2-9 - SK4 and SK5 on I/O Panel - AFI Connectors pin-out signals

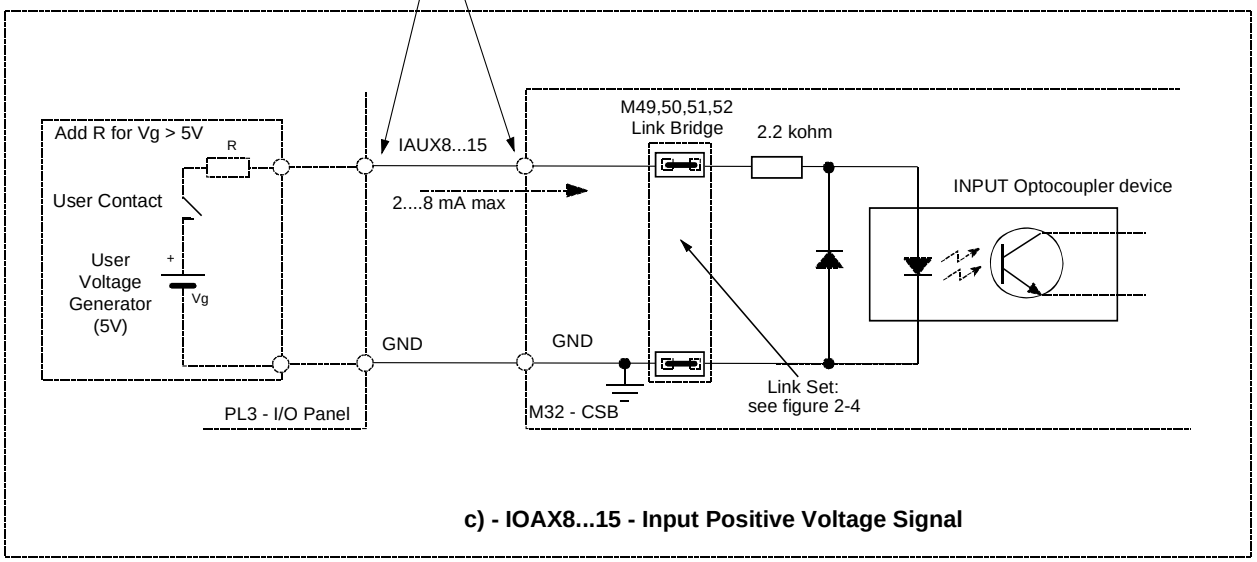
Connector SK4 (AF1)		Connector SK5 (AF2)		NOTE
PIN	Signal	PIN	Signal	
1	DIDFAFL1	1	DIDFAFL2	Identification from Assoc. Facility (Low)
2	DAF STL1	2	DAF STL2	Associated Facility Status (Low)
3	DRD AVL1	3	DRD AVL2	Redundancy availability (Low)
4	DBC OKL1	4	DBC OKL2	Beacon OK (Low)
5	DBC IAML1	5	DBC IAML2	N.U.
6	DI DTAFL1	6	DIDTAFL2	Identification to Assoc. Facility (Low)
7	DAF SELL	7	DAF SELL	Associated Facility Selection (Low)
8	(Spare)	8	(Spare)	
9	(Spare)	9	(Spare)	
10	(Spare)	10	(Spare)	
11	(Spare)	11	(Spare)	
12	(Spare)	12	(Spare)	
13	PGND	13	PGND	
14	DI DFAFH1	14	DI DFAFH2	Identification from Assoc. Facility (High)
15	DAF STH1	15	DAF STH2	Associated Facility Status (High)
16	DRD AVH1	16	DRD AVH2	Redundancy availability (High)
17	DBC OKH1	17	DBC OKH2	Beacon OK (High)
18	DBC IAMH1	18	DBC IAMH2	N.U.
19	DI DTAFH1	19	DI DTAFH2	Identification to Assoc. Facility (High)
20	DAF SELH	20	DAF SELH	Associated Facility Selection (High)
21	(Spare)	21	(Spare)	
22	(Spare)	22	(Spare)	
23	(Spare)	23	(Spare)	
24	(Spare)	24	(Spare)	
25	PGND	25	PGND	Ground



a) - IOAX0...7- Input Ground Signal (active low)

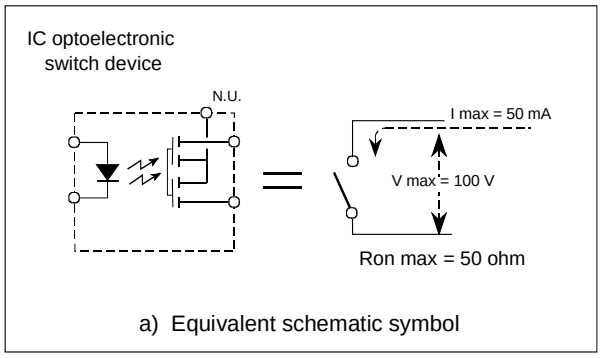


b) - IOAX8...15- Input Ground Signal (active low)

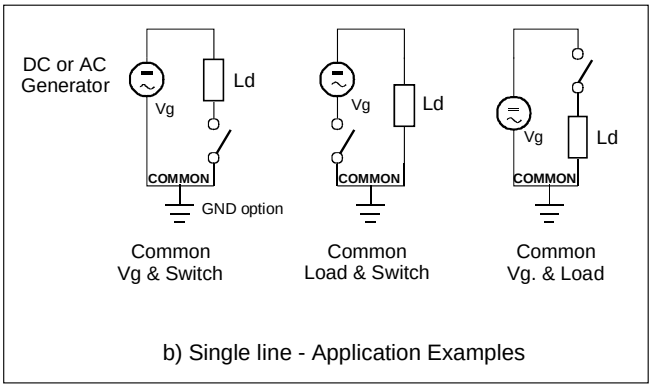


c) - IOAX8...15 - Input Positive Voltage Signal

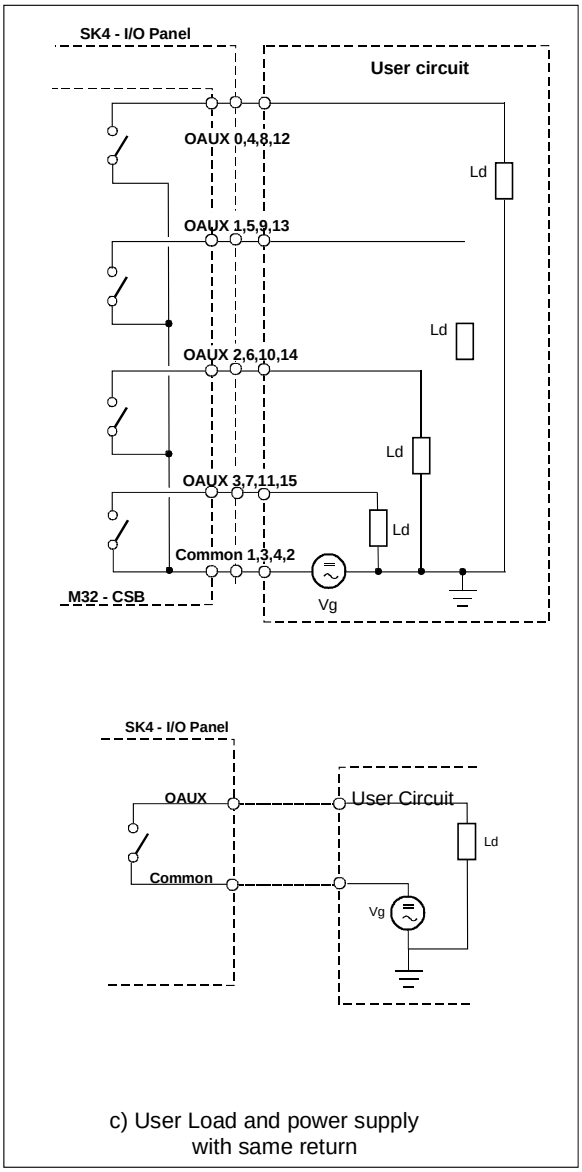
Figure 2.21. Parallel Input Lines application



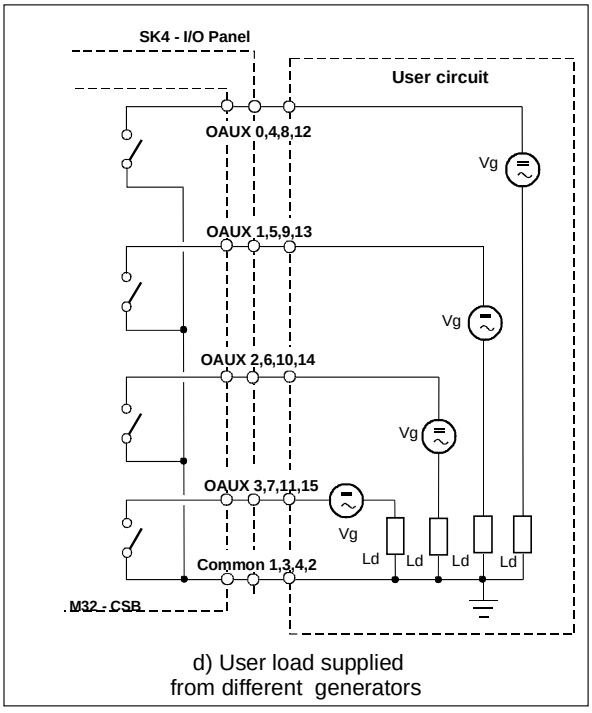
a) Equivalent schematic symbol



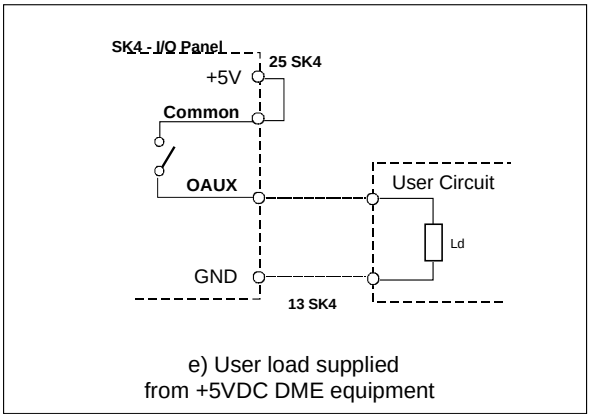
b) Single line - Application Examples



c) User Load and power supply
with same return



d) User load supplied
from different generators



e) User load supplied
from +5VDC DME equipment

NOTE:

See also pin-function table 2-2. User External Load = Ld
Vg = DC or AC user Generator (or user power supply)

Figure 2.22. Parallel Output Lines application

2.6.7 Link set - Jumper presetting

The right positioning of linker on CSB module is shown in figure 2.23 with layout of PBA on fig. 2.24
The right positioning of linker on DMD module is shown in figure 2.25 with layout of PBA
The right positioning of linker on MON module is shown in figure 2.26 with layout of PBA
The right positioning of linker on TX module is shown in figure 2.27 with layout of PBA
The right positioning of linker on AFI module is shown in figure 2.28 with layout of PBA

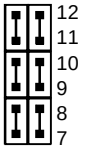
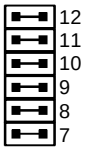
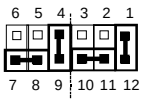
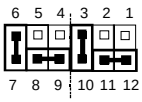
Schematic Reference	Function	Link Factory preset	Alternative link position	NOTE
M1	Battery BT1			The link is open for storage or transportation purpose. Must be closed during normal operation
M3	NMI from WATCH DOG (WD)			The link used OFF, only for laboratory test
M6	WDL Auto-reset repeater of WD			Allows multiple reset in case the CPU does not toggle the watch dog input
M9	VCC/VBAC			Jumper on 3-4 = Memory supplied from VCC Jumper on 1-2 = Memory supplied from VBAC
M10	MCS2 CHIP SELECT			Jumper on 3-4 = CHIP SEL for Memory supplied from battery BT1 Jumper on 1-2 = CHIP SELECT for Memory supplied from VCC
M11	EPROM Memory			Jumper on 1-2 = 4 MBit Memory Jumper on 3-4 = 1 MBit Memory
M12	SRAM Memory			Jumper on 1-2 = 1 MBit Memory Jumper on 3-4 = 4 MBit Memory
M19	INT3			N.U. - Jumper on 1-2 =IAUX8 Selection N.U. - Jumper on 3-4 = INTEXP Selection
M24	Serial Data RX			Jumper on 1-2 = Channel 4 used as RS232 Jumper on 3-4 = Channel 4 used as RS485
M25	TX-RX			No Jumper =Allows a four wire serial RS-485 Jumper on 3-4 & 1-2 = Allows a two wire serial RS-485
M28	ENTXCK			Disable RS-485 CLOCK transmission
M31	DTE/DCE Channel 3 Serial line switch			Jumper on 1-12, 2-11, 3-10, 4-9, 5-8, 6-7 = DCE configuration Jumper on 1-2, 12-11, 3-4, 10-9, 5-6, 8-7 = DTE configuration
M49 (IAUX8 & IAUX9) **M50** (IAUX810 & IAUX11) **M51** (IAUX12 & IAUX13) **M52** (IAUX14 & IAUX15)	Parallel ports Input signals switch for photocoupler			Jumper on 4-9, 7-8 =Ground input signal for IAUX8, IAUX10, IAUX12, IAUX14 Jumper on 1-12, 11-10 =Ground input signal for IAUX9, IAUX11, IAUX13, IAUX15 Jumper on 4-9, 7-8 = Positive voltage input signal for IAUX8, IAUX10, IAUX12, IAUX14 Jumper on 1-12, 11-10 = Positive voltage input signal for IAUX9, IAUX11, IAUX13, IAUX15

Figure 2.23 . List of Links Set on CSB Module

Jumper: default position

M9, M11, M12, M24: **link 1-2** M10, M19: **link 3-4** M49, M50, M51, M52: **link 7-8, 4-9, 10-11, 1-12**
M3, M6, M28: **link ON** M25: **open** M31: **link 1-2, 3-4, 5-6, 7- 8, 9-10, 11-12**
M1= Normal operation: link **ON**. Open during transport and storage only

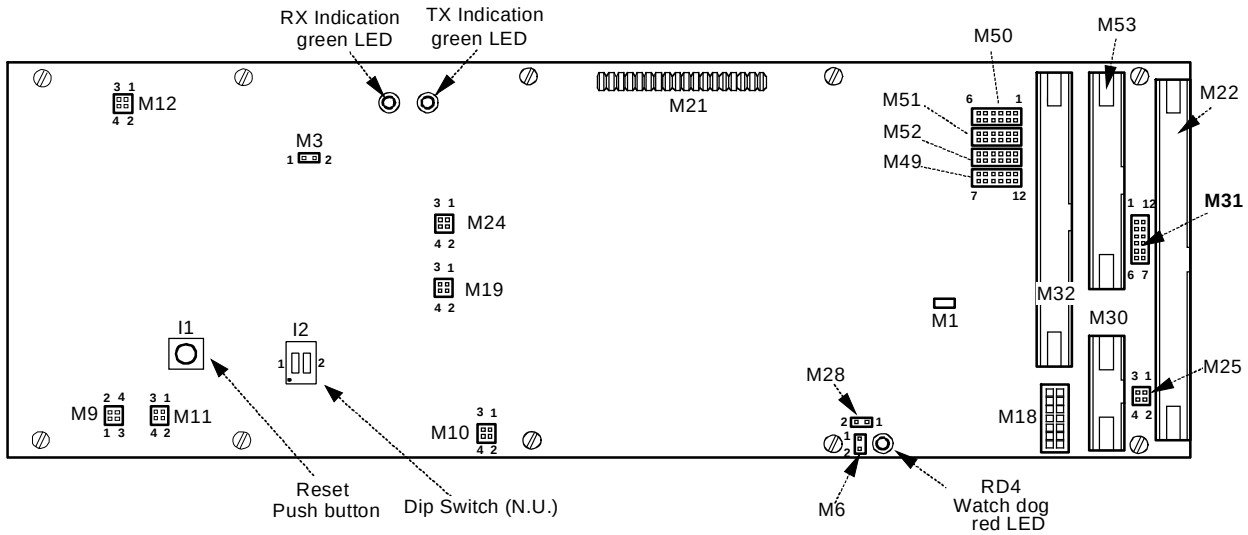


Figure 2.24. Links Setting on CSB Module

The jumpers topographic position on PBA DMD module is shown in figure 2.25
The jumpers topographic position on PBA MON module is shown in figure 2.26
The jumpers topographic position on PBA TX100 module is shown in figure 2.27
The jumpers topographic position on PBA AFI module is shown in figure 2.28

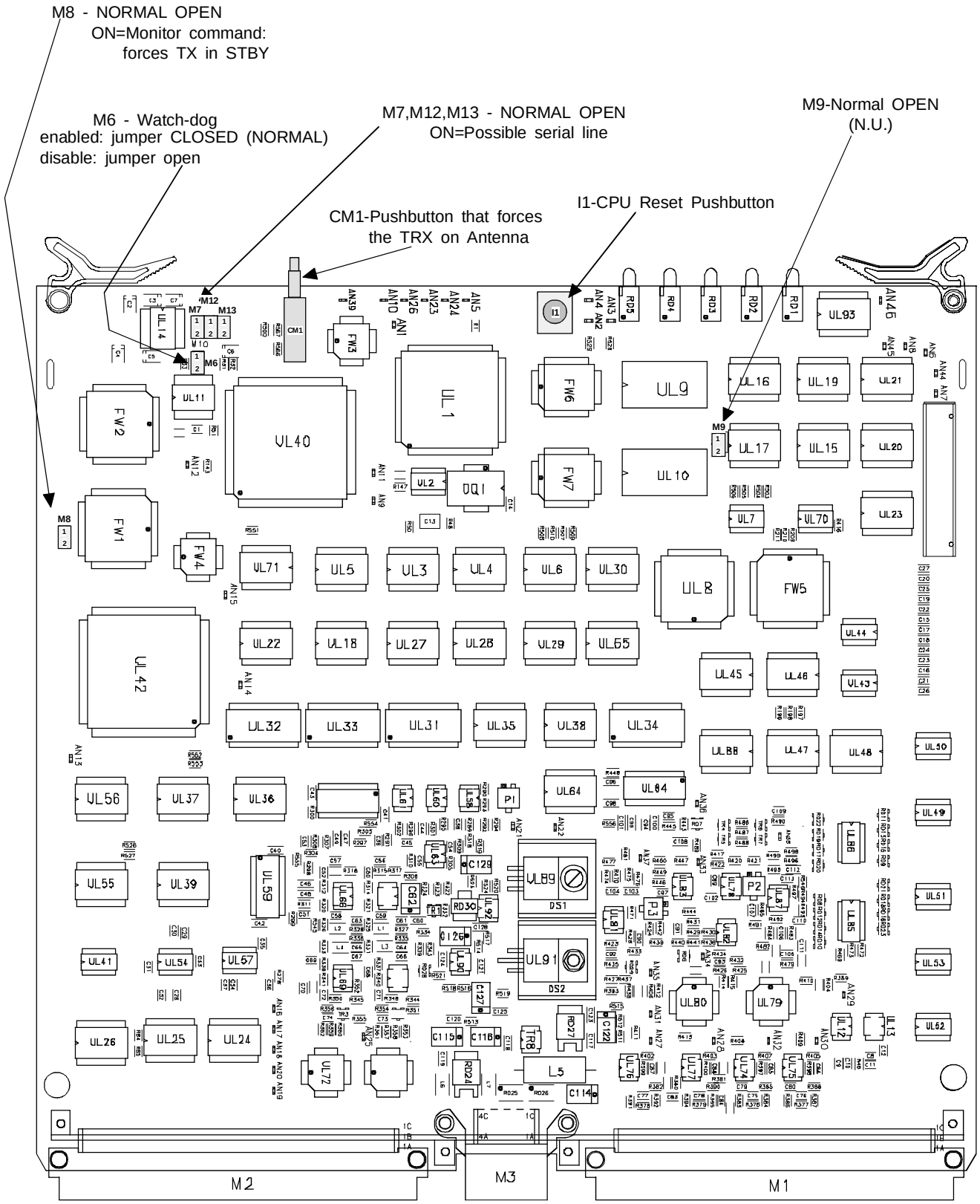


Figure 2.25. Links Setting on DMD Module

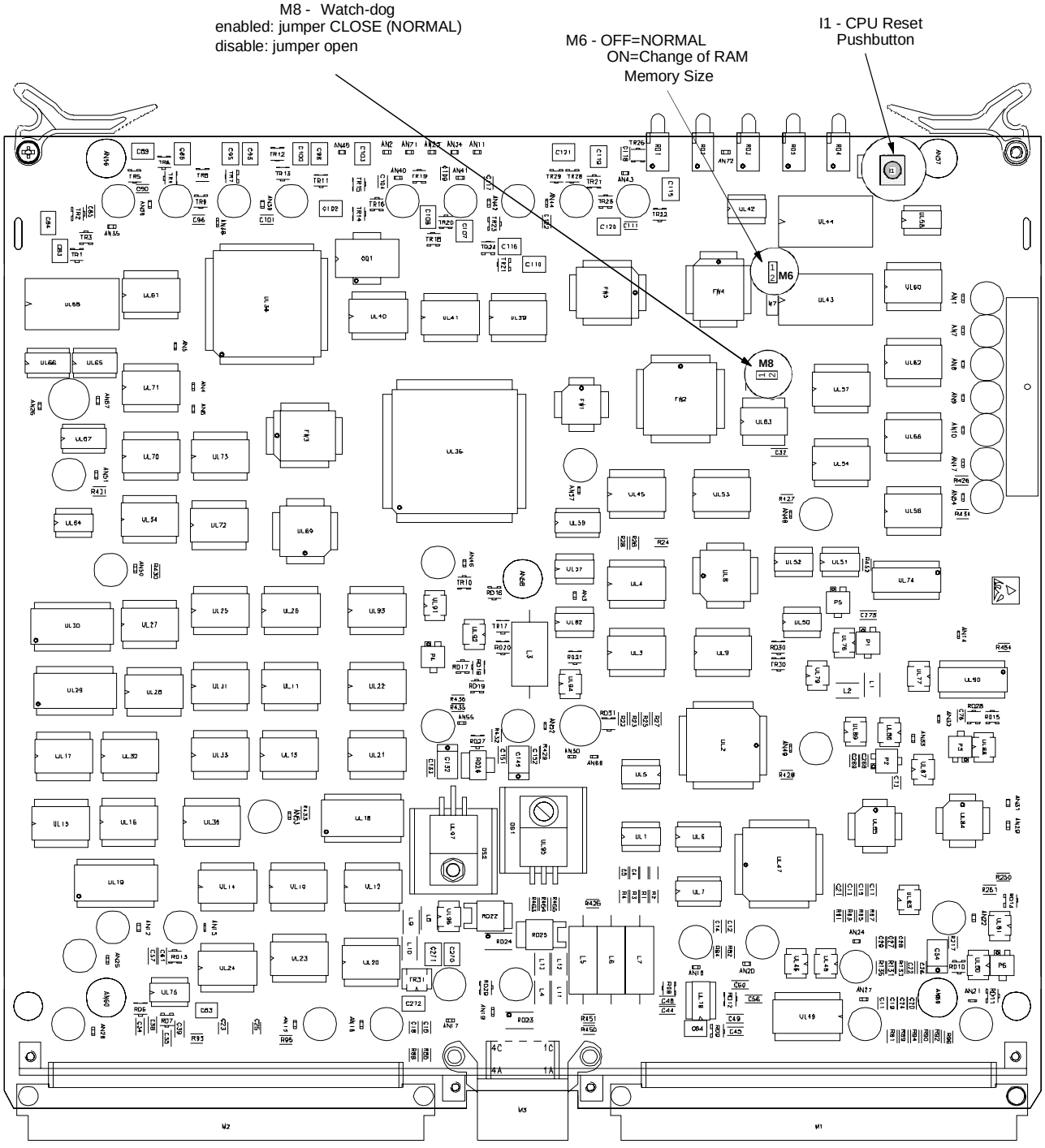


Figure 2.26. Links Setting on MON Module

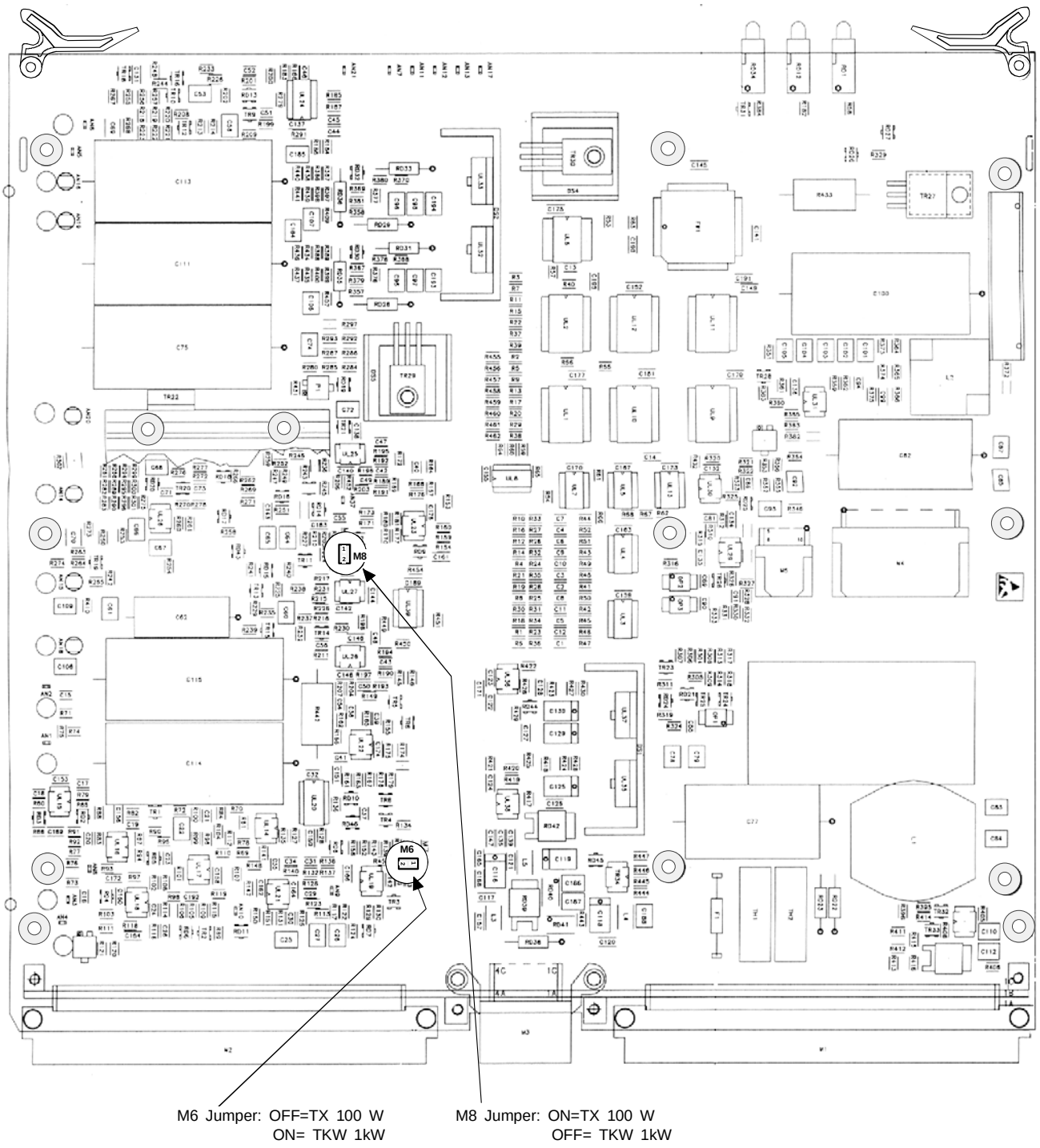


Figure 2.27. Links Setting on TX Module

2.6.8 Associated Facility Interface

Electrical interfacing, i.e. identity association can be easily performed as well, by means of a highly flexible interface board (AFI), inside the DME cabinet.

The DME ground beacon can be associated to VHF equipment such as a VOR or ILS. In this case, the beacon must be equipped with the appropriate AFI interface module.

The DME can operate either as master or as slave in the association (software configurable), according to the VOR or ILS capability and to system requirements.

A cable with a single connector fitted is supplied for this connection. This connector must be connected to connector SK4 or SK5 (called AF1 or AF 2 ASSOCIATED FACILITY) on the I/O panel of the equipment (on top of the cabinet). The other end of the cable must be connected to the associated VHF equipment.

AF1 or AF2 are selected by means of an external switch (e.g. by Control tower room): see applications in figure 2.29. In default condition, is enabling the AF1 connector.

The connection to associated equipment of the identity and beacon status signals input and output, is shown in the figure 2.29 (application) and the block diagram is shown in figure 1.30 (section 1 - General information).

The lists of the pin signals on connectors SK4 and SK5, on top end I/O panel, are in Tables 2-9 and 2-10.

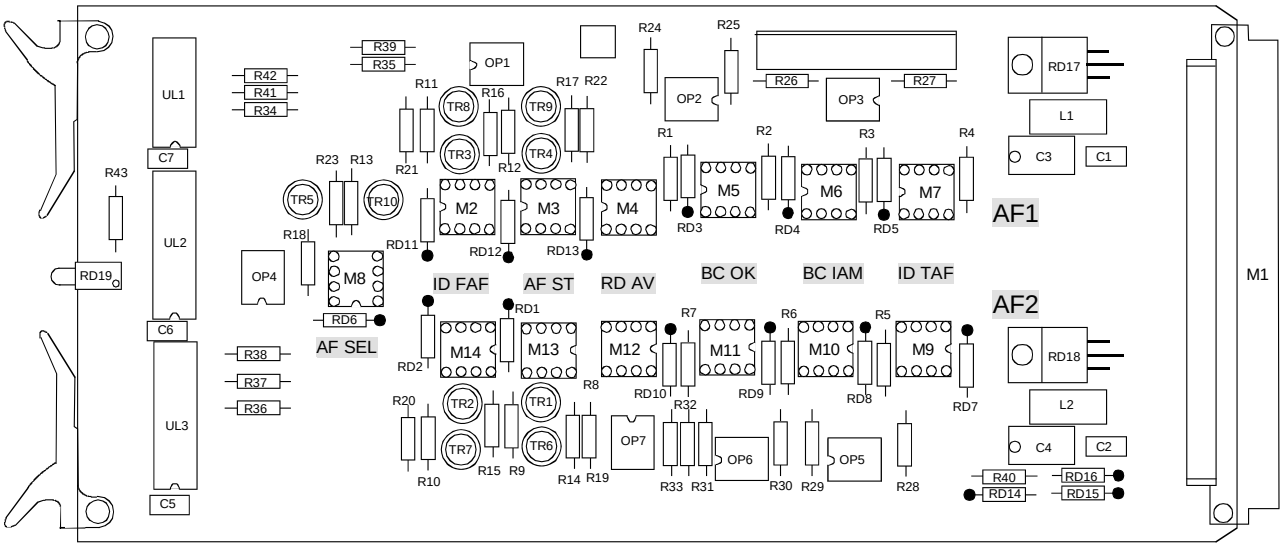
It is possible change the current source (source external or source internal) rotating 180 degree the 8 pin DIL header plug, shown in figure 2.28, of the module AFI layout for a correct positioning of the links

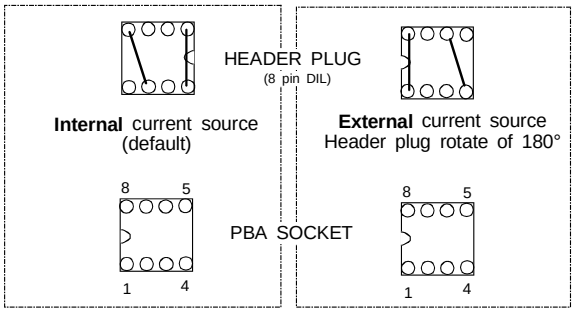
Figure 2.30 gives a few association examples with equipment associated.

Table 2-10 - AFI Connectors pin-out signals

Acronyms	Definition	SK4 pin		SK5 pin		AFI PBA - M1 pin		
		H	L	H	L	H	L	
AF SEL	Input-Associated Facility selection	20	7	20	7	18c	18a	
ID FAF 1	Input- Identification from Associated Facility	14	1	-	-	3a	4a	
AF ST 1	Input- Associated Facility Status	15	2	-	-	5a	6a	
ID FAF 2	Input- Identification from Associated Facility	-	-	14	1	3c	4c	
AF ST 2	Input- Associated Facility Status	-	-	15	2	5c	6c	
ID FTF 1	Output - Identification to Associated Facility	19	6	-	-	16a	17a	
BC OK 1	Output- Beacon OK	17	4	-	-	12a	13a	
RD AV 1 (*)	Output- Redundancy Available	16	3	-	-	7a	8a	
BC IAM 1(*)	Output- Beacon IA Mode degraded	18	5	-	-	14a	15a	
ID TAF 2	Output - Identification to Associated Facility	-	-	19	6	16c	17c	
BC OK 2	Output- Beacon OK	-	-	17	4	12c	13c	
RD AV 2 (*)	Output- Redundancy Available	-	-	16	3	7c	8c	
BC IAM 2 (*)	Output- Beacon IA Mode degraded	-	-	18	5	14c	15c	
ID FAF	To transponder - Identification					-		22a
AF ST	To transponder - Status					-		22c
ID TAF	From transponder - Identification					-		25a
BC OK	From transponder – Beacon OK					-		24a

NOTE 1: (*) N.U. on DME/N
NOTE 2: SK4 used for Associated equipment AF1 (standard default).
SK5 used for Associated equipment 2. It is used also on possible emergency conditions (e.g. failure on AF1 section), if equipment 2 is not available (in this case, the pin 7 and 20 of "AF SEL" signal will be short-circuited).

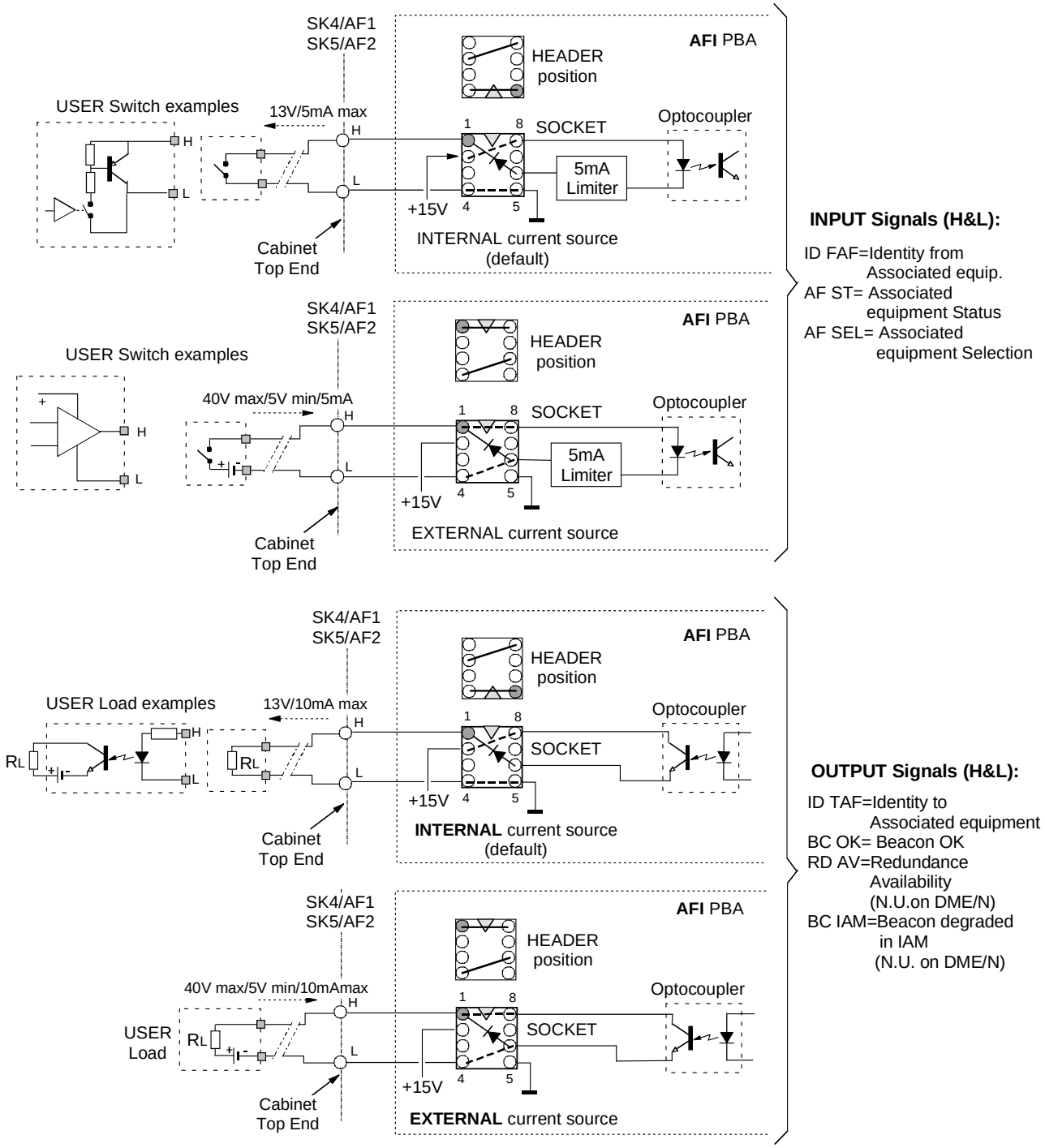




INPUT Signals (H&L):
ID FAF=Identity from Associated Facility equipment
AF ST= Associated Facility equipment Status
AF SEL= Associated Facility equipment Selection

OUTPUT Signals (H&L):
ID TAF=Identity to Associated Facility equipment
BC OK= Beacon OK
RD AV=Redundance Availability (N.U.)
BC IAM=Beacon degraded IAM (N.U.)

