3T Communications
A SEPURA COMPANY

eXTRAS

eXtensible Trunked RAdio System

TETRA

SOLO

Maintenance Manual

EX0C00 EN 531.11 Version 1.1

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Illustrations

Tables

---------- END OF SECTION ----------

1 Introduction

This section contains general information, including useful information about the document itself (cautions, typography) as well as references to other documents.

1.1 Purpose

The Maintenance Manual provides an overview of eXTRAS (**eX**tensible **TR**unked **RA**dio **S**ystem) SOLO.

The Maintenance Manual describes all essential parts of the unit (hardware and software), the functional scope of the unit, and the steps necessary for system installation and administration. In addition, the manual provides instructions to support ongoing operations. For experienced maintenance technicians, the manual also includes a reference section for system information.

Due to possible software revisions or specific system settings, the screen shots shown in this manual may differ slightly from the screens in the applications actually delivered.

The connectors on computers follow generally accepted colour-coding schemes and use the corresponding symbols. However, due to rapid product cycles, the position of these connections may change. In cases of doubt, please refer to the equipment manufacturer's documentation.

1.2 Target Group

This document is intended for the people responsible for implementing and maintaining eXTRAS SOLO as well as operating the equipment.

1.3 Prerequisites

It is assumed that the reader is familiar with handling IT hardware and telecommunications equipment (computers, routers, UPS, etc.), working with the Microsoft Windows operating system, and with the basic concepts and functions of a TETRA radio system.

Before working with the eXTRAS SOLO, please be sure to familiarize yourself with the Safety Guidelines (see section 1.4.1). Please also observe local rules and regulations when working with the eXTRAS SOLO.

This manual and the Safety Guidelines contain warnings (see section 1.5.2), recommendations and safety precautions which absolutely must be observed when working with the eXTRAS SOLO.

All of the warnings, cautions, recommendations and safety procedures contained in or referred to in this document must be observed in order not to violate the terms of the warranty for the eXTRAS SOLO.

The operation of personal computers and their operating systems is not discussed in this manual. For additional information on those topics, please refer to the online help for the personal computer and operating system.

1.4 References

1.4.1 3T Communications AG Documents

- Safety Guidelines (00A46 E500)
- eXTRAS SOLO Hardware Documentation (EX0C00 EN760)
- eXTRAS SOLO User Information
  (EX0C00 EN204 to 210, depending on eXTRAS SOLO's frequency band)

1.4.2 External Documents

- TETRA (EN 300 394-1 V3.1.1)
- Directive EN50383, 1999/5/EU
- Directive 2004/40/EG (Radio&Telecommunications Terminal Equipment Directive) for radio equipment
  - EN 301 489-1 V1.8.1 Class B
  - EN 301 489-18 V1.8.1
  - EN 300 394-1 V3.1.1 (radiated spurious only)
  - EN 60950-1:2006 + A1:2010 (Electrical Safety)

1.5 Usage

This section describes the structure of the Maintenance Manual and the warning messages used in the text.

1.5.1 Structure of the Manual

Related topics are merged together in specific sections in the Maintenance Manual.

Section 1 - Introduction
This section contains general information, including useful information about the document itself (cautions, typography) as well as references to other documents.

Section 2 - eXTRAS SOLO Concept
This section provides an overview of the eXTRAS SOLO concept. It also describes the functional scope of the unit within an eXTRAS FR400 network.

Section 3 - Component Identification
This section shows the various views of the eXTRAS SOLO and describes all elements of the unit.

Section 4 - Setup
This section discusses the safety precautions to be taken and the fundamentals of eXTRAS SOLO on-site integration and start up.

Section 5 - Operations
This section describes the eXTRAS SOLO homepage which is used for monitoring the unit. Additional the log files are described which give access to the so called service records (call data).

Section 6 - Utilities and Configuration
This section provides a detailed description of the required administration programs as well as an overview of system administration tasks and associated activities.
Further on details regarding the configuration possibilities are part of this section.

Section 7 - Troubleshooting
eXTRAs SOLO administration tasks – such as exchanging air filters – are explained in a compact and task-oriented form. These procedures are described on the basis of insights from the operation of the unit.

1.5.2 Description of Warnings

	**Prohibited**
	**Risk of electric shock**
	**Risk of injury or of severe damage to equipment**
	**Caution when handling electrostatic discharge sensitive devices (ESDs)**
	**Rule for operation**
	This symbol emphasizes additional information.

1.6 Typographical Conventions

Names such as key labels, field labels, proper names and the like are printed in *italics*.

Examples:

ESC	key label
Password	field label
Administrator	proper name

File names and paths as well as commands are shown in the `Courier New` font.

Examples:

`example.txt`	file name
`C:\PROGRAMS\EXAMPLE\`	path

1.6.1 Notation for Keys and Buttons

1.6.1.1 Keyboard Keys

In this manual, all keyboard keys are shown inside a `frame`.

Example:

Press `Esc` to cancel.	Press the keyboard key labelled *Esc*.

Where it is necessary to press two or more keyboard keys simultaneously, they are linked by a plus sign (+).

Example:

`Strg` + `Alt` + `Del`	Press the keys labelled *Ctrl*, *Alt* and *Del* simultaneously.

In general, key labels are used where the result is attained without pressing additional keys.

Example:

Press `5`.	Press the keyboard key labelled *5* in order to insert the number five in the text.
Press `⇧` + `5`.	Press the 'Shift' key and the *5* key in order to insert the percent sign (*%*) in the text.

In this manual, keys labelled with symbols are depicted as shown in Tab. 1-1.

Key Symbol	Description
⇆	Tabulator key
⇩	'Shift lock' key
⇧	'Shift' key
←	'Back' key
↵	'Enter' key
↑ , ↓ , ← , →	Arrow keys
⊞	Windows key

Tab. 1-1: Key Symbols Used in the Manual

1.6.1.2 Graphical User Interface (GUI) Elements

In this manual, all controls and buttons used on screen are shown in frames with a gray background.

Example:

Click OK to confirm.	Click the button labelled *OK* on the screen.

1.6.2 Lists

Lists which need only be highlighted typographically are shown using bullet points:

Example:

- Screen
- Keyboard

1.6.3 Operation and Work Steps

Instructions which serve to depict a chronological process (work steps) in operation and maintenance are listed with Arabic numerals followed by a period (e.g., 1., 2., 3. etc.).

Example:

1. Unlock and open the cabinet door.
2. Check the power supply.
3. Close and lock the cabinet door.

1.7 Numbering of Illustrations

1.7.1 Captions

Illustrations are labelled with the relevant section number, followed by a hyphen and a consecutive Arabic numeral:

Example:

Fig. 3-5: Illustration title

Consecutive number

Section number (top level)

1.7.2 Location Numbers

Location numbers are used in some illustrations in order to indicate specific parts shown in an illustration. The explanations for each location number are shown in a table directly below the caption. These tables are not included in the index of tables. Where additional details are provided, the elements referenced are colour-coded.

Example:

Fig. 1-1: Examples of Location Numbers

1	Fixing screws
2	Power supply

Where the text makes reference to location numbers in an illustration, the location number and the illustration number are indicated in parentheses.

Examples:

Power supply (**2**, Fig. 1-1)

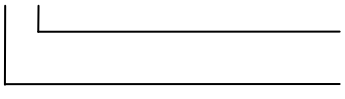
Fixing screws (**1**, Fig. 1-1)

1.8 Table Numbering

Tables are numbered with the relevant section number followed by a hyphen and a consecutive Arabic numeral:

Example:

Tab. 3-5: Title of table



Consecutive number

Section number (top level)

---------- END OF SECTION ----------

2 eXTRAS SOLO Concept

This section provides an overview of the eXTRAS SOLO concept. It also describes the functional scope of the unit within an eXTRAS FR400 network.

The eXtensible Trunked Radio System (eXTRAS) SOLO meets all of the requirements relevant to a terrestrial trunked radio (TETRA) cell.

The eXTRAs SOLO is a 25 W single carrier stand-alone TETRA base station. It can be operated free standing or integrated in a 19" rack. It provides 4 logical channels and supports all TETRA functionality. Two co-located (up to one meter apart) SOLO base stations can be inter-connected in a master slave configuration to support two carrier operation (8 logical channels).

It can operate either in stand-alone mode or as part of a networked configuration (multi-site with central equipment) where it is able to provide single cell operation even when it is isolated from the rest of the network.

The descriptions in this manual provide information which generally applies to eXTRAS SOLO. Individual projects may exhibit specific differences. For a detailed description of project-specific details, please refer to the system specification.

The diagrams and explanatory examples in this manual are for illustration purposes only and may differ from what is displayed in operation.

The eXTRAS SOLO is designed on the basis of the TETRA standard. Fig. 2-1 shows the TETRA interfaces and provides references to the relevant ETSI (European Telecommunications Standards Institute) specifications.

Also the network elements in an eXTRAS FR400 system and their logical interfaces are derived on that basis.

Fig. 2-2 shows an overview of a eXTRAS SOLO with a connected service notebook.

If necessary the eXTRAS SOLO will use TCP/IP connections to individual network nodes (e.g. a second eXTRAS SOLO for a two carrier base station, or to connect the service notebook).

Also the external communication (e.g. eXTRAS SOLO used with an eXTRAS FR400 network) is based on VoIP and for the system internal signalling TCP/IP is used. In this case SIP is supported by the gateway to connect external networks. In general the voice transmission is done with RTP in an eXTRAS FR400 network.