Figure 2.28. Header plugs setting on AFI Module



NOTE: Pin-out on SK4/SK5 according to tables 2-6 & 2-7 and to AFI module layout fig. 2.23

AF1 = Associated Facility equipment 1 (default)
AF2 = Possible Associated Facility equipment 2

INPUT signal "AF SEL": with user switch OFF (open) the only AF1 (EQPMT 1) is enabled; with user switch ON, the only AF2 (EQPMT 2) is enabled

Figure 2.29. AFI Module - Input and output signals application

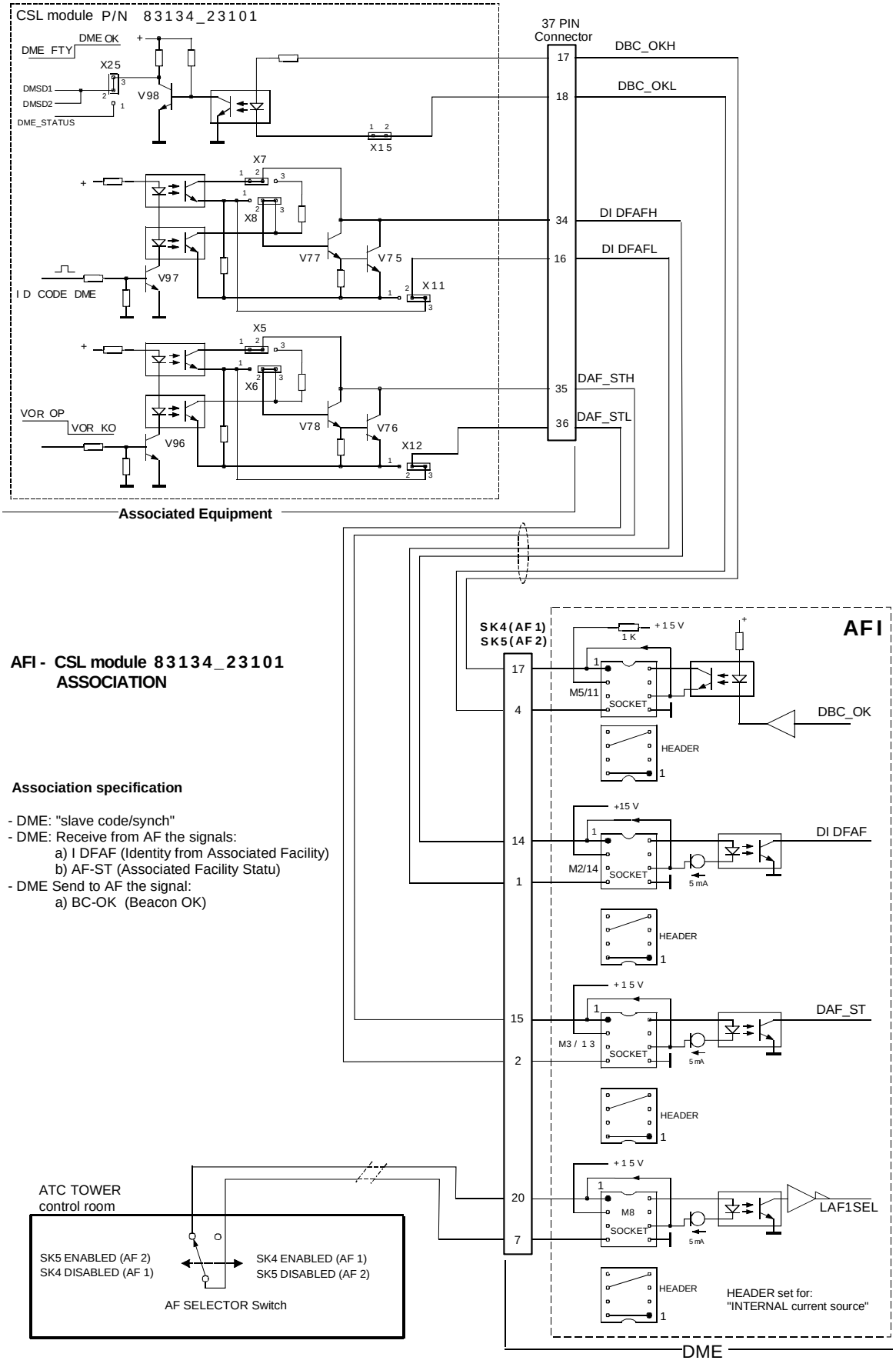


Figure 2.29a. AFI Module – Association example with VOR/ILS 400

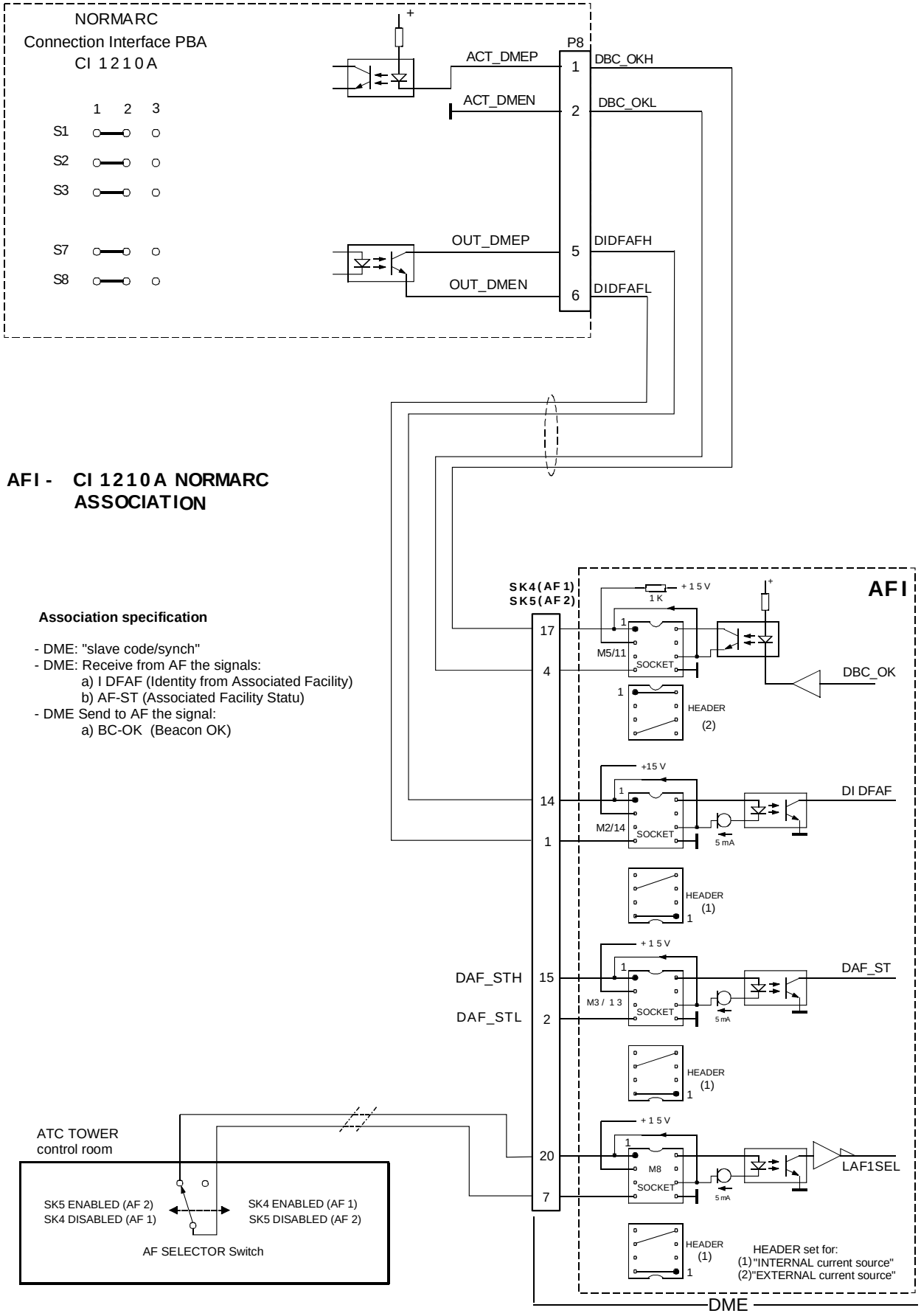
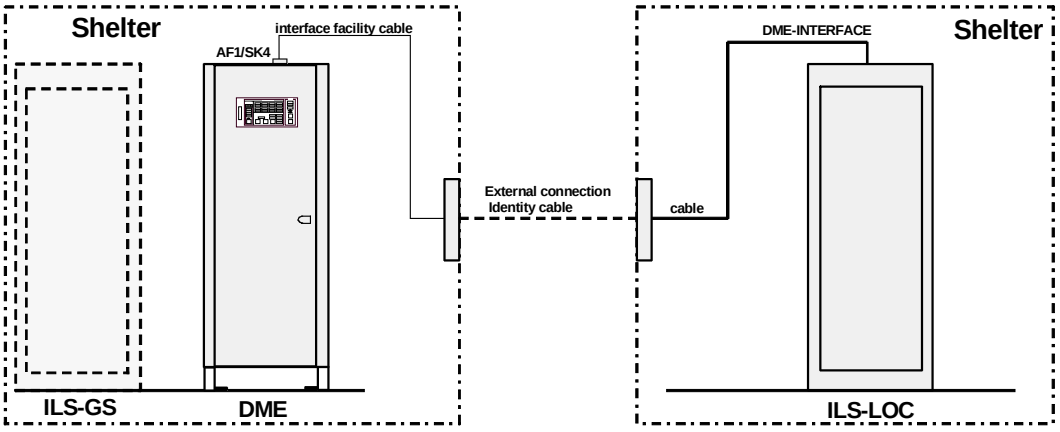
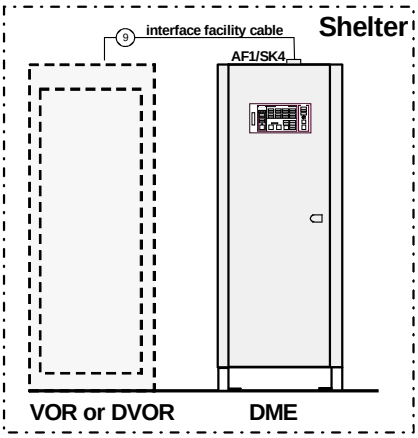


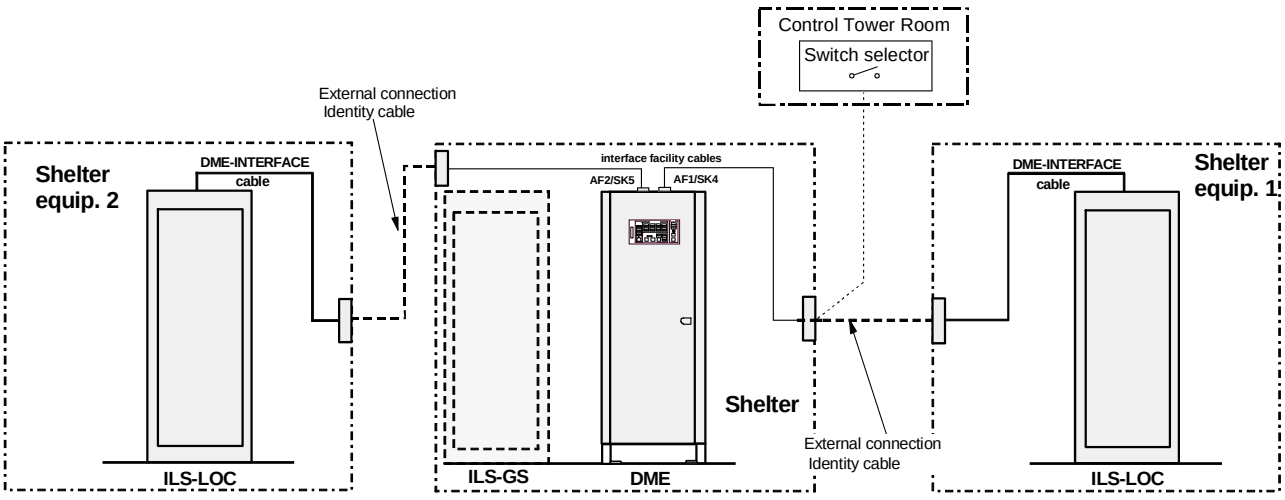
Figure 2.29b. AFI Module – Association example with VOR/ILS NORMAC



DME - LOC Identity Connection cable



DME - VOR Identity Connection cable



DME Identity Connection cable with two LOC equipments

Figure 2.30. Equipment associated examples

2.6.9 Remote Control and Status Indicator

Typical examples of connections to remote control and repeater Main Status Indication are shows in figure 2.31. Information concerning the installation of the Remote Control is given on "RCSI or RCSE or MCS Technical Manuals ".

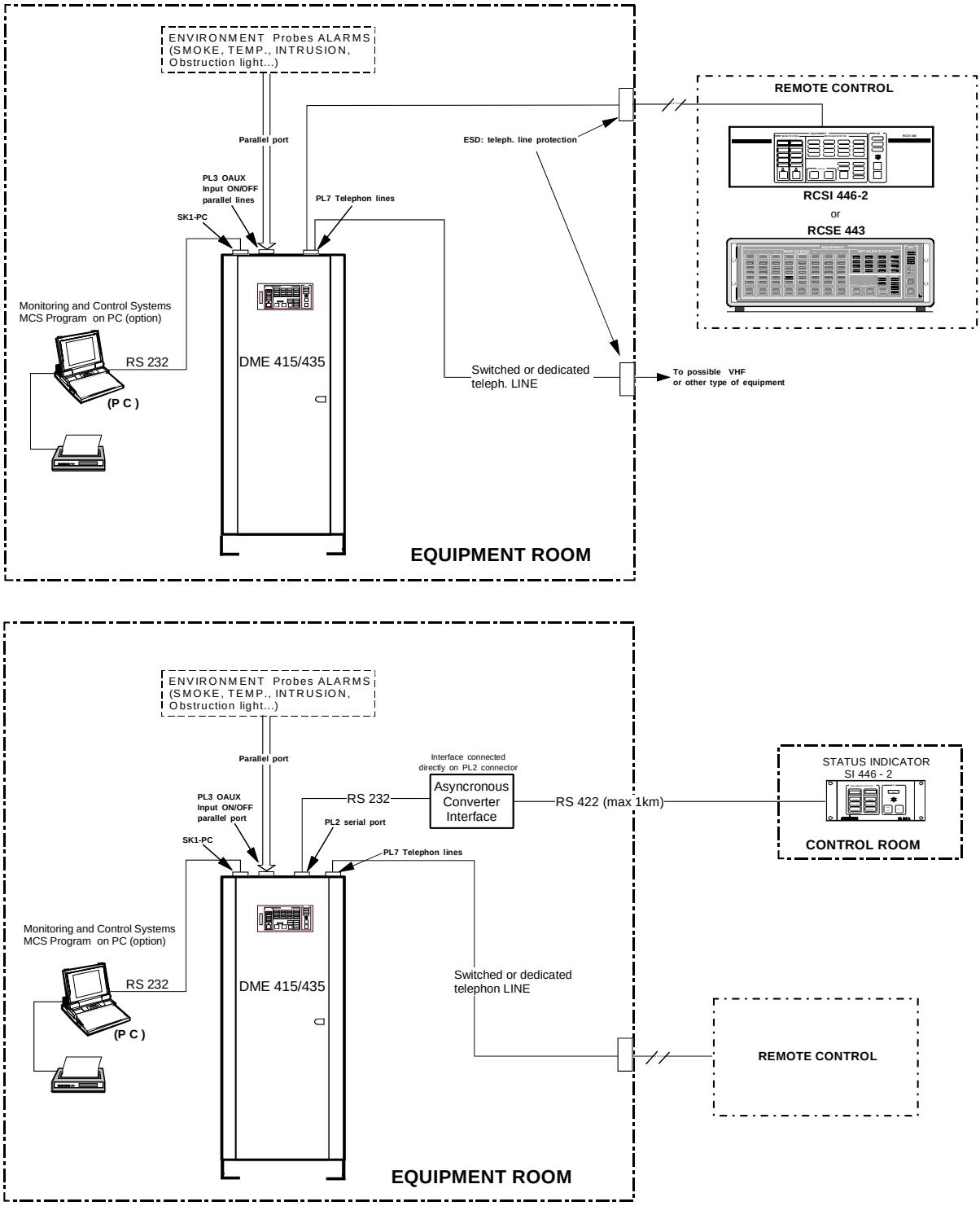


Figure 2.31. Remote Control and Status Indications connection examples

2.6.10 PC Installation

For local mode the cable is connected to the RS-232 terminal on the front panel of the local control and status unit (LCSU) or on SK1 connector of the I/O panel of the cabinet
In the case of remote mode, the data transfer is achieved via the modem and the remote control unit (e.g. RCSI 446/RCSE443, see figure 2.32).

NOTE:

The procedures of program installation on PC are described in section 3 of this volume, paragraph 3.5 - and para 3.6.

The program installation is described in Appendix sections of this volume:

- *APPENDIX B*-PC user WINDOWS SUPERVISOR;
- *APPENDIX C*-PC user WINDOWS ADRACS SUPERVISOR;
- *APPENDIX D*-PC user EQUIPMENT MANAGER.

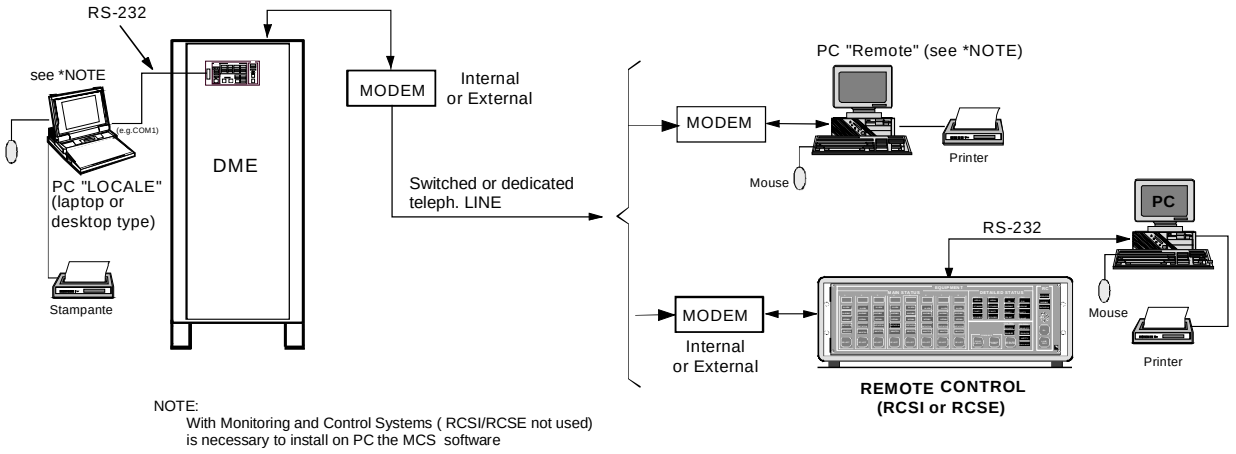


Figure 2.32. PC connection examples

2.6.11 Power supply with BCPS subrack of Frako type (optional version)

The grounding and supply connections are similar to like described in para 2.6.2 and 2.6.3. For this optional version to refer at figures 2.33 and also at para 1.6.8.2.1 section 1 in this volume.

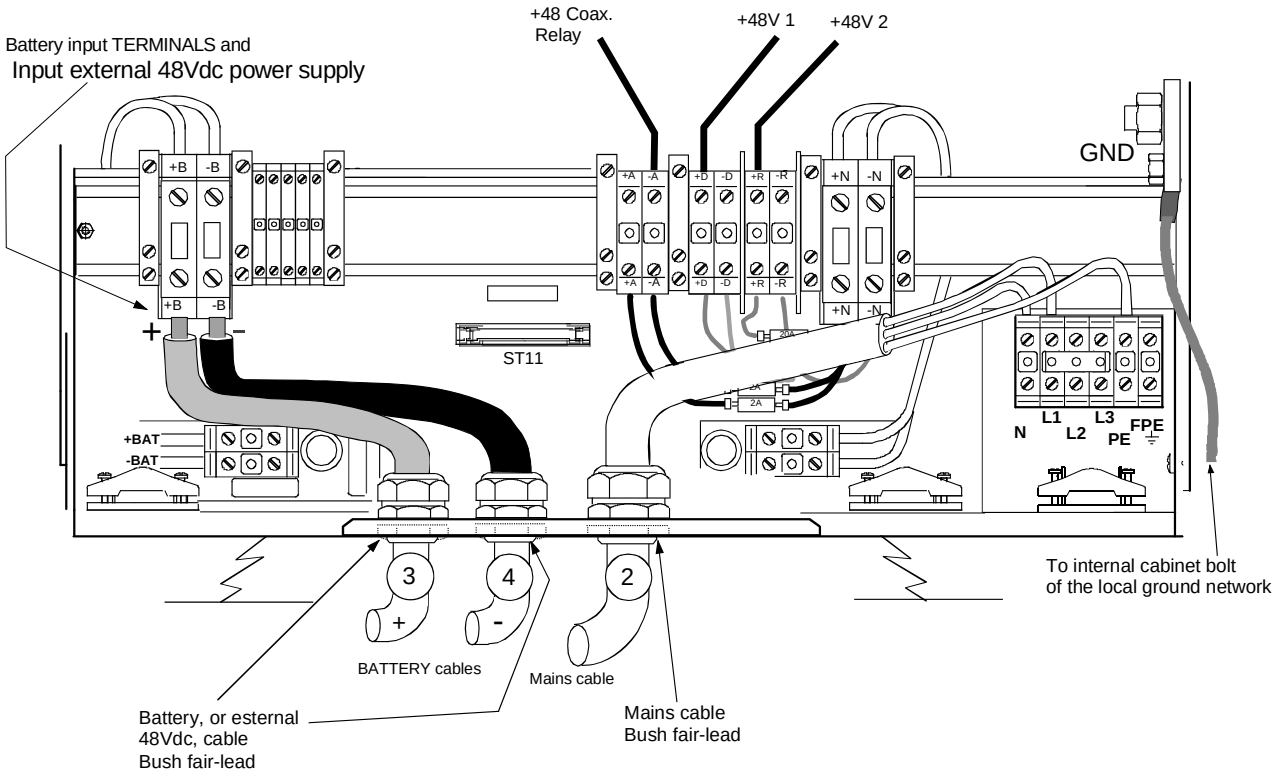


Figure 2.33. BCPS subrack of Frako type - Supply cables connection

2.6.11.1 External power supply 48Vdc connection (Frako subrack)

BCPS unit is equipped with the Supervisor module and without the AC/DC converters.

Connect cables 3 and 4 of table 2-1, to "± B" terminals (Fig. 2.33). Cable “2” is not used.

Configure the LCSU as described in Section 3 para. 3.2.2.1.2.3 (Aux Input 8..15), disabling the warning messages for: MAINS/BATT, AC/DC FAULTY, PREDEPL.

NOTE: fuses F1-F2 of the printed circuit board, inside the Battery Supervisor module, must be removed.

WARNING

During power supply connection: be sure the breaker of the Battery Supervisor is OFF.

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THALES

Description, Installation, Operation, Maintenance | Reference: Vol. 1 Code 955 900 031 C

GROUND BEACON

DME 415/435

Technical Manual

VOLUME 1

Equipment description, Installation, Operation, Maintenance and PC user

SECTION 3

OPERATION and USE INSTRUCTION

Vers. D, September 2005

Table of CONTENTS

List of FIGURES

List of TABLES

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SECTION 3

OPERATION and USE INSTRUCTION

GENERAL

For local operation, only a few functions are operable with the Control and Indication Panel (LCSU). The configuration, alignment procedure and the maintenance are performed with a locally connected PC via a user program "WINSV Supervisor" installed on a PC (typical connections example in section 1 on Vol.1 of this technical manual).

In the normal case standard of remote operation, is carried out via a control interface, connected at a Remote Control and Status Indicator unit (typical connections example in section 1 on Vol.1 of this technical manual).

3.1 LOCAL CONTROL AND INDICATION PANEL

The local controls and indicators are to be found on the front panel of INC Module of the LCSU unit only, located at the front door.

The Control and Indication Panel is subdivided into the following fields:

- MAIN STATUS
- DETAILED STATUS
- COMMAND
- CONTROL
- STATION
- LCSU

The individual fields contain indications and keys. Only those indications currently in message status are lit up and thus legible. This ensures that misinterpretations are avoided. The meaning of the indications and keys in the various fields are described in the following paragraphs.

These controls and indicators are listed in tables 3-1 and shown in figure 3.1.

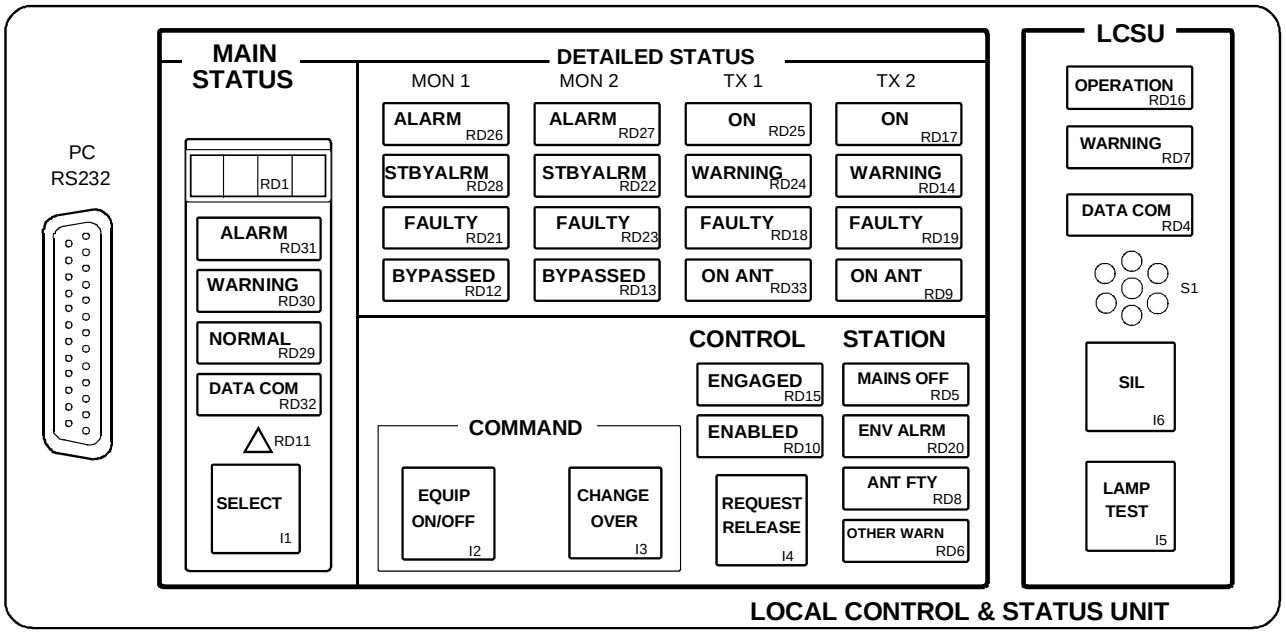


Figure 3.1. LCSU Front panel

Table 3-1. Controls and Indications on the Front panel of LCSU (Main Status)

Definition	Color of indicator	Reference to Fig. 3.1	DESCRIPTION
MAIN STATUS field			Field with display always active
PC RS232 connector	-	(SK6)	Serial RS 232 connector that permits insertion of the cable of the serial line to interconnect a local PC. This connector is “pin to pin” parallel of SK1 located on the I/O Panel at top end of equipment.
Display	-	RD1	Text display: N° 4 programmable digit alphanumeric, electronic dataplate that makes it possible to highlight the equipment code or identification of the site. These indicators are managed and stored with the configuration program.
ALARM	Red	RD31	Normally OFF. In AUTOMATIC mode, indicates shut-down of the beacon. In MANUAL mode, the led is always ON because the radiated signal not is longer guaranteed.
WARNING	Yellow	RD30	Normally OFF. ON: Indicates that the beacon is affected by: - a secondary alarm of the transponder on antenna; - a faulty DMD or DPR irregular functioning of these; - a faulty monitor; - alarm on the transponder in ST-BY; - mains failure; - beacon OFF; - other general faults.
NORMAL	Green	RD29	Normally ON. No ALARMS or WARNINGS have been found.
DATA COM	Red	RD32	Normally OFF. Indication of errors or faults in the serial communication system between equipment and LCSU.
-	Green	RD11	Acknowledgement for SELECT key - Triangular shaped that indicates selection of enabling to highlight detailed states by the local operator.
SELECT key	-	I1	Selection key to disable and enable detailed status indications.

Table 3-2. Controls and Indications on the Front panel (Detailed status)

Definition	Color of indicator	Reference to Fig. 3.1	DESCRIPTION
DETAILED STATUS field			This field must be enabled by the operator using the “SELECT” key
MON 1 ALARM	Red	RD26	Normally OFF. Indicates that Monitor 1 has found one or more of the parameters of the transponder, on antenna, out of tolerance.
MON 1 STBY ALARM	Yellow	RD28	Normally OFF. Indicates that Monitor 1 has found an error or defect in the transponder on the dummy load.
MON 1 FAULTY	Yellow	RD21	Normally OFF. Indicates a fault due to Monitor 1 or that Monitor 1 has not passed the tests of its own self-check correctly.
MON 1 BYPASSED	Yellow	RD12	This indicator is ON when the operator sets the beacon to MANUAL mode. In this case, the intervention functions by Monitor 1 are ignored. It switches on, together with MON2 BYPASS (RD13).
MON 2 ALARM	Red	RD27	Normally OFF. Indicates that Monitor 2 has found parameters of the transponder on antenna out of tolerance.
MON 2 STBY ALARM	Yellow	RD22	Normally OFF. Indicates that Monitor 2 has found an error or defect in the transponder on the dummy load.
MON 2 FAULTY	Yellow	RD23	Normally OFF. Indicates a fault due to Monitor 2 or that Monitor 2 has not passed the tests of its own self-check correctly.
MON 2 BYPASSED	Yellow	RD13	This indicator is ON when the operator sets the beacon to MANUAL mode. In this case, the execution functions by Monitor 1 are avoided. It switches on, together with MON1 BYPASS (RD12).
TX 1 ON	Green	RD25	Normally ON. Transmitter 1 has received the ON OPERATING command and is operating correctly, providing power either on antenna or on dummy load.
TX 1 WARNING	Yellow	RD24	Normally OFF. Indicates faults or secondary alarms (one or more) found on transponder 1.
TX 1 FAULTY	Red	RD18	Normally OFF. Indicates a primary alarm on transponder 1. TRX 1 is shut down by monitor system due to an alarm
TX 1 ON ANT	Green	RD33	Indication that makes it possible to check whether the transponder is on antenna. In this case, it indicates transponder 1 on antenna: therefore, transponder 2 is connected to the dummy load.
TX 2 ON	Green	RD17	Normally ON. - Transmitter 2 has received the OPERATING command and is operating correctly providing power either on antenna or on dummy load. In single configuration, it is always in OFF
TX 2 WARNING	Yellow	RD14	Normally OFF. - Indicates faults or secondary alarms (one or more) found on transponder 2. In single configuration, it is always in OFF
TX 2 FAULTY	Red	RD19	Normally OFF. Indicates a primary alarm on transponder 2. TRX 2 is shut down by monitor system due to an alarm. - In single configuration, it is always in OFF
TX 2 ON ANT	Green	RD9	Indication that makes it possible to check whether the transponder is on antenna. In this case, it indicates transponder 2 on antenna: therefore, transponder 1 is connected to the dummy load. In single configuration is on when the TX1 is on Dummy-load

Table 3-3. Controls and Indications on the Front panel (Control, Commands, Station)

Definition	Color of indicator	Reference to Fig. 3.1	DESCRIPTION
CONTROL Field			Field with display enabled by SELECT key
ENGAGED	Yellow	RD15	Indicates that one of the operators is controlling the equipment, through Local PC or other Remote Control (priority).
ENABLED	Green	RD10	Indicates that the local operator using the «REQUEST-RELEASE - I4» key has acquired control of beacon commands. It flashes during the execution of the ON/OFF and CHANGE-OVER commands.
REQUEST RELEASE key	-	I4	Press the REQUEST/RELEASE key to request control and wait for the ENABLED indication. Button with whom the local operator (priority) can enable or release equipment controls. This action depending of "control superseding" parameter configuration: Disable = overridden never on the user in operation Enable = overridden always on the user in operation Priority = overridden only if preset is better of priority on the user in operation On receiving the request, the beacon changes to AUTOMATIC mode. Perform the desired command on/off or change over of transponder by pressing the corresponding key EQUIP ON/OFF or CHANGE OVER. Press the REQUEST/RELEASE key again to release the control for PC or Remote Control. The ENGAGED indication is OFF when the control taken by the local control.
COMMAND Field			
EQUIP ON/OFF key	-	I2	Key that makes it possible to switch the beacon ON and OFF. This button is enabled by “REQUEST/RELEASE” key.
CHANGE OVER key	-	I3	It is used to change over the conditions of operating on antenna by one or the other transponder. Therefore, the transponders connected to the dummy load will invert their role. This key is enabled by “REQUEST/RELEASE” key. The transponder on antenna conditions can be deduced from the indications of RD33 and RD9 (ON ANT) for transponder 1 and 2 respectively.
STATION field			
MAINS OFF	Yellow	RD5	Indicates a mains failure (black-out or mains power off) and that the equipment is operating with the back-up batteries.
ENV ALRM	Red	RD20	Indicates that one or more site signals are in alarm condition. For example the signals indicating: smoke, intrusion, high temperature or failure of obstacle lights, etc.
ANT FTY	Red	RD8	Not used (only relevant for TACAN and NDB).
OTHER WARNING	Yellow	RD6	Normally OFF. Extra general type indication of any alarm conditions that may not necessarily put the equipment out of service. The indication is associated to the WARNING indication of MAIN STATUS.

Table 3-4. Controls and Indications on the Front panel (LCSU status)

Definition	Color of indicator	Reference to Fig. 3.1	DESCRIPTION
LCSU Section			Section with display always active
OPERATION	Green	RD16	Normally ON. Indicates correct functioning of the permanent and continuous self check of the CSB module as regards both its own HW circuits and SW programming. Also assures continuous checking of the correctness of the +5VDC voltage via the CSB watchdog circuit.
WARNING	Yellow	RD7	Normally OFF. Indicates any alarms in the CSB module such as incorrect RTC (Real Time Clock).
DATACOM	Red	RD4	Not used.
BUZZER		S1	Audible alarm that informs the operator of a primary alarm on both transponders and is activated concurrently with the MAIN STATUS ALARM message. The buzzer sounds until it is reset manually with the “SIL” button. In MANUAL Mode, the buzzer is not activated.
SIL key		I6	Buzzer reset pushbutton.
LAMP TEST key		I5	Checks correct functioning of the lamps of the INC module and efficiency of the buzzer for optical and acoustical testing purposes. This action envisages switching off all the leds, switching on again one at a time and then reset to the initial condition. At power-on, this test is carried out automatically.

On CSB module PBA (printed board assembly) the following LED and keys are placed:

- green LED, indication of data on the transmission serial line
- green LED, indication of data on the receiver serial line
- green LED, watch-dog OK
- Key of *reset* of the CPU

The layout of module CSB is in section 5 - Maintenance and Repair - of this volume

3.2 LCSU UNIT CONFIGURATION PROCEDURE

In this paragraph, feel shown examples of the screens which will be to visualize during the procedure of configuration. The notes on the screens are of comment and memorandum during the phases of the procedure.

The procedure of configuration of unit LSCU can be active even when the DME is operational, since the radio beacon is managed by a specific program.

3.2.1 LCSU PARAMETER CONFIGURATION

This utility program is necessary of the all LCSU unit parameters configuration

3.2.1.1 Program install on PC

Normally the LCSU is supplied as configuration standard

3.2.1.1.1 From floppy disk

Make sure WINDOWS operating system is installed on PC

The "**Util** " floppy disk configuration TERMINAL EMULATOR program containing these files:

- **install.exe** installation program,
- **zutil.exe** program to configure the modem through the Modem.exe file,
- **emul.exe** terminal emulator program to enable the LCSU unit configuration including the serial and parallel lines (as well as the operation checks of all these lines through the specific "Hardware test" program).

readme.doc text file with the information concerning the installation of the files.

Load the "UTIL" program provided on the 3,5" diskette onto the PC hard disk

- Insert the " disk UTIL" into the 3,5" floppy disk drive (usually "a:");
- Type the A: command and press the ENTER key;
- Type <**install c:\<name>** > and press the ENTER key;

  <**name**> is an indication and the actual name can be established by the user. "**c**:" is the usually drive where the program is installed on hard disk.

3.2.1.1.2 From CDROM

Make sure WINDOWS operating system is installed on PC

The program is provided on CDROM complete of program "*Terminal emulator configuration*" in the directory "WinSv" and includes the file:

emul.exe program "*terminal emulator*" to enable the configuration of LCSU unit, included the lines parallel and serial, by the program "*Hardware test*"

Load the program **emul.exe** on the hard disk as it is known as in the section of the APPENDIX B, in this volume.

3.2.2 LCSU CONFIGURATION PROCEDURE

To modify the LCSU configuration parameters connect a PC to connector SK1 on the I/O panel (or directly to the front panel of the LCSU unit named PC RS232)

This paragraph describes some video page examples that are displayed during the configuration procedure. The notes concerning some video pages are remarks and memorandum to be followed when loading the configuration procedure.

The LCSU configuration procedure can also be activated when the DME is operating, since the beacon is managed by a specific program.

To load the program, proceed as follows:

- run the "**EMUL.exe**" program from the PC;
- press the "I1" RESET push-button on the PBA of CSB module (reached from the back of the equipment front door);
- when the starting video page is displayed, press the keyboard space bar at least **three times** within a few seconds to access the configuration mode;
- if access is not obtained with the first configuration video page, repeat the RESET operation;
- perform the configuration procedure following the instructions displayed in the menu;
- after configuration, save the variations in EEPROM; it is suggested to save the new data on a back-up diskette.
- Before running the supervisor program change the parameters in the **config.ini** file according to LCSU configuration.

3.2.2.1 Main Menu

Figure 3.2 shows the main video page of the configuration program. Besides the options indicated, it is also possible to return to the previous menu by pressing the ESC key.

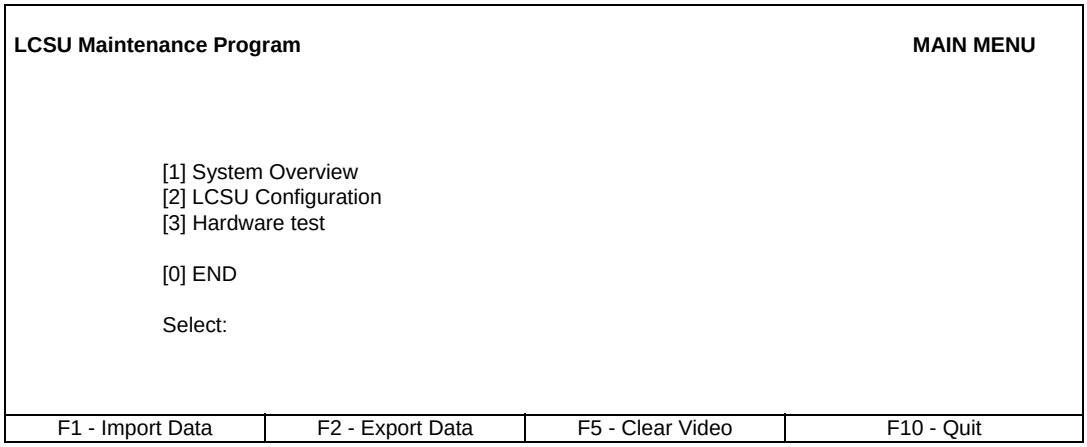


Figure 3.2. Main Menu

If, when starting up the program, an EEPROM failure is detected (faulty or containing data no longer valid), the following message is displayed at the bottom of the video page:

Invalid configuration data, press a key to load default parameters.

NOTE: F1, F2, F5, F10 are key of PC keyboard - ESC = previous menu

3.2.2.2 System Overview

Selecting option [1] from the Main Menu the example video page shown in figure 3.3 is displayed.

The goal of this screen is to show to the operator some important feature of the software:

- Internal NAME of the equipment (CODE & MANUFACTURER);
- Programmable COMMUNICATION line;
- Number of the STATES and COMMANDS allowed for each equipment;

For each equipment:

- Number of History DATABASE provided;
- Number of DIGITAL I/O specific for the equipment.

These informations are useful during configuration job.

All the informations of this screen are fixed.

LCSU Maintenance Program — System Overview

V1.01-DMXXU101

Index	Name	Mnfct	Code	Comms	States	Cmds	Dbases	Dig_in	Dig_out
[0]	LCSU Unit	0	0	0	48	16	1	0	0
[1]	ANS-DMEN 415/435	1	1	0	80	3	4	12	0

Press <ESC> to exit

F1 - Import Data | F2 - Export Data | F5 - Clear Video | F10 - Quit

Figure 3.3. System Overview

V1= actual version of software

The items have the following meanings:

Index: List of equipment managed by LCSU

Name: Managed equipment codes

Mnfct: Manufacturer
0 = LCSU System
1 = ANS (Thales)

Code: Equipment code
0 = LCSU
1 = DME/N
2 = DME/P

Comms: Number of Communications Serial Port used
LCSU = 0 (No Port used)
DME = 0

States: Quantity of state messages available
LCSU = 48
DME = 80

Cmds: Max. quantity of commands managed
LCSU = 16
DME = 3

Dbases: Data Bases (History) associated to the equipment
LCSU = 1
DME = 4

Dig_in: Parallel input lines - Number of lines for beacon management
LCSU = 0
DME = 12

Dig_out: Parallel output lines - Number of lines for beacon management
LCSU = 0
DME = 0

3.2.2.3 LCSU Configuration

This screen groups the entire Submenu configuring the software and two option (EXPORT & IMPORT) to save SAVE/RESTORE the changes made.

Selecting option [2] on the Main Menu displays the page shown in figure 3.4.

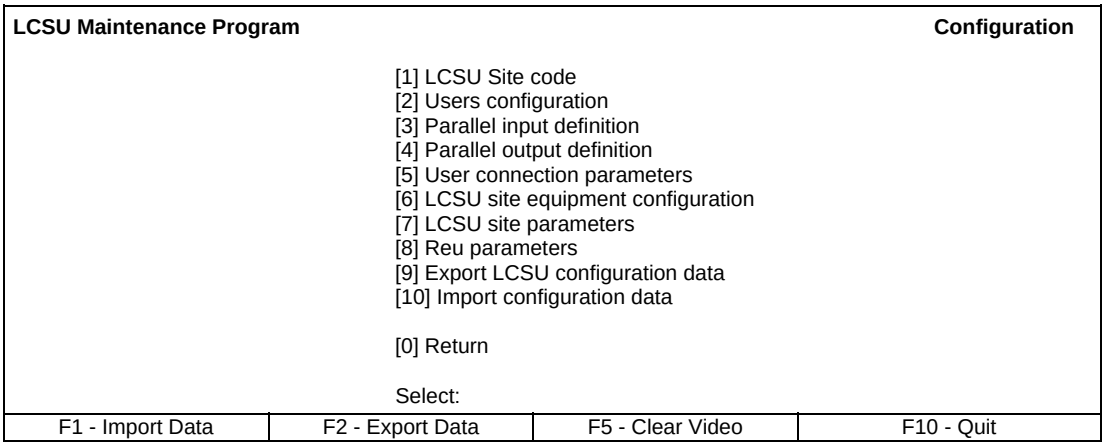


Figure 3.4. Configuration menu

3.2.2.3.1 LCSU Site Code

Select option [1] on the "Configuration" page to enter the beacon or site identity code as shown in figure 3.5.

This screen allows the operator to change the SITE name, which is the name used by all the users (PC, RCSI 446 or RCSE445, SI 446) to communicate with the DME.

Only CAPITAL letters and DIGIT are allowed.

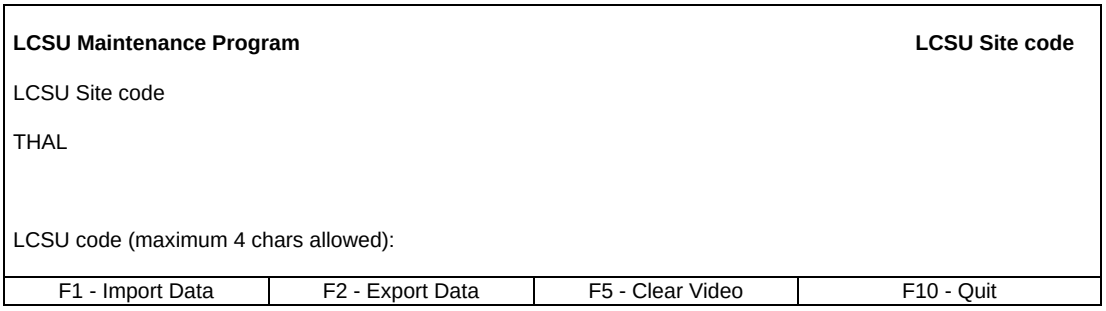


Figure 3.5. Site Code

3.2.2.3.2 User Configuration

Selecting option [2] from the “Configuration” menu displays, the example page shown in figure 3.6.

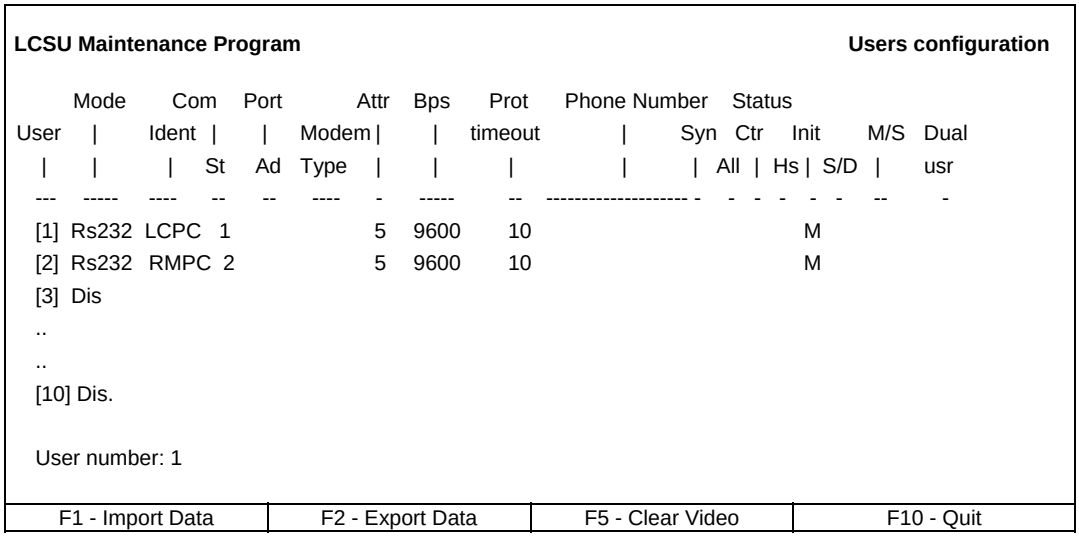


Figure 3.6. Users Configuration

This screen defines the parameters needed to manage the communication with the user:

- Kind of connection (RS232, Dedicated, switched, party line);
- Communication parameter (Port, Baud Rate, Protocol timeout);
- Identifier of the User;
- Kind of Modem (internal, external);
- Dialing parameters (Phone number and call logic) meaningful for switched line only;
- Master/Slave parameter (Party line only).

For each kind the connection, are to configure:

- **User** name
  Identifier of user. It is the NAME of the user known everywhere in the network.
- **Mode**: Connection modes possible for each user
  0 = Dis. (disabled: as if non existent)
  1 = RS232C (type of serial line)
  2 = Ded.Call (dedicated telephone line via modem in “originate” mode)
  3 = Ded.Answ. (dedicated telephone line via modem in “answering” mode)
  4 = switched
  5 = Party line
- **Ident**: Identity code name of user (max. 4 alphanumeric characters).
- **Com Port** (Communication Port):

  Valid values are from 1 to 3 (CH1, CH2 and CH3). Port 4 to 6 are reserved for internal use of equipment.

  Port 1 is generally used for local connection (line maintenance PC), Port 2 and 3 are generally used with remote connection trough Modem (switched line, dedicated line or party line).

- **St** : Status Request only with switched line modems - Changing any bit of the status word – **Y** (yes) the user is called upon a change of one of the main states of the equipment, **N** (no) in case of equipment state variations the user is not called for updating

- **Ad**: This is a communication port used in addition to the other when the customer requires the redundancy of the communication line. Therefore is possible to communicate with the same user on two different lines. The additional port is used only if the first port is wrong.
  A 0 value disable the line redundancy.
- **Modem type**: EX= External; LGM=Logem internal
- **Attr** Attribute

  1 = Displays the states of equipment and connections; 2 = Reserved; 3 = Enables the operator to equipment commands control; 4 = Reserved; 5 = Enables database reset and date updating
- **Bps**: Baud rate - Transmission rate selection (only RS232) 1:300, 2:1200, 3:2400, 4:4800, 5:9600,
- **Protocol timeout**

  Maximum waiting time during data exchange between LCSU and user: typical 10 seconds (1 to 30 s allowed)
- **Phone Number** : User phone number, only switched line (maximum 20 digits)
- **Status**

  Syn: Synthetic - Variation of at least one of synthetic states (Normal, Warning, Alarm, Communication faulty). - **Y** = (yes) it is called at every user state variation.