Fig. 2-4 shows an eXTRAS system overview containing an eXTRAS SOLO and all advanced network elements and logical interfaces. This overview covers medium-sized to large systems. In the diagram, the circle encompasses the entire TETRA infrastructure. The elements shown outside of the circle refer to the subscribers and external network elements connected to the system. The diagram shows a system implementation without redundancy in the base stations or switch. Logical interfaces are shown with double-ended arrows, while physical interfaces are indicated by straight lines

connecting the objects. Interfaces which go beyond the system's boundaries are open and can be used by the customer.

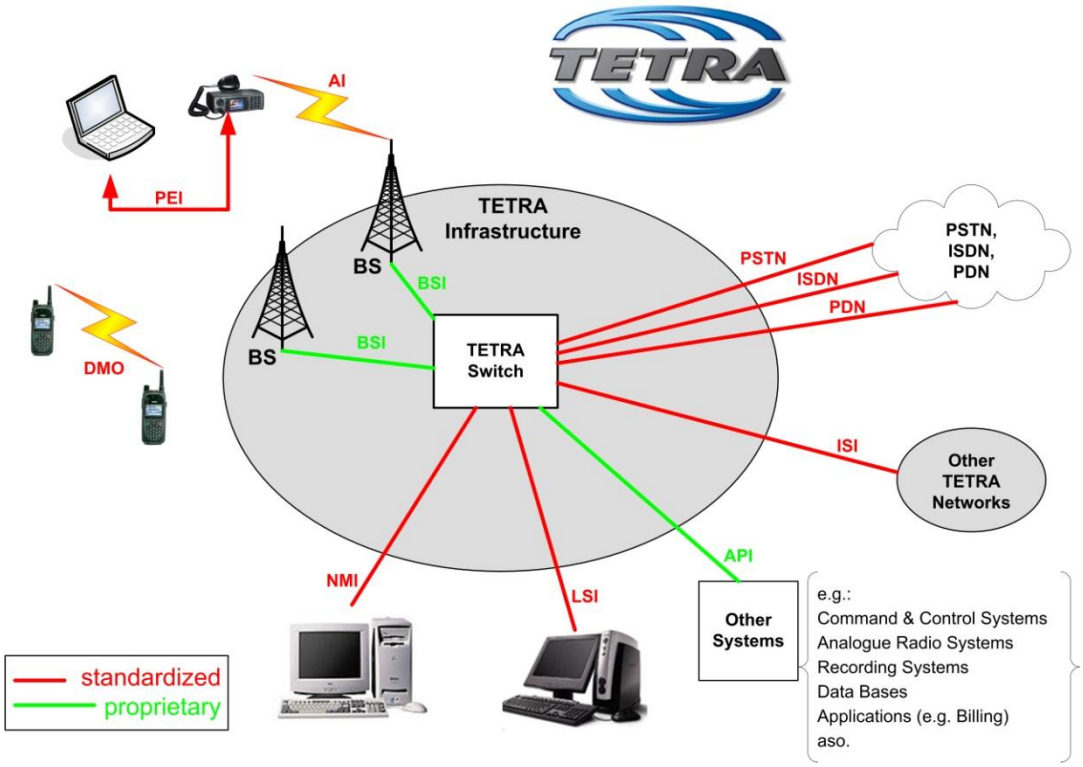


Fig. 2-1: TETRA Interfaces

AI	Air Interface, ETS 300 392-2
API	Application Programming Interface
BSI	Base Station Interface
DMO	Direct Mode, ETS 300 396-1 … 10
ISDN	Integrated Services Digital Network, ETS 300 392-4-2
ISI	Inter System Interface, ETS 300 392-3
LSI	Line Station Interface
NMI	Network Management Interface
PDN	Packet Data Network, ETS 300 392-4-3
PEI	Peripheral Equipment Interface, ETS 300 392-5
PSTN	Public Switching Telephone Network, ETS 300 392-4-1