  All: **Y** = (yes) the user is called whenever there is a change of one of the equipment fundamental states. **N** = (no) if there is a variation in the equipment state the user is not called for updating.

  Ctr : Control - selection **Y**=(yes): the consumer will be called every time that another consumer takes or liberates the control of the equipment. Selection **N**=(no): that consumer won't be advised when another consumer acquire or liberated the control. Up

  Hs: Database updating - Y = (yes) the authorized user is called by LCSU for a variation in the database.

  Init : Initialization (**M** = Mandatory, **O**= Optional) Recommended value: **M**

  M/S : Definition of party-line use, of the network communication protocol (**M** = master, **S** = Slave, 0 to 9 = slave address)

  Dual usr: Dual user. Enable the user redundancy.
  For instance, may have two PC's redundant in the Remote site. It's sufficient to update all only. The other PC may get the data from first.
  In case of call the LCSU tries to communicate with the first PC; in case of wrong connection, it tries with the dual user. This avoid loss of data in the switching network isn't good .
  A "**S**" value means user redundancy disabled
  A "**D**" value means user redundancy enabled

  Dual user number. It defines the Dual user. This value must be get from the column "User" of the screen

The allowing information needed to configure the software depends on the kind of connection, as follows:

⇨ RS 232

The connection between the DME and the user is made through a serial line RS232. In general, this mode is used when the user is on maintenance PC or on RCSI in the site.

⇨ *Dedicated call* (direct call)

The connection between the DME and the user is made trough a Modem programmed in ORIGINATE mode. In general, the user is a RCSI. (modem type: desk external LGM Internal (only LOGEM 28,8)

The parameters needed to make the configuration are:

- Baud rate
  1:300, 2:1200, 3:2400, 4:4800, 5:9600

⇨ *Dedicated Answer* (direct reply)

The connection between the DME and the user is made trough a Modem programmed in *answer* mode
The parameters needed to make the configuration are the same as dedicated call mode.

⇨ Switched line

The connection between the DME and the user is made trough a Modem programmed in Switched mode.

The parameters needed to make the configuration are the following:

– Additional port (**Ad**)

This is a communication port used in addition to the other when the customer requires the redundancy of the communication line. Therefore is possible to communicate with the same user on two different lines. The additional port is used only if the first port is wrong.
A 0 value disable the line redundancy.

– Modem kind

External: a desk Modem
LOGEM: an internal Modem (only "Logem 28,8" is supported).

– Phone number

Phone number of the user: 18 characters are allowed

– *Call logics*: they define which the LCSU must call the ignore user. Syn, All, Ctr, Hs, Dual user: definitions described status above

⇨ *Party line*. This kind of line is used when the DME is collocated with many equipment (in general these of an ILS). All linked to a remote user using a *multi point* connection.

The parameters needed to make the configuration are the following:

– User Mater/Slave

It defines which is the Mater of the communication, in general the user. A "**M**" means user is master (this is the suggested value), an "**S**" means user is slave.

– Slave Address

It define the address of the slave (from 0 to 9). If the user is Master, this is the Address of the DME, else is the Address of the Remote

The value to set depends on the configuration made on Remote Site.

The final data for each “user” option considered, has been entered in fig. 3.7 video page. The data is shown in sequence each time the operator enters the correct reply based on the requests sent out by the program (in bold type). If the operator gives a wrong reply, the sequence must be repeated starting from the request for “user number”.

The control priority is intended as the possibility to exclude the operators of the subsequent “user” from the equipment control (an operator excluded by another with higher priority has to wait until the latter has finished before being able to have control of the equipment). The priorities have the following order of importance:

1 = LCSU
2 = Local PC
3 = Remote PC and any other RCSI/RCSE

The higher priority is assigned to the “user” associated to the lower number

LCSU Maintenance Program **Users configuration**

User	Mode	Com Ident	St	Port Ad	Modem Type	Attr	Bps	Prot timeout	Phone Number	Status Syn	Ctr All	Init Hs	M/S S/D	Dual usr
[1]	Rs232	LCPC	1			5	9600	10				M		
[2]	Rs232	RMPC	2			5	9600	10				M		
[3]	Ded.A	IJKL	5		Ext.	5	2400	10				M		
[4]	Swt	MNOP	5	0	Lgm.	5		10	0123456789	Y Y Y Y		M	S	
[5]	Swt	UVXY	6	1	Ext.	5		10	22222222222	Y Y Y Y		M	D	2
[6]	Dis													
[7]	Dis													
[8]	Dis													
[9]	Dis													
[10]	Dis													

User number:

F1 - Import Data | F2 - Export Data | F5 - Clear Video | F10 - Quit

Figure 3.7. Users Configuration Table example

3.2.2.3.3 Parallel Input Definition

Selecting option [3] in the “Configuration” menu the page is displayed, showing the ports and parallel input lines (figure 3.8) for the definition of the control logic.

LCSU Maintenance Program **Parallel input definition**

[n] port name

[0] CONTROL INPUT
[1] AUX INPUT 0..7
[2] AUX INPUT 8..15
[3] ADDITIONAL INPUT 0..3

Port:

F1 - Import Data | F2 - Export Data | F5 - Clear Video | F10 - Quit

Figure 3.8. Parallel Input Definition

The ports and input lines listed are relevant to (signals AUX In- ON/OFF):

- [0] CONTROL INPUT 0 = Managing controls and beacon commands
- [1] AUX INPUT 0..7 = Inputs to connector PL3 on the I/O panel (from AUX 0 to AUX 7)
- [2] AUX INPUT 8..15 = Inputs to connector PL3 on the I/O panel (from AUX 8 to AUX 15)
- [3] ADDITIONAL INPUT 0..3 = TTL inputs (from IN 0 to IN3)

The goal of this screen is to allow the customer to define how manage the digital input signals.
There are different kinds of signals:

- Control panel keys
  Silent, Lamp, Select, Commands (Request/Release, Equipment ON/OFF, Changeover).
  They use the control input port.
- Auxiliary Signals

They come from outside and in general they define an Alarm condition. They use the AUX Input 0 to 7 ports.

- Internal Signals

  They come from supply modules and define an alarm condition on a power supply module. They use AUX input 8 to 15 and additional input IN 0 to 3 ports.

Both control panel keys and internal signals are wired in fixed way, but for more flexibility, they must be configured in this screen.

For each line of the port must be set the following parameters:

- Enabling

  This line is unused, it is possible to disable it.

- Functional mode, explained forward

When an input port is selected a page is displayed similar to that shown in figure 3.9 relating to the options selection needed to configure the INC module on the front panel.

LCSU Maintenance Program **Parallel input definition**

Port: CONTROL INPUT

inp	mode	logic	eqp_id	control_id	sharing_id	type	aux_descr
1	sElect	Low			1		
2	Cmdkey	Low	1	1		Pnl.	
3	Cmdkey	Low	1	2		Pnl.	
4	Cmdkey	Low	1	0		Pnl.	
5	Lamp	Low					
6	Buzzer	Low	1				
7	Disab						
8	Disab						

Press a key (<ESC>= abort, <+>= next, <->= previous, <ENTER>= modify):

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.9. Parallel Input

For each line of the port must be set the following parameters:

Logic Active *Low/High* (fig 3.10)

This is the acquiring logic for the line. For control panel keys the logic is always "*Low*", for internal signal is always "*High*"

In general, the configuration of the auxiliary input signal can be active "*high or low*". The LCSU in "high way", sees alarm when the wire are not connected.

eqp_id: equipment identifier. To obtain it from "*System Overview - equipment code*"

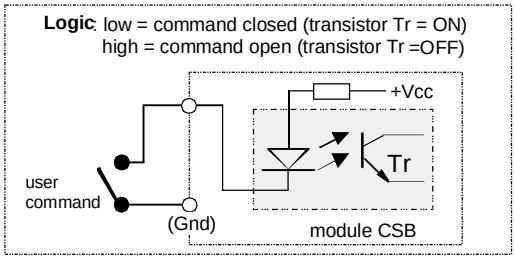


Figure 3.10. Input command Logic

control_id: an internal number from 0 to 15, ("CONTROL-ID"), used by the LCSU to communicate to the Remote Users, in short way the signal changes

sharing_id: identifier of sharing, taken by the column of the control panel

type: indication of the signal type - PNL = panel (Inc), ext. = external commands, env = alarm of environmental state of site

aux_descr: a string ("AUX-DESCR") of description, which is written on the history when the status arrive signal changes

When a line is not used it is possible to disable with: "*Disab*"

The allowed function mode, are the following:

- **Mode** Auxiliary Input

  The input is a signal carrying the status of an External Hardware line status port (smoke alarm, temperature alarm, intrusion alarm, obstr. light …).

- Environment alarm LED lightning

  The signal may be looked as an “Environment alarm". Therefore when, the signal goes in alarm state, the corresponding LED on the Control Panel, light ON.

Figure 3.11 shows a significant example relating to the configuration for remote indications concerning the beacon site ambient conditions and shows examples relating to indications used.

LCSU Maintenance Program **Parallel input definition**

Port: AUX INPUT 0..7

inp	mode	logic	eqp_id	control_id	sharing_id	type	aux_descr
1	Auxil	Low		0			LIGHT ON
2	Auxil	Low		1		env	DOOR
3	Disab						
4	Disab						
5	Disab						
6	Disab						
7	Disab						
8	Disab						

Line number: 1

Press a key (<ESC>= abort, <+>= next, <->= previous, <ENTER>= modify):

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.11. Example of Beacon Site Environment

LCSU Maintenance Program **Parallel input definition**

Port: AUX INPUT 8..15

inp	mode	logic	eqp_id	control_id	sharing_id	type	aux_descr
1	Paral	High	1	10			
2	Paral	High	1	11			
3	Paral	High	1	4			
4	Paral	High	1	5			
5	Paral	High	1	8			
6	Paral	High	1	6			
7	Paral	High	1	9			
8	Paral	High	1	7			

Press a key (<ESC>= abort, <+>= next, <->= previous, <ENTER>= modify):

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.12.a. Aux input 8...15 - Configuration Examples

LCSU Maintenance Program — Parallel input definition

Port: ADDITIONAL INPUT 0..3

inp	mode	logic	eqp_id	control_id	sharing_id	type aux_descr
1	Paral	Low	1	0		
2	Paral	Low	1	1		
3	Paral	Low	1	2		
4	Paral	Low	1	3		
5	Disab					
6	Disab					
7	Disab					
8	Disab					

Press a key (<ESC>= abort, <+>= next, <->= previous, <ENTER>= modify):

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.12.b. Additional input 0.. 3 - Configuration Examples

In general, the auxiliary input configurations are to active high signal. In such way, the LCSU looks the signal in alarm when the wire is not connected to.

- Command

  The input is coming from the keys on the Control Panel or from an external panel.

  To the signal are associated:

  - An Internal Number, defining the pressed key

    0=Request/Release

    1=Equipment ON/OFF

    2=Changeover

  - The equipment identifier

    This number must be kept from System Overview screen. For DME 415/435 is always =1

- Lamp test

  This function define where is the Lamp Test key of the Control Panel.

  No other information are required as the other keys on the Control Panel.

- Buzzer Silent

  This function define how the silent key must be managed.

  The only information needed is the referred equipment identifier to link to the silent key to the DME, therefore the identifier, as explained before for the Commands, will be=1.

- Selection

  This function defines the management of the "Select key" which allows the operator to enable the "Detailed" section on the Control Panel.

  The only information needed is the "Sharing Identifier" defining the equipment to show in the "Detailed" section. In this case the Identifier is given by the column on the Control Panel when is the Selection key. In the DME this Identifier is always =1

- Parallel internal Input

  This function define the management of 12 Input Signals inside the DME cabinet carrying information about mains and battery modules.

Are needed two information:

1) The equipment identifier. Obviously this is the DME and the value is always =1
2) The input identifier, which must be chosen from following table:

Table 3-5. List of the input Identifier

IDENTIFIER	MEANING
0	+48V dc output AC/DC module 1 fail
1	+48V dc output AC/DC module 2 fail
2	+48V dc output AC/DC module 3 fail
3	+48V dc output AC/DC module 4 fail
4	Mains AC in AC/DC module 1 fail
5	Mains AC in AC/DC module 2 fail
6	Mains AC in AC/DC module 3 fail
7	Mains AC in AC/DC module 4 fail
8	Battery disconnected
9	Battery pre depletion
10	+ 5vdc PWS module Subrack 1 fail
11	+ 5vdc PWS module Subrack 2 fail

Figure 3.12 shows a significant example relating to the configuration concerning the Aux input.

3.2.2.3.4 Parallel Output Definition

Selecting option [4] in the “Configuration” menu the page is displayed showing the ports and parallel output lines (figure 3.13) for the definition of the control logic.

The ports and output lines listed in figure 3.13 are relevant to:

- [0], [1], [2], [3] OUTPUT 1, 2, 3, 4 = INC module indications
- [4], [5] AUX OUTPUT 1, 2 = AUX 0..15 outputs
- [6] ADDITIONAL OUTPUT 0..4
- [7] BUZZER = Buzzer activation

LCSU Maintenance Program **Parallel output definition**

[n] port name

[0] OUTPUT 0
[1] OUTPUT 1
[2] OUTPUT 2
[3] OUTPUT 3
[4] AUX OUTPUT 0..7
[5] AUX OUTPUT 8..15
[6] ADDITIONAL OUTPUT 0..4
[7] BUZZER

Port:

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.13. Parallel Output Definition

When a port or an output line is selected, a page is displayed similar to that shown in figures 3.15 relating to the options selection [0,1,2,3] needed to configure the INC module on the front panel, and figure 3.16 to configure the BUZZER.

The goal of this screen is to allow the customer to define how manage the digital output signals.

They are different kinds of signals

- Control Panel Indications

  "Detailed indication", Main Status Indication, "LCSU" Indications, "Station" Indication, Buzzer.

  They use the ports output 0,1,2,3 and Buzzer

- Auxiliary Output Signals

  They carry out to outside some internal status of interest for the customer.

  They use the AUX output 0 to 7, AUX output 8 to 15 and Additional output 0 to 4 ports.

- Parallel Internal Output AUX 0 to 4

  Not provided

The Control Panel indications are wired in fixed way, but for more flexibility, they must be configured too.

For each line of the port must be set the following parameters:

- **Out** - group of output lines
- **mode** - Functional mode description
- **logic**: Active Low/High Level (see figures 3.14 and 3.15). It defines how change the status of the signal. The indication of the control panel acquires a "Low" state to light ON.
- **eqp_id**: This function will carry out a status bit of an equipment , generally to light ON an indication
- **status_id**: This function will light ON an indication of the "Detailed " status section.

- **sharing_id**: This function will light ON the select Indication (green arrow on the select key)
- **type**: signal type - pnl = panel (INC); ext. = external commands; (LEV) or (PLS)
- **aux_descr**: string of parameter description. A description of the moved signal (this description will be recorded in the history database)
- "**Disab**" - When a line is not used

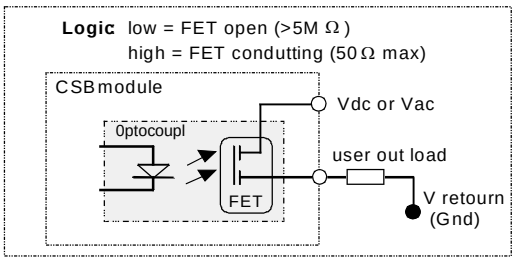


Figure 3.14. Output command Logic

LCSU Maintenance Program **Parallel output definition**

Port: OUTPUT 0

out	mode	logic	eqp_id	status_id	sharing_id	type	aux_descr
1	State	Low	0	2			
2	Detail	Low		21			
3	Detail	Low		18			
4	State	Low	0	0			
5	Disab						
6	Detail	Low		15			
7	Detail	Low		17			
8	sElect	Low			1		

Press a key (<ESC>= abort, <+>= next, <->= previous, <ENTER>= modify):

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.15.a. Parallel Output Definition - OUT 0

LCSU Maintenance Program **Parallel output definition**

Port: OUTPUT 1

out	mode	logic	eqp_id	status_id	sharing_id	type	aux_descr
1	Disab						
2	Detail	Low		11			
3	Detail	Low		7			
4	Detail	Low		6			
5	Detail	Low		9			
6	Detail	Low		12			
7	Detail	Low		13			
8	Detail	Low		19			

Press a key (<ESC>= abort, <+>= next, <->= previous, <ENTER>= modify):

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.15.b. Parallel Output Definition - OUT 1

LCSU Maintenance Program **Parallel output definition**

Port: OUTPUT 2

out	mode	logic	eqp_id	status_id	sharing_id	type	aux_descr
1	Detail	Low		10			
2	Detail	Low		5			
3	Detail	Low		3			
4	Detail	Low		4			
5	Detail	Low		8			
6	Detail	Low		0			
7	Detail	Low		1			
8	Detail	Low		2			

Press a key (<ESC>= abort, <+>= next, <->= previous, <ENTER>= modify):

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.15.c. Parallel Output Definition - OUT 2

LCSU Maintenance Program **Parallel output definition**

Port: OUTPUT 3

out	mode	logic	eqp_id	status_id	sharing_id	type	aux_descr
1	State	Low	1	12			
2	State	Low	1	2			
3	State	Low	1	3			
4	State	Low	1	0			
5	Disab						
6	Disab						
7	Disab						
8	Detail	Low		14			

Press a key (<ESC>= abort, <+>= next, <->= previous, <ENTER>= modify):

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.15.d. Parallel Output Definition - OUT 3

LCSU Maintenance Program **Parallel output definition**

Port: AUX OUTPUT 0…7

out	mode	logic	eqp_id	status_id	sharing_id	type	aux_descr
1	Auxil	High		0		pls	LIGHT OFF
2	Auxil	High		1		Lev	COOLER
3	Disab						
4	Disab						
5	Disab						
6	Disab						
7	Disab						
8	Disab						

Press a key (<ESC>= abort, <+>= next, <->= previous, <ENTER>= modify):

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.15.e. Parallel Output Definition - AUX OUTPUT O..7

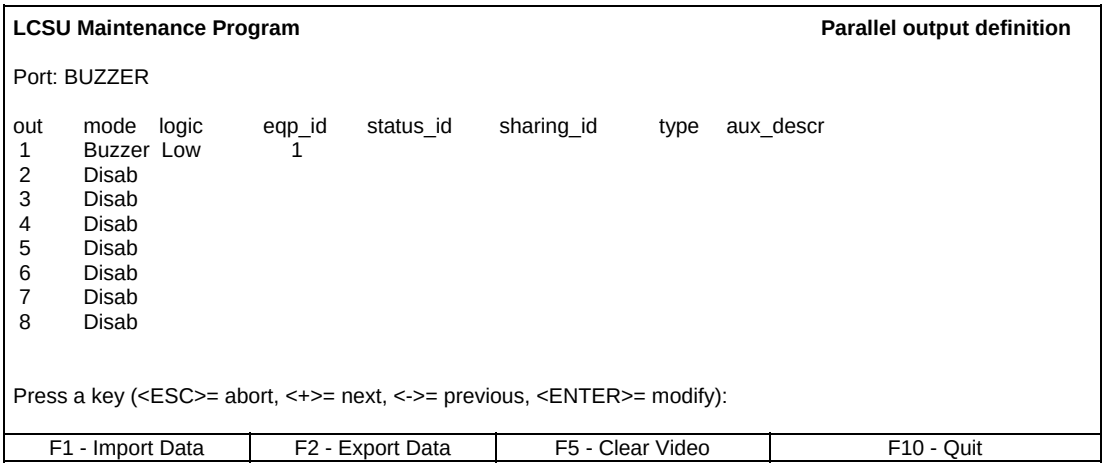


Figure 3.16. Parallel Output Definition - Buzzer

The allowed function "mode" are the following:

- Auxiliary output

  This function carries out an internal state of an equipment. It needs of the following parameters:

  - A description of the moved signal (this description will be recorded in the history database)
  - An Internal Number (from 0 to 15) used by the LCSU to communicate to the remote user the change made. The internal state is the status bit of the equipment 0 (/LCSU), computed as this number + 32.
  - The kind of change to do

    Pulse (PLS): the LCSU will force the signal in active state for 0,5 second and then returns to in active states,

  – Level (LEV): the signal will follow the conditions of the related internal state.

  – Equipment Status ("eqp_id")

  This function will carry out a status bit of an equipment , generally to light ON an indication, and requires the following information:

  - The involved equipment

    0=LCSU ; 1=DME

  - The status bit ("Status _Id")

    A number kept from the table 3-7 (for DME) or 3-8 (for LCSU) in the column "Spec. Number".

    This function is used in "Main Status" or "LCSU" sections of the Control Panel and for other external control Panels.

  – Selection ("sharing_id")

  This function will light ON the select Indication (green arrow on the select key) when the detailed section is enabled. It requires only the "Sharing Identifier", computed as the same parameter of selection key (parallel input).

  Therefore will be=1 always.

  – Buzzer ("eqp_id")

  This function defines how enable the buzzer. It receives only the "Equipment Identifier" of the involved equipment. This parameter is always =1.

  – Detailed Status ("Status_id")

  This function will light ON an indication of the "Detailed " status section. It requires only the Detailed Indication to change.

  This information may be found in the following table 3-6 (column IND):

Table 3-6. List of the Detailed Status Indications

IND	DESCRIPTION	IND	DESCRIPTION
0	Monitor 1 Alarm	1	Monitor 2 Alarm
2	Monitor 1 StbyAlarm	3	Monitor 2 StbyAlarm
4	Monitor 1 Faulty	5	Monitor 2 Faulty
6	Monitor 1 Bypassed	7	Monitor 2 Bypassed
8	TRX1 ON	9	TRX2 ON
10	TRX1 Warning	11	TRX2 Warning
12	TRX1 Faulty	13	TRX2 Faulty
14	TRX1 on Antenna	15	TRX2 on Antenna
16	Control Engaged	17	Control Enabled
18	Mains OFF	19	Environment alarm
20	Antenna faulty	21	Other Warning

The linking of the Detailed Indication with the Status Bit of the equipment is made in the "LCSU Site Equipment" status list table 3-7.

Table 3-7. List of Equipment Status

Spec. Number	STATUS	Front panel "INC" Indications	Spec. Number	STATUS	Front panel "INC" Indications
0	DATA COMM faulty	MAIN STATUS	40	Trx2 operating	TX2 ON
1	NORMAL	MAIN STATUS	41	Trx2 ok	
2	WARNING	MAIN STATUS	42	Trx2 shutdown	TX2 FAULTY
3	ALARM	MAIN STATUS	43	Trx2 degraded	
4	Maintenance		44	Reserved	
5	Reserved		45	Reserved	
6	Reserved		46	Reserved	
7	Beacon under user control	MAIN STATUS	47	Reserved	
8	Beacon off		48	Monitor 1 faulty	MON1 FAULTY
9	Beacon qual ok		49	Monitor 2 faulty	MON2 FAULTY
10	Beacon qual. Degraded		50	Reserved	
11	Beacon qual faulty		51	Reserved	
12	Beacon operating		52	Communication faulty with Monitor 1	
13	Alarm		53	Communication faulty with Monitor 2	
14	Warning		54	Communication faulty with TRX 1	
15	Reduced power		55	Communication faulty with TRX 2	
16	reserved		56	OR of equipment communic. faulty	
17	Reserved		57	Beacon restart active	
18	Power from Battery	MAINS OFF	58	TRX 1 Warning	
19	Trx standby faulty		59	TRX 2 Warning	
20	Trx1 on antenna	TX1 ON ANT	60	Single Monitor	
21	Trx2 on antenna	TX2 ON ANT	61	Single Transponder	
22	Automatic Routine Check		62	One monitor faulty	
23	Equipment in default parameter		63	Reserved	
24	Monitor alarm disagreement		64	Trx 2 standby ok	
25	Change over		65	Trx standby degraded	
26	Manual control		66	Mon1 qual. Trx on ant. OK	
27	Other Warning	OTHER WARN	67	Mon1 qual. Trx on ant. degraded	
28	Trx 1 off		68	Mon1 qual. Trx on antenna faulty	
29	Trx1 standby		69	Mon1 qual. Trx stby OK	
30	Trx1 on		70	Mon1 qual. Trx stby degraded	
31	Trx1 operating	TX1 ON	71	Mon1 qual. Trx stby faulty	MON1 STBALRM
32	Trx1 ok		72	Mon2 qual. Trx on ant. OK	
33	Trx1 shutdown		73	Mon2 qual. Trx on ant. degraded	
34	Trx1 degraded		74	Mon2 qual. Trx on ant. faulty	
35	Reserved		75	Mon2 qual. Trx stby OK	
36	Trx 1 F.A. faulty		76	Mon2 qual. Trx stby degraded	
37	Trx 2 off		77	Mon2 qual. Trx stby faulty	MON2 STBALRM
38	Trx2 standby		78	Monitor 1 bypass	MON1 BYPASSED
39	Trx2 on		79	Monitor 2 bypass	MON2 BYPASSED

Table 3-8. List of the Indications from LCSU to User

Spec. Number	STATUS	"INC" Indications	Spec. Number	STATUS	"INC" Indications
0		DATA COM	9 ( )	Clock calendar faulty	
1	NORMAL		10 ( )	History faulty	
2 (*)	WARNING (*)	LCSU WARNING	11 ( )	Clock calendar warning	
3	ALARM		12 ( )	Environmental Alarm	ENV ALRM
4	MAINTENANCE		13 ( )	Frozen state	
5	-		14,15	-	
6	-		16..31	Auxiliary input 0...15	
7( )	LCSU under user control		32..47	Auxiliary output 0...15	
8 ( )	Battery faulty			Watch Dog (Hardware)	LCSU OPERATION

(*) Warning = "OR" of the Specification Number "8 ( ) to 13 ( )"

3.2.2.3.5 Commands equipments list

In this paragraph are listed the available controls to command the different equipment.
They can be assigned to parallel on/off inputs, coming from the control panel or external devices.
To configure the inputs, enter the number corresponding to the desired command required.

Table 3-9. Equipment Commands list

EQUIPMENT	NUMBER	DESCRIPTION
DME AN 415/435 DME FSD 40/45	0	take/release the control
	1	beacon on/off
	2	changeover
	3	beacon off (No valid on DME 415/435)
	4	tx 1 main (No valid on DME 415/435)
	5	tx 2 main (No valid on DME 415/435)

3.2.2.3.6 User Connection Parameters

Select option [5] on the "Configuration" menu to display the page shown in figure 3.17 that enables modification of some modem connection parameters.

LCSU **User connection parameters**

Leased line parameters
[0] Connection attempt duration: 60 sec. (20 - 120)
Switched line parameters
[1] Connection speed: 3 (1: 300 , 2: 1200, 3: 2400, 4: 4800, 5: 9600)
[2] Dial attempt duration: 90 sec (20 - 120).
[3] 2nd call delay: 2 min.
[4] 3rd call delay: 5 min.
[5] 4th call delay: 10 min.
[6] Subsequent calls delay: 0 min. (0: disabled)
[7] Full connect. idle timeout: 0 min. (0: disabled)
[8] Delay before call-back: 10 sec.
[9] Call back 0 (0:disable 1:enable)
Party line parameters
[10] Preliminary waiting time: 0 sec (1 - 5000, 0:disable)
[11] Post waiting time: 0 sec (1 - 5000, 0:disable) Up to march 05
[12] Intermediate waiting time: 0 sec (1 - 5000, 0:disable)

Select:

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.17. User Connection Parameters

Below the meanings of each parameter that can be modified are given:

- Connection attempt duration
time interval within which the connection in *dedicated line* should take place.

- Connection speed
Baud rate of the connection between LCSU and Modem

- Dial attempt duration
time interval within which the connection in switched line should take place

- 2nd call delay
time to wait before retry the second call in case of dial connection not made. – 0 means no retry

- 3rd call delay
time to wait before retry the 3rd call in case of dial connection not made. – 0 means no retry

- 4th call delay
time to wait before retry the 4th call in case of dial connection not made. – 0 means no retry

- Subsequent calls delay
delay time for subsequent calls - 0 (disabled): the user is not called again after an unsuccessful attempt.

- Full connect. idle timeout
maximum connection time allowed in full without exchange of messages.

- Delay before call-back
Delay between end of call and call-back.

- Call back
Call-back enable. When called, the LCSU recall the User in order to authorize it to send the commands, if enabled for this operation.

Party-line parameters: waiting times of communication

- **Preliminary waiting time:** 0 msec (1 - 5000, 0: disable)
- **Post waiting time:** 0 msec (1 - 5000, 0: disable) Up to march 05
- **Intermediate waiting time:** 0 msec (1 - 5000, 0: disable)

3.2.2.3.7 LCSU Site Equipment Configuration

This screen option [6] (figure 3.18) allow the customer to link the outputs mapped as "Detailed" in the "Parallel Output Definition" to the Equipment Status (see table 3-7) - List of Equipment Status –

The elements have the following effect:

Description: description of the equipment to be represented
Manuf: Producer: 0 = LCSU System, 1 = Thales (ANS)
Eqp code equipment code: 0 = LCSU, 1 = DME/N, 2 = DME/P, 3 = NDB 436
Position in Main Status LCSU = Disab; 1 = equipment on which LCSU is assembled
Select: 1 = line configuration; 2 = detailed status configuration
Inserting selection 2 "*Detailed status configuration*" is shown the fig. 3.19

First must be set the "position in Main Status", that indicates the position on the Control Panel, where is shown the equipment status. For the DME this position is always =0

The next sub-screen (figure 3.19) allows, doing the linking said before.

Each selection is referred to an indication on the control Panel (in the Detailed Status section). The value to set must be kept in the table 3-7.

A value=1 disable the indication. For instance, the DME doesn't have the status of the antenna, then the indication [20] (Antenna faulty) must be disabled.

The indication [16] (control Engaged), [17] (control Enabled) and [19] (Environment Alarm) don't have any reference to the equipment status; therefore a value different than the 1 (disable) is shown as enabled.

The indication [22] (Mains status label) allow the operator to define the label to set in the display on the main status

LCSU Maintenance Program **LCSU site equipment configuration**

[n]	Description	Manuf	Equip. Code	Position in Main status
[0]	LCSU unit	0	0	Dis
[1]	ANS-DMEN 415/435	1	1	1

Select:
1: Line configuration 2: Detailed Status Configuration

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.18. LCSU Site equipment menu

LCSU Maintenance Program **LCSU site equipment configuration**

Equipment: 1 Position in Main status: 1

[0]	Monitor 1 Alarm	:68	[1]	Monitor 2 Alarm	:74
[2]	Monitor 1 Stand-by Alarm	:71	[3]	Monitor 2 Stand-by Alarm	:77
[4]	Monitor 1 Faulty	:48	[5]	Monitor 2 Faulty	:49
[6]	Monitor 1 Bypassed	:78	[7]	Monitor 2 Bypassed	:79
[8]	Trx 1 On	:31	[9]	Trx 2 On	:40
[10]	Trx 1 Warning	:58	[11]	Trx 2 Warning	:59
[12]	Trx 1 Faulty	:33	[13]	Trx 2 Faulty	:42
[14]	Trx 1 On Antenna	:20	[15]	Trx 2 On Antenna	:21
[16]	Control engaged	:Ena	[17]	Control engaged	:Ena
[18]	Mains off	:18	[19]	Environment alarm	:Ena
[20]	Antenna faulty	:Dis	[21]	Other warning	:27
[22]	Main status label: THAL				

Select the item to change (0 to 22):

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.19. Status of LCSU Site equipment

3.2.2.3.8 LCSU Site Parameter

This screen option [7] (figure 3.20) allow the operator to change some information about the site:

[0] Number of changing before status freezing:

This parameters allows the operator to stop the recording of some auxiliary input that changes is value too fast. This option prevent the history database is filled with a lot of unused records.

[1] Control superside

It defines how the LCSU must manage the Control Request coming from outside or from the control Panel when another user is controlling the equipment.

Three choice are allowed:

1) *Disable*: a new Control Request is refused, an user that has the equipment control cannot be interrupted by another user
2) *Enable*: it is the opposite of the previous item, any user may keep the equipment control, interrupting any other user.
3) *On Priority*: this is the classic way to manage the Request. The control Request is accepted only if the requestor has an higher priority than the present owner.
   The Local Control Panel has the highest priority, than follows the local PC and the Remote Control RCSI. The priority is computed as the number of intermediate nodes between the user and equipment.

LCSU Maintenance Program **LCSU site parameter**

[0]	Number of changing before status freezing:	0	(1-100, 0:disabled)	Dis
[1]	Control superside:	1	(0:dis, 1:on prior, 2:Ena)	

Select:

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.20. LCSU Site parameter

3.2.2.3.9 REU parameters

Selecting option [8] in the “Configuration” menu the page of figure 3.21 is displayed. This screen enables the change to the parameters of the REU (When equipment is in station system with Remote Equipment Unit on RCSE unit, otherwise the values won't be considered).

LCSU Maintenance Program **Reu parameters**

[0] Lke Equipment address:	160 (0..4095)
[1] Lke Reu address:	16 (0..4095)
[2] Modem identifier:	MODEM 001

Select:

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.21. Reu Parameters

This table must be compiles in a system of connection in telephone switched line with remote control type REU - Otherwise the values won't be considered.

- In the option [0] some first line must be inserts the identifier of the LCSU: value to be deduced from the manual of the remote control REU to which is postponed
- In the option [1] must be inserts the identifier of the remote control REU: value to be deduced from the manual of the remote control REU to which is postponed
- In the option [2] must be inserts always the string "Modem 001"

Identifiers of LCSU and of REU must have carry over in the file *. ptt to be loaded in the program of REU necessarily called "LLKE".

3.2.2.3.10 Export Configuration Data

Select the option [9] on the menu “Configuration” to show on the display (fig. 3.22) the page with the procedure of export of the configuration data with the information: *LCSU ready to send configuration dates to the PC*. Press key F1 to transfer the configuration data from the LCSU to PC after entering the indication requested relevant to the name of the file where the data is to be stored.

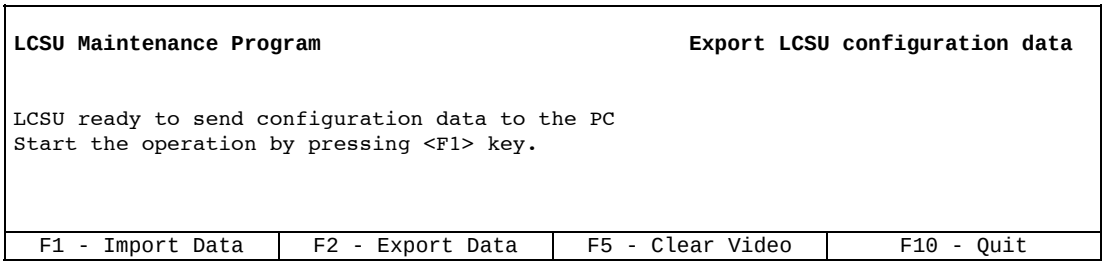


Figure 3.22. Export LCSU configuration data

3.2.2.3.11 Import Configuration Data

To select the option [10] on the menu “Configuration” to show on the display (fig. 3.23), the page with the procedure of import of the configuration data with the information: *LCSU ready to get configuration dates from the PC*. Press key F2 to start the configuration data loading from PC to LCSU.

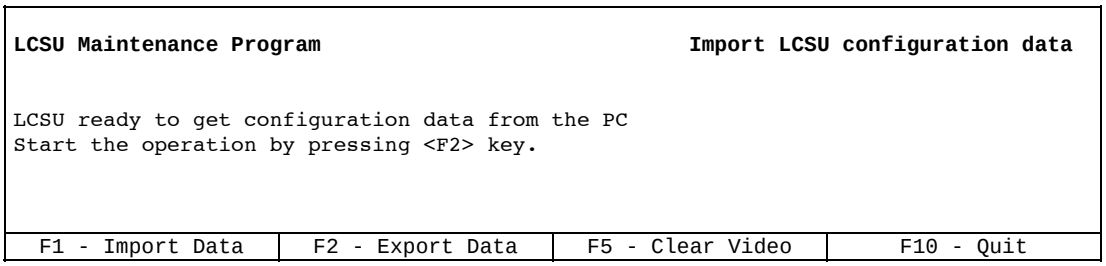


Figure 3.23. Import LCSU configuration data

3.2.2.3.12 Hardware Test

Select option [3] from the Main menu to display the page shown in figure 3.24 containing the options relating to functionality verification of the input and output ports and the control emulating the serial lines.

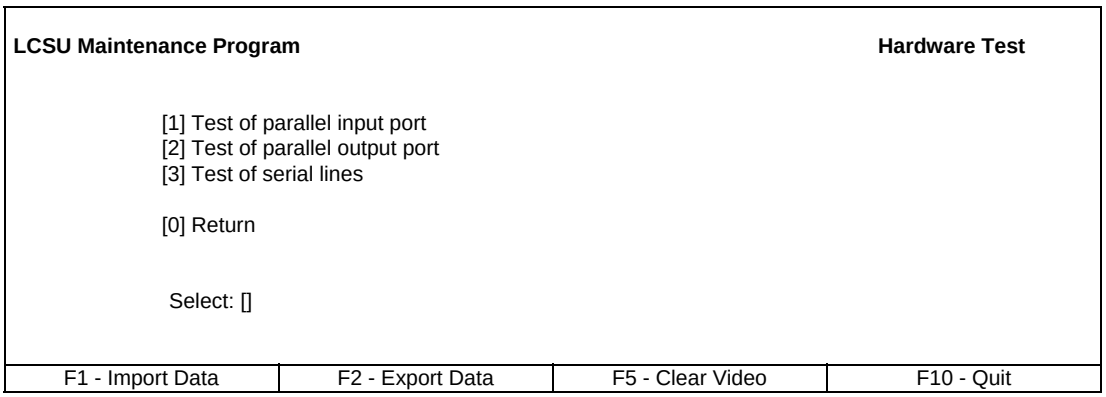


Figure 3.24. Hardware Test

3.2.2.3.13 Test of Parallel Input Port

Select option [1] on the “Hardware Test” menu to display the page shown in figure 3.25 that is used to test the input ports.

LCSU Maintenance Program **Test of parallel input port**

[n] port name

[0] CONTROL INPUT
[1] AUX INPUT 0..7
[2] AUX INPUT 8..15
[3] ADDITIONAL INPUT 0..3

Select:

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.25. Test of Parallel Input Port

Some examples of tests that can be made to verify the inputs listed below are shown in the figures that follow:

CONTROL INPUT (figure 3.26)

The test is performed through the push-buttons on the INC module, which can be found according to the configured arrangement using the procedure described in paragraph 3.2.2.3.3

AUX INPUT (figure 3.27)

the test is performed by creating a closure to the common pin, through the pins on connector PL3 of the I/O panel. These can be found according to the configured arrangement using the procedure described in paragraph 3.2.2.3.3.

ADDITIONAL INPUT (figure 3.28)

the test is performed by creating a closure to the common pin, through the pins on connector PL3 of the I/O panel. These can be found according to the configured arrangement using the procedure described in paragraph 3.2.2.3.3.

Port: CONTROL INPUT - Current read line status:

1->LOW 2->LOW 3->LOW 4->LOW 5->LOW 6->LOW 7->LOW 8->LOW

Press a key to start status monitor or <ESC> to exit.

** Monitor on input line active **

Changed line number 2 LOW ==> HIGH

Changed line number 2 HIGH ==> LOW

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.26. Test Control Input

Port: AUX INPUT 0..7 - Current read line status:

1->HIGH 2-> HIGH 3-> HIGH 4-> HIGH 5-> HIGH 6-> HIGH 7-> HIGH 8-> HIGH

Press a key to start status monitor or <ESC> to exit.

** Monitor on input line active **

Changed line number 8 HIGH ==> LOW

Changed line number 8 LOW ==> HIGH

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.27. Test Aux Input

Test Aux Input

Port: ADDITIONAL INPUT - Current read line status:

1->HIGH 2->HIGH 3->HIGH 4->HIGH 5->HIGH 6->HIGH 7->LOW 8->HIGH

Press a key to start status monitor or <ESC> to exit.

** Monitor on input line active **

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.28. Test Additional Input

3.2.2.3.14 Test of Parallel Output Port

Select option [2] on the “Hardware Test” menu to display the page shown in figure 3.29 that is used to test the parallel output ports.

LCSU Maintenance Program **Test of parallel output port**

[n] port name

[0] OUTPUT 0
[1] OUTPUT 1
[2] OUTPUT 2
[3] OUTPUT 3
[4] AUX OUTPUT 0..7
[5] AUX OUTPUT 8..15
[6] ADDITIONAL OUTPUT 0..4
[7] BUZZER

Select:

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.29. Test of Parallel Output Port

The operator can choose to test all eight lines of each port or only separate lines (A = all bits or n = line number). LEDs on the INC module light up after the selection to indicate that the selected line is operating correctly. The AUX OUTPUT lines have to be checked with an ohmmeter if they are not connected to specific indicators.

Using <+> and <-> keys the operator may also check brightness of the LEDs on the Control Panel. The brightness is arranged in 7 levels, shown in the column Bright.

This procedure is meaning only if the port under test is referring to the Control Panel

The figures below show some examples of tests to check the following outputs:

OUTPUT 0,1, 2, 3 (figure 3.30)

use the keyboard to select the line to be tested and check output variation.

AUX OUTPUT (figure 3.31)

use the keyboard to select the line to be tested and check output variation.

BUZZER (figure 3.32)

Port: OUTPUT 1 - All lines initialized to ACTIVE status:

Select line to change (A = all bits; 1-8 = line number; <+>, <->= brightness) or <ESC> to exit.

1->LOW 2->HIGH 3->LOW 4->LOW 5->LOW 6->LOW 7->LOW 8->LOW BRIGHT=3
1->LOW 2->LOW 3->LOW 4->LOW 5->LOW 6->LOW 7->LOW 8->LOW BRIGHT=3
1->LOW 2->HIGH 3->LOW 4->LOW 5->LOW 6->LOW 7->LOW 8->LOW BRIGHT=3
1->HIGH 2->LOW 3->HIGH 4->HIGH 5->HIGH 6->HIGH 7->HIGH 8->HIGH BRIGHT=3

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.30. Test Output port 1

Port: AUX OUTPUT - All lines initialized to ACTIVE status:

Select line to change (A = all bits; 1-8 = line number; <+>, <->= brightness) or <ESC> to exit

1->HIGH 2->HIGH 3->HIGH 4->HIGH 5->HIGH 6->HIGH 7->HIGH 8->HIGH BRIGHT=3
1->LOW 2->LOW 3->LOW 4->LOW 5->LOW 6->LOW 7->LOW 8->LOW BRIGHT=3
1->HIGH 2->HIGH 3->HIGH 4->HIGH 5->HIGH 6->HIGH 7->HIGH 8->HIGH BRIGHT=3
1->HIGH 2->LOW 3->HIGH 4->LOW 5->HIGH 6->HIGH 7->HIGH 8->HIGH BRIGHT=3

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.31. Test Aux Output

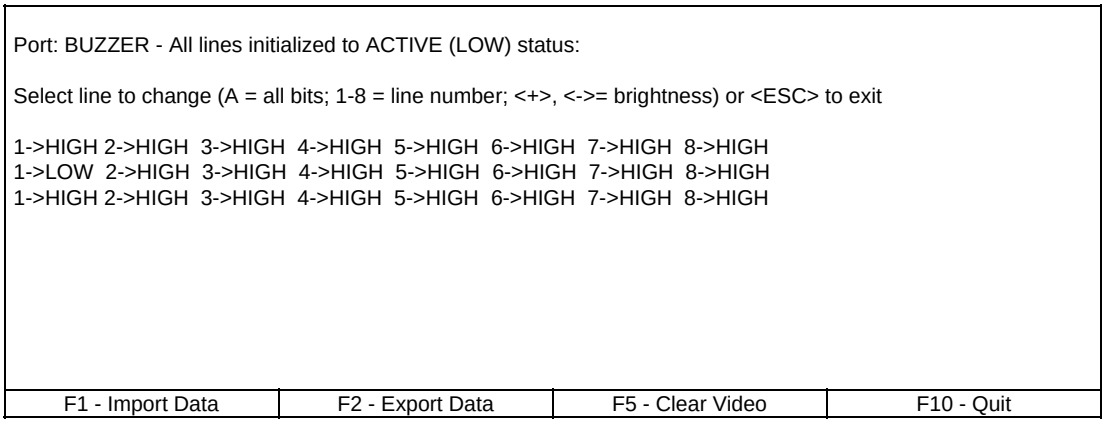


Figure 3.32. Test Buzzer

3.2.2.3.15 Test of Serial Lines

Select option [3] on the “Hardware Test” menu to display the page shown in figure 3.33 that is used to perform the tests on serial lines.

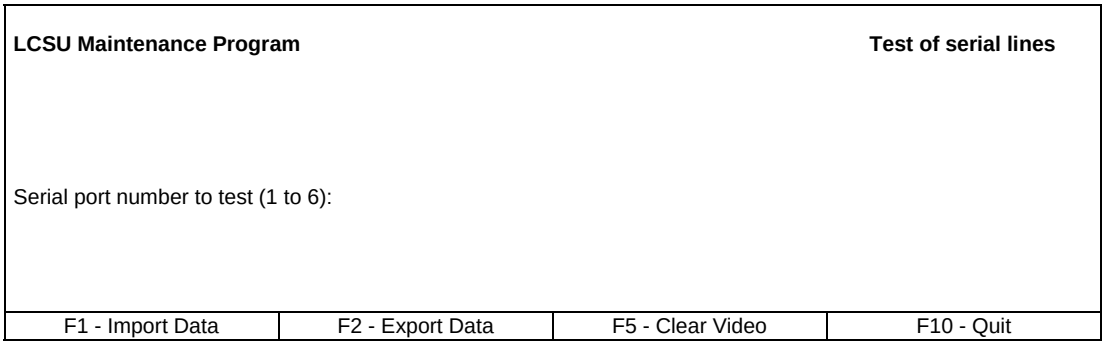


Figure 3.33. Test of Serial Lines

When the number of the port to be tested is selected, a page is displayed similar to that shown in figure 3.34, that indicates an example of a test on port number 2, for which a modem connection is necessary.

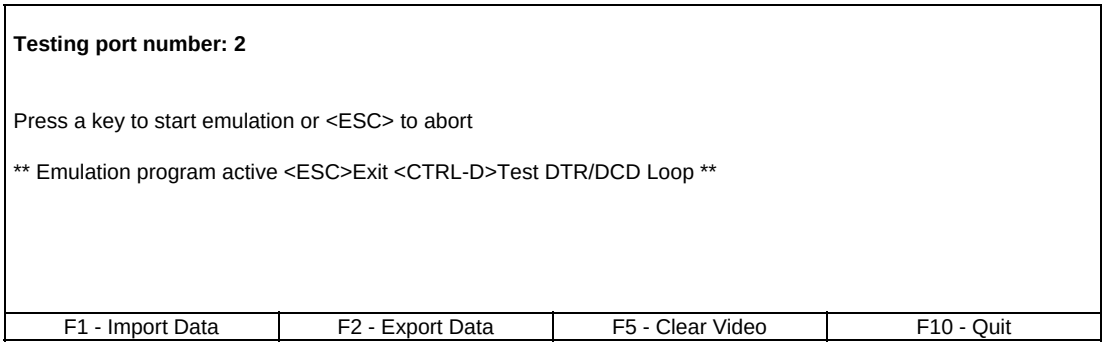


Figure 3.34. Testing of Port Number

NOTES

- The serial port diagnostics are performed when module CSB on the LCSU is powered on;

- The request to test port 1 is followed by a message “The emulation port is not testable. Press a key to continue...” since this is the connection port to the PC that the operator is using to dialogue;
- For DME equipment the modem 1 and 2 is usually connected to serial port 2 and 3 (PL2 and PL1 of I/O panel);
- The functional verification is performed by typing one or more alphanumeric characters from the keyboard, the relevant echo is shown on the PC screen;
- The operator must respond to the request to define the baud rate of the modem, if provided on the serial port to be tested:

  1 = 300; 2 = 1200 ; 3 = 2400 ; 4 = 4800 ; 5 = 9600; 6 = 19200
- Upon the request message PARITY (N)one, E(ven), O(dd); “N” in other cases.

3.2.2.4 Test Data Consistency

To terminate the configuration procedure it is necessary to return to the “Configuration” page and select option [0].

The program then asks the operator whether the configuration data modifications saving procedure is to be performed. The following message will be displayed:

“Save configuration changes? (Y/N):”

If the reply is “Y” a test is run that can be seen in figure 3.35. If the result is positive, the last line will display the message:

“Press a key to start saving.”

whereas if the result is negative the previous message is replaced by the indication of the fault found. (E.g.: “E^2PROM faulty, data not saved. Press any key to continue..”)

The saving operation is indicated by a row of asterisks that appear in sequential order at the end of the operation.

Testing data consistency...
Testing site code... OK
Testing port connection... OK
Testing user identification codes... OK
Testing buzzer connection... OK
Testing control commands equipment connection... OK
Testing commands equipment connection... OK

Press a key to start saving.

F1 - Import Data	F2 - Export Data	F5 - Clear Video	F10 - Quit

Figure 3.35. Test Data Consistency

3.2.2.5 To Exit from the Program

To exit from the configuration procedure, first return to the “MAIN MENU” and select option [0].
To close the “EMUL.exe” program, press F10 (quit.).

CAUTION

Do not forget to select the option [0] of the "Main Menu": the CSB does not leave the configuration program if you press F10 key only.

3.2.2.6 Modem Configuration

When using a modem for connections to the different units at a distance from the site where the beacons are installed, it has to be suitably configured for the specific service it is prepared for.

Modems used for the various connections have to operate:

- in the phonic band (300 - 3400 Hz);
- on 2-wire dedicated or switched lines;
- in accordance with CCITT V21, V22 and V22bis standards;
- with AT protocol controls;
- with asynchronous mode communication.

The modem configuration is prepared modifying its internal parameters through AT controls.

The configuration may be in two ways:

1. Connect a PC to the modem using a terminal emulation program; it is then possible to modify the relevant parameters using a series of AT commands.
   This type of operation requires detailed knowledge of the modem parameters.
2. Connect a PC to the modem and run the program typing in **<modem mdfile.mdm>,** then press the ENTER key.
   The **modem.exe** program imports the configuration data from the mdfile.mdm file and sends it, in sequence, to the modem, verifying each time that it has been accepted correctly.

The UTIL - Configuration Utility diskette contains several examples of *.mdm files previously prepared for some types of modem. The AT standard does not guarantee that all modems have the same commands, therefore it is necessary to prepare the *.mdm files for each specific modem. These files can be edited by the user, starting from one of the existing examples and using a normal text editor the desired parameters can be modified to obtain the suitable file.

The main parameters to be configured in order to work correctly with LCSU are:

AT&L0(1)	line type (dedicated or switched)
ATB0 CCITT	full duplex standard
ATFn	line speed (n defines the standard and depends on the modem used)
AT&C1	Interfaced criteria forced to work state
ATX0	Blind dial without busy or ready tone recognition
AT&D3 DTR	transition ON -> OFF cause modem reset
AT&G0	Guard tone disabled
ATS10=40	Carrier faulty disconnect delay time 1/10 s
ATT(P)	Tone/pulse dialing
ATS0=2	Number of rings (only in switched)

3.2.3 File Configuration in Supervisory Program

A personal computer can be connected in the following way:
- LOCAL, directly through a serial port.
- REMOTE, through a modem on dedicated or switched lines.

Installation and procedure refer APPENDIX B –"PC User WINDOWS SUPERVISOR" section

Examples are in figure 3.36

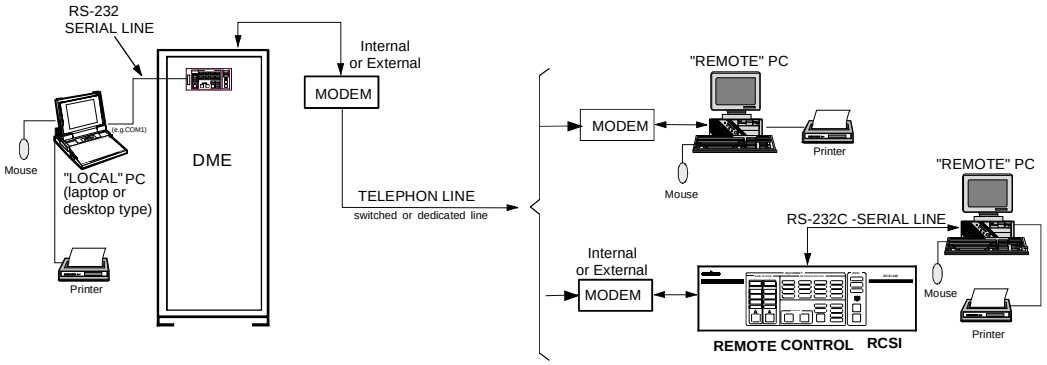


Figure 3.36. System control via PC (example)

3.3 INDICATORS ON THE MODULES

This paragraph shows the set of indicators on the various modules of the beacon. The LCSU front indicators are described in table 3-1. The front outlines of the modules are gives on the figures 3.37, 3.38, 3.39 and indicators of each module are described in table 3-10.

Table 3-10. LEDs Indicators on the Front of every modules

Module	REF	Lamp color	LABEL	DESCRIPTION	Normal condition
PWS		Red	PWS Faulty	Possible overload, overvoltage, overheat or module failure	OFF
		Green	INPUT	Correctly input voltage	ON
MON	RD4	Red	WATCHDOG	LED on when failure of Watchdog operation (Monitor CPU: stop condition)	OFF
	RD5	Yellow	Morse Code	The led ON during the decoded and self check of identity frequency (1350 Hz)	
	RD3	Yellow	TRX ALARM	The LED ON, when secondary and primary alarm of transponder in antenna occur	
	RD2	Red	MON FTY	The LED ON when failure self-check on Monitor module occur.	OFF
	RD1	Green	EXEC. MON	LED ON when monitoring Executive is running normally	
DPR		Yellow	IDENTITY	The LED ON when DME transmitted identity code	
DMD		Red	WDOG	The ON indication, directly connection with CPU watchdog, to indicate failure operation. (During watchdog self check procedure and reset test initialization, the led flash once)	OFF
		Green	MOD	The LED flashes during the running of the modulation task. Failure of the modulation task with led continuously off or on.	flash
		Green	CAL	The LED flashes each 5/6 seconds, during the running of the calibration task (pilot pulse). Failure of the calibration task with led continuously off or on.	flash
		Green	COD	The LED is ON during the running of the Morse code task . Failure of the Morse code task with LED continuously off.	
		Green	CHK	The LED flashes each 10/15 seconds, during the memory (RAM, EPROM,…) self check. Failure of the self-check operation with led continuously off or on.	flash
TX		Red	RF PROT	LED ON when antenna or Dummy-Load not connected (or output module not loaded on 50 ohm)	OFF
		Green	RF ON	LED ON for transmitter with output RF	ON
		Green	DC/DC ON	Command and internal 50Vdc (40V typical value for DME415) power supply is OK in ON operation	ON
AFI		Yellow	IDENTITY	LED ON for Morse code identification in normal operation	
TKW		Red	RF PROT	LED ON when antenna or Dummy-Load not connected (or output module not loaded on 50 ohm)	OFF
		Green	RF ON	LED ON for transmitter with output RF in normal irradiated condition	ON
		Green	DC/DC ON	Command and internal 50Vdc (typical value) power supply is OK in ON operation	ON
AC/DC		Green	Module OK	ON in normal operation (DC/DC out voltage OK)	ON
		Green	Mains OK	Correctly mains input voltage in normal operation	ON
CSB		Green		Internal LED (rear of anterior door)– CSB watchdog to indicate normal operation (LED OFF = failure watchdog operation)	ON
		Green		Internal LED (rear of anterior door) – serial signal RX indication	flash
		Green		Internal LED (rear of anterior door) - serial signal TX indication	flash

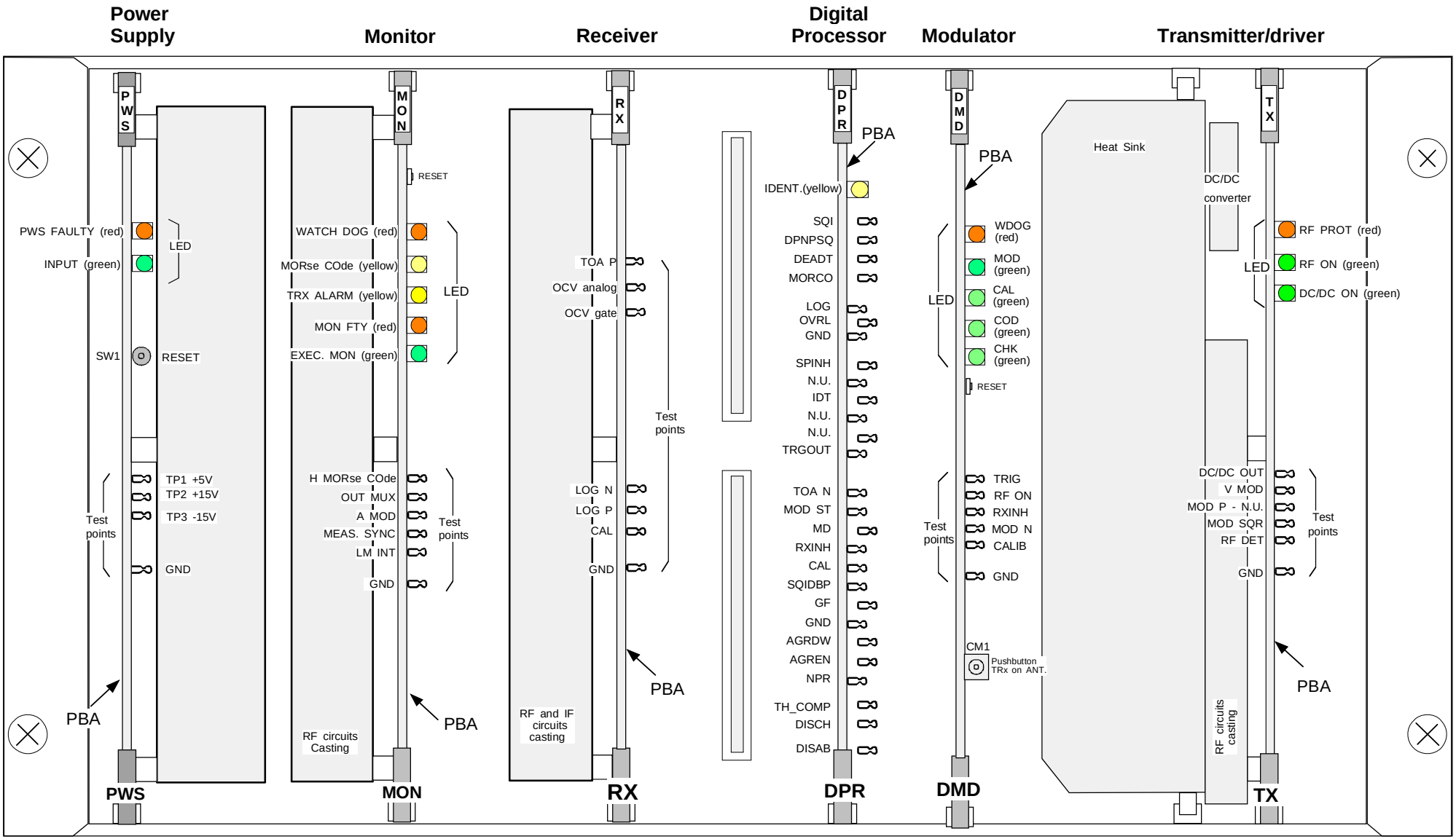


Figure 3.37. LED indicators on transponder modules

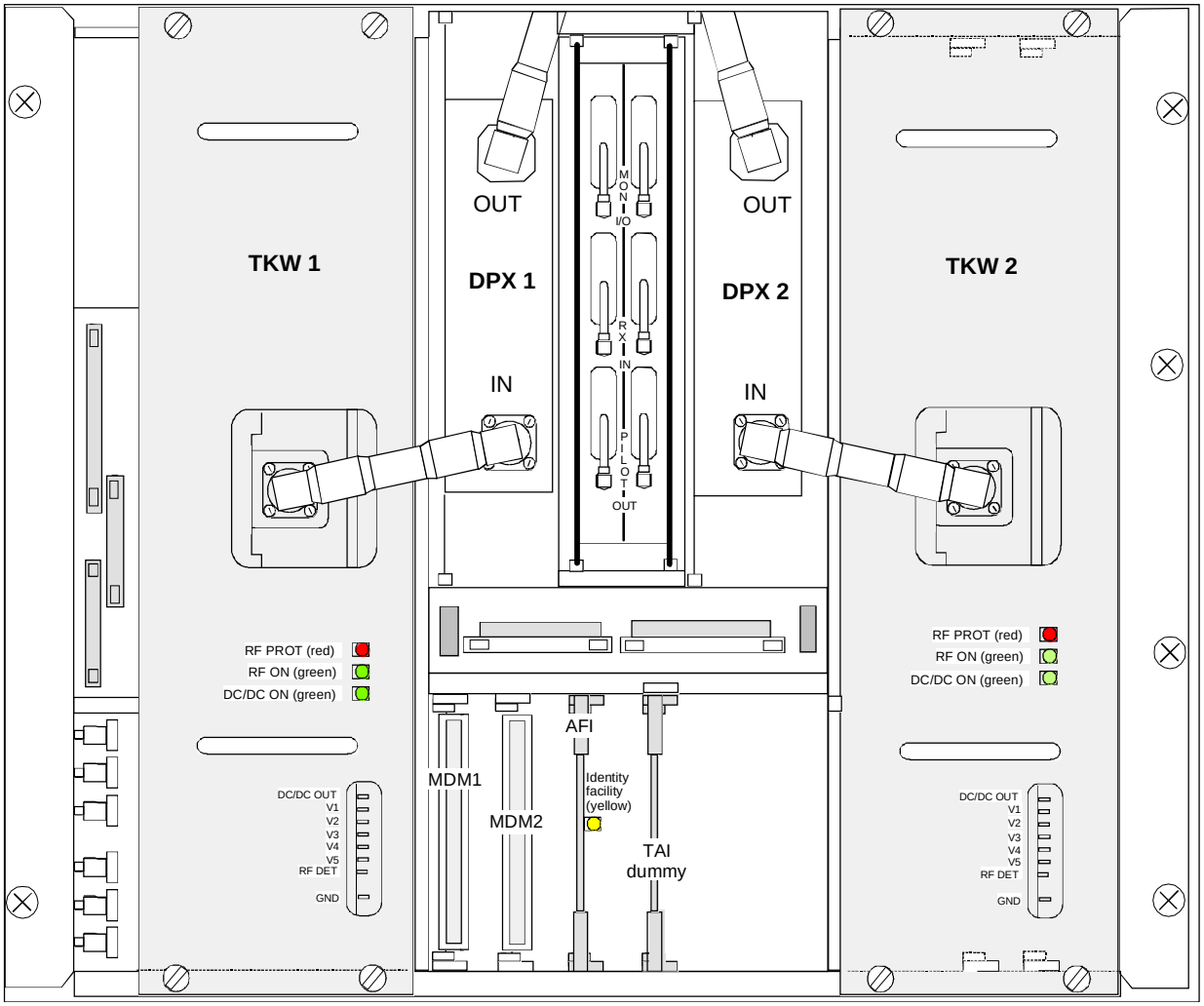


Figure 3.38. LED indicators on 1 kWp RF amplifiers and AFI modules

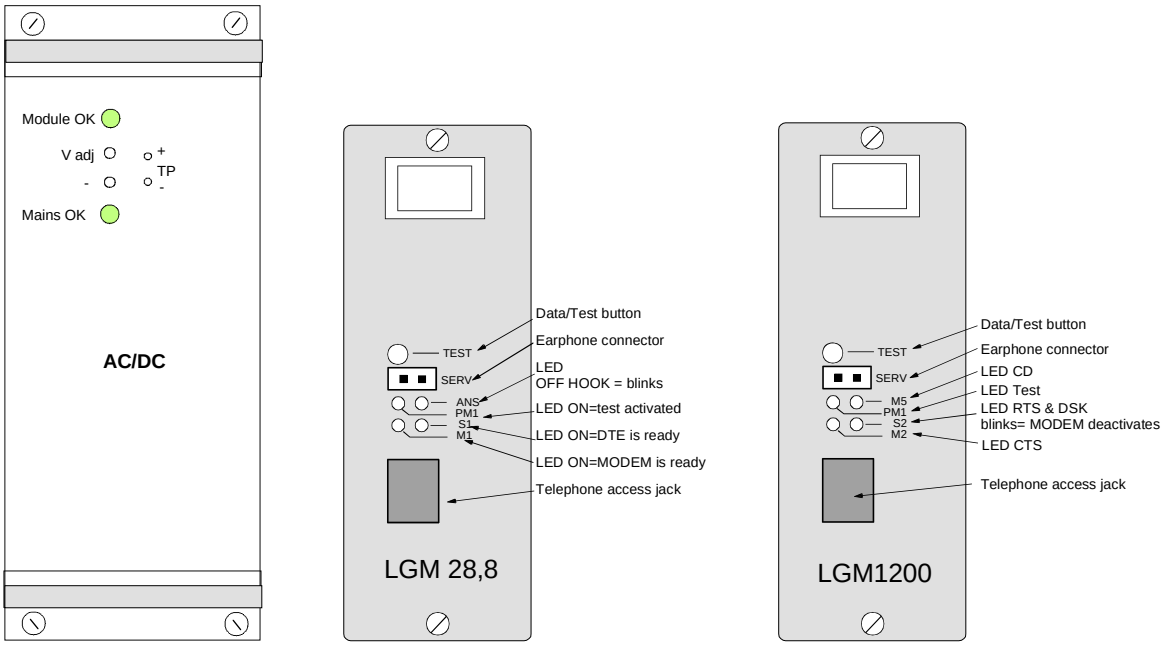


Figure 3.39. LED indicator on AC/DC power supply module and on the MODEM

3.4 I/O FUNCTIONING

The equipment can be controlled form the site where the beacon is installed (local site) or from a remote station (remote site).

At the local site, the equipment can be controlled thorough direct use of the controls on the LCSU Front Panel or using a PC (Personal Computer) connected to the PC RS-232 connector or SK1 of I/O panel.

Usually, the priority of remote connections is lower than that of the local connections (default condition)

At the local site equipment control, priority is: Control Panel and lastly PC connected to the LCSU unit.

The local operator can activate local commands using the REQUEST RELEASE button, thereby disabling any commands received from a remote operator. The indications remain active on all the remote stations connected.

From the remote site, the equipment can be controlled via a PC connected directly to the LCSU unit through a switched or dedicated line modem.

Operation mode Intrusive or detailed, Line monitoring, Maintenance and so on, are allowed only using a PC (in Local or Remote site) connected in any mode (directed, trough interposed RCSI/RCSE/MCS, Switched line and so on)

A detailed description of the permissible operations of the PC with supervisor program is used, is given in next paragraphs and APPENDIX sections.

3.5 USER SOFTWARE INSTALLATION ON PC

3.5.1 General

The use of usual PC standards and operating systems ensures a familiar operating environment for the user.

The most important status displays and control functions are also provided on the station's front local control unit (LCSU) so that operation is easy also without a PC system connected. Using a PC connected to connector SK1 - RS-232 (PC) with a user program (WINSV, WINDME400 or MCS) all informations are provided.

The dialog software represents the core of the operation devices. All control, monitoring, and maintenance functions are represented on the screen in colors, in the form of menus. They are carried out in control windows by means of functional keys or mouse control.

Via an online help function texts explaining functions or screen masks can be requested and, if required, printed out. The user software interprets the operating data input by the operator, checks it for plausibility, formats it into a specified format, and transmits it to the respective system or subsystem components (monitor, transmitter). This operating data and the data for remote maintenance is input via the keyboard of a personal computer (PC desktop or laptop) by authorized operating personnel of the respective operator (usually air traffic control authorities).

System control can be ensured via the PC with the same software both in local mode in direct connection to the system and in remote mode via a modem link. Depending on the selected modem, the data can be transmitted via a switched line or a dedicated line. If a switched line is used the subsystem is automatically selected by the remote station if the selection on the PC has been made accordingly.

Status information of the subsystem is represented on the PC screen in an easily interpretable form. Via a printer connected to the PC system data can be printed out and thus documented.

3.5.2 PC user programs INSTALLATION

NOTE: The connection and control of the PC and the operating system software are to be carried out in compliance with the manufacturer documentation. It is assumed that the user is familiar with the basics of PC hardware handling, floppy disk handling, and the operating system (WINDOWS 95 or NT). The respective handling instructions in the manufacturer documentation must be observed.

The connection of the PC is established via RS232 serial cable. For local mode, the cable is connected to the RS-232 terminal on the front panel (LCSU) or SK1 of I/O Panel of the DME cabinet.

Examples of programs references to be installed on PC are in figures 3.40, 3.41, 3.42, **Errore. L'origine riferimento non è stata trovata.**

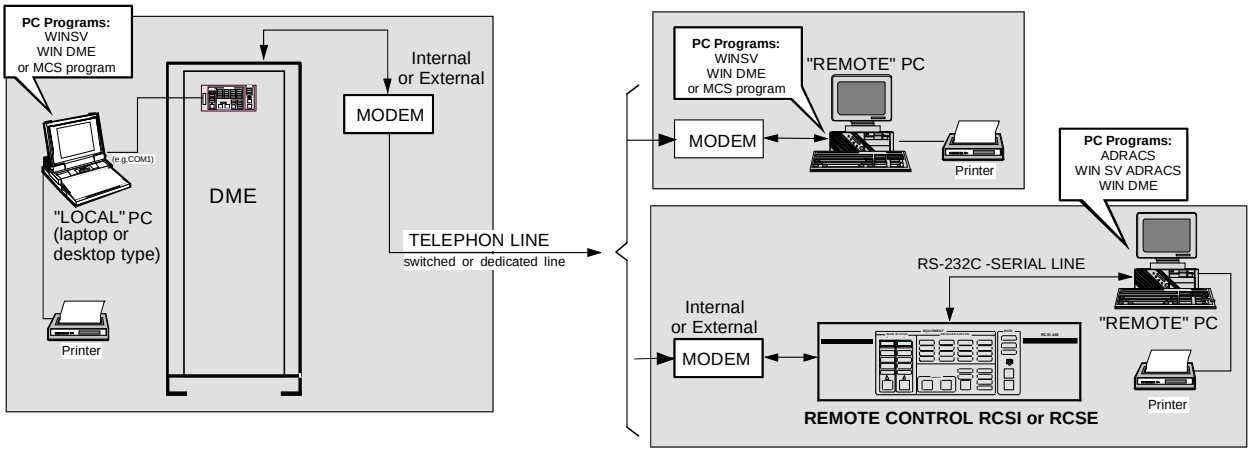


Figure 3.40. Examples of PC user programs with DME stand alone

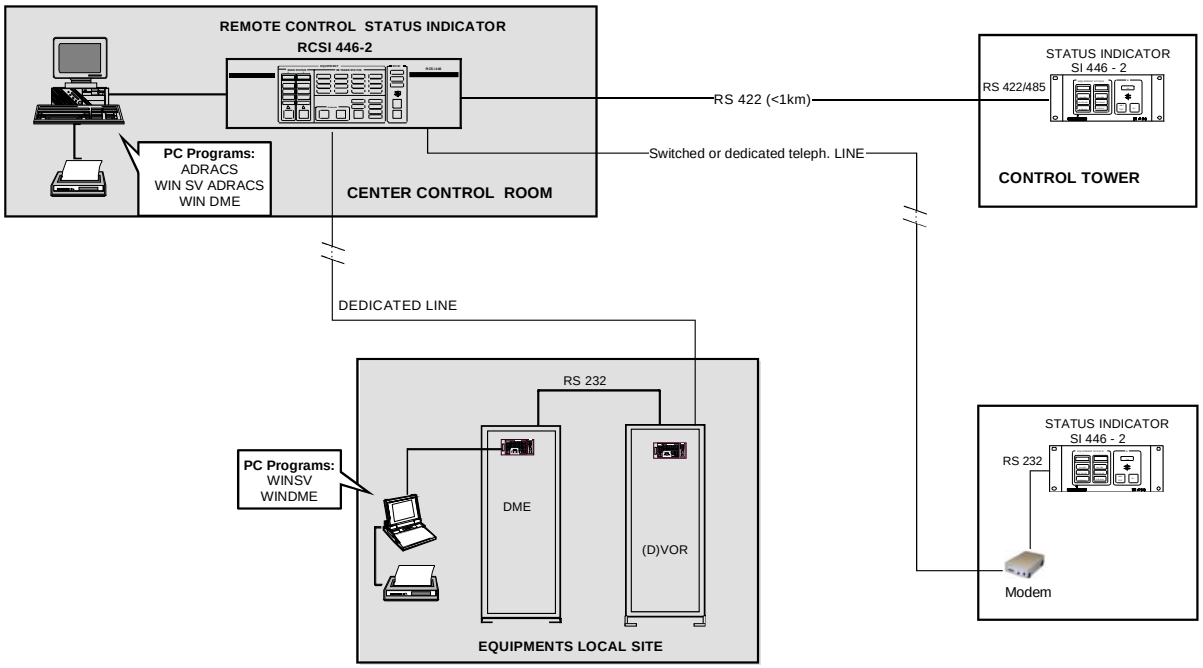


Figure 3.41. Examples of PC user programs in VOR-DME system

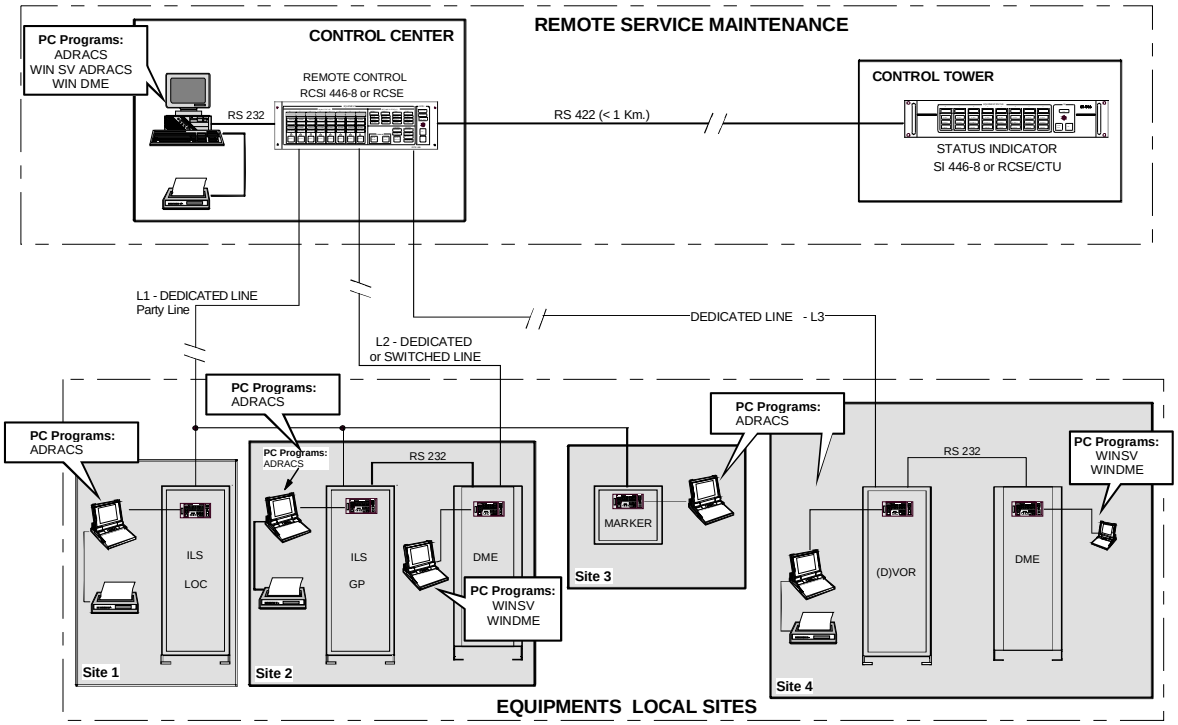


Figure 3.42. Examples of PC user programs with multi-sites

For installation on PC of the MCS program to see the suitable technical manual

3.5.2.1 PC REQUIREMENTS

The user operating software must be installed on a PC system. The PC must meet the recommended requirements described on APPENDIX B in this volume.

3.6 INSTALLATION ON PC OF USER OPERATING PROGRAM

Detailed procedures of installation are on APPENDIX "B" of this volume

a) User programming on Floppy disk

The PC Supervisor software to be installed first and it is supplied on 3,5” floppy disks.

NOTE:

a) It is recommended to make a backup of the original floppy disks prior to installation.

b) Selection and processing of windows and displays follows the usual instructions according to the WINDOWS manual.

c) To avoid bringing in a computer virus it is not allowed to run computer games generally and to use software programs, which are not authorized on the Maintenance Data Terminal (PC). It is recommended to test the computer or disks with a virus checker.

The disks required to install the "PC supervisor" program are on para B.3 of ANNEX "B" in this volume

NOTE: The disk labeled as "UTIL" is used for the LCSU configuration. (see para. 3.2.2).

b) User programming on CDROM (one disk)

To install on PC the programs ODBC, WinSv or Adracs WinSv and WinDME400 is sufficient to insert the disk supplied, in CDROM drive of the PC and to follow the indications which appear on the screen of the PC screen. The disk is prepared for the execution in AUTORUN.

For detail to see APPENDIX "B" on this volume

3.6.1 "PC Supervisor" program composition

The procedures of installation on PC and the Windows programs are described in the sections APPENDIX B, C, D of this volume:

- APPENDIX B User Programs WINDOWS for PC - WINSV SUPERVISION
- APPENDIX C User Programs WINDOWS for PC SUPERVISION WINSV ADRACS
- APPENDIX D User Programs WINDOWS for PC - WINDME400, CONTROL of the EQUIPMENT, DME 415/435
- if the equipment were supplied complete of PC, standard programs necessary, operational system and user's programs relating to the system beacon, they were already installed on the hard disk by the manufacturer.

3.6.1.1 Windows SuperVisor (WINSV)

The Windows Supervisor is a software that is able to simultaneously display several sites where one or more equipments can be installed.

It must be used to control DME, TACAN and NDB equipments when DVOR and ILS are not present in the system configuration; otherwise you must use Adracs WinSv Windows Supervisor program. To see the status and to control an equipment, it's also necessary to load its correspondent software manager (e.g. Windows DME/N Equipment Manager).

Operation and install program: see APPENDIX B - WINSV-32 in this volume

3.6.1.2 WinSv ADRACS Windows Supervisor

The WinSv ADRACS Windows Supervisor has the same function of the Windows Supervisor, but must be used when in the system configuration DVOR or ILS 400 series nav-aide equipments are also present.

ADRACS = Automatic Data Recorder And Control System

Operation and install program: see APPENDIX C – WINSv ADRACS SUPERVISOR" in this volume

3.6.1.3 Windows DME/N Equipment Manager - WINDME/N-32

The operating instructions concern the use of the control program of the DME 415/435 equipment.

The program works in a Windows environment and makes it possible to display the information concerning the DME 415/435 equipment for which control has been acquired through a series of pull-down menus, typical of Windows applications.

The examples described refer to model DME 435 (1 kW output power), but they are also valid for model DME 415 (100 W output power).

Operation and use program: see APPENDIX D - WINDME/N-32 "Equipment Manager" in this volume

3.6.1.4 MCS programming

Operation and use program: to see the suitable Technical manual MCS

3.7 FIRST SWITCHING ON

CAUTION

Make sure that the antenna or adequate dummy loads are correctly connected to antenna connector. Make sure that inside to equipment the internal dummy load is correctly connected

a) Verify:
- that beacon set-up is as required.
- that the modules are correctly inserted, connected and secured.
- that power supply and ground connections to the antenna and to the other equipment connected to the beacon, if any, are correct.
- that the calibration of peak power was checked for the operational channel, like procedure in paragraph 5.3.4 and 5.3.5 of section 5 - MAINTENANCE - in this volume.

b) On module CSB, to insert the M1 jumper, link of activation of the battery of maintenance of memories RAM

c) Checking of the jumpers positioning on each module, as by tables of section 2 - Installation - in this volume

d) Check the voltages value of the mains and the battery.
Power the beacon ON by means of the breakers provided on the external electrical switchboard (mains or external 48vdc or both)

e) The indications on the control and status panel light up.
Press the key LAMP TEST present on the Control panel and to check the lighting of all the LED and the activation of acoustic alarm (BUZZER)

NOTE: The LCSU has been configured with the necessary programs standard by the manufacturer. If it is necessary to change or modify the installed configuration to refer at the para 3.2.2 "LCSU CONFIGURATION PROCEDURE"

- To change from Remote Control to Local Control use key REQUEST RELEASE on the control and status panel.
- Maintenance operation is only necessary when operational values have to be adjusted on the transmitter or when a maintenance check has to be performed. It is carried out using the maintenance control unit (PC).
- Acoustic Alarm
- When the SIL key is pressed, the acoustical alarm stops (F4 on PC keyboard).

Since the monitor carries out normal checks of function and accuracy, the operation of the installation is faultless when the control and status panel indicates NORMAL. If however the control and status panel shows WARNING or ALARM, a check of the installation via PC is possible after pressing the REQUEST RELEASE key to change from local to remote control.

f) Open the cabinet front door and check for LED indication as described in paragraph 3.3 and table 3-10: the LED green OK, LED red off

g) Power the PC on.

h) Load the user programs onto the PC hard disk, if necessary, as described on "Supervisor (WINSV-32) program Installation" of APPENDIX B or "WIN 32 ADRACS Supervisor" of APPENDIX C in this volume.

NOTE: If the equipment has been supplied with PC included, the necessary enable programs standard have already been installed on the hard disk by the manufacturer.

i) Select the SYSTEM CONFIGURATION and make sure the different optional parts are correctly selected in accordance with the current beacon configuration.

j) Restore the beacon automatic control and verify that no warning or alarm message is displayed.

k) Perform all diagnostic procedures on the transponder connected to the antenna, wait till they are over and check for any malfunction message.

l) Change the transponders over, perform the diagnostic procedures on the second transponder (if present) and check for any malfunction message at the end of these procedures.

m) Make OFF the equipment while pressing on key EQPT ON/OFF and to check the extinction of the green LED "NORMAL".

n) Checking the beacon in absence of mains (black-out condition). With related batteries connected to open the 220Vac line of mains: the functionality of the equipment should not be degraded. To restore the mains after this test.

o) Switch the equipment in automatic mode

On section 5 "Maintenance" in this volume it describes procedures and suggestions in the event of damages or faulty persistent operations.

3.8 POWER OFF PROCEDURE

These operations are:

a) the beacon operation is interrupted and as a result no signal will be radiated by entering the OFF command in automatic mode or the beacon STBY in Maintenance mode, provided in the main menu. Or by pressing the BEACON ON/OFF pushbutton, on the Control Panel, after taking control of beacon operation by means of the EQUIP ON/OFF pushbutton on the same panel.

The indications on the Control Panel are also active after beacon STBY or beacon OFF

NOTE: The power supply of regulated voltage +5V and ±15V are continuously present: the "stand by" or "Beacon OFF" commands stop the RF signal radiated only and not the low voltages.

b) All power supply voltages may then be disabled by pressing the two breakers provided on the external electrical switchboard.
Then switch the PC in OFF by means of the suitable on/off switch.
In this case all power supply voltages are disabled and the indications on the control and status panel, extinguish.

NOTE: Executing the command: EQUIP ON/OFF from remote control it is possible to switch off the radiated signal of the beacon on condition that, in local site, the command REQUEST/RELEASE is in remote position (illuminated indication ENGAGED).

THALES

Description, Installation, Operation, Maintenance | Reference: Vol. 1 Code 955 900 031 C

GROUND BEACON

DME 415/435

Technical Manual

VOLUME 1

Equipment description, Installation, Operation, Maintenance and PC user

SECTION 4

TECHNICAL SPECIFICATIONS

Vers. D, September 2005

Table of CONTENTS

List of TABLES

SECTION 4

TECHNICAL SPECIFICATIONS

4.1 GENERAL

Equipment DME 415/435 is a ground beacon located in a subrack of 19", equipped with two transponders and a system dual monitoring, microprocessor controlled.

This equipment can be also configured like DME/N for 100Wp (DME 415) or 1kWp (DME 435).

The following characteristics are valid for the two configurations if that is not specified differently.

4.1.1 Applicable Documents:

The DME ground beacons comply with the following specifications:

- ICAO Annex 10, 5th edition, International Standard and Recommended Practices
- EUROCAE ground DME, MPS (Minimum Performance Specification), ed.57, Iss. December 1986.
- C E directives for Transceiver ETS 300 339 (EMC)
  EN 60065 – EN6215 (Safety)
- EEC Directives for CE marking: EMC/89/336
  Electrical Safety/73/23.

4.2 ENVIRONMENTAL AND SERVICE CONDITIONS

The optimal environmental conditions for beacon operation are given below:

- Temperature operation indoor: from –10°C to +55 °C.
- relative humidity: up to 95% (-10 to +35°C); max 60% (> 35°C);
- pressure: from 760 to 500 millimeters of mercury from sea level to an altitude of approximately 3000 meters; if the equipment is to be installed on sites at even greater altitudes, consult the manufacturer.

As regards beacon storage and transport, the temperature must be within the limits –40 °C and +70 °C and pressure up to 15000 m.

4.3 PHYSICAL CHARACTERISTICS

The beacon physical characteristics of the equipment single 19" standard cabinet are as follows:

- height: 1730 mm;
- width: 580 mm;
- depth: 610 mm (cabinet code 297 509 004); 635 mm (cabinet code 297 509 007) ;
- weight: approx. 145 kg DME 415 (optional modules included).
  approx. 165 kg DME 435 (optional modules included)

Completely modular with plug-in module type. Plug-in units are used as double or single Euroform printed multi-layer circuit boards, with dimensions of 233.4 x 220 [mm] or 100 x 220 [mm] accommodate on four subracks (full version). The RF modules are accurately shielded in casting boxes.

4.3.1 Equipment Versions

The two versions have the same modules and the same of principles of operation.

- Approach DME 415 – Solid state 100 Wp to be co-located with ILS
- En route DME 435 – Solid state 1kWp to-be co-located with VOR or DVOR

The equipment is configurable in following standard version:

- Full dual: Two Transponders/monitors/duplexers
- Single: One transponder/monitor/duplexer

Other possible configurations are available by request

NOTE: Each version of DME can be assembled in cabinet indifferently with code 297 509 004 or code 297 509 007

4.4 GENERAL FEATURES AND TYPE OF SERVICES

All the features listed below refer to the DME beacon antenna connector where no other indication is given.

4.4.1 Type of Services

This system provides a method of measuring the direct distance between an aircraft and a selected transponder within the coverage limits dictated by the operational requirements.

Each DME transponder provides synchronous replies to the DME/N interrogation signals.

4.4.2 Coverage and Accuracy

Coverage can be either omnidirectional or sectorial, depending on the type of antenna selected, and is determined in relation to the following power densities:

On the transponder antenna: –93 dBW/m^2 for DME 415; –103 dBW/m^2 for DME435,

On the aircraft antenna: –83 dBW/m^2 for the DME/N.

At present, the total accuracy of a DME system can be considered within the maximum values specified below: ±0.12 NM +0.05% of the distance. From 0 to 65 nautical miles, and ±0.17 NM +0.05% of the distance, above 65 nautical miles.