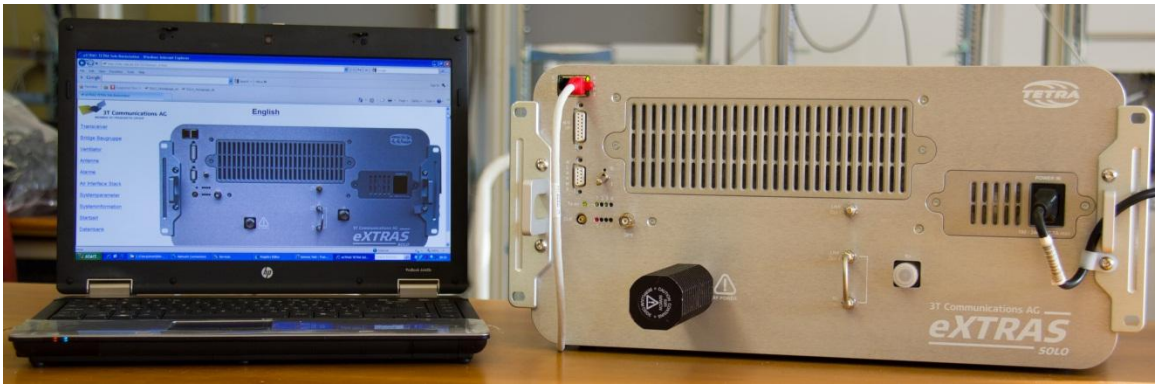
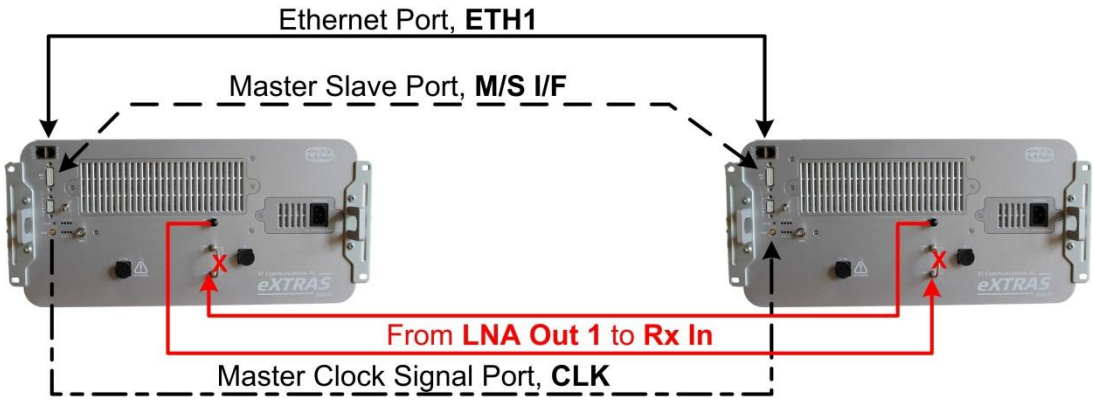


Fig. 2-2: eXTRAS SOLO with Service Notebook

Fig. 2-3 shows a sample overview of a two carrier eXTRAS SOLO configuration.



X: remove loop connection and terminate **LNA Out 2** port with 50 Ω !