4.4.3 Radio frequency and polarization

The transponder antenna is vertically polarized and it radiates in the frequency band ranging from 960 MHz to 1215 MHz. The interrogation and reply frequencies comply with the ICAO Annex 10 standards.

4.4.4 Nominal Reply Delay – Pair Pulse Code – Channeling

The DME 415/435 beacon is configured as DME/N, it will be possible to select one of the 252 (standard ICAO) N channels (126 X channels and 126 Y channels: see table 1.2 on section 1 in this volume).

Table 4.1 illustrates the channel code, pulse code, reply delay and operating mode of the various channels.

Table 4.1 Channel code, pulse code, reply delay

CHANNEL CODE	NOMINAL INTERROGATION PULSE PAIR SPACING CODE [µs]	TRANSPONDER REPLY PULSE PAIR SPACING CODE [µs]	TRANSPONDER NOMINAL REPLY DELAY [µs]
X	12	12.0 ± 0.1	50
Y	36	30.0 ± 0.1	56

4.4.5 Reply Efficiency

The Reply Efficiency is better than 70% and internal noise not cause more than 10 pair transmission/s

4.4.6 Traffic Capacity

The DME beacon is always capable of giving distance information to a maximum of 200 interrogating airborne equipment.

It is however, possible to select two transmissions rates values: ranging from 800 to 4800 ppps or ranging from 2700 to 4800 ppps.

The difference is given by the minimum number of pulse pairs per second (800 ±50 ppps or 2700 ±90 ppps) transmitted by the equipment. Even in case of no interrogations from the airborne interrogators; as a result, the power consumption will be different.

4.4.7 Reply Delay

The reply delay may be defined as the reply interval between an interrogation, in antenna, and the corresponding reply at the same point.

On a DME/N beacon, the reply delay may be selected in 0.05 µs steps, as follows:

- from 35 µs to 75 µs for X channels;
- from 50 µs to 75 µs for Y channels.

As far as reply delay accuracy according to interrogation level is concerned:

Interrogation level	delay variation (average)	distance accuracy (average typical)
from –10 dBm to –79 dBm	± 0,2 µs	± 30 m
from –79 dBm to –89 dBm	± 0,4 µs	±60 m
from –89 dBm to –91 dBm	± 0,6 µs	±90 m

4.4.8 Automatic Stabilization of the Reply Delay

The reply delay can be automatically adjusted according to the measurements performed by the monitors and of specific circuits on the transponder (circuits of pilot pulse) that they measure and they adjourn the precision of the reply delay in continuity with step of 12,5ns.

The average value of the measurements from both monitors is used to modify the reply delay presetting in steps of 12,5 ns.

The automatic reply delay stabilization will continue even if one of monitors is faulty, if the monitoring logic set will permitted.

4.4.9 Reliability

In the calculation of the beacon reliability, all alarms of the monitors have been considered primary and the monitors in "parallel" configuration. So that both monitors must detect an alarm at the same time in order to trigger a changeover or a beacon shutdown.

The failure rate of the various modules has been calculated in relation to the to MIL-HDBK-217E in Ground Fixed conditions at an ambient temperature of 20 °C and of 55 °C. The following values have been calculated:

MTBF	at 20 °C	at 55 °C
DME 415, dual station:	over 18.000 hrs	over 11.000 hrs
DME 435, dual station:	over 16.000 hrs	over 10.000 hrs
DME 415, single station:	over 9.500 hrs	over 6.000 hrs
DME 435, single station:	over 8.500 hrs	over 5.500 hrs

4.5 EQUIPMENT DATA

4.5.1 TRANSMITTED signal

The stability of the transponder radio frequency signal output is better than 0.001 % apart from the nominal channel frequency.

4.5.1.1 Pulse shape

The characteristics of each pulse transmitted are given below:

- rise time: 2.5 µs with a tolerance ranging between –1 µs and +0.5 µs, measured between the points where the amplitude corresponds to 10% and 90% of the peak value;
- duration: 3.5 µs with a tolerance ranging between ±0.5 µs, measured between the points where the amplitude corresponds to 50% of the peak value;
- decay time: never longer than 3.5 µs measured between the points where the amplitude corresponds to 10% and 90% of the peak value;
- pulse top: between the points on the leading and trailing edges of the pulse at which the amplitude is 95% of the maximum, the instantaneous amplitude does not fall below 95% of the maximum voltage amplitude.

4.5.1.2 RF Pulse Signal Spectrum

The pulse spectrum of the modulated signal is such, that during the pulse the output power, contained in a 0.5 MHz band centered to ±0.8 MHz with respect to the nominal channel frequency. It is not greater than 20 mW, while in the same band, centered to ±2 MHz, it is not greater than 0.2 mW.

Any lobe of the spectrum is of lower amplitude than the adjacent lobe, which is closer to the nominal channel frequency. The power in the frequency bands is the energy that the frequency band contains, divided by the time of pulse transmission.

The time of pulse transmission is the interval, measured between the points on the rise and decay edges of the pulse envelope, at 5% of the maximum voltage amplitude

4.5.1.3 Out of Band Spurious Output

The spurious output is below -40 dBm/kHz at all frequencies between 10 and 1800 MHz, with the exception of the frequency band between 960 and 1215 MHz.

4.5.1.4 In-Band Spurious Output

The RF output level in the interval between transmission of pulse pairs is at least 80 dB lower than the maximum power level during the pulses. In addition, between the pulses of each pair, there is an interval of at least 1.0 µs during which the RF output level and is at least 80 dB lower than the maximum power level of each pulse. Finally, the CW output signal does never exceed 5 mW.

4.5.1.5 Harmonics

The output power of CW harmonics of the carrier frequency does not exceed -10 dBm. In addition, the peak of any harmonic of the carrier does not exceed +20 dBm.

4.5.1.6 Peak Power Output

The transponder output power at the peak of each pulse is not less than 100 Wp for DME 415 and not less than 1kWp for DME 435.

It is possible to reduce this power value to 50 Wp ± 1dB (DME 415) and to about 500 Wp ± 1dB (DME 435), programmable a step of 1dB.

4.5.1.7 Transmitted Pulses

Only pulse pairs are transmitted. Each transmitted pulse pair is coded accordingly to the operation channel.
The difference between the peak power levels of the pulses of any pulse pair does not exceed 1 dB.
The difference between the peak power levels of the pulses of each pulse pair (squitter or reply) does not exceed 1 dB.

4.5.1.8 Replies to Valid Interrogations

Replies to valid interrogations have a nominal reply delay for the operating channel, as indicated in table 4.1.

Any differences from the nominal reply delay do not exceed the following values:

- ±0.2 µs BIAS and ±0.2 µs NOISE, on a basis of 95 % for interrogations having any level between -5 and -81 dBm.
- ±0.4 µs BIAS and ±1 µs NOISE for interrogations having levels between -81 and -91 dBm.

4.5.1.9 Identification Using Morse Code

The identity signal (ID) consists of pulse pairs transmitted at a constant rate of 1350 (±0.2 %) per second during the key down time express in code Morse international

The characteristics of the identity code transmission rate for the DME transponder are as described below.

The dots have duration of 100...160 ms with a tolerance of ±5 %.

The dashes have duration of three dots.

The interval between the dots and/or the dashes of a character has duration equal to one dot.

The interval between two consecutive characters is not less than three dots.

The maximum duration for the identity code is equal to 64 dots.

The code repetition rate is at least once every 40 s.

The manipulation time with "key down" does not exceed 4 s for each identity group.

4.5.1.10 Squitter Output Pulses

The squitter pulse pairs are automatically generated and controlled to maintain a transponder minimum transmission rate (replies and squitters) equal to 800 (±50) pulse pairs per second (or 2700±90 pps in case of pulse transmission ranging from 2700 to 4800 pps).

These pulse pairs are randomly spaced, but their spacing is never less than 200 µs and there is no spacing in the range from 730 to 750 µs (typical spacing of the identity code).

When the transmission rate is greater than 800 pairs per second (or 2700 pps in the other case), no squitters are added.

4.5.1.11 Transmission Priority

The transmission of the output signals from the transponder has the following order of priority:

- Identity pulse pairs
- Reply pulse pairs
- Squitter pulse pairs

Transmission priority is established in the following way:

- The identity code inhibits the replies and the squitters as long as the dots and dashes last.
- The decoded pulses inhibit the squitter pulses at the encoder input until the reply is transmitted.

4.5.2 RECEIVER AND PROCESSOR CHARACTERISTICS

The transponder provides the required performance in response to interrogations from the airborne equipment. The interrogating signals comply with the standards laid down in the ICAO Annex 10 and EUROCAE MPS.

4.5.2.1 Receiver Sensitivity

When there is no overload, the DME 415 / 435 transponder's sensitivity is typical better than -91 dBm (can be preset between -76 and -94 dBm via PC keyboard).

The reply efficiency is better than 70%. Under these conditions, the transponder internal noise does not radiate more than 10 reply transmissions per second.

4.5.2.2 Receiver Dynamic Range

Accuracy is maintained for interrogating signals having levels between receiver sensitivity threshold selectable values and -5 dBm. The reply efficiency is at least equal to 95%, for a single interrogator with signal levels of at least 10 dB or more greater than the receiver sensitivity threshold.

4.5.2.3 Sensitivity Variation with Pulse Coding

If the interrogation pulse spacing differs from the nominal spacing value by ±1.0 µs, and there are no further interrogations, the receiver sensitivity threshold does not decrease by more than 1 dB. Interrogations with a spacing that differs by more than ±2.0 µs and an interrogating level up to a maximum of -10 dBm are rejected. Single pulse is not decoded.

4.5.2.4 Sensitivity Variation with Frequency

If there are no other interrogations, the nominal sensitivity threshold value does not decrease by more than 1 dB, when the interrogating signal frequency differs from the nominal value of the operating frequency set by ± 200 kHz.

4.5.2.5 Sensitivity Variation with the Interrogation Load

With the echo suppression disabled, and with a decoding dead time of 60 µs, the nominal receiver sensitivity will not decrease by more than 1 dB, when the number of replies has any value up to a maximum of 3600 pulse pairs per second.

4.5.2.6 Sensitivity Variation due to Interrogations on the Adjacent Channel

The transponder sensitivity threshold increases by no more than 1 dB in presence of interrogating signals on the adjacent channel at frequencies of ±900 kHz or more far from the on-channel interrogation frequency and correctly coded (for the channel in use), at any level up to -10 dBm and at any interrogation rate up to 3600 pairs per second. The transponder does not reply to interrogations on adjacent channels.

4.5.2.7 Recovery Time

The receiver sensitivity will not be reduced by more than 1 dB, when the valid interrogation pairs are preceded by a single undesired pulse which occurs 8 µs or more before the valid interrogation. The period between a single undesired pulse and the valid interrogation pair is measured between the 50% points of the rising edge peak value of the single pulse and the first pulse of the interrogating pair. The single undesired pulse may have all amplitudes up to a maximum of 60 dB above the receiver sensitivity set. The above is valid when no echo suppression device is activated.

4.5.2.8 Continuous Wave (CW) Signal Interference

A continuous wave interfering signal on the assigned channel frequency or at any other frequency within the receiver pass band, with peak power of -100 dBm at the receiver input, does not preclude compliance to specifications or modify the reply efficiency to interrogations from the value obtained without CW interference.

4.5.2.9 Spurious Suppression

The signal received at the intermediate frequency (63 MHz) is suppressed by at least 80 dB. Any other spurious reply or signal in the band between 960 and 1215 MHz and image frequencies are suppressed by at least 75 dB.

4.5.2.10 Decoding Dead Time

The decoding of each valid pair of interrogation pulses generates a dead time interval during which the decoder output is disabled, and therefore any subsequent valid interrogations will not be processed and transmitted, even though they are decoded.
The duration of the dead time interval, which is normally set at 60 µs, can be selected from the range of values 50 to 150 µs, at 1 µs steps.

4.5.2.11 Echo Suppression

- Short Echo Suppression

  Echo pulses which, occur between the pulses of a valid interrogation pair, will not affect the reply timing by more than 0.15 µs.
  In addition, the reply efficiency will not be reduced by more than 10% with respect to the value obtained, when there are no echo pulses.
  This occurs for an interrogating signal with a level between -10 dBm and 10 dB beyond the sensitivity threshold set for the receiver, and for an echo level up to 3 dB lower than the direct signal level.

- Long Echo Suppression

  The long echo suppressing circuits are used to suppress the echo pulses, which fall after the dead time interval.

These circuits are activated after the decoding of a valid interrogation with an interrogating level, which exceeds the activation threshold of the long echo suppression circuits. The threshold can be selected from the values between 0 dBm (deactivated echo suppression circuits) and -60 dBm.

The threshold used for long echo suppression has a level, which is 3 (±3) dB above the interrogating signal level which activated the echo suppression circuits. It has a duration, which can be selected from the values between 50 and 300 µs.

4.5.2.12 Receiver Bandwidth

The bandwidth at the 12 dB and 60 dB points do not exceed 2 MHz and 12 MHz respectively.

4.5.2.13 Interrogation Overload

The maximum transponder transmission rate is 4800 (±150) pulse pairs per second.
When overload occurs, the sensitivity of the receiver is automatically reduced to limit the transmission rate of the transponder. The range of sensitivity reduction is 50dB.
The transmission rate is automatically controlled by simple preventing further replies.
The transponder components are additionally protected if transmission should exceed the maximum rate in case of malfunctioning.

4.5.2.14 Receiver Inhibition during Transmission

During transmission the receiver is inhibited for a period of time that will not exceed 10 µs for each pulse transmitted.

4.6 MONITORING SYSTEM

4.6.1 General

The typical monitoring system consists of two independent monitors, controlled by µP and managed by suitable program.
the two monitors have primarily the function to take measurements whose results, provided to the system of control, make it possible to check the services of the equipment and emitted signal RF. To take various measurements one uses pulses produced by the interrogators having the same characteristics as the signal coming from RF interrogator of the airborne.
The monitors basically perform the following measurements in order to check that the beacon is operating correctly:

a) *Executive monitoring;* tests continuously carried out on the transponder output signal.

b) *Monitor self-check;* additional tests carried out together with the executive monitoring to ensure the monitor integrity.

c) *Routine checks;* pre-established tests of the most important parameters of the transponder and of the monitor itself that can be performed during the normal operation of the beacon; they can be repeated periodically or when requested by the operator.

d) *Manual tests;* tests specific for maintenance operations; to perform quantitative measurements on the relevant parameters while keeping the beacon in normal operation: the operator may select the type of test.

e) *Diagnostics;* tests performed in sequence and when requested by the operator, useful to determine the efficiency of the monitor itself and of the transponder connected to the dummy load.

4.6.2 Executive Monitoring

This monitoring action, check the output signal of the transponder(s) and generates a condition of alarm as specified in this section when the predetermined limits are exceeded.

It is continuously carried out for the main transponder connected to the antenna; it can also be carried out contemporary both for the transponder on antenna and for the transponder on dummy load if the standby mode selected is "hot".

The operator is supplied with the values of the controlled parameter measurements obtained by both monitors. These values are continuously updated.

The tests are performed in approx. 1 s; after a pre-defined delay an out of tolerance parameter generates an alarm condition and as a result the transponders will be changed over or the equipment will be shutdown.

See details on the measurements in the table 4.2.

It is possible to select a *AND* or *OR* monitor logic.

- In case of *OR* monitor logics, both monitors must work correctly to make beacon operation possible. An alarm condition will occur (beacon shut down) when one monitor detect an out of tolerance condition of one parameter.
- In case of *AND* monitor logics, the beacon will keep working even if one of the two monitors is faulty. An alarm condition will occur when both monitors detect an out of tolerance condition of one parameter (AND logic=best reliability condition default preset).

4.6.2.1 Executive Monitoring Terms

- A *primary alarm* starts an automatic sequence of events to inhibit signal transmission and consequently, restore correct operation by inserting the reserve equipment, if present.
- A *secondary alarm* starts an automatic sequence of events to provide the proper signaling and engage the spare transponder if this can provide a better service. A secondary alarm does not inhibit signal transmission. The measuring period is the interval necessary for acquiring samples of a parameter.
- The *average value* of a parameter is calculated in the measuring period.
- The *reaction time* (time monitors alarms delay) is the interval between an out of tolerance condition occurring and the changeover or shutdown of the transponder by the controller. The reaction time takes the monitor and equipment delays into account.

4.6.2.2 Monitor Insertion Delay

The monitors are inhibited for approx. 5 s after the "equipment on" command.

4.6.2.3 Monitor Response to Alarms

After primary or secondary alarms the following operations are performed:

- The transponders are switched or powered off.
- A visual and acoustic alarm is emitted at both the local and remote sites.
- The cause of the alarm is identified (monitor parameter), and the value at the time of alarm is stored.

❑ Switching a Single Transponder

If there is no standby equipment available, the single equipment is deactivated only when the monitors detect a primary parameter, which is outside of the specified limits. A primary alarm completely interrupts transmission from the station within the given reaction time.

❑ Switching Dual Equipment

When there is a standby equipment available, switching guarantee that service continues with the best available hardware, including the secondary alarm conditions.

A secondary alarm on the operating transponder causes the equipment to be switched only if the standby transponder's conditions are perfect.

❑ Standby Mode

The standby mode of the transponder connected to the dummy load can be set to:

- Normal : Transmitter is *off*.
- Hot : Transponder is *operating*.

To table 4-2 are deferred, for each parameter, the alarm threshold, the measuring accuracy, the reaction time as well as the procedure of measurement. The parameters to which corresponds a secondary alarm can be redefined individually in way such as the condition of alarm which is associated to them the primary type

Table 4.2 DME 415/435: Executive Monitoring

PARAMETER	ALARM TYPE	ALARM THRESHOLD	TEST ACCURACY	MONITORS ALARMS DELAY	TEST METHOD
REPLY DELAY	Primary	±0.1 µs (adjustable at ±0.4 µs max.)	±20 ns	4 s (adjustable from 1 to 10s)	Average of 32 tests obtained by interrogating with 40 ppps and -40 dBm ±2 dB level
REPLY PULSE SPACING	Primary	±0.25 µs	±20 ns	4 s (adjustable from 1 to 10s)	4 tests are averaged every second
REPLY PULSE POWER	Primary	–3 dB	±0.5 dB	4 s (adjustable from 1 to 10s)	4 tests are averaged every second
TRANSMISSION FREQUENCY	Primary	±200 ppm	±50 ppm	4 s	By means of the counter
TRANSMISSION RATE	Secondary (selectable to primary)	720 ppps	±20 ppps	10 s	By means of the counter
IDENTITY CODE	Secondary (selectable to primary)	–	–	–	Enabled alarm if the identity code unit is delayed by more than 1 cycle Alarm at 2nd cycle after the last valid cycle.
REPLY EFFICIENCY	Secondary (selectable to primary)	66%	±2%	10 s	Replies to 50 inter-rogations at a level 6 dB (±2 dB) greater than the receiver sensitivity threshold; updated approx. every 2.5 s

Note 1: The secondary alarm parameters can be set individually to operate as primary alarms and the reaction time for each alarm can be preset between 1 and 10 s.

Note 2: The reply delay alarm limit can be adjusted up to 0.4 s on request of the user.

Note 3: The number of interrogations generated by the monitor system does not exceed 120 per second.

4.6.3 Monitor Self-check

Each monitor is kept under constant control to check its operation in order to avoid false alarm detection. This is done by performing suitable tests, which are repeated every second. If the monitor fails to pass all tests, it is declared faulty and deactivated within 1 s.

The following tests are performed:

- Frequency synthesizer
- Interrogator
- IF detector
- AD and DA converters
- Timers and counters
- Morse Code detector
- Digital circuits (µP, RAM, Eprom).

4.6.4 Routine Checks

A routine check is carried out on request or periodically at intervals, which are preset by the operator. It performs quantitative measurements of the transponder and monitor parameters; the results can be stored in the database of the equipment.

These measurements do not affect or delay the normal monitoring and do not alter the beacon's performance:

- Reply delay at interrogation levels of : -10; -30; -50; -71 dBm, and 3 dB above the sensitivity threshold.
- Spacing between the reply pulses.
- Pulse peak power
- ERP of the 1st and 2nd pulse and peak power droop.
- Transmission rate.
- Transmitter frequency.
- Reply efficiency for interrogation levels at +3; +2; +1 dB; 0 -1; -2; -3 dB in relation to the nominal sensitivity value.
- Rise, duration and decay times of the first pulse transmitted.
- Rise, duration and decay times of the second pulse transmitted.
- Receiver bandwidth: Reply efficiency at 1 dB over the sensitivity threshold and with a variation in frequency of ±200 kHz.
- Rejection of the adjacent channel: Reply efficiency at an interrogation level of -10 dBm and with a variation in frequency of ±900 kHz.
- Decoder operation: Reply efficiency at an interrogation level of 1 dB above the sensitivity threshold and with a variation in spacing between the interrogating pulses of ±1 µs; then reply efficiency at an interrogation level of -10 dBm and variations in the spacing between the interrogating pulses of ±2 µs.
- Rejection of the single pulse: Reply efficiency at -10 dBm and with single pulse interrogations.
- Recovery time: Reply efficiency at 1 dB above the sensitivity threshold with the previous pulse 9 µs before and a level of 60 dB above the sensitivity threshold.
- Echo suppression, as for operator setting.
- Dead time: Reply efficiency to interrogations which occur within the dead time of a previous interrogation and immediately afterwards.
- Identity code: Detected code, dot/space duration, dash/interval duration, identity code repetition speed and period.

4.6.4.1 Monitors Routine Check

The following operations are performed:

- Interrogation 1st & 2nd pulse level
- Interrogation pulse spacing
- Interrogation 1st & 2nd pulse shape

4.6.5 Manual tests

The tests are carried out individually, when requested by the operator, and they perform quantitative measurements on the relevant parameters. The normal monitoring of the transponder connected to the antenna is not interrupted.

The tests are as follows:

- All those indicated above (Routine Checks) which can be preselected individually.
- Variation in the sensitivity with the interrogating load: Reply efficiency with interrogation levels at +3; +2; +1; 0 –1; -2; -3 dB with respect to the sensitivity value, and with 3600 pulse pairs per second of interrogations on channel.

- Receiver sensitivity with interrogations on the adjacent channel: Reply efficiency with an interrogation level equal to 1 dB above the sensitivity threshold with 3600 interrogations on the adjacent channels (±900 kHz from the nominal channel frequency).
- Interrogation overload: The transmission rate with 10,000 interrogations.
- Variation in the reply efficiency with CW interference: Reply efficiency with an interrogation level equal to the receiver sensitivity and with an interfering CW signal on the channel at -100 dBm.

4.6.6 Diagnostics

The diagnostic function performs sequentially a series of tests both on the monitor(s) and on the transponder connected to the dummy load with the purpose of locating the cause of a possible malfunction and the corresponding (Line Replaceable Unit) LRU(s).

During diagnostic execution, the message DIAGNOSTIC TEST RUNNING is indicated.

At the end DIAGNOSTIC TESTS: ALL OK is indicated.

Otherwise if a failure is detected, the list of failed tests along with the list of modules, which caused the malfunction, is displayed.

At the end of this list, END DIAGNOSTIC is displayed.

The sequence of tests performed concerns:

- Power supply (check of flags)
- LRU interface addressability
- I/O operation
- Monitor µP operation
- Transponder µP operation
- Frequency synthesizer
- Monitor interrogator circuits
- Monitor measurement circuits
- Receiver and log detector
- Digital Processor
- Pilot pulse operation
- Digital Modulator
- Automatic modulation control
- Transmitter Driver
- RF output signal at the transmitter driver
- Power RF 1 kW amplifier
- RF output signal at the power RF 1 kW amplifier
- Duplexer

4.7 LOCAL I/O SYSTEM

LCSU

I/O Parallel line:	Input n° 8+8 optocoupled (Ig 0= max 0,5 mA ; Ig 1= max 10mA) Output n° 8+8 Solid-state relays (max 350V/100mA - insulat. volt. 1,5kV) Input n° 8+8 optocoupled (optional) (Ig 0= max 0,5 mA ; Ig 1= max 10mA) Output n° 8+8 Solid-state relays (optional) (max 350V/100mA - insulat. volt. 1,5kV)
I/O Serial line:	No 5 Channel RS232 (port 5,6 equipment internal used)
	No 1 Channel RS485/422 (port 4 equipment internal used)
Front panel:	LED indications & membrane push buttons
	PC connector Serial line SubD 25 pin, female
I/O Panel (at top of cabinet)	PC connector Serial line SubD 25 pin, female
	Connector Serial line Port 3 SubD 25 pin, male. (Not available if MDM2 is used)
	Connector Serial line Port 2 SubD 25 pin, male. (Not available if MDM1 is used)
	Connector OUT Parallel line SubD 25 pin, female. (16 lines out - standard)
	Connector IN Parallel line SubD 25 pin, male. (16 lines input - standard)
	Connector OUT Parallel line SubD 25 pin, female. (16 lines out - optional)
	Connector IN Parallel line SubD 25 pin, male. (16 lines input - optional)
	Connector Pair of Telephone lines SubD 9 pin, male.
INTERFACES	n° 2 connectors SubD 25 pin, female on top of cabinet
(Associated Facility)	I/O optocoupler: IN Ig 0= max 0,5 mA ; Ig 1= max 10mA
	OUT Ig max 35V/100mA
MODEM	Connector SubD 9 pin, male on top of cabinet. - Pair of 2-wire switched or dedicated line

4.8 DUPLEXER AND RF PATH

Coax Relay	Four port transfer type : 28V/ 200mA
	VSWR $\leq$ 1,1
	Isolation $\geq$ 60 dB
RF Patch panel	Test external for specific measurement: SMA connectors

4.9 POWER SUPPLY REQUIREMENTS

The beacon is powered by the optional BCPS unit located in the lower part of the cabinet.

Beacon power supply characteristics:

- Mains AC line: 230 Vac +10/-15%; Frequency 48 to 64 Hz
- DC external source: 40 to 60 Vdc
- Back up Battery 48V nominal – These batteries are recharged by the BCPS unit at 54 Vdc.

  Once they have discharged, the batteries are disconnected by a optional specific protection breaker which opens at a minimum nominal voltage of 42 Vdc (depleted)

  E.g.: on DME 415 a continuous power supply, from battery of 50 Ah, is > 12 h with functioning of the transmitter with a duty cycle of 800 ppps. For equipment DME 435, is: >7 h

4.9.1 Consumption:

NOTE: The data given below are valid in full dual version and for equipment with all the modules and accessories efficient and with an RF output power in antenna connector: DME 415=100 Wp. DME 435=1kWp

- If the beacon is powered using an external **48 Vdc** power source or the back-up battery, typical consumption values are as follows:

DME 415	115 W	typical, with one transponder active and the other on stand-by at 800 ppps of duty cycle transmitted;
	160 W	typical, with one transponder active and the other on stand-by a 2700 ppps of duty cycle transmitted
DME 435	140 W	typical, with one transponder active and the other on stand-by at 800 ppps of duty cycle transmitted;
	220 W	typical, with one transponder active and the other on stand-by a 2700 ppps of duty cycle transmitted

- If the beacon is powered from the mains, typical consumption values are as follows:

DME 415:	145 W	typical**,** with one transponder active and the other on stand-by at 800 ppps of duty cycle transmitted
	170 W	typical**,** with one transponder active and the other on stand-by at 2700 ppps of duty cycle transmitted
	200 W	typical**,** with two transponder active (one on Antenna other on Dummy load) 2700 ppps of duty cycle transmitted
	500 W	typical**,** with one transponder active and the other on stand-by at 2700 ppps of duty cycle transmitted during battery charging at typical value of 5A

Redundancy is such that each AC/DC module serves one transponder. In the case of an AC/DC module fault, there is sufficient power to supply both transponders at the following operating conditions:

- beacon with one transponder active and the other on standby, 800 ppps, RF Po = 100 Wp;
- battery charging typical current max. 5 A.

DME 435: 200 W typical**,** with one transponder active and the other on stand-by at 800 ppps of duty cycle transmitted

300 W typical**,** with one transponder active and the other on stand-by at 2700 ppps of duty cycle transmitted

400 W typical**,** with two transponder active (one on Antenna other on Dummy load) 2700 ppps of duty cycle transmitted

700 W typical**,** with one transponder active and the other on stand-by at 2700 ppps of duty cycle transmitted during battery charging at typical value of 5A

Redundancy is such that each AC/DC module serves one transponder. In the case of an AC/DC module fault, there is sufficient power to supply both transponders at the following operating conditions:

- beacon with one transponder active and the other on standby, 2700 ppps, RF Po = 1kWp;

4.9.2 Power supply PWS module: +5V and ± 15V

Low voltage DC/DC converter for supply the transponder and monitor

Input voltage	38 to 72 Vdc
Regulated outputs	+ 5,1V ± 2% - max. 10A
	+15 V ± 3% - max. 1,5A
	- 15 V ± 3% - max. 1,5A
Protections (each voltage):	
Output	:Over voltage with crow-bar and ESD (electro static discharge) device
	:Under voltage
	:Short circuit continuous
Input	:Over current (with fuse for each input voltage)
	:Over voltage
	:Under voltage
	:Over temperature
Indications	
Led	green ON: Input voltage OK
	red ON: Output voltage out of voltage limits
Signals logic	Power Supply Faulty: normal "low", with led red ON go to "high"
	+ 5V faulty: normal "low"; go to "high" when 5V is out of voltage limits
Test point	one for each output regulated voltage
Push-button Reset	Test for casual fail

4.9.3 BCPS subrack and AC/DC module

The optional BCPS subrack can house up to four AC/DC modules. In the dual configuration, two plug-in AC/DC converter optional modules are required. Total power handling: 600 W (n° 1 AC/DC module) to 2400W (n°4 AC/DC modules)

Dimensions:

- Height 262 mm (6HU front panel) – housing 220mm
- Width 84 TE
- Depth 320 mm included output connector

Terminal board:

Mains input (n° 3 terminals)

Battery input (or external 48 Vdc power supply) : n° 2 terminals

Output 1 "48VBT1" with fuse 10 AT (6,3x32) (n° 2 terminals)

Output 2 "48VBT2" with fuse 10 AT (6,3x32) (n° 2 terminals)

Output S "48VBTS" with fuse 2 AT (6,3x32) (n° 2 terminals)

Ground local network (n°1 terminal)

AC/DC module main characteristics:

- Rectifier unit with Power factor correction and active parallel load sharing bus function
- OUTPUT
  - Nominal voltage 54 Vdc (± 0,2 Vdc)
  - Adjusting range ± 0,5V (Adj. potentiometer on AC/DC module front panel)
  - Nominal current (± 5%) 10A with current limit ≤17A
  - Short circuit protection static (continuous) and dynamic
  - Load regulation 0,5 V from 0,5A to 10 A of load
  - Over voltage protection typical 75 V

- INPUT
  - Input voltage and freq. 195 to 264 Vac - frequency 48 to 64 Hz
  - Nominal input current 3,0 A typical @ input voltage 230Vac
    Inrush current < 20A
- Efficiency > 85%
- Power Factor ≥ 0,95 – Load range 0,25 to 1 nominal load
- Fuse Internal line 10 A M (6,3 x 32) input over current protection
- Indication led (on front panel) Green "MODULE OK"– AC/DC module output voltage is OK
  Green "MAINS"– Input mains voltage OK
- Signaling free contacts of floating potential:
  "MAINS" closed contact = mains OK
  open contact = black out or blow fuse
  "AC/DC FAULTY " closed contact = AC/DC module operating
  open contact = output voltage of out limits or battery operating
  "BATTERY PRE DEPLETION" closed contact = battery > 46 Vdc
  open contact = battery ≤ 46 Vdc
  "BATTERY DISCONNECTED" closed contact = battery > 42 Vdc
  open contact = battery ≤ 42 Vdc
  (this contact is able to driver the winding of the battery depletion, optional, breaker)
- Remote control ON-OFF – On = TTL level : "0" or open
  Off = "1" level
- Test point Output voltage on front panel

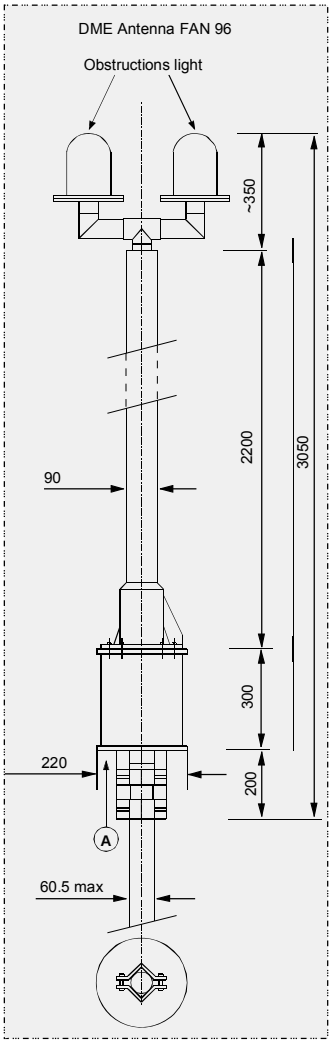
- Dimensions:
  - Height 262 mm (6HU front panel) – housing 220mm
  - Width 106 mm (21 TU)
  - Depth 285 mm included output connector
  - Weight approx. 4,5 kg
- Protection class IP20
- Connectors (in/out) DIN 41612 H15

4.10 ANTENNA

4.10.1 Omnidirectional FAN 96 type

Mechanical Characteristics

- Weight 32 kg max.
- Dimensions See figure
- Protection Fiberglass tube
- Max. bearable wind speed 150 km/h with 12 mm of ice; safety factor not < 2
- Wind pressure 40 kp max. (equal to 150 km/h with 12 mm of ice)
- Turn-over moment at base 70 mkp max.
- Environmental conditions:
  - Temperature between -40 and +60 °C
  - Humidity up to 100% with heavy rain not < 400 mm/Hg
- Obstruction lights Siemens 5NQ3208-0A type or equivalent



Electrical Characteristics

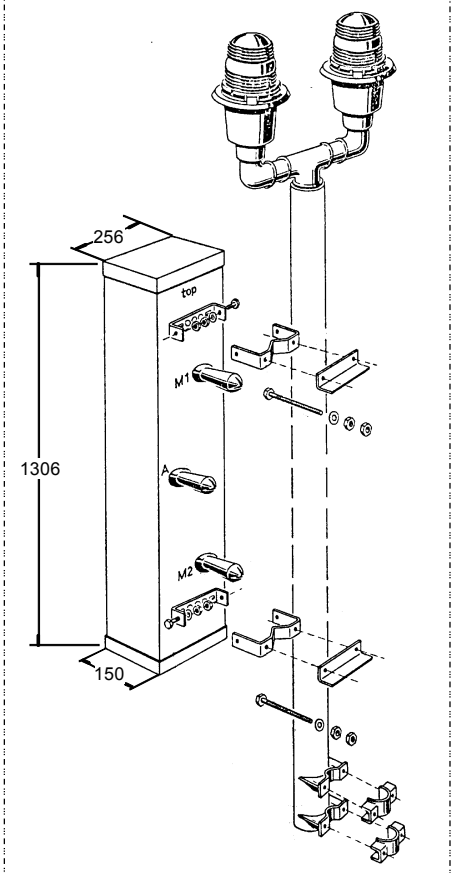
• Frequency range	960 to 1215 MHz
• Polarization	Vertical
• Input impedance	50 ohm, unbalanced
• V.S.W.R	Less than 1.8 measured at the antenna input.
• Gain	≥ 9 dB referred to isotropic source
• Horizontal lobe Circularity	Omnidirectional ≥ ±1.5 dB
• Vertical lobe Lobe width of antenna radiation in the plane	max. radiation at 4° (±1°) above horizon ≥ 6°
• Input RF Power	5 kWp, modulated and transmission cycle not greater than 5 %
• Decoupling of the antenna monitor probes	21,5±3 dB (flatness and stability: ±0.25 dB)

4.10.2 Sectorial FAN-88

Mechanical Characteristics

• Type	FAN-88, directional antenna
• Net weight	12 kg
• Dimensions	See figure
• Max exposed area	0.38 m^2
• Lateral thrust	60 kp at 160 km/h = 100 mph
• Wind velocity	rated (1.65 safety factor)*/survival (*based on the yield point)
• w/o ice	280 km/h / 360 km/h
• 1/2" radial ice	250 km/h / 330 km/h
• Packing	142 x 36 x 25 cm
• Temperature range (environment)	-30° to +60° C
• Lightning protection	The antenna is DC grounded by a cross-section of 640 mm^2 hot dip galvanized steel.

DME SECTORIAL ANTENNA FAN 88



Electrical Characteristics

• Frequency range	960 – 1215 MHz
• Bandwidth	255 MHz
• V.S.W.R.	<1.6 at antenna input
• Coupling attenuation	25 ±3 dB (antenna / monitor probes)
• Beam tilt	+4° ±0.5°
• RF peak power	10 kWp; duty cycle 2 %
• Polarization	Vertical
• Horizontal lobe	66° (3 dB width, at mid band)
• Vertical lobe	13° (3 dB width, at mid band)
• Gain (ref. to half wave dipole)	14 dB (in main lobe direction, at mid band)
• Input (antenna and monitor probes)	50 ohms; Type N female connector

THALES

Description, Installation, Operation, Maintenance | Reference: Vol. 1 Code 955 900 031 C

GROUND BEACON

DME 415/435

Technical Manual

VOLUME 1

Equipment description, Installation, Operation, Maintenance and PC user

SECTION 5

MAINTENANCE and TROUBLESHOOTING

Vers. D, September 2005

Table of CONTENTS

List of FIGURES

List of TABLES

SECTION 5

MAINTENANCE and TROUBLESHOOTING

5.1 GENERAL

This section contains all data required for maintenance of the Model DME 415/435 - Distance-Measuring Equipment - ground beacons. This section provides standards and tolerances, maintenance requirements, required test equipment, performance check procedures, information supporting flight check of the station, alignment and adjustment procedures, fault isolation, module replacement procedures, and technical performance records for the DME ground station.

Maintenance on the DME beacons is made easier by using a personal computer (PC) based control and monitoring system. This allows the operator to measure and control the main parameters of the DME transponder using the PC keyboard and display.

This beacon does not require any particular maintenance operation. It has been conceived, from a mechanical (plug-in system) as well as from an electrical point of view (use of mainly integrated, solid state components) paying the greatest attention to the reliability factor. This intrinsic reliability is further enhanced by the quality control method as per AQAP-1 requirements, as regards to production cycles, structure and inspection; additionally, all automatically tested modules undergo "burn-in" procedures.

The DME 415/435 has been designed to minimize maintenance requirements using built-in computer controlled test equipment and digital design techniques. Remote access to the equipment through the modem interface allows the built-in test equipment (BITE) to be used to assure proper DME operation without the need to visit the site.

The faulty modules may be detected following the information given in paragraph 5.3. Remove and replace time is minimized by the use of plug-in assemblies that are easily accessed from the front of the cabinet.

Troubleshooting is made easier by the executive monitoring and test procedures, which perform real-time

Usually, operator, at the local site, does not control the beacon, although its operating conditions may be checked through the messages displayed on the remote PC. The operator may also detect possible parameter variations by displaying the information concerning the automatic monitoring cycle (EXECUTIVE MONITORING), by performing the Routine Check, or by standard or specific measurements in manual tests (Maintenance mode). Then comparing the results obtained to the previous data.

Faster on-site troubleshooting is possible using light-emitting diodes (LEDs) located on the modules. These make it possible to detect a module failure by looking for an illuminated red LED on any card in the DME card-cage. Another important instrument for troubleshooting is the DIAGNOSTIC function, which displays the name of the faulty module. The diagnostic function is described in paragraph D.3.4.4 ANNEX D.

There are a few activities of normal maintenance, which should be performed in DME 415/435. All the main parameters are maintained at the preset values throughout the entire life of the system by means of specific circuits and a microprocessor controlled transponder, so that drift as a result of aging, will not occur. No parts that are subject to mechanical wear are used. Since, the periodic maintenance intervals can be made only whenever necessary and the number of measurements restricted to a minimum.

In addition, the radiated signals are checked by 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. Each monitor is a complete programmable DME instrumentation set in itself (BITE - Built In Test Equipment), capable to perform all tests and checks required for routine maintenance and for automatic diagnostics.

Preventive maintenance activities should be reduced in accordance with local regulations as actual data proves that the requirements in ICAO 8071 are overly conservative.

Skilled operators and technicians may perform more, accurate measurements using external instruments. The details about any of these measurements are given in the following paragraphs

5.1.1 Standards and Tolerances

The main standards and tolerances for the 415/435 DME are listed in table 5-1.

Table 5-1. Standards and Tolerances

Parameter	Lower Limit	Standard	Upper Limit	Reference Paragraph
Reply delay	Standard minus 0.2 μs	Assigned at commissioning	Standard plus 0.2 μs	5.2.2
Reply coding	Standard minus 0.1 μs	Assigned at commissioning	Standard plus 0.1 μs	5.2.2
Reply efficiency	66%	95%	...	5.2.2
Transmitter power	-3.0 dB of standard	Assigned at commissioning	...	5.2.2
Radiated power	-3.0 dB of standard	Assigned at commissioning	...	5.2.2
Transmitter pulse rate	80 pulse pairs per second (pp/s) below minimum	Assigned at commissioning 800-2700 or 2700-4800 pps	...	5.2.2
Transmitter pulse rise time	1,5 μs	2,5 μs	3 μs	5.2.2
Transmitter pulse width	3 μs	3,5 μs	4 μs	5.2.2
Transmitter pulse decay time	1,5 μs	2,5 μs	3,5 μs	5.2.2
Ident cycle time	25 s	30 s	40 s	5.2.2
Transmitter frequency	- .001%	Nominal channel frequency	+.001%	5.2.5.4
50 V supply low-power transmitter (TX)	48 V	50 V	52 V	5.2.5.8
50 V supply high-power amplifier (TKW) (435 only)	48 V	50V	52 V	5.2.5.8
Bus voltage	52 V	54V	55 V	5.2.5.8
5 V supply	4.75 V	5.00 V	5.25 V	5.2.5.8
15 V supply	14.25 V	15.00 V	15.75 V	5.2.5.8
-15 V supply	-15.75 V	-15.00 V	-14.25 V	5.2.5.8
AC supply	187 VAC	230 VAC	276 VAC	5.2.5.8

5.1.2 Documentation of Flight Test

The data recorded during the flight test establishes the baseline for each DME installation. Documentation is recorded by the printer connected to the PC or in a file on the PC (the Routine Check is the typical file used). The data recorded during the commissioning and flight check should be recorded and stored in a reference file. The same procedure should be followed when performing further checks, so the data recorded can be compared with the original flight check data.

5.2 MAINTENANCE

5.2.1 Periodic MAINTENANCE

The procedure is performed using the monitors BITE as measurement instruments.

Each parameter of the transponder in antenna is measured in real time by the monitor(s), which incorporate a full measuring devices (BITE = Built In Test Equipment). These instruments are constantly verified by its own self-check (integrity check of monitor) and the possible failure will be visualized through proper failure messages and the faulty monitor will be switched off.

The frequency of this test might be reduced according to operator's requirements, to environmental conditions and to the practical experience collected over time. Several customers suggest a periodicity of once every two years.

Every parameter to be measured is associated with the corresponding limits according to Annex 10, Doc. 8071 Part III DME ICAO specifications, the standards and tolerances in para. 5.1.1, and manufacturer's in technical specification data (section 4).

The BITEs are performed using a local or remote PC. General information is given in the following paragraphs:

- the parameters measured with the EXECUTIVE MONITORING and ROUTINE CHECK programs may also be measured using the CHECKS menu;
- in addition to the standard tests, the skilled operator may use the PRESETTABLE tests (ANCILLARY - see ANNEX D section) to create special tests, not provided by the system, necessary to perform particular checks
- before starting every ordinary maintenance procedure, it is necessary to analyze any possible alarm or warning condition which may have occurred from the last maintenance intervention so as to perform more accurate controls on the parameters showing signs of degradation;
- at the end of the maintenance procedures, print the last Routine Check and the data relating to every measurement performed; compare them to the previous data and to the data obtained upon installation.
- these controls must be performed on both transponders and it is advisable to perform a final control on the two of them using the diagnostic function (DIAGNOSTIC TEST).