Fig. 2-3: eXTRAS SOLO, Overview Two Carrier Configuration

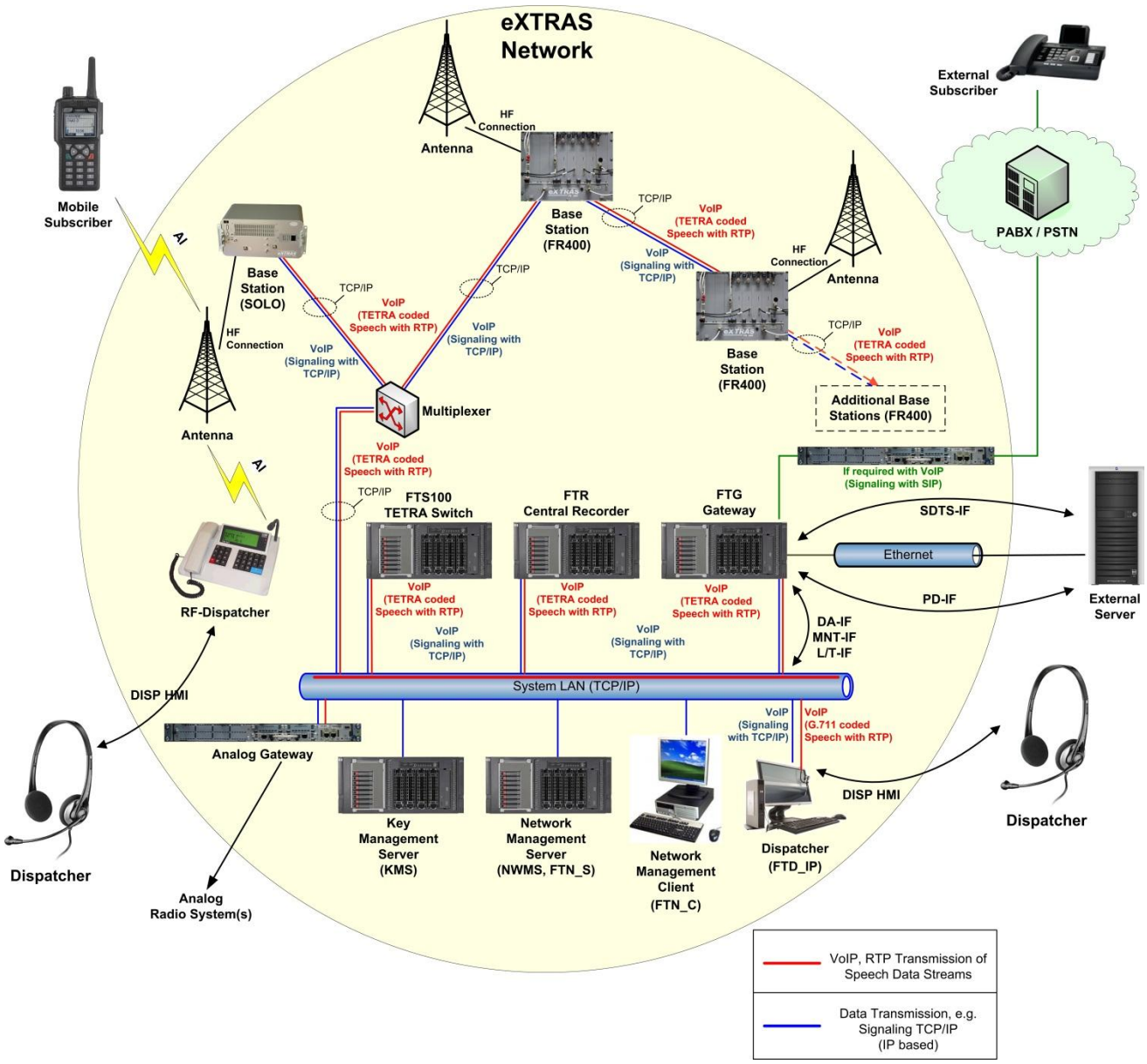


Fig. 2-4: eXTRAS Network Elements and Logical Interfaces without Redundancy

AI	Air Interface
DA-IF	Dispatcher Access Interface
DISP HMI	Dispatcher Human Machine Interface
L/T-IF	Logging and Tracing Interface
MNT-IF	Maintenance Interface
NWMC	Network Management Client
NWMS	Network Management Server
PABX	Private Automatic Branche Exchange
PD-IF	Packet Data Interface
PSTN	Public Switching Telephone Network
SDTS-IF	Short Data Transport Service Interface

Tab. 1-1 provides a full overview of all system components in an eXTRAS system. In smaller systems, not all of these components are deployed.

System Component	Description
Base Station *SOLO*	The *SOLO* Base Station implements a single TETRA cell in the *eXTRAS* system and all layers of the TETRA Air Interface. One carrier frequency is integrated on one *SOLO*. A two carrier cell can be supported by adding a second *SOLO*.
Base Station *FR400*	The *FR400* Base Station implements a single TETRA cell in the *eXTRAS* system and all layers of the TETRA Air Interface. Up to four carrier frequencies can be integrated on one *FR400* rack.
TETRA Switch *FTS100*	The *FTS100* Switch is used to handle TETRA-encoded voice packets. The switch handles packets not only for the connected base stations, but also for the connection to the *Gateway(s)*. Where a Central Recorder is implemented, the TETRA-encoded voice packets (RTP) are forwarded to the recorder via the switch.
Gateway *FTG_64*	The *FTG_64* Gateway provides voice interfaces (e.g., ISDN, Dispatcher LAN, VoIP) and data interfaces (e.g., SDS, PD). It is also a central network element in the administration of an *eXTRAS* system. The number of Gateways is depending on system size and reliability. The integration of a Gateway can be done on a TETRA Switch *FTS100* or an indipendent server.
Dispatcher *FTD_IP*	The *FTD_IP* Dispatcher is a TETRA subscriber with enhanced features and allows full access to voice calls, SDS and subscriber data. The dispatcher can monitor multiple groups (up to 10) simultaneously, and as an additional option it can be used to manage dynamic groups (DGNA).
NWM Server *FTN_S*	The *FTN_S* Network Management Server (NWM) provides the *FTN_C* Network Management Client with monitoring data and functions for the *eXTRAS* system.
NWM Client *FTN_C*	The *FTN_C* Network Management Client provides the user with access to monitoring functions for the *eXTRAS* system.
Central Recorder *FTR*	The *eXTRAS* system also supports an optional *FTR* Central Recorder. The Central Recorder records TETRA-encoded voice packets, converts them into WAV format and provides playback functionality.
Key Management Centre *KMC*	The *eXTRAS* Key Management Centre (*KMC*) uses a server to manage the keys for the TETRA Encryption Algorithm (TEA).

Tab. 2-1: eXTRAS System Components

---------- END OF SECTION ----------

3 Component Identification

This section shows the various views of the eXTRAS SOLO and describes all elements of the unit.

3.1 Front View

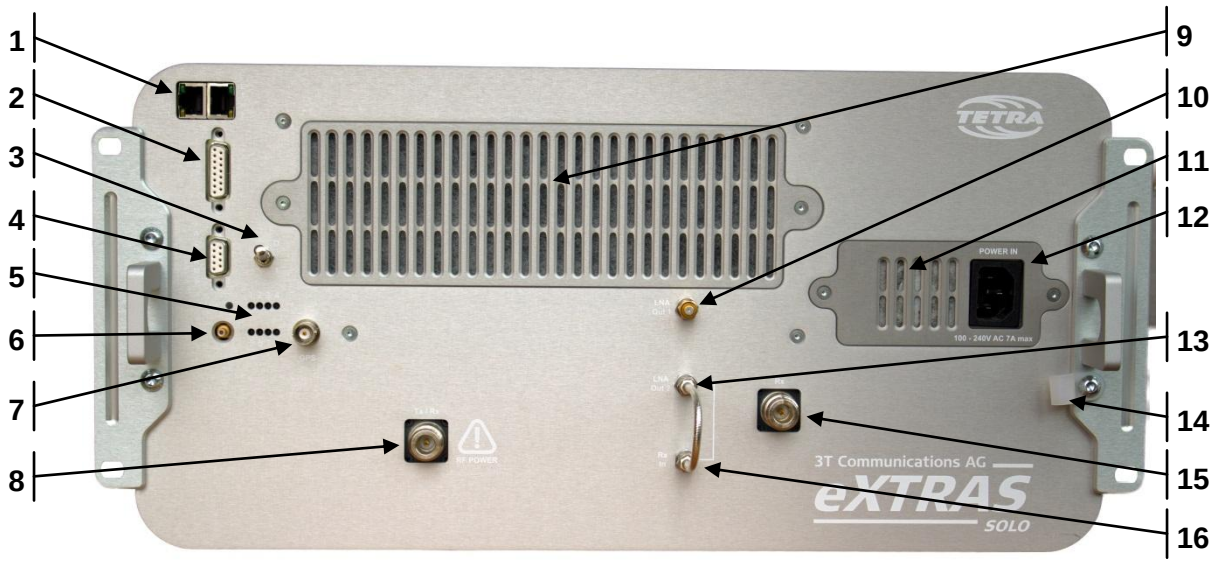


Fig. 3-1: eXTRAS SOLO Front View

1	Ethernet ports 1 & 2
2	Master slave interface
3	Power ON/OFF switch
4	Alarms (I/O)
5	LED indications
6	Clock port
7	GPS-antenna input
8	RF in-/output
9	Large Ventilation Grid
10	LNA output 1
11	Small Ventilation Grid
12	Power supply connector
13	LNA output 2
14	Power Cord Retainer
15	RF diversity input
16	Rx Input

3.2 Side View

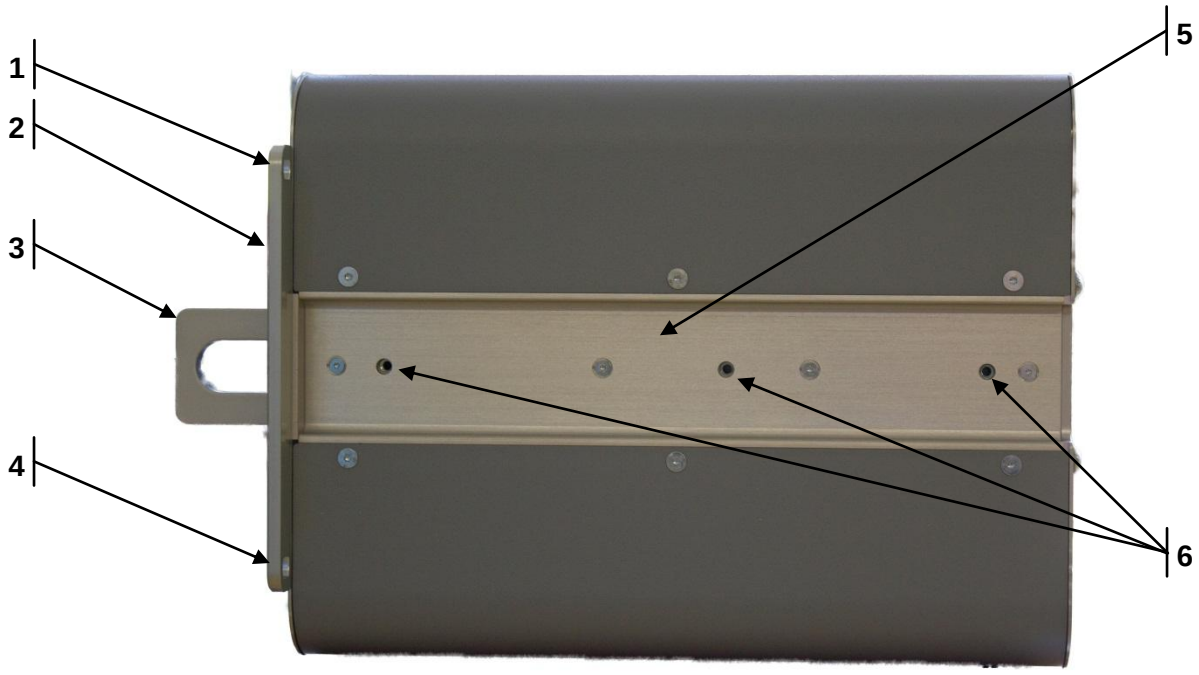


Fig. 3-2: eXTRAS SOLO Side View

1	Upper hole for 19” rack mounting
2	Rack bracket
3	Rack handle
4	Lower hole for 19” rack mounting
5	Slide rail guide
6	3 x M4 for slide rail fixing (optional)