Therefore, the equipment does not require typical scheduled maintenance. Only ordinary cleaning maintenance is suggested.

For shelter, air conditioner and emergency battery (if applicable), observe, the manufacturers maintenance recommendations. Battery type suggested: low maintenance or sealed type.

Additional external measurements are documented in paragraph 5.2.5. These allow the operator to test the validity of the measuring devices inside the monitor by means of external instruments. These procedures may be used at the discretion of the maintenance technician.

5.2.2 Routine Tests

Routine tests will verify the proper performance of the DME transponder and monitor. This performance test should be run at discretion of operator. All limits should conform to the tolerances in table 5-1 or those dictated by local regulations. All tests must pass.

If any tests fail, repeat the tests two or three times to verify the failure; then refer to paragraph 5.3 for troubleshooting assistance.

a. For this procedure, data will be printed or saved to disk. If a printer is to be used it must be connected. If the data is to be saved to a disk, use the save to a file option that is available when the printer screen appears.

b. Connect the PC to the DME. This may be done locally or remotely through telephone lines.
c. Log on.
d. Request control of the DME.
e. Select *Checks* and then "*Executive monitoring on antenna"* and "*Monitor self check"*.
f. Select *Abort* to freeze the data.
g. Print the displayed data or save to a file. Exit screen.
h. Select *Checks* and then *Routine check - Trx on Antenna*. Wait for the tests to complete (tests will take few minutes). When the “END ROUTINE CHECK” box appears, press RETURN or click on OK. Review and confirm all data is within tolerances.
i. Print the displayed data or save to a file. Exit screen.
j. Select *Checks* and then *Routine Check- On Monitor*. Wait for the tests to complete (tests will take several minutes). When the “END ROUTINE CHECK” box appears, press RETURN or click on OK. Review and confirm all data is within tolerances.
k. Print the displayed data or save to a file. Exit screen.

The following may be done to document the setup of the equipment.

a. Select *Settings* and then *Transponder Parameters*.
b. Print the displayed data or save to a file. Exit screen.
c. Select *Settings* and then *Operational Parameters*.
d. Print the displayed data or save to a file. Exit screen.
e. Select *Settings* and then *Monitor Thresholds*.
f. Print the displayed data or save to a file. Exit screen.
g. Select *Settings* and then *Restart delay*.
h. Print the displayed data or save to a file. Exit screen.
i. Log off.

5.2.3 Monitor Operation

This test verifies that the monitor will alarm and that a transfer (dual system) or shutdown (single system) will occur if a parameter is out of tolerance. This test will take the system off the air in automatic mode operation.

5.2.3.1 Single System Test

a. Remove the monitor one coax. cable at the top of the cabinet. This will cause the transmission rate and radiated power parameters to alarm.
b. Verify the system shuts down by looking at the front panel indications.
c. Verify there are no green LEDs illuminated on the transmitter assembly (TX). This confirms the transmitter is off.
d. Replace the monitor one cable.
e. Restore the system to normal operation using the front panel.

5.2.3.2 Dual System Test

a. Remove the monitor one coax. cable at the top of the cabinet. This will cause the transmission rate and radiated power parameters to alarm on monitor one.
b. Remove the monitor two coax. cable at the top of the cabinet.
c. Verify the system transfers to transponder 2 by looking at the front panel indications.
d. Verify there are no green LEDs illuminated on the transmitter one assembly (TX). This confirms the transmitter is off.
e. Verify transponder two shuts down by looking at the front panel indications.
f. Verify there are not green LEDs illuminated on the transmitter two assembly (TX). This confirms the transmitter is off.

g. Replace the monitor one and two cables.

h. Restore the system to normal operation using the front panel.

5.2.1.1 Standby Operation Test

These procedures provide for checking the station batteries (if is not used the sealed type) and correcting any deficiencies that may be found. These procedures should be performed to observing the periodic maintenance of the manufacturers recommendations.

WARNING

Batteries, generate an explosive gas under normal operating conditions if is not used the sealed type.
Special care should be taken to avoid creating sparks that could ignite this gas.
Ensure no tools or other metal objects can fall onto the batteries or otherwise contact the batteries and cause a short.
Batteries contain a very corrosive electrolyte that can cause serious injury to the skin and eyes.
Wear proper protective clothing and eye, hand, and face protection when working with the batteries.

a. Visually inspect each battery and verify it is free of any bulges, cracks, or other deformations. Replace any defective batteries.

b. Check all battery terminal connections and verify they are tight and free of corrosion.

c. Check that batteries are clean and free of corrosion. If necessary, remove dust or dirt by wiping with a water moistened cloth. If battery electrolyte is present on the outer surfaces of the batteries, neutralize it with a solution made up of 1/2-pound baking soda in 1 quart of water (0.22-kilograms soda/liter water). Initially, this solution will bubble. The electrolyte is neutralized when bubbling no longer occurs when fresh solution is applied. When electrolyte is neutralized, wipe battery clean with a water moistened cloth. Dry battery with a dry clean cloth.

d. Using a digital multimeter or equivalent, measure voltage across all batteries. This voltage should be approximately 54 volts DC. Record this voltage.

e. Divide the voltage recorded in step "d." by 4 and record this voltage.

f. Measure and record voltage across each battery. The voltage across each battery should be the voltage recorded in step "e" ± 0.2 volt DC.

g. Turn off the AC power and record the time.

h. Five minutes after performing step "g", measure and record voltage across battery supply.

i. Twenty minutes after performing step "g", measure and record voltage across battery supply. This voltage should be no less than 0.2 volt DC less than the voltage recorded in step "h". If battery supply fails this check, measure and record voltage across each battery. If voltage across one battery is 0.5 volt DC or more below voltage recorded in step "e", replace that battery. Charge the battery and repeat steps "d" through "i". If the voltage across two or more batteries is 0.5 volt DC or more below voltage recorded in step "e", charge battery supply and repeat steps "d" through "i".

j. Turn on the AC power.

5.2.4 General Ordinary maintenance

WARNING

To avoid an electrical shock hazard, verify that the equipment is powered down before attempting any general maintenance work.

5.2.4.1 Cleaning

Clean the outside and inside of shelter if necessary.

Clean the inside and outside of the equipment cabinet when become necessary.

Avoid transferring dirt on DME cabinet during the cleaning: use always a vacuum cleaner.

CAUTION

Cleaning aids, such as brushes and dusters, must be made of anti-static material. Use only a soft cloth; do not use corrosive and abrasive substances.

The local control and status unit (LCSU) front panel, may be damaged by some types of chemicals used for cleaning. To remove layers of dirt on the LCSU panel, use ethyl alcohol, glycol, or clean water. Moisten a cloth with one of the liquids mentioned above and remove dirt.

Dusting of the subassemblies should only take place in conjunction with removal of a subassembly when this becomes necessary. 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 for voltage-sensitive semiconductors.

5.2.4.2 Other checks

- Inspect all components to ensure that there is no damage, corrosion, or evidence of overheating.
- Verify that all components are securely mounted.
- Verify that all electrical connections are secure.

5.2.4.3 Antenna Installation inspection

Inspect complete antenna mast installation, coax and connectors of antenna cables, line and obstruction lights for any damage caused by corrosion, rodents, termites, or others. The periodicity of inspections depends of environmental conditions of the site.

Tight fitting of all RF cable connections (internal and external)

5.2.5 Maintenance operation procedures using external instruments

This paragraph gives a simple and concise description of the main procedure, which may be performed by operators and skilled technicians using the external additional measurement instrumentation on site.

These paragraphs describe procedures to externally verify some of the important measurements made using test equipment built in to the DME. These procedures are normally not required but can be used at the discretion of the maintenance technician.

NOTE: If during maintenance operations it is necessary to stop the irradiated signal, the responsible authorities (e.g. ATC/Controls) must be informed before commencing any maintenance work in accordance with national regulations.

5.2.5.1 Necessary tools and instruments

This is a list of test equipment required for site level maintenance on the DME. Equivalent test equipment may be used. Common tools such, as screwdrivers, pliers, and wrenches. A 5/16-inch, 5-inch-pound torque wrench is recommended for tightening the SMA cable connector nuts.

In addition to the material supplied with the beacon (tool kit and extender board), the following measuring instruments are required:

- Personal Computer, if missing at local site (Lap/palm top or STD PC), cables connection, startup disk, printer, adapter connectors
- Oscilloscope dual/four vertical channels ,100 MHz BW, type (Tek 2235A or PM3050)
- Multimeter (input 1 MΩ impedance)
- Peak Power METER (HP 8900) with probe 1 W f.s. and a series of precision attenuators (± 0,1 dB) 10 dB/5W, 20dB/1W, 30dB/1W (or directional coupler)
  or kit: BIRD wattmeter (digital RF mod 4391 with elements: 1000J,250J,100j,25J)
- Timer-Counter up to 2 GHz (Hp 5315A-H10-003, Tek CMC251)
- Spectrum Analyzer up to 2 GHz (if necessary: see note in para 5.2.5.5.)

5.2.5.2 Output Power measurement

The detailed procedure of alignment and checking of the TX100 and TKW modules RF output power are described to paragraph 5.3.4 with a specific "DME400 E^2prom TX/TKW" program

5.2.5.2.1 On Dummy-Load procedure

NOTE: This test will take the system no stop during the test

a) Perform the EXECUTIVE MONITORING or Routine Check at Peak Power Output measurement on TRX in Dummy Load (Maintenance Environment)

b) Verify and record the peak power value

c) Switch OFF the TRX on dummy load and take the place of the 50 Ω dummy load by the probe of the wattmeter, via 30dB precision attenuator (DME415) or 40dB precision attenuator (DME435).

CAUTION

Do not set the beacon to OPERATING when the antenna or dummy load is not connected.

d) Set the beacon to operating and read the value by the instrument

e) Verify that the value read is equal to the value recorded by internal monitor (s) (±10%)

f) At the end of the measurements, take note of the values concerning both transponders and restore the initial connections

5.2.5.2.2 On antenna procedure

NOTE: This test will take the system off the air during the connection of the instruments

a) Connect test equipment as shown in figure 5.1. a) for the type of power meter that will be used, for the Bird-type peak power meter set up and figure 5.1. b) for the HP-type peak power meter set up.

b) Perform the EXECUTIVE MONITORING or Routine Check at Peak Power Output measurement on TRX (Maintenance Environment)

c) Verify and record the peak power value

d) Switch OFF the beacon.

CAUTION

Do not set the beacon to OPERATING when the antenna or dummy load is not connected.

e) Set the transponder to be measured to operating and read the value by the instrument

f) Verify that the value read is equal to the value recorded by internal monitor (s) (±20%)

g) At the end of the measurements, take note of the values concerning both transponders and restore the initial connections.

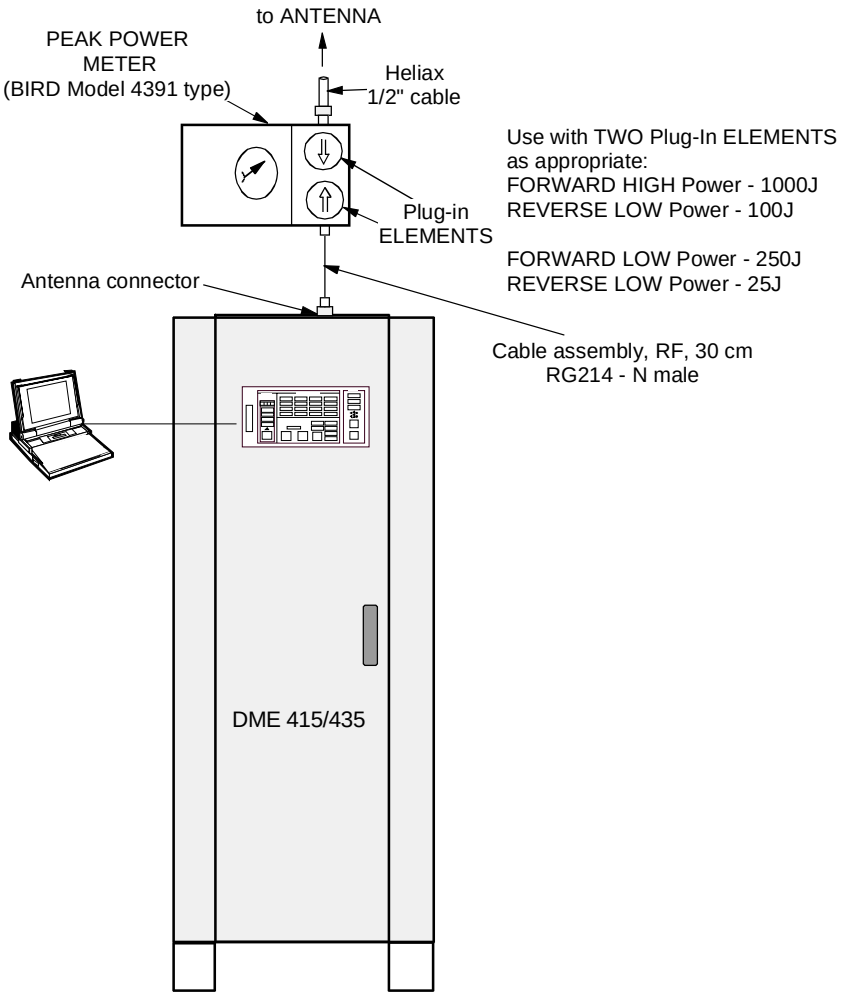


Figure 5.1. a) Output Power test on antenna procedures - Test set-up (BIRD 4391)

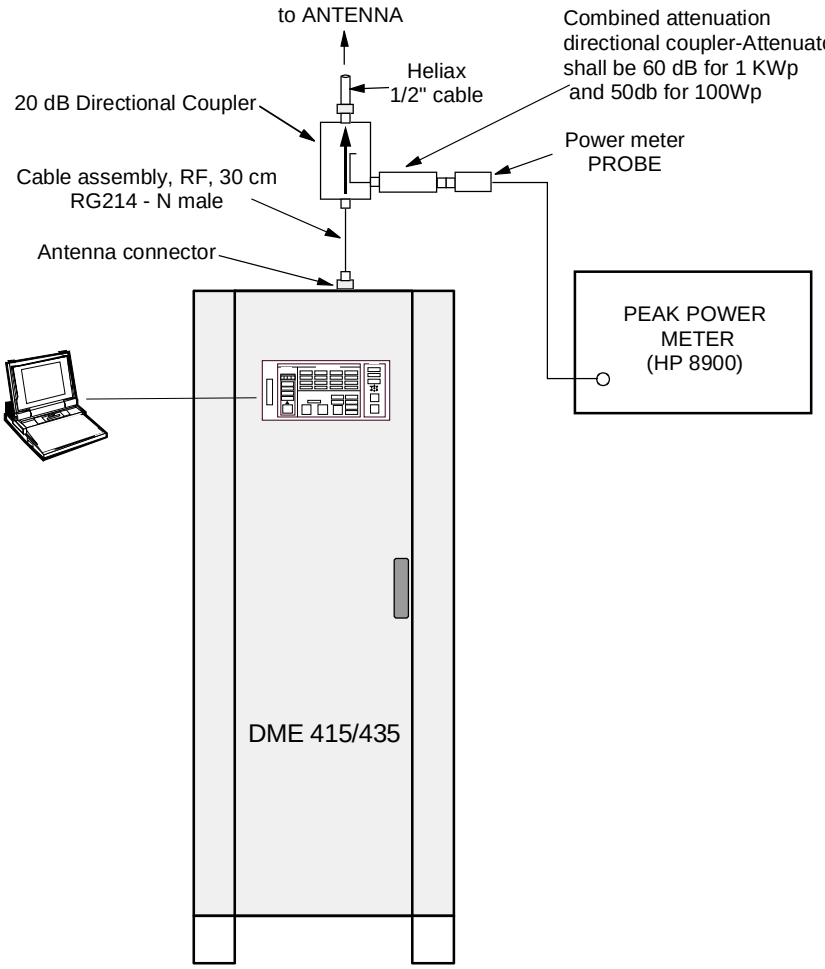


Figure 5.1. b) Output Power test on antenna procedures - Test set-up (HP8900)

5.2.5.3 Pulse shape, pulse spacing and Reply Delay

This procedure allows the operator to measure the pulse shape and pulse spacing of the transmitter output. The operator can also measure the system reply delay. The procedure uses a dual channel oscilloscope. This method is not as accurate as the technique used in the monitor. The results obtained using the scope will typically be with ±5 percent of the readings displayed by the monitor.

Oscilloscope connections:

- Channel one is connected to monitor test point AN34. See figure 5.23
- Channel two is connected to transmitter test point AN7 (TX100-DME 415) or "AN 7 RF detected" (TKW - DME 435). See figure: 5.30 (DME 415), 5.33 (DME 435)
- The external trigger input of the oscilloscope is connected to monitor test point AN2 (or AN72). See figure 5.16.
- Adjust the time base and trigger to allow the interrogations on channel one and the replies on channel two to be displayed on the screen.

a. **Rise Time**. Examine the pulses on channel two of the oscilloscope. Set the oscilloscope time base to 1 or 2 μs. To measure the rise time, measure the time for the leading edge of the pulse to transition from 10 percent of its peak value to 90 percent of its peak value. Record this time.

b. **Duration**. Examine the pulses on channel two of the oscilloscope. Set the oscilloscope time base to 1 or 2 μs. To measure the duration, measure the time between the 50 percent point of a pulse rise time and the 50 percent point of the pulse fall time. Record this time.

c. **Decay Time**. Examine the pulses on channel two of the oscilloscope. Set the oscilloscope time base to 1 or 2 μs. To measure the fall time, measure the time for the trailing edge of the pulse to transition from 90 percent of its peak value to 10 percent of its peak value. Record this time.

d. **Pulse Spacing**. Examine a pulse pair on channel two of the oscilloscope. To measure accurately the pulse spacing, measure the time between the 50 percent point of the pulse rise time of the first pulse and the 50 percent point of the pulse rise time of the second pulse. Record this time.

e. Verify that the values read on the scope are equal (± 2 percent) to the values measured by monitors (on test of executive monitoring or routine check).

f. **Reply Delay**. Channel one shows the interrogation pulses. Channel 2 shows the transmitter pulses. Set the oscilloscope time base to 10 μs. Measure, accurately, the time from the 50 percent point of the leading edge of the first constituent pulse of the first pulse pair on channel one, to the 50 percent point of the leading edge of the first constituent pulse of the first pulse pair on channel two.

   Other method of measure, of the replay delay, is that shown in figure 5.19.

g. Verify that the values read on scope are equal (± 1 percent) to the values measured by monitors (on test of executive monitoring or routine check).

5.2.5.4 Transponder Frequency Measurement

This procedure measures the DME transponder frequency. The frequency source used by the transmitter and receiver is located in the receiver module.

a. Connect PC to DME front panel RS-232 connector.
b. Log on. Use *Commands* to turn beacon one off.
c. Remove the low-power transmitter module (TX). The module may be removed with power on.
d. Connect frequency counter to the upper RF connector that interfaces with the removed transmitter assembly. Use the BNC female to backplane female adapter to convert the top connector to a BNC female connector. This will allow a cable with BNC male connectors on both ends to be used with the frequency counter.
e. Frequency counter should indicate station assigned carrier frequency ±0.001 percent.
f. Disconnect adapter, cable, and frequency counter.
g. Replace transmitter.
h. For a dual system, use *Commands* to turn beacon two off. Repeat steps c through g with the second transmitter.
i. Replace the transmitter(s). Restore the system to normal operation.
j. Log off.

5.2.5.5 Pulse Spectrum

NOTE

This procedure is significant for sites where beacons or other radio equipment are installed within a radius of 5 NM (Nautical Miles) and have adjacent channel frequencies. Therefore, it is not necessary if these conditions are not present.

Procedure:

a. Using a 40 dB attenuator for DME 435 and 30 dB for DME 415, connect the spectrum analyzer to the coaxial cable, coming from one of the two antenna probes. First, disconnect the cable from its connector on top of the equipment cabinet.

b. Use a 30 to 100 kHz/div band width and select the beacon frequency for the spectrum analyzer. Position the spectrum lines on the raster center of the instrument display and adjust the signal peak level so that it touches the first top line of the raster.

c. Verify that with FREQUENCY SPAN equal to 0.5 MHz/div, all the spectrum lines at a frequency greater than the beacon frequency ±2 MHz are attenuated of at least 65 dB for DME 435 and 58 dB for DME 415 with respect to the beacon frequency peak level, at raster center.

d. Verify that with FREQUENCY SPAN equal to 0.2 MHz/div, all the spectrum lines at a frequency greater than the beacon frequency ±0.8 MHz are attenuated of at least 47 dB for DME 435 and 40 dB for DME 415 with respect to the beacon frequency peak level, at raster center.

e. At the end of the measurements, take note of the values concerning both transponders and restore the initial connections.

5.2.5.6 Transmission rate

a) Perform the executive monitoring cycle and/or the Routine Check and/or TRANSMISSION RATE manual test.

b) Verify that the obtained value comes within the limits indicated.

c) Connect the frequency counter to AN7 test points of transmitter TX module. See figure 5.30.

d) Set the counter to read the frequency values in the low frequency range (<100 kHz and high input impedance) and to count the pulses. Because of the random nature of DME output pulses, the frequency counter will not display a constant value. The reading will be affected by aircraft interrogations. Do not use a value measured during a DME identification period. The counter reading will increase during the DME identification period. Divide the frequency counter reading by two to obtain the frequency of pulse pairs (as read by the monitor).

e) Read the value given by the instrument and verify the reading (divided by two) is within the indicated tolerance limits.

NOTE

The actual ppps number depends on the transmission rate selected and on the number of interrogating aircraft at the instant the measurement is made.

5.2.5.7 Monitor Interrogation - Pulse shape, pulse spacing and peak pulse level

The external trigger input of the oscilloscope is connected to monitor test point AN2. See figure 5.16

Connect the probes of oscilloscope on test point AN34 "Out MUX" of the MON module and record:

- Rise time
- Duration
- Decay time
- Pulse spacing
- Peak pulse level

Verify that the values read on scope are equal (± 2%) to the values measured by monitors (on test of executive monitoring or routine check)

5.2.5.8 Power Supply Measurements

This test measures the key power supply voltages in the 415 DME.

a. Measure the +5 volt (nominal value: 5,1V), +15 volt, and –15 volt levels using the test points on the PWS module. See figure 5.17 for the test points location. See table 5-1 for tolerances. For a dual system, perform measurement on both PWS modules.

b. Measure the AC input voltage. The voltage should be measured at the terminal where AC power comes into the cabinet.

WARNING

Dangerous voltage (240 V AC) exists within the DME system (only on subrack BCPS unit). Contact with this voltage can cause personnel injury or death.

c. Measure the DC bus voltage. This can be done at the top, left (front) corner of each transponder card cage backplane. This point is labeled +48. The point to be measured has a red wire. Chassis ground can be used as a reference.

   The DC bus voltage can also be measured using the + and – test points on the AC/DC module. See figure 5.35.

d. Measure the output of the DC/DC converter on the low-power transmitter module (TX). See figure 5.30 (AN 17) for the test point location. See table 5-1 for tolerances. For a dual system, perform measurement on both TX modules.

e. Measure the output of the DC/DC converter on the 1000 watt transmitter module (TKW). See figure 5.33 (AN 1 DC/DC Out) for the test point location. See table 5-1 for tolerances. For a dual system, perform measurement on both TKW modules.

5.2.5.9 Verification with Diagnostic Function

The Diagnostic is the last operation to be performed and is used to check both transponders.

If this verification and previous inspections and controls confirm the good beacon operating conditions, all beacon mechanical and electrical components as well as its software can operate correctly. With regard to the software, it should be noticed that most of its functions have been enabled during the measurements.

To run the Diagnostic software, place the DME in maintenance. Select the Diagnostic test from the *Checks* menu. See Annex D for more information.

5.3 TROUBLESHOOTING

This paragraph contains only the information necessary to detect and replace faulty modules, which should then be repaired at an authorized repair facility.

Troubleshooting is made easier thanks to the built-in testing available in the 415/435 DME.

By looking at the failure messages displayed on the PC video, the operator may easily detect any beacon malfunction; these messages make it possible to detect the malfunctioning module, if any, and to take the necessary organization and urgency measures (primary or secondary alarm) so as to repair the module at the local site. Considering the functional services offered by the beacon, when both transponders are shut down, it is advisable to first restore one of the two transponders using the redundant and operating modules of the other one.

The technicians involved in troubleshooting should have a good knowledge of 415/435 theory of operation. The technician must be familiar with safety measures required to prevent injury to maintenance personnel and damage to the beacon.

Replace the modules in the sequence indicated by the diagnostics; before every replacement, display all possible stored alarms or warnings occurred from the last maintenance intervention.

According to the color, the warning lights on the different modules will have the following meanings:

- Green light: normally on, it indicates that the module or circuit being controlled is operating.
- Red light: normally off, it comes on in case of failure of the module.
- Yellow light: normally on, it provides further indications (secondary or partial) about beacon operation.

The same color method is used for the messages displayed on the video: these messages may be seen only if a color video is used. The WARNINGS, ALARM, SHUT-DOWN and HARD (primary alarm presence indication) messages are red and flashing so as to be easily seen even on a monochromatic video.

When the beacon is in good operating conditions, no red LED should be on and no red message should appear on the PC video.

Before replacing a module with a red LED on, it is advisable to reset the module or the beacon since a transient malfunction might have caused a protection to be activated and therefore the LED to be lit. The reset pushbutton on the DMD or MON modules can not be used if an initialization is being performed.

Connections made with flat and coaxial cables and to passive, non-plug-in components offer a high reliability level; they, however, should not be overlooked, but may be checked in conclusion.

WARNING

Proceed with great care when it is necessary to work on BCPS unit rear part since a 220 Vac dangerous voltage is present.

Radio frequency voltage on RF power amplifier modules output represent a personnel hazard.

Inside AC/DC modules there are the 220 Vac mains voltage and the corresponding 300 Vdc rectified voltage whose capacitors may remain loaded for several seconds after the modules are disconnected. After removing the modules wait for a few minutes before touching the internal circuits.

CAUTION

RF loads (antenna cable, 50 Ω loads) should always be connected when the transponder is set to OPERATING to prevent the RF components from being damaged.

5.3.1 Useful Information for Troubleshooting

The procedures for the remote site are true for the local site as well, but not vice versa. The remote site is a center or a control site situated far away from the place where the beacon is installed. The local site is the place, near the antenna, where the beacon is installed. The two sites may be a few meters or many kilometers apart.

Remember that the modules should be replaced when the beacon is off/stby condition.

For repairing operations at local site, the following items are required:

- tool kit and spare fuses, supplied with the beacon;

- digital voltmeter;
- spare modules, especially those which are not redundant on the beacon such as LCSU, AFI ;
- IBM compatible Personal Computer (Lap/Palm top) provided with video, keyboard, 3.5" and CDROM disk drive, cable for connection to the beacon, printer and startup programs disk.

5.3.1.1 Protection Devices

Fuses are employed to protect the BCPS unit and the PWS, TX and TKW (DME435 only) modules; their features are listed in table 5-2.

Table 5-2. List of fuses

Module	TYPE OF FUSE	Q.TY	NOTE
BCPS/pcs	10 A type T (6.3 x 32) 2 A type T (6,3 x 32)	2 1	Placed on terminal boards of the transponders 48 Vdc power supply line. They are located on the terminal board
BCPS/Frako	10A type T (6.3 x 32) 2 A type T (6,3 x 32)	2 2	Inline Fuse-holders
PWS	6 A type T (5 x 20)	1	48 Vdc line - Placed on PBA of PWS module
TX	3A solder type	1	48 Vdc line - Placed on PBA of TX module
TKW	6A solder type	1	48 Vdc line - Placed on PBA of TKW module

5.3.2 Troubleshooting Procedures

5.3.2.1 Diagnostics

The diagnostics can be run, upon command from the operator (remote or local site), either in automatic mode or in manual mode to check the efficiency of the transponder connected to the dummy load by carrying out a sequence of tests. Since both monitors are used for the tests, these monitors and the power supply modules are checked before all the other modules. Any possible faults are indicated with appropriate error messages displayed on the video of the PC from which the diagnostics has been activated.

5.3.2.1.1 Primary Voltages

The local or remote operator may obtain only the information relating to the site, where the equipment is standing. Remember what follows:

The type of power provided to the beacon is clearly indicated on the PC video (POWER:MAINS and POWER:BATT. messages).

If the mains power fails the beacon will be switched to battery power supply and its operation will not be interrupted: the POWER:BATT. message will appear on the video.

A protracted mains failure may lead to battery depletion and to a resulting interruption of beacon operation. 50 A/h batteries standard autonomy is approx. 8 hours; it is therefore advisable to check the external electrical panel breaker should the mains failure protracts for more than 4 hours.

If both mains and battery power supplies fail, the PC video will be in initialization request message by the equipment displayed on the PC video.

5.3.2.1.2 Stabilized Power Supplies

The operator may obtain only the information relating to the site, local or remote, where he is standing.

Remote Site

A faulty AC/DC module in the BCPS unit is indicated by the relevant warning message AC/DC FAULTY, on PC monitor .The POWER:BATT. message may be visualized if there is no power from the mains, or also if both AC/DC modules are faulty.

WARNING

Before removing the housing of AC/DC module waiting for about 1 minute after shoot-down the supply and removing the line connections

Failure of the PWS, TX, TKW modules is indicated by message of warning and may be visualized the value of regulate voltages.

Local Site

A faulty AC/DC module in the BCPS unit may be detected through the green LED on the front of the module.

The faulty PWS module may be detected by the corresponding green LED off. In this case, proceed as follows: reset the module by pushing the appropriate pushbutton, check and if necessary replace the module fuse and, if the malfunction can not be eliminated, replace the module.

The correct operation of the TX and TKW (DME435 only) module DC/DC converters is indicated by the corresponding green LEDs, which should be on if the corresponding transponder, is set to OPERATING.

5.3.2.2 I/O System

The parts of the I/O system that could result faulty are listed below, starting with the most probable:

- CSB module in the LCSU unit;
- INC module in the LCSU unit;
- I/O panel (connectors on top of the cabinet);
- interconnecting cables and connectors.

Diagnostics is essentially based on checking the indications provided by the front panel of INC module. Some of the more common cases are described below.

a. No indication or command possible
Probably a power failure: check the voltage (+5V) of CSB module. If the measured value is +5V ± 5%, the fault is probably on the CSB or INC board, or the connection cable.

b. Green OPERATION indicator in LCSU section switches off.
Probable hardware or software fault on CSB board; this condition is also caused by <4.7 V power supplies.

c. Yellow WARNING indicator switches on in LCSU section.
A hardware fault in RTC (Real Time Clock) circuit on CSB board.

d. Red DATA COM indicator switches on in MAIN STATUS section.
Indicates no communication between LCSU unit and the equipment modules. This condition may be caused by faults in the serial port circuit on CSB board, or the interconnecting cables and connectors.

Before replacing the CSB board, make these two tests:

a. Press the LAMP TEST pushbutton located in the LCSU section and verify the indicators are working properly.

b. Shut down all the equipment from the control panel then switches on again after a few seconds.

If the fault persists, replace the CSB board since the failure is not caused by a transient fault condition.

The INC board can be indirectly tested through the LAMP TEST. By verifying that the individual indicators and buzzers are operating and using the control push-buttons, check they are working efficiently.

If the indications and commands are correct on the PC and the corresponding indications are different on the INC module, there may be an INC board fault or the configuration made is not correct.

The serial and parallel ports I/O can be checked by verifying the ON/OFF levels using the Hardware Test described in section 3 in this volume; item [3] of the main menu displays the HARDWARE TEST command that can be used to test all the parallel line inputs and outputs and all the serial channels either separately or in groups.

Cable or connector faults are unlikely to occur. When they are present, a visual inspection will often indicate where a cable has been damaged.

5.3.3 Modules Replacement Procedures

a) All the modules may be removed and installed without removing power. The special design of the connector that supplies power to each module prevents damage to the electronics from occurring.

b) Modules replacement is made easier thanks to the plug-in technique and to the upper and lower extractors every module. To extract these modules, lift the extractors (push them towards the inside of the beacon) and pull the module out of its guides. To reconnect the module, reinsert it back in its guides, push it in and lower the extractors.

c) Several of the modules have jumper switches on their printed circuit boards. It is essential to check that the switches or jumpers on the new PBA are set to the same positions as on the old module. Section 2 "INSTALLATION" contains the list of the jumpers.

d) Modules with extractors do not require any special operations for their replacement, except for the DPX and TKW modules, which requires unscrewing the proper front screws and coax. cables disconnection.

e) Outline drawing are shown in this section

f) For other modules, not proved with extractors and requiring particular procedures, proceed as described below.

g) The specific RF connectors plug-in, situate at the back panel and associated to semi-rigid coax cables, must be fixed in sure way from the proper nut, by using the spanner of 16 mm. They must have little end clearance to help the insertion system. On each removed module, to check and regulate manually that each RF connector on the back panel are under the previously mentioned conditions. The modules interested at these notes are RX, MON, DPX, TX100 and TKW.

Connectors SMA must be fixed with the torque wrench (1Nm/8.9in-lbs) code 870952302X. You have this spanner in the tool bag of the equipment.

Connectors "N" of coax cables, must be screwed and blocked in sure way.

NOTES: 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

On some modules are scheduled opportune trimmers that are factory adjusted: they must not be tampered with, if the maximum precision of system wants to be obtained.

After having replaced the TX100 or/and TKW module it is essential to follow the described procedures to paragraphs 5.3.5 and 5.3.4 for the respective channel of operation

The following table shows the procedures for to obtain the better performance during the modules replacement

Table 5-3. Procedures check during the modules replacement

Module	LED and TP	Trimmer	Procedures check
MON	Fig. 5.18 Tab. 5-6	P6	To adjust trimmer P6 as para 2.6.4.2.2 "Measurement calibration of the TRANSMITTED POWER (radiated)" of the section 2 - Installation On PC to verifier, the parameters from menu CHECK: "Routine check - on monitors" and "monitor self check". Parameters measures must not exceed given limits.
PWS	Fig. 5.17 Tab. 5-5	-	Repeat the check as to para. 5.2.5.8
RX	Fig. 5.23 Tab. 5-5	-	On PC, to verifier the parameters from menu CHECKS: "Executive Monitoring" e/o "Routine check" - TRX on Antenna. Especially verify the following parameters: Transmission frequency, Adjacent channel rejection, Echo suppression, Reply efficiency, Reply delay, sensitivity, dead time, Identity Code. Parameters measures must not exceed given limits.
TX	Fig. 5.23 Tab. 5-7	P3	Fine adjust RF power level for calibration of RF Power out (factory adjusted) Repeat the check as to para. 5.2.5.8 for the power supply regulated voltages On PC, to verifier the parameters from menu CHECKS: "Executive Monitoring" e/o "Routine check" - TRX on Antenna. Especially verify the following parameters: Peak power Out, Pulse shape, Pulse spacing, Transmitter frequency, Transmitter power, Transmission rate, Reply delay, Identity code. Parameters measures must not exceed given limits.
TKW	Fig. 5.33 Tab. 5-11		Repeat the check as to para. 5.2.5.8 for the power supply regulated voltages On PC, to verifier the parameters from menu CHECKS: "Executive Monitoring" e/o "Routine check" - TRX on Antenna. Especially verify the following parameters: Peak power Out, Pulse shape, Pulse spacing, Transmitter frequency, Transmitter power, Transmission rate, Reply delay, Identity code. Parameters measures must not exceed given limits.
DPX	-		On PC, to verifier the parameters from menu CHECKS: "Executive Monitoring" e/o "Routine check" - TRX on Antenna. Parameters measures must not exceed given limits.
DPR	Fig. 5.25 Tab. 5-8		On PC, to verifier the parameters from menu CHECKS: "Executive Monitoring" e/o "Routine check" - TRX on Antenna Parameters measures must not exceed given limits.
DMD	Fig. 5.28 Tab. 5-9		On PC, to verifier the parameters from menu CHECKS: "Executive Monitoring" e/o "Routine check" - TRX on Antenna Parameters measures must not exceed given limits.
AC/DC	Fig. 5.35 Tab. 5-13		Repeat the check as to para. 5.2.5.8 for the 54V power supply

To replace, proceed as follows:

5.3.3.1 TX Module

NOTE: *After having replaced the TX 100 or/and TKW module it is essential to follow the described procedures to paragraphs 5.3.4 and 5.3.5 for the respective channel of operation*

Extract or insert it when the transponder is not set to OPERATING.

Note: During the correct insertion of the modules, to follow the paragraph 5.3.3 g) explanation

5.3.3.2 TKW Module (DME435 only)

NOTE: *After having replaced the TX100 or/and TKW module it is essential to follow the described procedures to paragraphs 5.3.5 and 5.3.4 for the respective channel of operation*

Make sure the transponder to which the module is associated is off/stby, then proceed as follows:

a) disconnect the coax cables of the two RF OUT of TKW module and RF IN of DPX module connectors;
b) loosen the four screws (two on each up and lower side);
c) remove the module by means of two handles knobs.

Note: During the correct insertion of the modules, to follow the paragraph 5.3.3 g) explanation

5.3.3.3 DPX Module

a) disconnect the coax cables of the two RF OUT and RF IN connectors
b) loosen the four screws (two on each up and lower side);
c) remove the module

Note: During the correct insertion of the modules, to follow the paragraph 5.3.3 g) explanation

5.3.3.4 MON and RX modules

Note: During the correct insertion of the modules, to follow the paragraph 5.3.3 g) explanation

5.3.3.5 Local Control status Unit - LCSU

The modules are fastened with screws and screw-threaded supports. The INC board, fastened on the front metallic plate, supports the CSB board (figure 5.2)

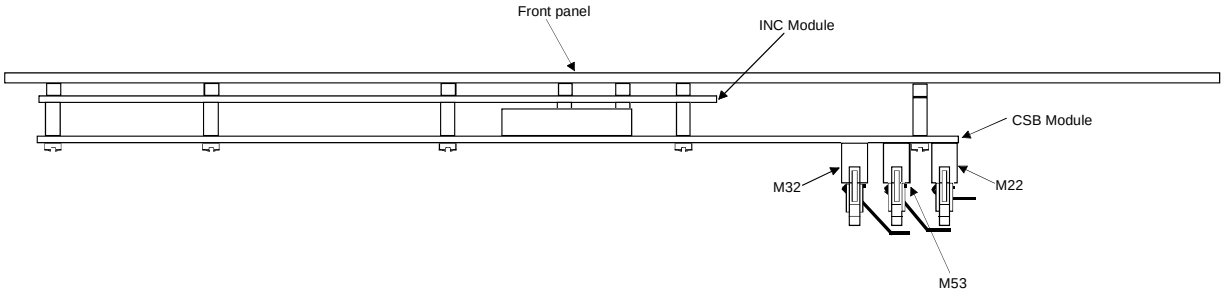


Figure 5.2. LCSU - Lateral Side View of PBA's

5.3.3.5.1 CSB Module

From the back of the beacon front door, remove the cable connectors relating to CSB board

NOTE

The M18 power supply connector must always be removed first and inserted last.

The modules must be extracted or inserted keeping them parallel to the front panel (to avoid connector pins warping)

After replacement of the CSB board, the I/O system has to be reconfigured.

Loosen the ten printed circuit screws; remember that M21/M17 plug-in connector from CSB module is used for the signal and power supply connections between the CSB and INC modules.

5.3.3.5.1.1 Battery replacement

To back up data in the non-volatile random-access memory (RAM) in case of a voltage drop, the subassemblies LCSU/CSB contain NI_CD batteries. The battery voltage is checked by the BITE of the system. The individual batteries are soldered to the PCB. The battery back up function is enabled via jumpers (M1 of Figure 2.19 section 2)set during first setup or before replacing the respective PCB. Contents of the RAM will be lost when the jumper is opened which enables battery voltage to the RAM device. Always observe the label on the battery. The battery has to be replaced by the same battery type.

The presence of dirt or moisture on the board can increase the battery current consumption and decrease the battery life. It's also necessary to check that the solder side of the board does not contact the conductive plane, in order to avoid short-circuits or excessive current consumption.

If replacement of the battery is necessary, attention must be paid to the correct polarity as well as the electrical characteristics of the new battery (see CSB board layout - component ref.: BAT1).

Replace the battery when the voltage is < 3Vdc, reading on proper terminals without the 5V power supply on the card.

A soldering iron with a grounded soldering tip should be used.

Remove M1 jumper during the battery replacement

Re-tin the soldering tags of the new battery in order to ensure a good soldered connection

WARNING

Do not recharge, disassemble, heat above 100°C, burn the cell. Do not short-circuit or solder directly on the cell. Violation of the rules regarding the use of rechargeable batteries may cause risk of fire, explosion, toxic liquid and gas to leak out. These batteries must be eliminated with proper precautions.

5.3.3.5.2 INC Module

To remove the board, loosen the two screws and six columns on the CSB board.

5.3.3.6 COAX Relay assembly

Make sure the transponder is off/stby

Loosen the ten screws located on top of cabinet

Disconnect the coax cables connectors as follows:

1. "N" connector on DPX's modules
2. "N" connector on Dummy Load
3. Connector 26 pin on board of driver MCKX

5.3.3.7 I/O Panel

Loosen the ten screws located on top of cabinet

On rear of panel, it is possible to replace the connector or the flat cable damaged

5.3.3.8 AC/DC Module

- loosen the four front screws;
- remove the module.

5.3.4 Peak power output Calibration Procedure

NOTE *This procedure must be carried out during the installation, in the event of substitution of module TX100 or/and TKW and also in case the channel change*.

The alignment is possible only on site (not by Remote Control)

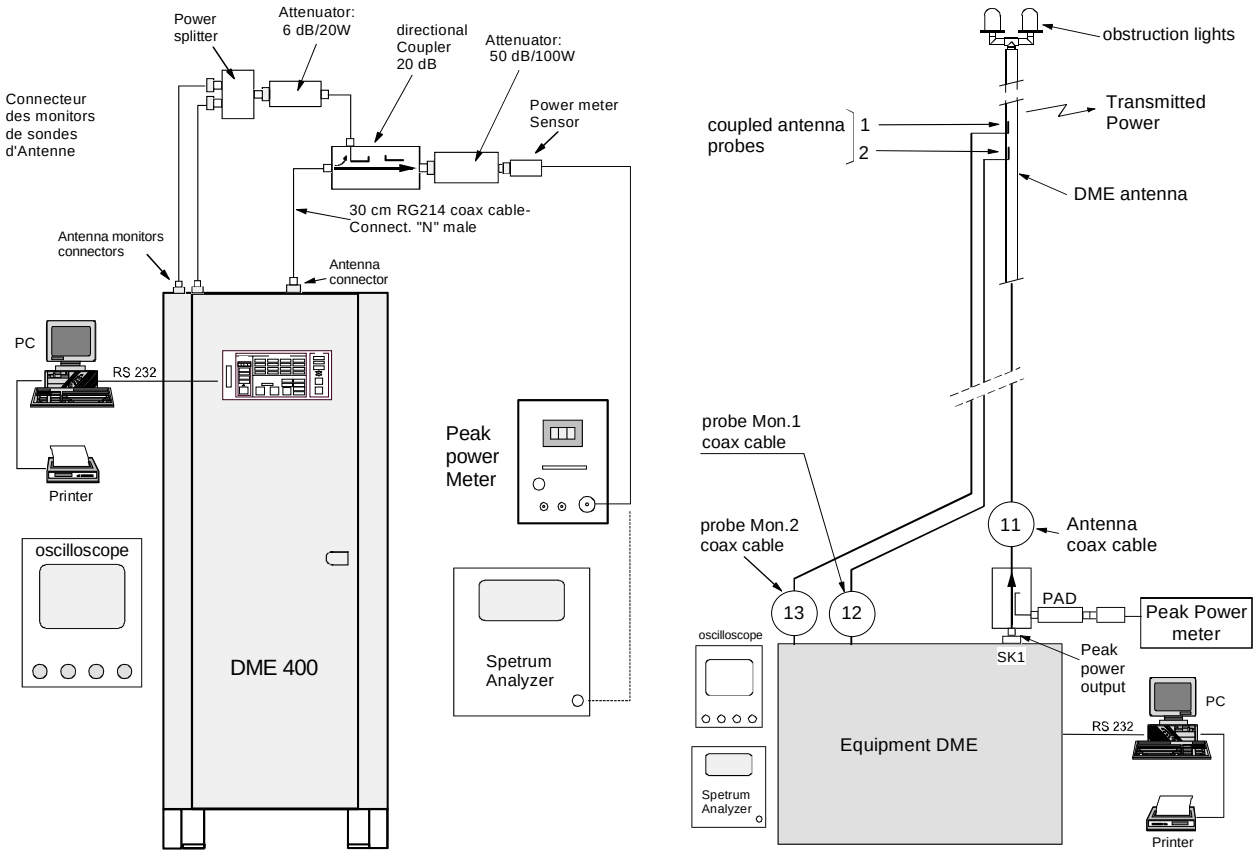
For calibration in the presence of antenna RF cables see section 2 - Installation and for measurements of Power Reading by the monitors, see procedures described in paragraphs 5.3.7.