3.3 Rear View

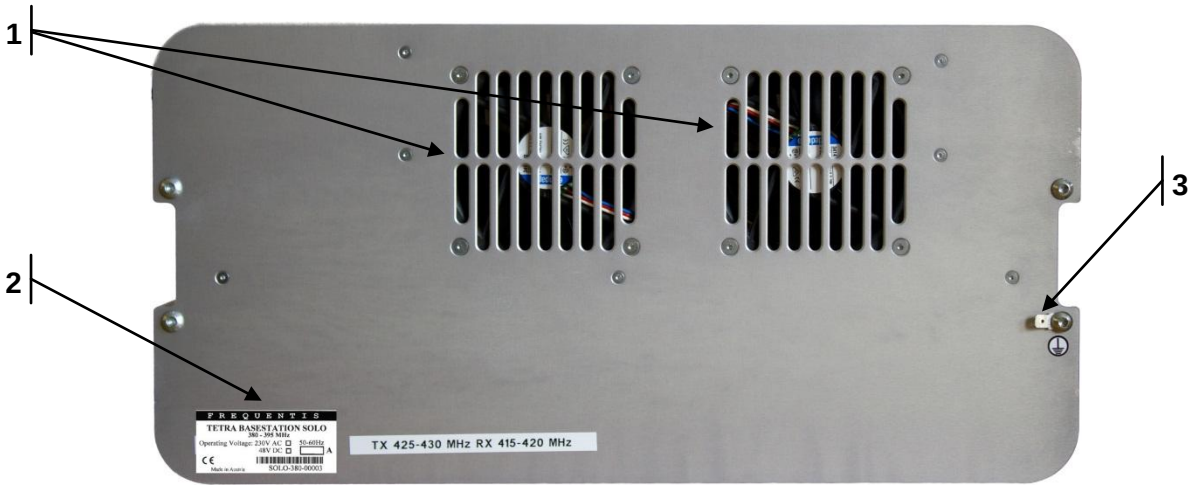


Fig. 3-3: eXTRAS SOLO Rear View

1	Ventilation Grids
2	Product label (e.g. serial number, bandwith)
3	Housing grounding point (for rack mounting)

3.4 LED Indications

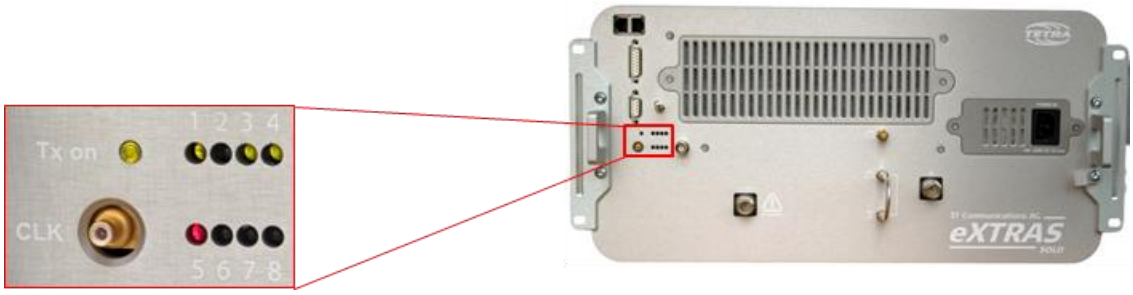


Fig. 3-4: eXTRAS SOLO LED Indications

LED	State	Colour	**Description** (yellow background indicates status after start up for stand-alone SOLO with GPS)
Tx on	ON	GREEN	The RF transmitter output (**Rx/Tx**) is activated
	OFF		The RF transmitter output (**Rx/Tx**) is deactivated
1	ON	GREEN	Power switch turned on (**1**), power supply OK
	ON	RED	Power supply failure
	ON	ORANGE	Mains is applied, power switch turned off (**0**)
	OFF		Mains is not connected
2	OFF		Unused
3	ON	GREEN	Master unit
	ON	RED	Used for internal tests only
	ON	ORANGE	Slave unit
	OFF		Power switch turned off, or initialisation
4	ON	GREEN	GPS signal *locked* and TETRA synchronization established
	ON	ORANGE	GPS signal *locked*, but TETRA synchronization not established
	ON	RED	GPS signal not *locked*
	OFF		Initialization state (at start-up) or GPS function is deactivated
5 *6* *7* *8*	ON	RED	MCCH, SCCH, or PDCH are assigned to the corresponding time slot
	ON	GREEN	A call has been established in the corresponding time slot (active, PTT activated)
	ON	ORANGE	A call has been established in the corresponding time slot (inactive, without PTT)
	OFF		The corresponding time slot is not busy

Tab. 3-1: LED Interpretation

---------- END OF SECTION ----------

4 Setup

This section discusses the safety precautions to be taken and the fundamentals of eXTRAS SOLO on-site integration and start up.