TX and TKW modules are equipped with EEPROM serial memory in which are memorized the data used by the software of automatic modulation. This software controls the leveling of the output power, specific channel and mode operating, and the optimization of the pulse shape. A special software package (EEPROM TX /TKW) is made for EEPROM reading and writing. This software is included in the "*equipment manager*" program (see section ANNEX D in this volume).

The software (EEPROM TX /TKW) is allowed on following conditions:

1) MAINTENANCE mode (see the section ANNEX D "WINDME400 equipment manager" in this volume)
2) The two transponders should be in stand by status
3) Instruments necessary for calibration:
   oscilloscope, peak power wattmeter, attenuators, spectrum analyzer

   The instrumentation of test set-up for measurements is shown in figure 5.3.



a) Lab. Test set-up **b)** Set-up with antenna cables, installed

Figure 5.3. Test set-up

5.3.4.1 DME 415 Program ACTIVATION

From "DME400 equipment manager" program in "Maintenance mode" and transponders in stand-by, activate the software "*E²prom TX/TKW*", pressing, at the same time, the combination keys "**CTRL+F10**" on the keyboard of the PC. The initial mask of references of figure 5.4 is shown for TRX 1 (or TRX 2 according to the selection).

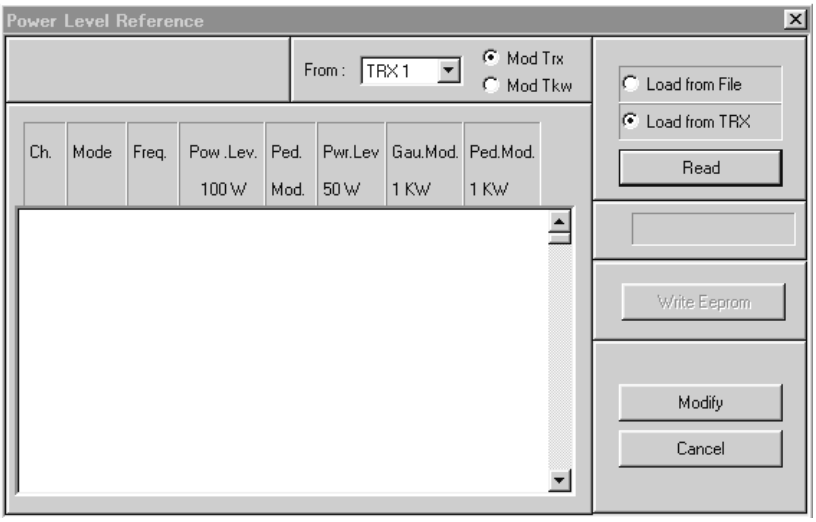


Figure 5.4. References initial mask for alignment of 100W peak power output

5.3.4.2 TX100 Modulation - adjust peak power output for DME 415

Starting from the mask of figure 5.4, to select the following options:

From: *TRX 1* or *TRX 2* and **Mod Trx** (100Wp transmitter)

"**Load from File**" for the parameters' reading when one chooses of to examine the existing default values or memorized in a file of the directory **c:\>winsv\site**. Click on the key "**Read**" of figure 5.4 to carry out the action.

"**Load from TRX**" when it is necessary to visualize the parameters values written in the E²prom of TX100 module. Click on the key of figure 5.4 " **Read** " to carry out the action (after approximately 10 seconds the data values are displayed as in example of figure 5.5).

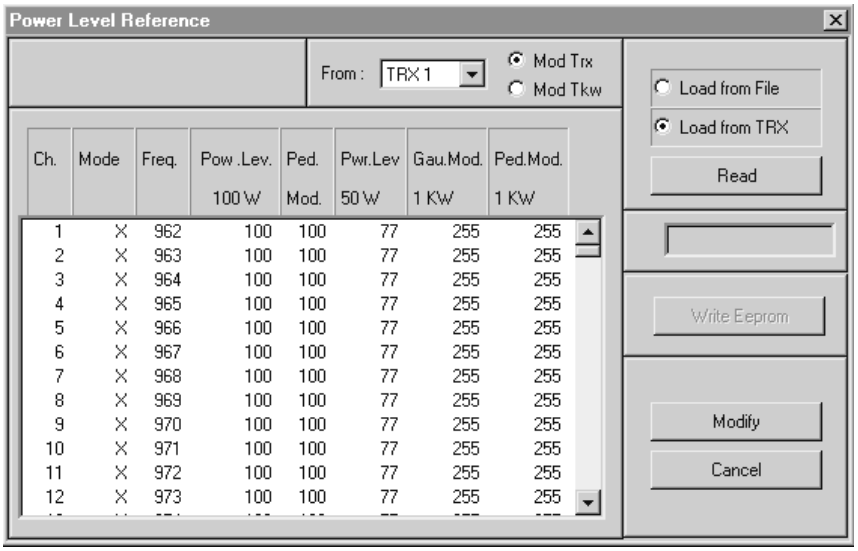


Figure 5.5. References Mask with values for Mod Trx (example)

5.3.4.2.1 Meaning of the labels and data displayed (TX100)

Meaning of the labels and data displayed on figure 5.5:

NOTE: the values of the parameters reference of the fourth to eighth columns are expressed in counts, that software of the DMD translated into voltage levels.

- The data of the first three columns (not modifiable) individualize the beacon parameter:

  Ch - beacon channel

  Mode of the beacon

  Freq. operating transmitter frequency: the lines of the table of figure 5.5 are 252 and they result ordinates for increasing frequencies. Through the slide cursor, the channel of interest is reached.

- The fourth column (**Pow. Lev. 100W**) is the level reference for 100W peak output power (DME415). Value = 100 counts of default and values limits to be used: from 80 to 130 counts.
- The fifth column (**Ped. Mod** - Pedestal Modulation Duration) is the modulation duration of pedestal referred to the 10% of the maximum peak detected pulse. Note that this parameter affects the spectrum considerably. Value = 100 counts of default and values limits to be used: from 90 to 110 counts. The change of this parameter asks the check of the spectrum signals with spectrum analyzer.
- The sixth column (**Pwr. Lev. 50W**) is the level reference of power for 50W (DME415); refers to the adjustment for the 3dB power reduction (see para. 5.3.6 Setting, "Transponder parameter"). Value = 70 counts of default and values limits to be used: from 50 to 90 counts.
- The seventh column (**Gau. Mod. 1KW -** Gaussian Modulation 1KW limit - not used for DME415) is the limit of level of the Gaussian modulation for 1KW and is employed by the DME 435 to limit the maximum variation of the AMC (Automatic Modulation Control). Value = 180/255 counts of default and values limits to be used: from 32 on 255 counts. (see change values in para 5.3.4.2.2 also)
- The eighth column (**Ped. Mod. 1KW** - not used for DME415) Used for the voltage level calibration of the pedestal. Is also the limit of maximum variation level of the pedestal modulation for DME435 1KW. Value = 220/255 counts of default and values limits to be used: from 0 on 255 counts. (see change values in para 5.3.4.2.2 also)

5.3.4.2.2 Modification of reference parameters values

Modify these parameters to select, with the pointer, the interested line of service channel and click on same line. Therefore, click on the key of figure 5.5 "**Modify**". The mask "**Modify References Maintenance"** of figure 5.6 will be displayed in which acting on the editable fields will be possible to perform the desired reference changes.

Meaning of parameters displayed on figure 5.6:

- **Power Level 100W:** Reference in counts for the calibration of the 100W peak power
- **Ped. Mod. Dur.** duration time for modulation of the pedestal
- **Power Level 50W:** Reference in counts for the calibration to -3dB reduction peak power
- **Gaussian Modulation 1KW**: Not used - *To always insert the value 255 counts when is used for DME 435*
- **Pedestal Modulation 1KW:** Pedestal level. *To always insert the value 255 counts when is used for DME 435*
- **OK**: press key to confirm the changes of the reference counts
- **Cancel :** press key turn back to the condition without modification

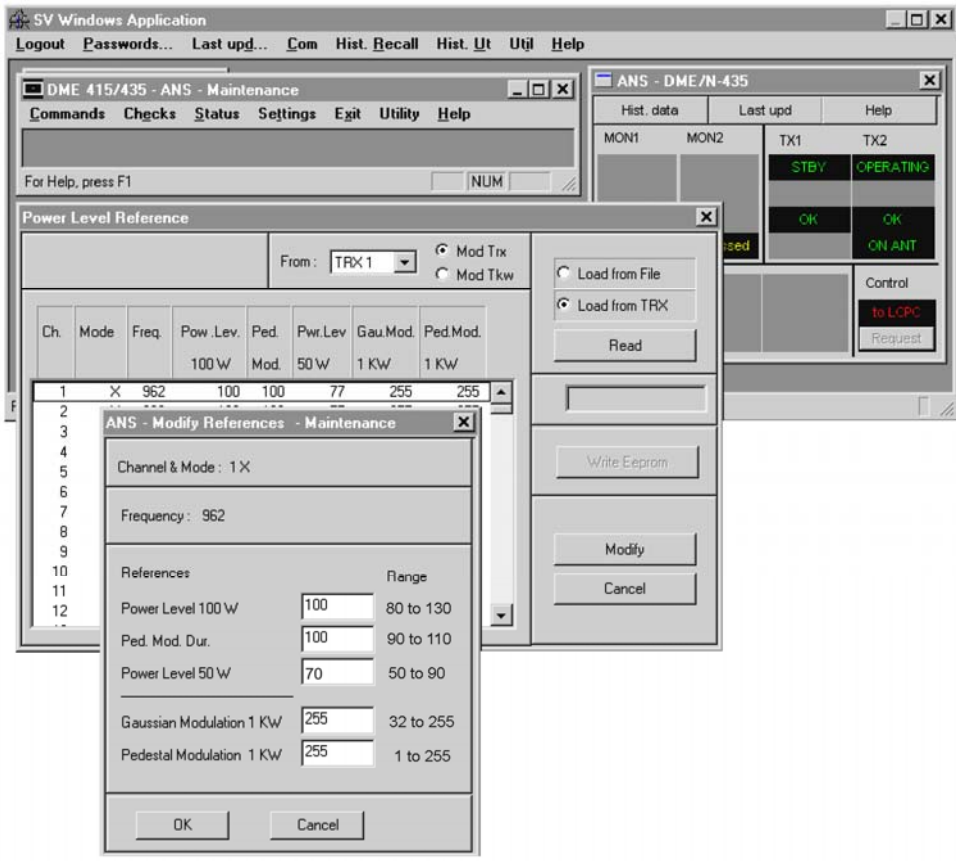


Figure 5.6. Modify references values for Mod Trx (example)

Procedures for data change:

1) Modify the parameters (**Power Level 100W**), (**Ped. Mod. Dur.**) and (**Power Level 50W**):
   Set in operate status the transponder TRX1 in antenna and to note the power result reading on the "**Peak Power Meter** " of figure 5.3
2) Modify the values to obtain the reading of power 100Wp on **Peak Power Meter**. Click on button **OK** after the modifications to confirm the changes
3) So ready, press key "**Write EEPROM**" (this will write the new parameters on E^2prom of the module and will create a file with the extension ".TMP" containing the new parameters). The box, under the key "Write EEPROM", when illuminated, will show the advance of the process in progress.
4) **Reset** on module **DMD** to stored new arrangement (**NOTE**: maintain pressed the button of reset during few seconds until to obtain lit red LED)

NOTE:. The Software of **A.M.C.** ("Automatic Modulation Control ") of **DMD** module acts as the multiplying coefficient with the reference number for the 10% of the detected peak pulse signal transmitted and changes the pedestal level on modulation signal. For example: one pulse pedestal duration approximately of 5.8µs must be reduced from value current 100 (in COUNT) by changing it into 95 (count). In this case, we will have: (95/100) * 5.8 = 0.95 * 5.8 = 5.51µs. The 5.51µs will be the new pedestal duration value; the width of pulse (measured at 50% of amplitude) is also proportionally reduced.

REMARK: Whereas is replaced a module TX100 (and/or TKW), it is always necessary to perform the reset hardware on **DMD** module with the purpose to align the DMD memory to the EEPROMs data. The new data of the reference counts are stored in E^2PROM, only after having carried out the reset on DMD

5.3.4.3 Notation for the calibration of RF output power of the TX100

Prepare the instrumentation as of figure 5.3

NOTES:

a) The automatic modulation control (AMC) is obtained by the signal detected at output of the TX module, which is addressed to the entry of the converter analog/digital of **DMD** module.

b) Channel 1 (CH1) of the oscilloscope is joined to detected signal RF on TX 100 output present on test-point AN36 of DMD module

c) Channel 2 (CH2) of the oscilloscope is joined to the signal of modulation **V_MOD** present on test-point AN13 of TX100 module

d) The trigger of external synchronism of the oscilloscope is joined on test-point AN11 of TX100 module

Figure 5.7 shows the waveform of the signal detected "**V_det"** (on test point AN36 DMD) with the main parameters in the conditions of optimal full power. The waveforms have the following definitions:

1) **V_det_peak**: Value of the peak voltage detected, offset level excluded. Value dependent narrowly by the modulation peak level (Typical value = 10mVolt x Counts in EEPROM: 1Vp for 100 counts).

2) **10% width**: Duration of the detected pulse on 10% of peak level (typical 5,8 µs for 100 accounts, 5,1µs for 95 accounts).

3) **Offset**: typical level value, approximately 100 mVolt, added in factory adj. on DMD module

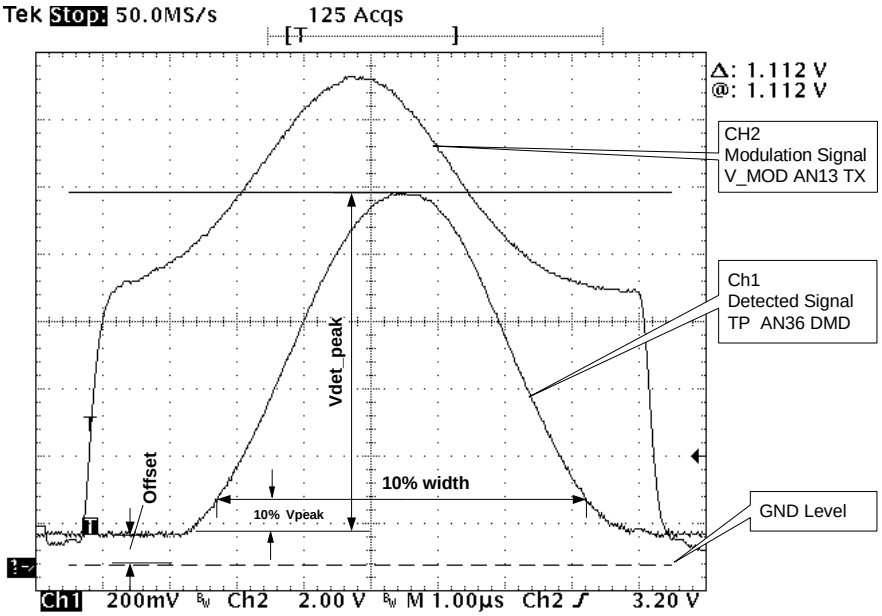


Figure 5.7. Waveforms of detection for TX100

Figure 5.8 shows the waveform of the modulation signal "**V_Mod"** (on test point AN13 of TX100) with the main parameters in the conditions of optimal full power. The waveforms have the following definitions:

1) **Vmod_peak**: Modulation peak voltage controlled by the DMD software. Values of 11Vp for the low channels until 36Vp for the high channels

2) **Vmod_ped**: Modulation pedestal voltage level controlled by the DMD software to obtain one duration to 10 % on the detected signal, (10% width). Values of 3V for the low channels until 8V for the high channels.

3) **Vmod_gauss**: Peak voltage level of the modulation Gaussian part. Values of 5V for the low channels until 30V for the high channels

4) **Offset**: Modulation level <1V factory adj. by the trimmer P1 of TX100 module

5) **Droop_correction**: Voltage difference between the peaks of the pairs pulses which, it is controlled by the software of the DMD in order to minimize it.

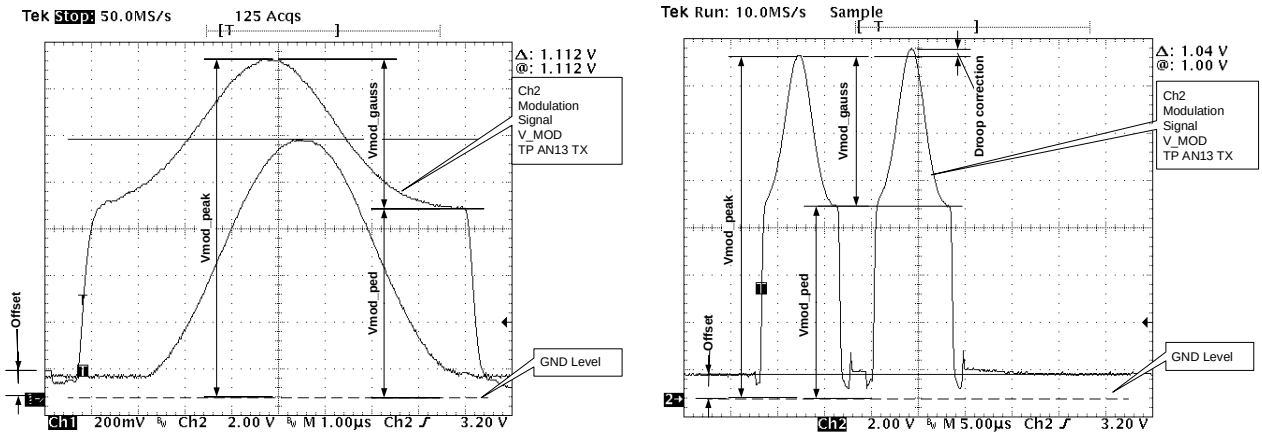


Figure 5.8. Waveforms of modulation for TX100

5.3.4.4 Calibration of output RF signal for TX100

1) With the equipment connected as figure 5.3 to measure the peak power output by wattmeter. The typical precision of measurement will be: ±10% (consists of tolerance of: coupler, attenuators, ….)
2) Modify counts of the parameter "**Power Level 100W**" as figure 5.6 for 100 W reading on the Wattmeter of figure 5.3.
3) Modify counts of the "**Ped. Mod. Dur.**" parameters in order to obtain the pulse shape, similar to the detected signal of figure 5.7. Avoid realizing pulses as in figure 5.9.
   Comply with the tolerances of the pulse shape defined by ICAO as in table 5-4.
   The counts " **Ped. Mod. Dur.**" changes the values of pulse width with 10% of the peak level.
   The counts "**Pedestal Modulation**" changes the levels of pedestal amplitude (typical value 255 counts).
   Check with the spectrum analyzer which the spectrum is within the limits of the characteristics marked in figure 5.36a) and, if necessary, to change the " **Ped. Mod. Dur.**" count parameter for to obtain the required results.
4) Set the transponders on **standby** status
5) **Reset** on module DMD to stored new arrangement
6) Press "**Write E^2prom**" on figure 5.5
7) Reiterate this procedure for each counts reference values variation and for best results.
8) Repeat this procedure for Transponder 2

Table 5-4 Tolerance of pulse envelope gaussian

Envelope Gaussian - Tolerance ICAO	
Pulse Rise time	Not exceed 3 µs
Pulse Decay time	Not exceed 3,5 µs
Pulse width (duration)	3,5 µs ±0,5 µs

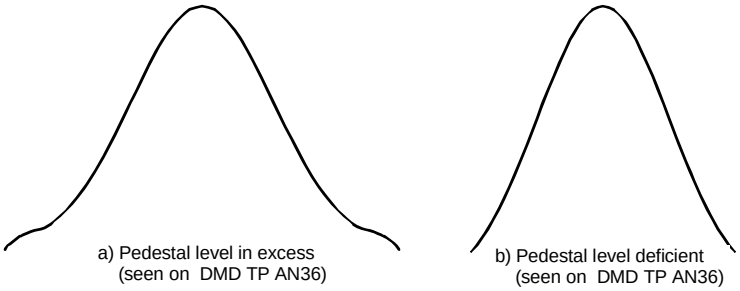


Figure 5.9. Incorrect Gaussian Pulses shape

5.3.5 TKW 1KW Peak power output Calibration Procedure

NOTE *This procedure must be carried out during the installation, in the event of substitution of module TKW and also in case the channel change*.

The alignment is possible only on site (not by Remote Control)

For calibration in the presence of antenna RF cables see section 2 - Installation - and for measurements of Power Reading by the monitors, see procedures described in paragraphs 5.3.7.

TX and TKW modules are equipped with EEPROM serial memory in which are memorized the data used by the software of automatic modulation. This software controls the leveling of the output power, specific channel and mode operating, and the optimization of the pulse shape. A special software package (EEPROM TX /TKW) is made for EEPROM reading and writing. This software is included in the "*equipment manager*" program (see section ANNEX D in this volume).

The software (EEPROM TX /TKW) is allowed on following conditions:

1) MAINTENANCE mode (see the section ANNEX D "WINDME400 equipment manager" in this volume)
2) The two transponders should be in stand by status
3) Instruments necessary for calibration:
   oscilloscope, peak power wattmeter, attenuators, spectrum analyzer
   The instrumentation of test set-up for measurements is shown in figure 5.3.

5.3.5.1 DME 435 1KW Program ACTIVATION

From "DME400 equipment manager" program in "Maintenance mode" and transponders in stand-by, activate the software "*E^2prom TX/TKW*", pressing, at the same time, the combination keys "**CTRL+F10**" on keyboard of the PC. The initial mask of references of figure 5.10 is shown for TRX 1 (or TRX 2 according to the selection).

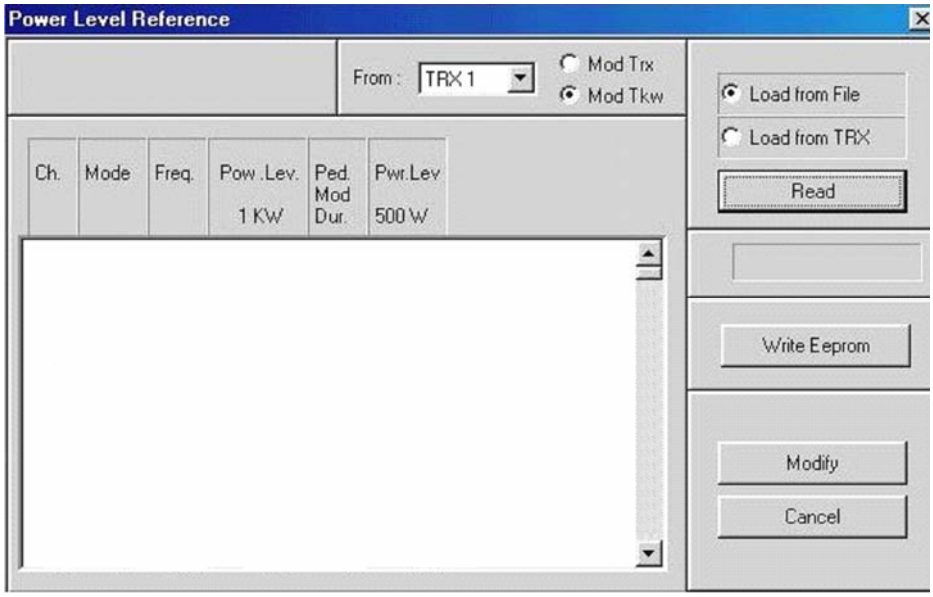


Figure 5.10. References initial mask for alignment of 1KW peak power output

5.3.5.2 TKW 1KW Modulation - adjust peak power output for DME 435

Starting from the mask of figure 5.10, to select the following options:

From: *TRX 1* or *TRX 2* and **Mod Tkw** (1KWp transmitter)

"**Load from File**" for the parameters' reading when one chooses of to examine the existing default values or memorized in a file of the directory **c:\>winsv\site**. Click on the key "**Read**" of figure 5.10 to carry out the action.

"**Load from TRX**" when it is necessary to visualize the parameters values written in the E^2prom of TKW module. Click on the key of figure 5.10 " **Read** " to carry out the action (after approximately 10 seconds the data values are displayed as in example of figure 5.11).

Check that on the operative channel, the **Gau.Mod. 1KW** and **Ped.Mod. 1KW** are "255 counts" for both. In the opposed case, choose the channel and click on the button **Modify** to change the value according to "255 "counts (see figure 5.6 f para 5.3.4.2.2) and click on the button **OK**. Click on the **Write Eeprom** key of figure 5.6, to save the data in Eeprom of the module. **Reset** on DMD module to charge new arrangement and to await initialization.

NOTE: Whereas the adjustment also of module TKW is concluded, the signal present in AN7 of TX100 will be similar on figure 5.13 and not more like figure 5.7.

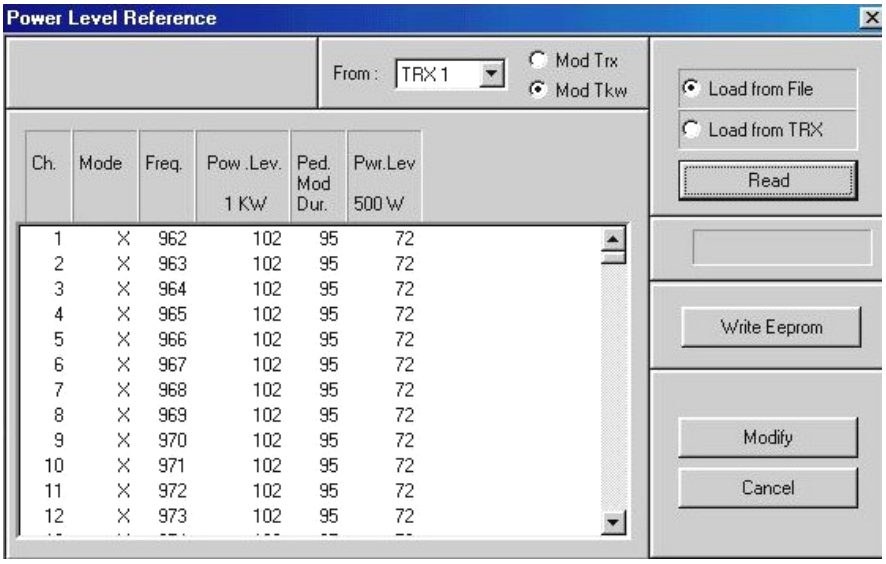


Figure 5.11. References mask with values for Mod Tkw (example)

5.3.5.2.1 Meaning of the labels and data displayed (TKW)

Meaning of the labels and data displayed on figure 5.11:

NOTE: the values of the parameters reference of the fourth to sixth columns are expressed in counts, that software of the DMD translated into voltage levels.

- The data of the first three columns (not modifiable) individualize the beacon parameter:

  Ch - beacon channel

  Mode of the beacon

  Freq. operating transmitter frequency: the lines of the table of figure 5.11 are 252 and they result ordinates for increasing frequencies. Through the slide cursor, the channel of interest is reached.

- The fourth column (**Pow. Lev. 1KW**) is the level reference for 1KW peak output power (DME435). Value = 100 counts of default and values limits to be used: from 80 to 130 counts.

- The fifth column (**Ped. Mod** - Pedestal Modulation Duration) is the modulation duration of pedestal referred to the 10% of the maximum peak detected pulse. Note that this parameter affects the spectrum considerably. Value = 100 counts of default and values limits to be used: from 90 to 110 counts. The change of this parameter asks the check of the spectrum signals with spectrum analyzer.

- The sixth column (**Pwr. Lev. 500W**) is the level reference of reduced power at 500W (DME4135); refers to the adjustment for the 3dB power reduction (see para. 5.3.6 Setting, "Transponder parameter"). Value = 70 counts of default and values limits to be used: from 50 to 90 counts.

5.3.5.2.2 Modification of reference parameters values

Modify these parameters to select, with the pointer, the interested line of service channel and click on same line. Therefore, click on the key of figure 5.11 "**Modify**". The mask "**Modify References Maintenance"** of figure 5.12 will be displayed in which acting on the editable fields will be possible to perform the desired reference changes.

Meaning of parameters displayed on figure 5.11

- **Power Level 1000W:** Reference in counts for the calibration of the 1000W peak power
- **Ped. Mod. Dur.** duration time for modulation of the pedestal
- **Power Level 500W:** Reference in counts for the calibration to -3dB reduction peak power
- **OK**: press key to confirm the changes of the reference counts
- **Cancel :** press key turn back to the condition without modification

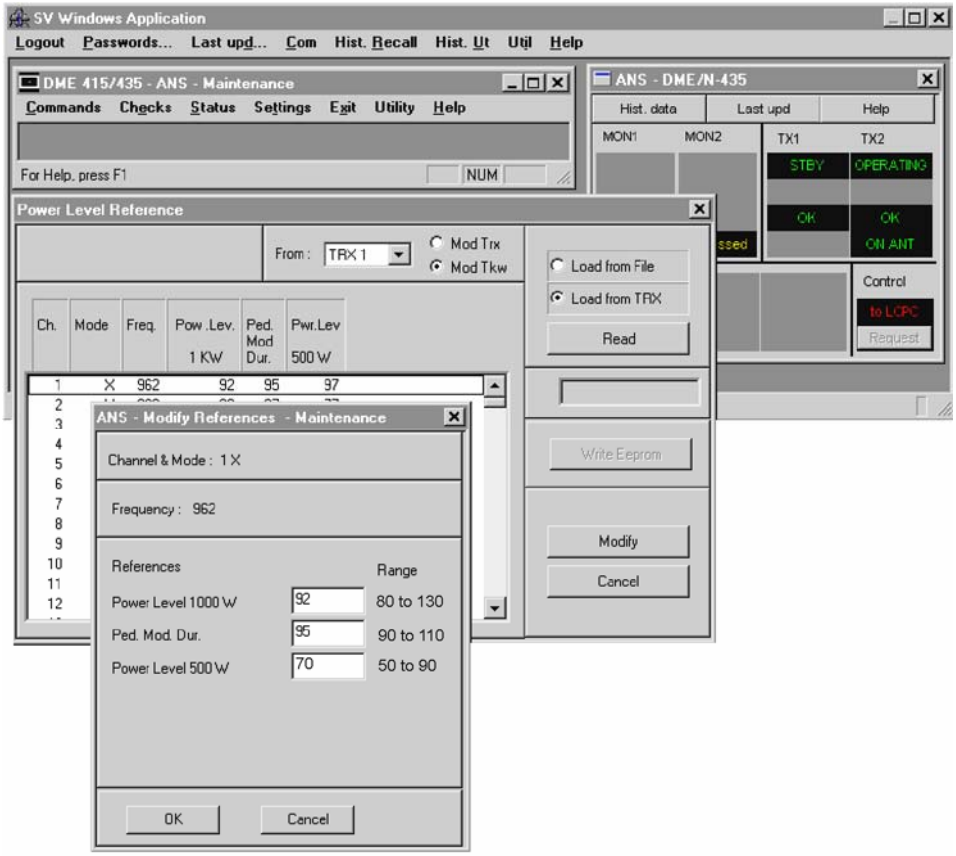


Figure 5.12. Modify references values for Mod Tkw (example)

Procedures for data change:

1) Modify the parameters (**Power Level 100W**), (**Ped. Mod. Dur.**) and (**Power Level 500W**):
   Set in operate status the transponder TRX1 in antenna and to note the power result reading on the "**Peak Power Meter** " of figure 5.3

2) Modify the values to obtain the reading of power 1000Wp on **Peak Power Meter**. Click on button **OK** after the modifications to confirm the changes.

3) So ready, press key "**Write EEPROM**" (this will write the new parameters on E^2prom of the module and will create a file with the extension ".TMP" containing the new parameters). The box, under the key "Write EEPROM", when illuminated, will show the advance of the process in progress.

4) **Reset** on module **DMD** to stored new arrangement (**NOTE**: maintain pressed the button of reset during few seconds until to obtain lit red LED)

NOTE:. The Software of **A.M.C.** ("Automatic Modulation Control " of **DMD** module) acts as the multiplying coefficient with the reference number for the 10% of the detected peak pulse signal transmitted and changes the pedestal level on modulation signal. For example: one pulse pedestal duration approximately of 5.8µs must be reduced from value current 100 (in COUNT) by changing it into 95 (count). In this case, we will have: (95/100) * 5.8 = 0.95 * 5.8 = 5.51µs. The 5.51µs will be the new pedestal duration value; the width of pulse (measured at 50% of amplitude) is also proportionally reduced.

REMARK: Whereas is replaced a module TX100 (and/or TKW), it is always necessary to perform the reset hardware on **DMD** module with the purpose to align the DMD memory to the EEPROMs data. The new data of the reference counts are stored in E^2PROM, only after having carried out the reset on DMD

5.3.5.3 Notation for the calibration of RF output power of the TKW

Prepare the instrumentation as of figure 5.3

NOTES:

a) The automatic modulation control (AMC) is obtained by the signal detected at output of the TKW module, which is addressed to the entry of the converter analog/digital of **DMD** module.

b) Channel 1 (CH1) of the oscilloscope is joined to detected signal RF on TKW output present on test-point AN36 of DMD module

c) Channel 2 (CH2) of the oscilloscope is joined to the signal of modulation **V_MOD** present on test-point AN13 of TX100 module

d) The trigger of external synchronism of the oscilloscope is joined on test-point AN11 of TX100 module

Figure 5.7 shows the waveform of the signal detected "**V_det"** (on test point AN36 DMD) with the main parameters in the conditions of optimal full power. The waveforms have the following definitions:

1) **V_det_peak**: Value of the peak voltage detected, offset level excluded. Value dependent narrowly by the modulation peak level. (Typical value = 10mVolt x Counts in EEPROM:1Vp for 100 counts)

2) **10% width**: Duration of the detected pulse on 10% of peak level (typical 5,8 µs for 100 accounts, 5,1µs for 95 accounts).

3) **Offset**: typical level value, approximately 100 mVolt, added in factory adj. on DMD module

5.3.5.4 Calibration of output power RF for TKW

1) With the equipment connected as figure 5.3 to measure the peak power output by wattmeter. The typical precision of measurement will be: ±10% (consists of tolerance of: ±1 count, coupler, attenuators, ….)

2) Modify counts of the parameter "**Power Level 1000W**" as figure 5.12 for 1000 W reading on the Wattmeter of figure 5.3.

3) Modify counts of the "**Ped. Mod. Dur.**" parameters in order to obtain the pulse shape, similar to the detected signal of figure 5.7 (TP AN36 DMD). Avoid realizing pulses as in figure 5.9.
Comply with the tolerances of the pulse shape defined by ICAO as in table 5-4.
The counts " **Ped. Mod. Dur.**" changes the values of pulse width with 10% of the peak level.
Check with the spectrum analyzer which the spectrum is within the limits of the characteristics marked in figure 5.36b) and, if necessary, to change the " **Ped. Mod. Dur.**" count parameter for to obtain the required results.

4) Set the transponders on **standby** status
5) **Reset** on module DMD to stored new arrangement
6) Press "**Write E^{2}prom**" on figure 5.11
7) Reiterate this procedure for each counts reference values variation and for best results
8) Repeat this procedure for Transponder 2

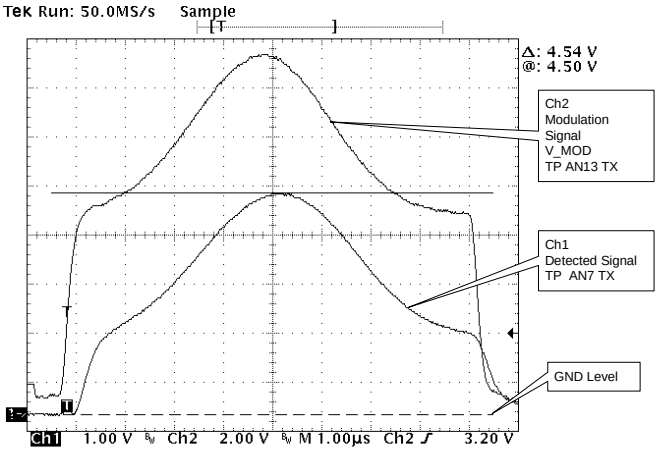


Figure 5.13. Pulse shape for TX100 drive of TKW (example)

5.3.6 Reduced power - Check operation

Setting power reduction as figure 5.14

Perform the check on every 4 points of figure 5.14, given on the following values of output power:

0dB OFF reduction - Corresponds to the 100% of full power
-1dB ON reduction - Corresponds to the approx. 79% of full power
-2dB ON reduction - Corresponds to the approx. 63% of full power
-3dB ON reduction - Corresponds to the approx. 50% of full power. This last level comes established while preparing the counts indicated in figure 5.6 (for DME415) or 5.12 (for DME435).

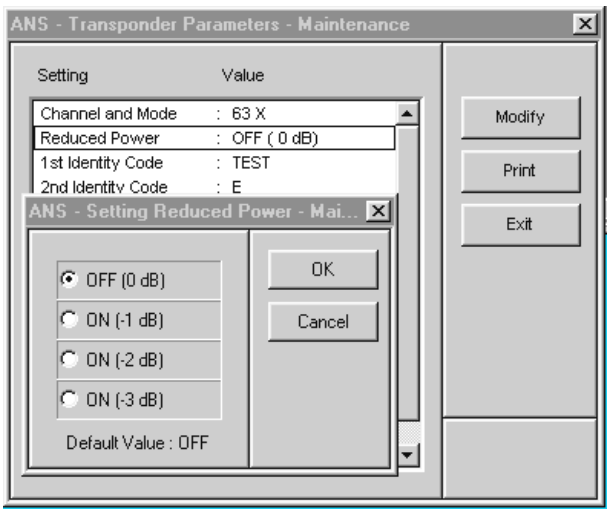


Figure 5.14. Setting Reduced power

5.3.7 Adjustment Power Monitor Reading

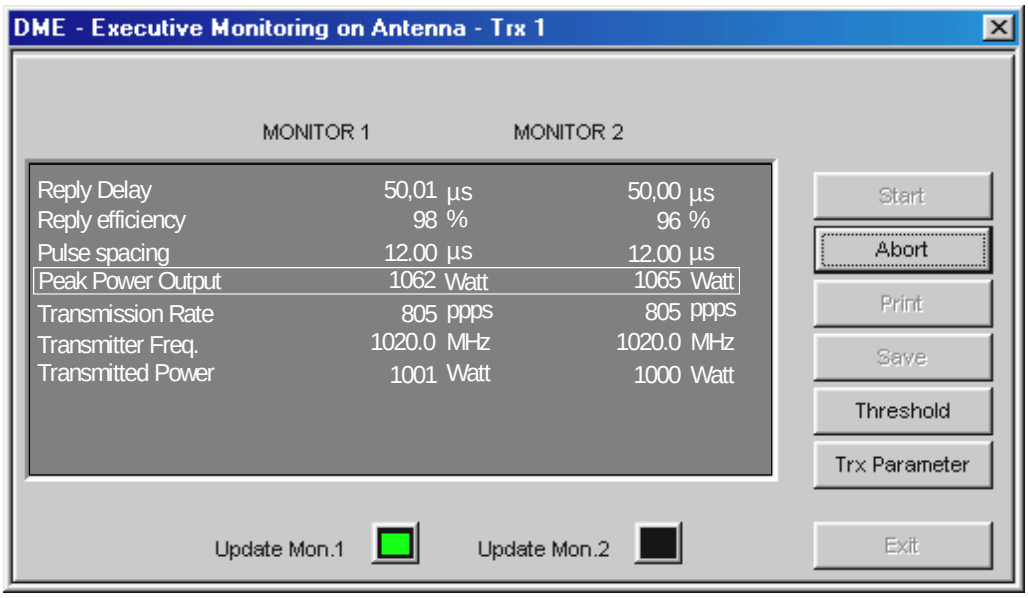


Figure 5.15. Screen of correct measurement by Monitor 1 & 2 (Example)

To adjust value of **Peak Power Output** (see figure 5.15) you have to change the following value of preset**:**

- MON1 Power Adj

- MON2 Power Adj

The range value is from –100 to +100. See figure 5.16**.**

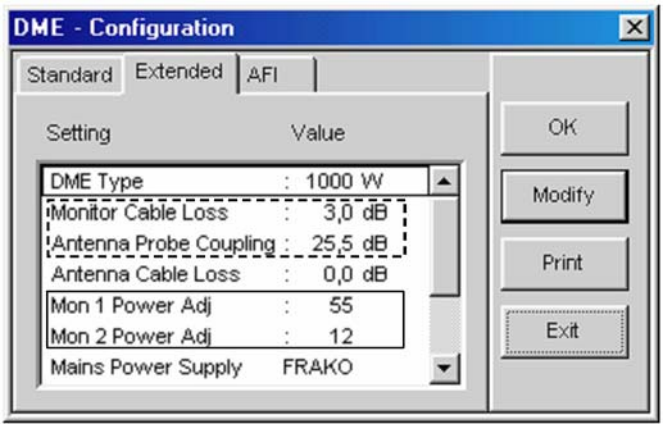


Figure 5.16. Screen of configuration for power reading adjustment

To adjust value of **Transmitted Power** for both monitors, you have to change the values of preset. See figure 5.16

- Monitor Cable Loss

- Antenna Probe Coupling

There is also a possibility to adjust value of power for each monitor, so you can align monitor1 with monitor2 by **TRIMMER P6** on monitor board**.**

NOTE: Be careful !!!! Don't touch any other TRIMMER on monitor board

5.3.8 Test Points and Led

The external test points (and LED position), to be found on the front of the beacon modules (see figures 5.17; 5.18 ; 5.23; 5.25, 5.26; 5.28; 5.30; 5.33; 5.34; 5.35) and the lists are on tables: 5-5 to 5-13.

The LED on beacon modules are listed in section 3, on table 3-7 and shown in figures 3.31 to 3.33

5.3.9 Waveform

Significant wave shapes relating to the test points are on the following pages.

The DME 415 & DME 435 equipments spectrums (typical) of the transmitted signal are shown in figures 5.36A) and 268H5.36B) respectively.

For every wave shape and for each scope channel the following information is given: scale used (in V/div), time base (in μs/div or in ms/div) and test point providing the synchronization signal, if an external synchronization signal is used for the measurement. If there is no synchronization indication, the synchronization is internal.

Table 5-5. Power Supply PWS module - External test points

TEST POINT	DESCRIPTION
TP1	Used to check for +5 V stabilized voltage. Typical value: 5,1 ± 0,1V
TP2	Used to check for +15 V stabilized voltage. . Typical value: +15± 0,2V
TP3	Used to check for –15 V stabilized voltage. . Typical value: -15± 0,2V
TP4	GND

SW1	Reset Pushbutton	- Check operation for verifier transient failure of module, when red led is lighted.

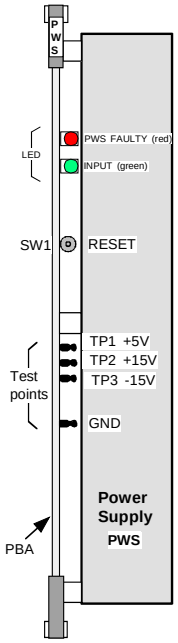


Figure 5.17. PWS outline – Test point and LED

Table 5-6. Monitors MON module - External test points

TEST POINT	DESCRIPTION
AN11	H MORCO – Identity Code - Detected identified Morse code signal.
AN34	OUT MUX - ADC input signals - RF pulses detected from antenna probes
AN23	A MOD –Analog signals of the interrogation Modulation
AN 71	MEAS. SYNC. - Signal trigger on oscilloscope for BITE measurement .
AN2	LM INT - Start generation and acquisition signal. Trigger on oscilloscope for check Executive Monitoring measurements.
AN45	GND

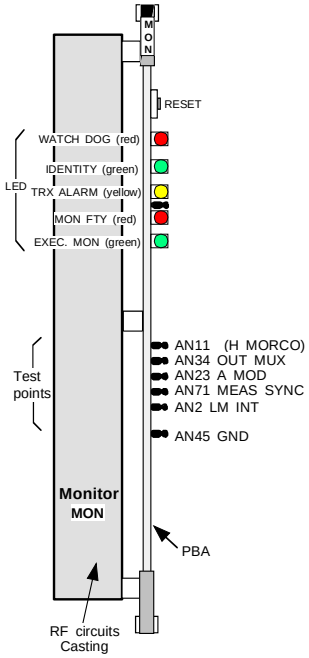


Figure 5.18. MON outline – Test point and LED

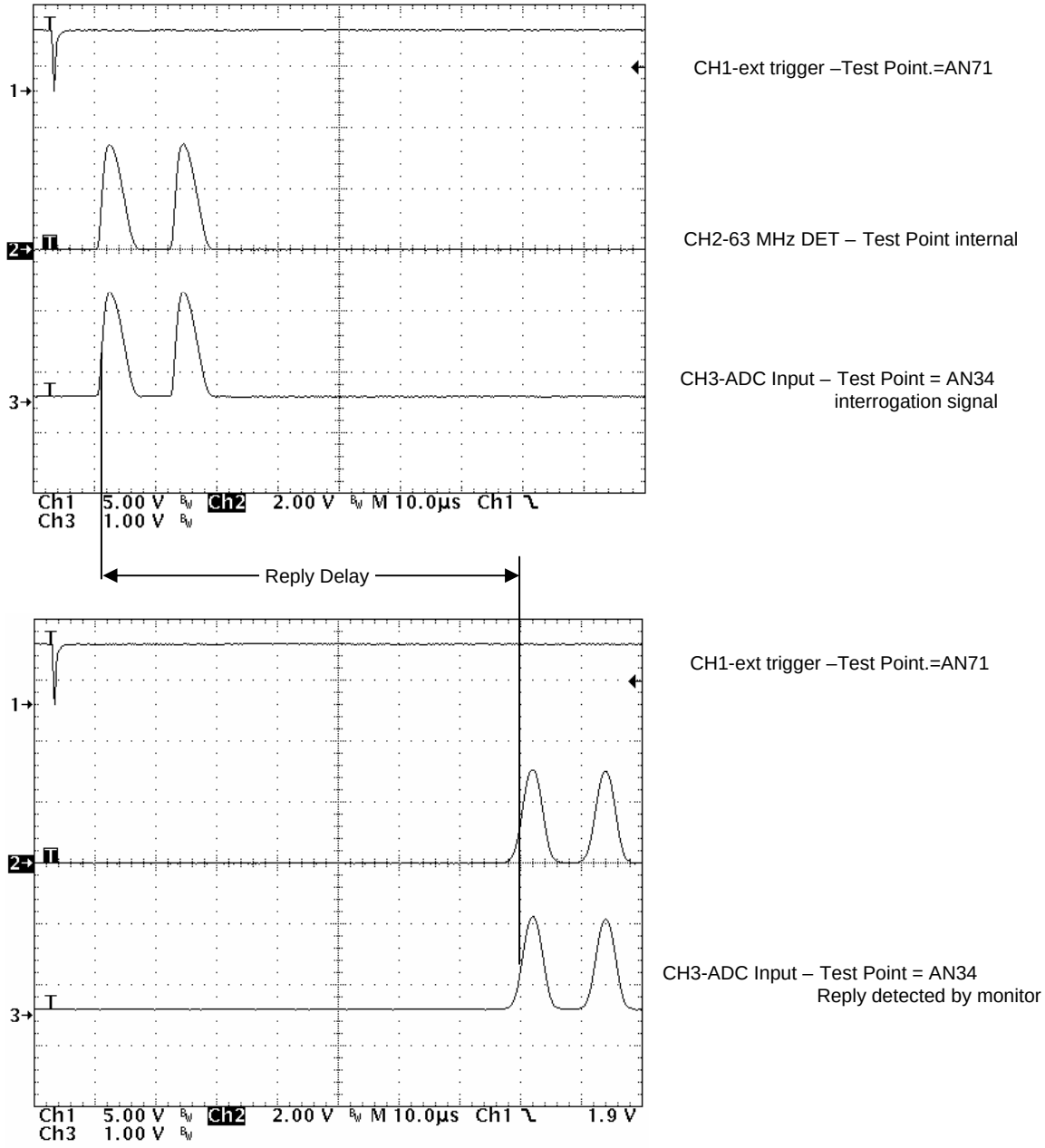
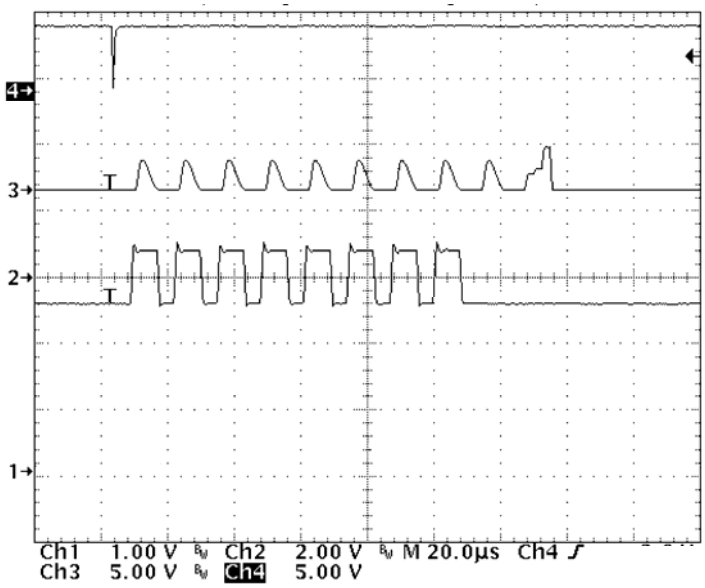


Figure 5.19. MON module – Waveform monitor: X mode Interrogation

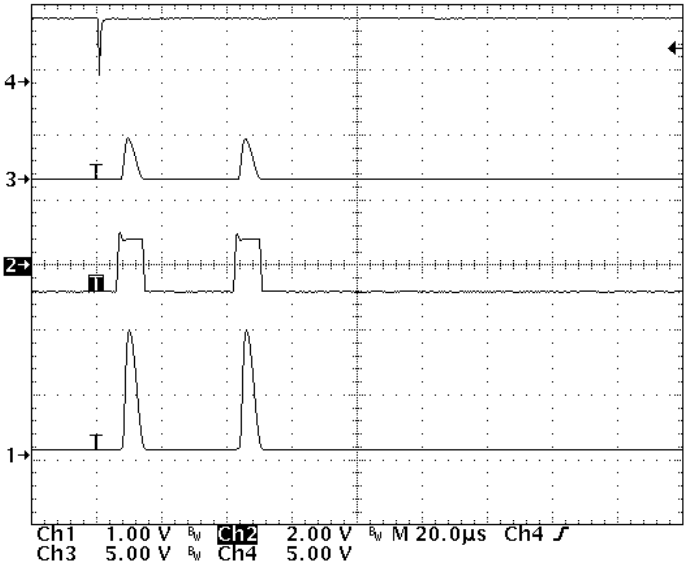


CH4-ext trigger –Test Point.=AN71

CH3-VTF signal – Test Point = internal

CH2- ON/OFF 63MHz enable – Test Point AN43

Figure 5.20. MON module – Waveform monitor self-check: Attenuators check



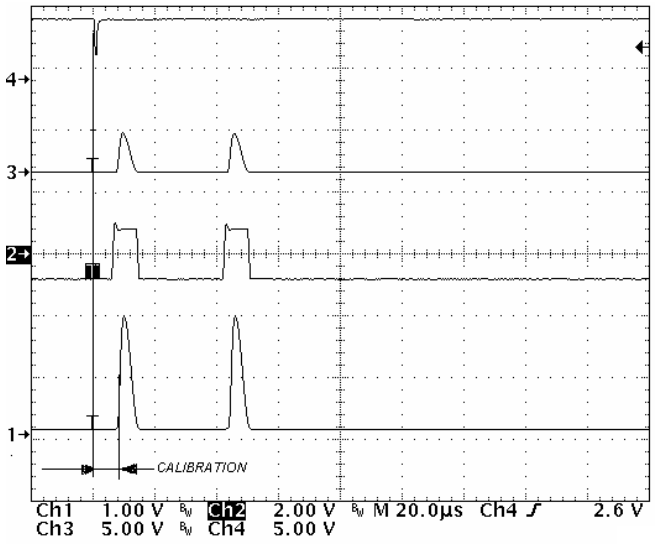
CH4-ext trigger –Test Point.=AN71

CH3-VTF signal – Test Point = internal

CH2- ON/OFF 63MHz enabl.– Test Point AN 43

CH1-ADC Input – Test Point = AN34

Figure 5.21. MON module – Waveform monitor self-check: Y mode Interrogation



CH4-ext trigger –Test Point.=AN71

CH3-VTF signal – Test Point = internal

CH2- ON/OFF 63MHz enabl.– Test Point AN 43

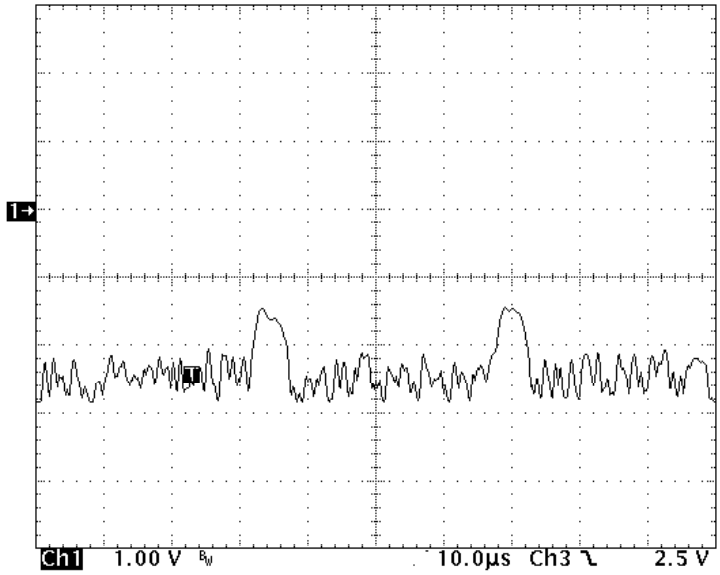
CH1-ADC Input – Test Point = AN34

NOTE: these waveforms are visualized during the interrogation towards the Rx. Previously acquisition by calibration is carried out internal to the Monitor with single pulse

Figure 5.22. MON module – Waveform monitor self-check: CALIBRATION Delay

Table 5-7. Receivers RX module - External test points

TEST POINT	DESCRIPTION
AN51	TOA Time of Arrival signal (N.U.).
AN	OCV analog - On Channel Validation analog signals pair pulses
AN	OCV Trigg. - On Channel Validation trigger gate digital signals
AN19	LOG N - Detected log signal output.
AN20	LOG-P - N.U.
AN7	CAL - Gate during pilot pulse Calibration. Signal trigger for log detected measurement on oscilloscope
AN18	GND



CH1-Log N
Test Point.=AN19
-90dBm interrog. level

Figure 5.24a. RX module – LOG N waveform Y mode

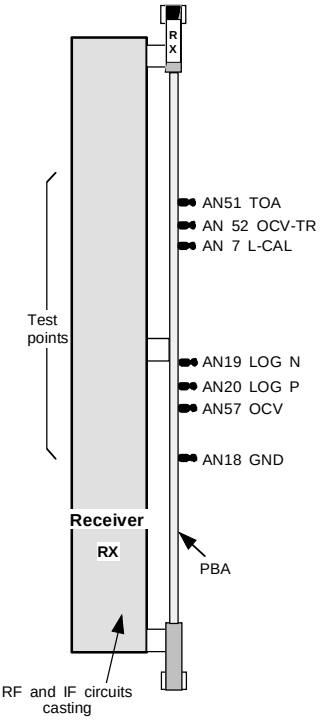
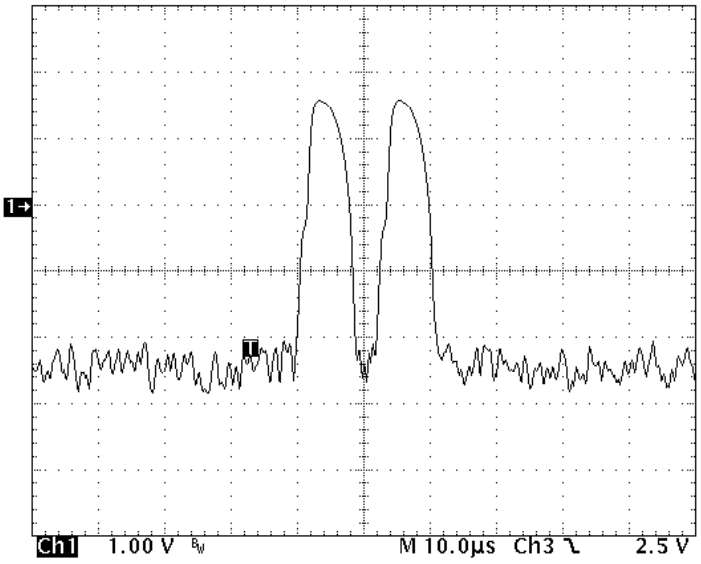


Figure 5.23. RX outline – Test point and LED



CH1-Log N
Test Point.=AN19
-30dBm interrog. level

Figure 5.24b. RX module – LOG N waveform X mode

Table 5-8. Digital Processor DPR module - External test points

TEST POINT	DESCRIPTION
AN20	SQI - Squitter pulses
AN19	DPNPSQ - Squitter/reply pulses
AN18	DAEDT - Dead time signal gate
AN17	MORCO - Used to check Morse code identity
AN32	LOG - Remake log Rx signal from internal DAC
AN13	OVRL - Transmission rate overload frequency (4800 Hz)
AN56	GND
AN16	SPINH - Spacing Inhibit (minimum squitter spacing)
AN15	IDT - Identity frequency (1350 Hz)
AN52	TRGOUT - Output trigger delay-compare comparator
AN40	TOA N - TOA Output digital trigger
AN39	MOD ST - Modulation start
AN5	MD - Main delay gate
AN7	HRXINH - Gate Rx inhibit during transmitted pulse
AN1	CAL - Calibration gate for scope trigger used to check pilot pulse signal
AN41	SQIDBP - Squitter-Identity (gate enable calibration pilot pulse)
AN9	GF – Gate former decoded
AN43	GND
AN11	AGRDW - N.U. (Automatic gain reduction down)
AN10	AGREN - N.U. (Automatic gain reduction enable)
AN59	NPR - Dc level of presetting Rx sensitivity.
AN51	TH COMP - Threshold TOA signal comparator
AN50	DISCH - Discharge gate TOA signal
AN57	DISAB - Disable TOA signal
AN55,AN54,AN14	N.U.

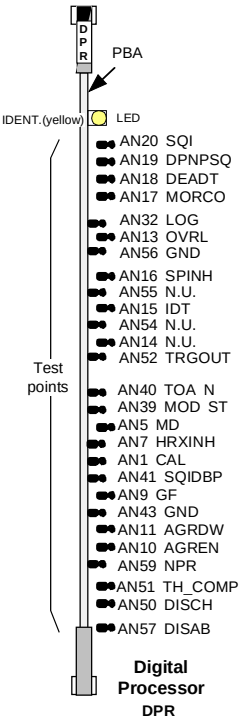


Figure 5.25. DPR outline – Test point and LED

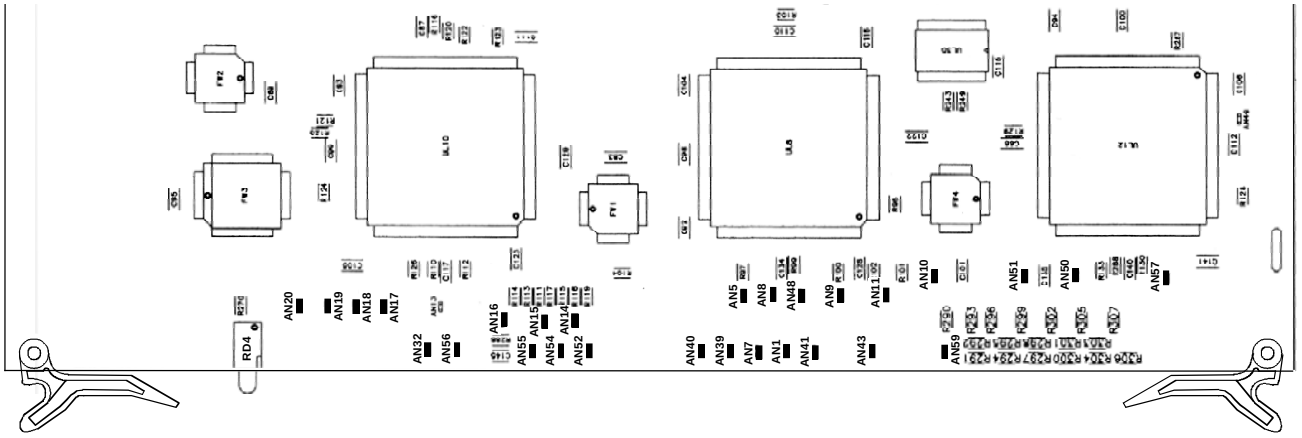


Figure 5.26 DPR module – Test point position

Table 5-9. Digital Modulator DMD module - External test points

TEST POINT	DESCRIPTION
AN5	Trigger - N.U. (used to check specific maintenance measurement)
AN24	RF ON - Gate RF transmitter enable
AN23	LRX INH - Gate Rx inhibit
AN26	MOD N - Modulation pulse (gaussian and pedestal waveform)
N10	CALIB - Gate calibration of pilot pulse
AN39	GND

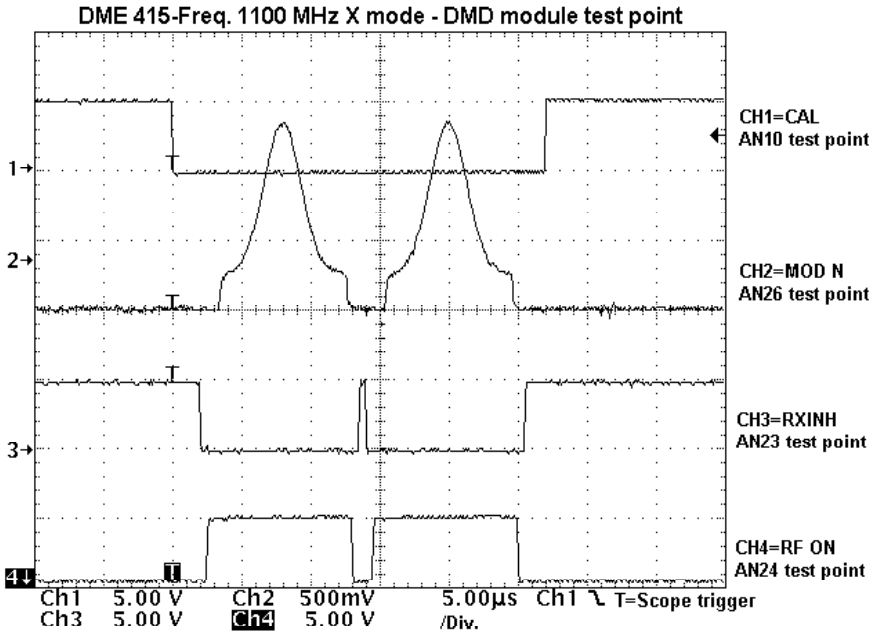


Figure 5.27. DMD module – Waveform, X mode

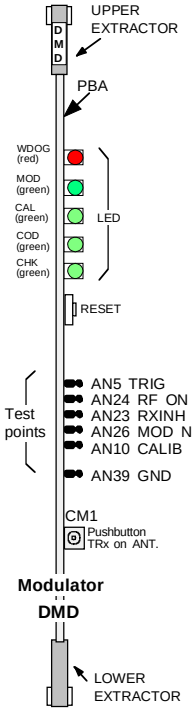


Figure 5.28. DMD outline – Test point and LED

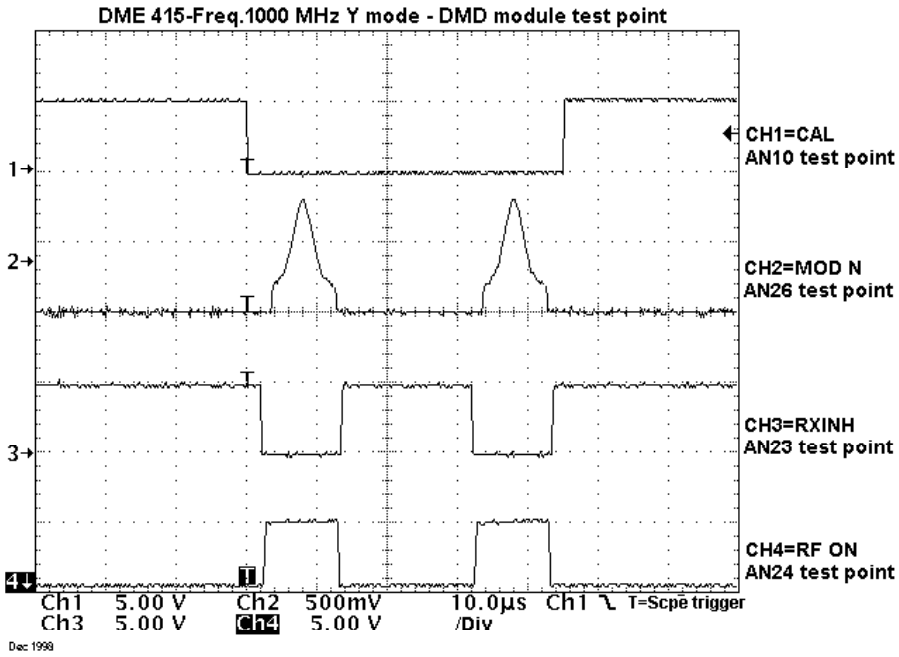


Figure 5.29. DMD module – Waveform, Y mode

Table 5-10. Transmitter /driver TX module - External test points

TEST POINT	DESCRIPTION
AN17	DC/DC converter regulated voltage - 100 W module (typical values: 50V/transmitter/driver)
AN13	V MOD - Video Modulation Voltage (gaussian and pedestal waveform).
AN12	N.U. (Mod P)
AN11	MOD SQR - Modulation square gate
AN7	RF DET - Output RF detected signal .
AN21	GND

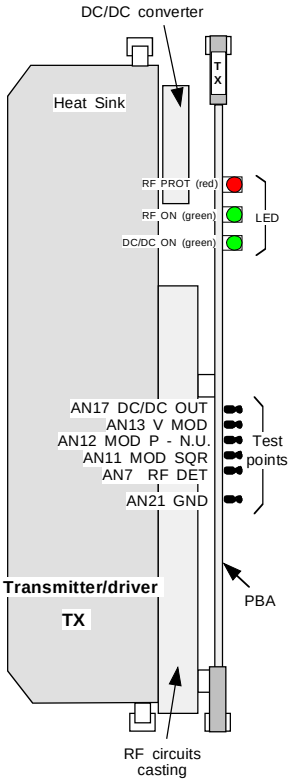


Figure 5.30. TX outline – Test point and LED

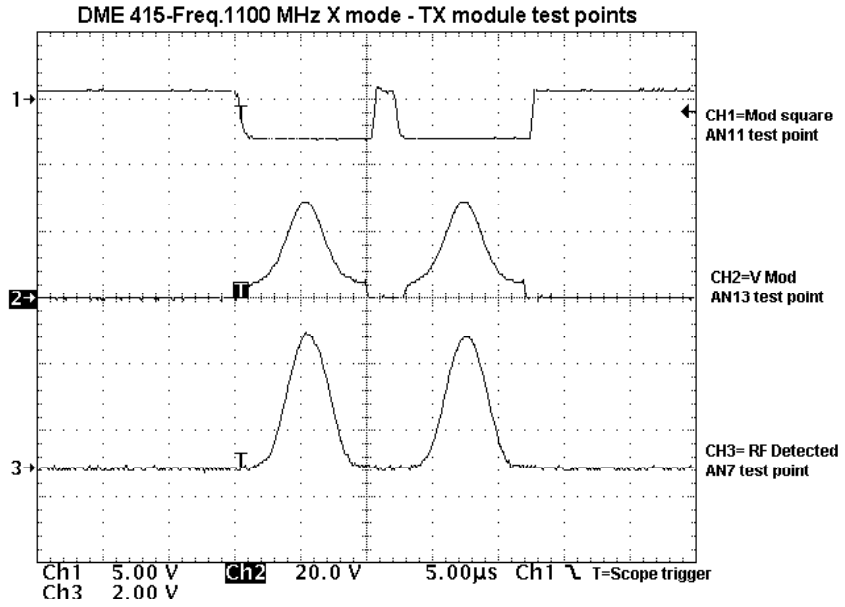


Figure 5.31. TX module – Waveform – X mode

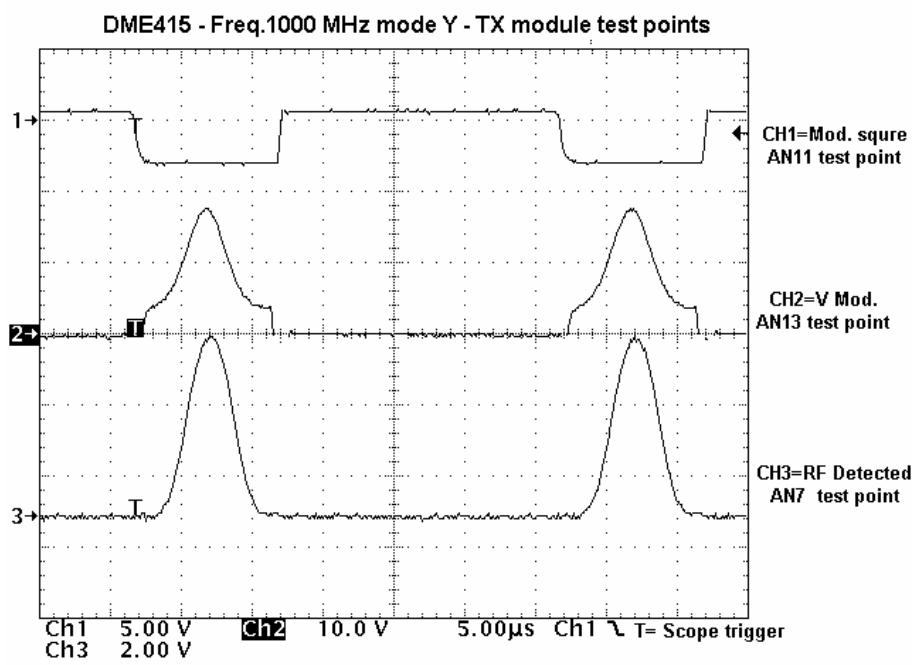


Figure 5.32. TX module – Waveform – Y mode

Table 5-11. RF 1KW Amplifier TKW module (only DME 435) - External test points

TEST POINT	DESCRIPTION
AN1	200W DC/DC regulated voltage; output value: 50V ±0,5V
AN2	Used to verify the absorption current of the final driver RF power amplifier; typical value measured between AN2 and the reference point AN1. Typical value: ≤350 mV (conversion factor 1 mV/1 mA).
AN3	Similar to AN2 but used to verify the current of the first final power amplifier.
AN4	Similar to AN2 but used to verify the current of the second final power amplifier.
AN5	Similar to AN2 but used to verify the current of the third final power amplifier.
AN6	Similar to AN2 but used to verify the current of the fourth final power amplifier.
AN7	Used to verify the detected RF signal output by the TKW module.
AN8	GND

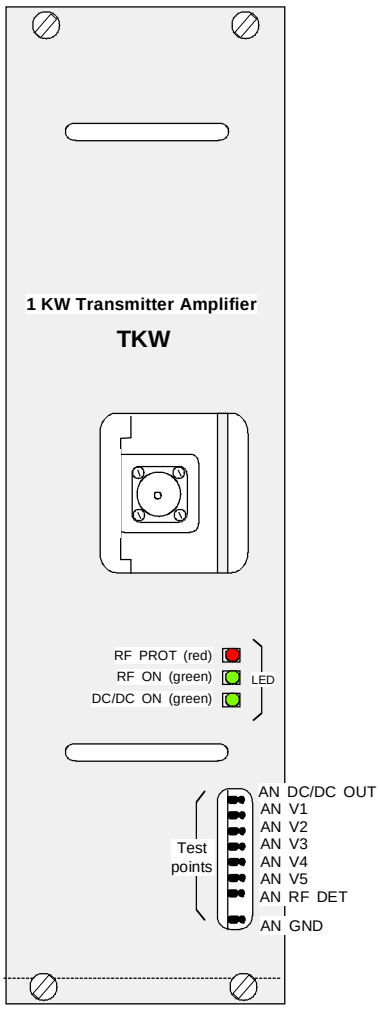


Figure 5.33. TKW module outline – Test point and LED

Table 5-12. CSB Module Test Points

TEST POINT	DESCRIPTION
AN1	INTSCC0-Interrupt serial Communic. Controller -TTL level
AN2	BT1- Backup battery -3.6 V nom; 5 V full charge; 2.8 V depleted
AN3	Freq. Xtal Q1 - 14745.6 kHz - pseudo-sine wave
AN4	VBAC - RTC supply voltage 3.6 V with standard load
AN5	BRG - Baud Rate Generator - Frequency = 7,372,800 Hz
AN6	WR - CPU Write -
AN7	RD - CPU Read -
AN8	BATF - BT1 Battery defective or depleted - Normal = Flag High
AN9	GND

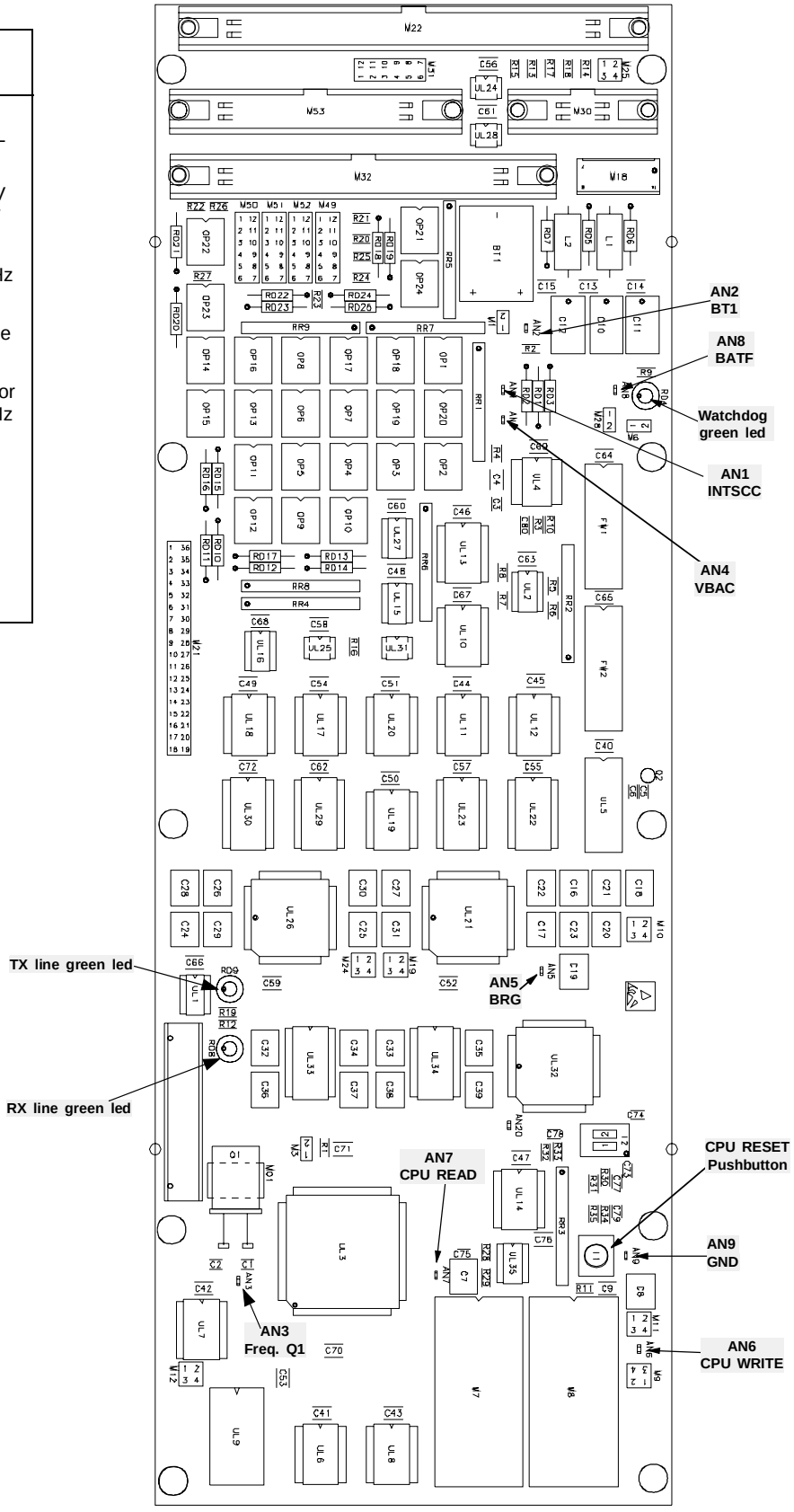


Figure 5.34. CSB Module – Test point position

Table 5-13. AC/DC Module Test Points

TEST POINT	DESCRIPTION
TP+/ TP-	Used to verify 54 Vout voltage.

V Adj	Output voltage adjustment : ± 1 V max variation (53 to 55 Vdc)

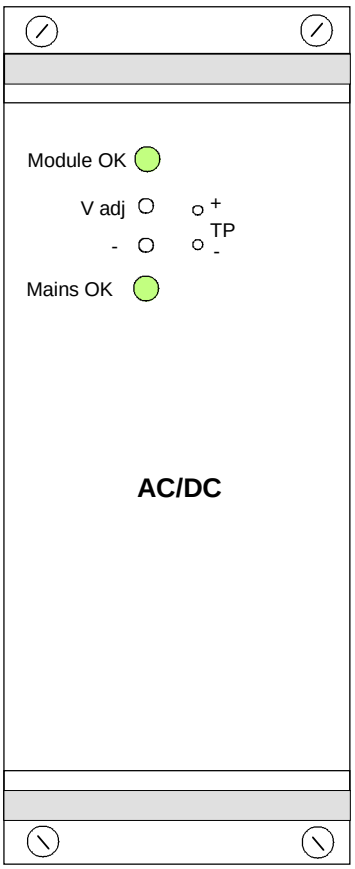


Figure 5.35. ACDC module – Test points and LED outline

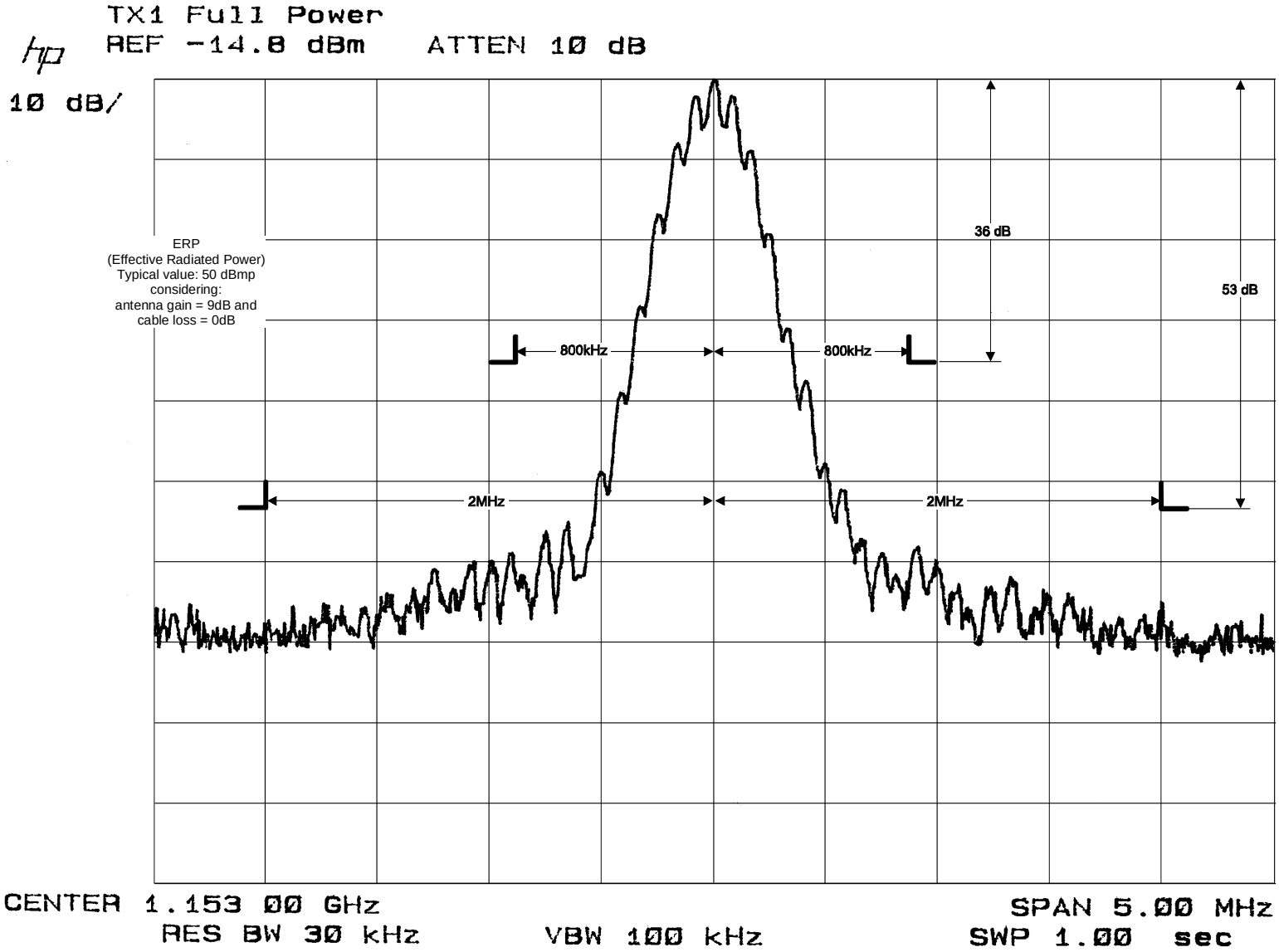


Figure 5.36a). DME 415 -Typical transmitted spectrum signal

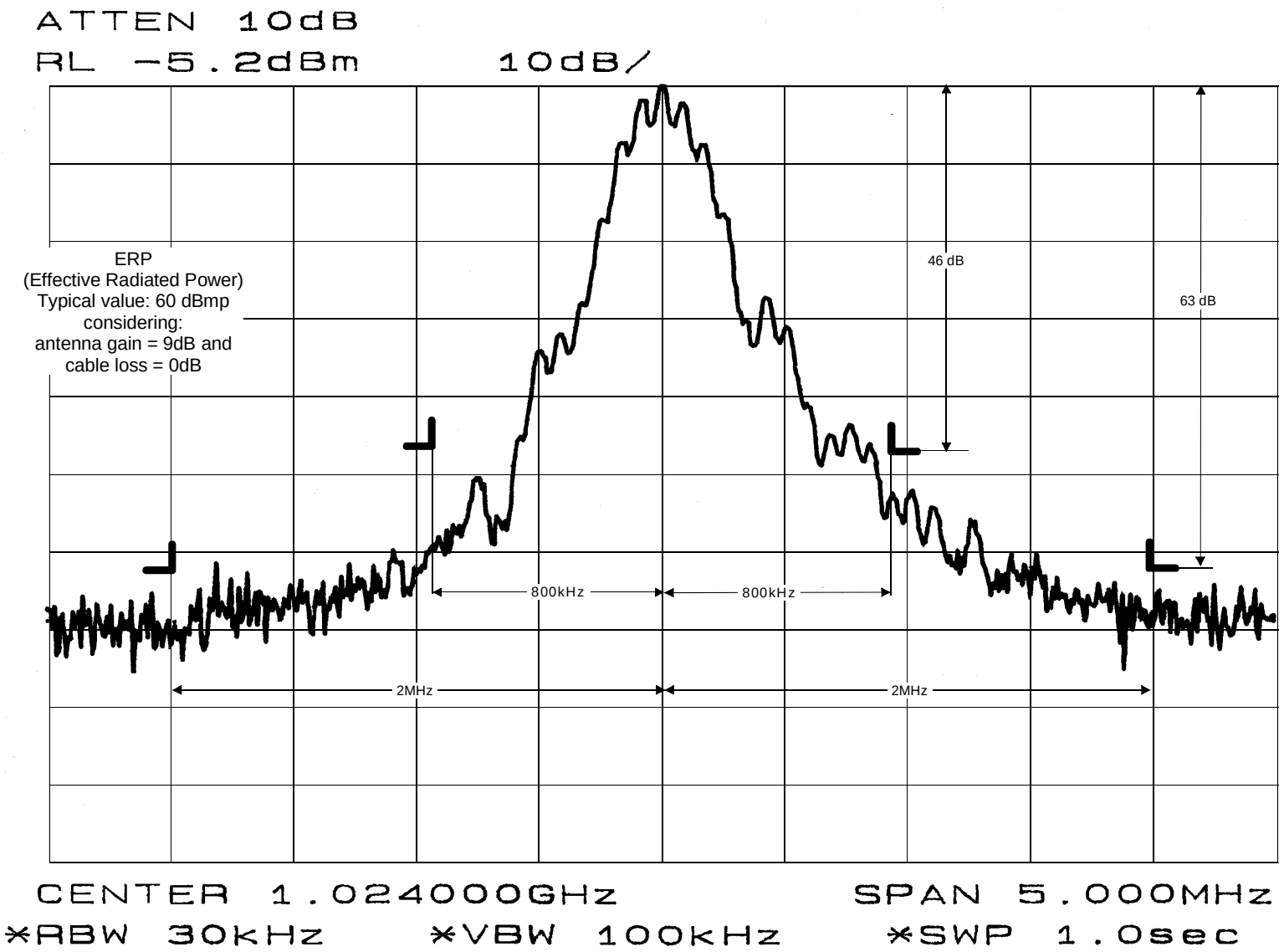


Figure 5.36b). DME 435 -Typical transmitted spectrum signal