4.1 Warnings to Users

Before working with the eXTRAS SOLO, familiarize yourself with the Safety Guidelines (see section 1.4.1).
Also observe local rules and regulations when working with the eXTRAS SOLO.

The default AC power supply supports operation in the range of 100 V ... 240 V AC. Consider the maximum current of 7A for the mains power supply.

Use a grounded (earthed) electrical outlet.

Do not operate the eXTRAS SOLO outdoor or in humid environment.

Keep ventilation grids clear. Don't place furniture, boxes, or other items where they will block airflow.

Always unplug mains before working on eXTRAS SOLO and then follow the appropriate procedures.

Only authorized persons with the appropriate knowledge and specific training may work on the system.

The hazardous RF-voltages of this unit may cause injury. To prevent electrical shock and/or RF-burns, never operate this equipment if its covers are removed!

Always ensure that the correct power supply voltages are used.

4.2 Periodic Maintenance

The following procedures should be performed at regular intervals. As certain tasks (such as changing air filters) depend on the conditions prevailing at the location of eXTRAS SOLO, a general time interval cannot be specified in all cases. The following activities must be included in the system's maintenance schedule:

- Check of system status using the service notebook with the eXTRAS SOLO homepage (see section 5.1).
- Visual inspection of eXTRAS SOLO and the cabling
  (e.g., for soiling, kinked cables, loose connectors).
- Check and replace air filters of eXTRAS SOLO
  For more information on this procedure, refer to *Instructions* (see section 7.2).

4.3 eXTRAS SOLO Monitoring

The eXTRAS SOLO is monitored with the service notebook and the eXTRAS SOLO homepage (for details see section 5.1).

The purpose of eXTRAS SOLO monitoring is to determine the current state of the base station and to retrieve node information.

Operational events are protocolled in the log files. The log files are stored locally (for details see section 5.2).

For an eXTRAS SOLO operated in a FR400 network SNMP traps are transmitted to and stored on the Network Management Server at regular intervals. This information is displayed using the SNMPc Client application.

4.4 Environment

The eXTRAS SOLO is designed to meet stringent environmental requirements for communication systems in multiple areas of application and to ensure compliance with the corresponding national and international standards. The system complies with the following requirements:

- Electrical: the equipment's resistance to the electrical environment, such as variations in the power supply or electromagnetic influences which might affect the equipment.
- Ambient: the equipment's resistance to effects from the surrounding environment in which the equipment is operated in accordance with relevant operational and technical specifications.
- Emissions: the environment generated by the equipment itself (also known as "emission characteristics"), which can have an effect on humans and other equipment.

The eXTRAS SOLO is generally designed to operate in an environment in which other electrical and electronic equipment such as navigation aids, radar systems as well as VHF/UHF radio transmitters and receivers are operated. Therefore, the system's susceptibility and emission characteristics ensure a high degree of electromagnetic compatibility (EMC).

4.4.1 Temperature

The environment in which eXTRAS SOLO operates is an important factor. The temperature should be regulated to ensure proper operation. Excessively high environmental temperatures reduce the life span of electronic equipment and may cause permanent damage.

The eXTRAS SOLO was tested in the environment described in Tab. 4-1 without any damage, malfunction or reduction in performance. This meets the requirements of the IEC 60068 standard.

Operating Temperature	
Base Station eXTRAS SOLO	-10°C ... +55°C
Service Notebook	+5°C ... +35°C

Tab. 4-1: Operating Temperature

4.4.2 Humidity

The eXTRAS SOLO was tested in the environment described in Tab. 4-2 without any damage, malfunction or reduction in performance. This meets the requirements of the IEC 60068 standard.

Operating Humidity	
Humidity	5% ... 95% (without dewing)
Service Notebook	10% ... 90%

Tab. 4-2: Operating Humidity

4.4.3 Corrosion

The equipment should not be directly exposed to corrosive environments. If the equipment site is located in a coastal area, proper air filtration for the site should be in place to protect the equipment from salt mist contamination.

4.4.4 Air Quality

The eXTRAS SOLO works properly in spaces where the air is comparable to the environment in normal offices, business premises or equipment rooms with average air conditioning systems.

4.5 Electrical Installation

This section covers all of the topics relevant to the electrical installation of the eXTRAS SOLO.

4.5.1 Power Consumption

The eXTRAS SOLO is supplied by specially designed, wide-range power supply. The device meets the applicable standards (EN 60950-1:2006 and A1:2010) and ensures reserves as well as a high level of performance. Within the following range, the devices work properly without loss of performance:

Power consumption for each eXTRAS SOLO base station is less than 185 W.

Tab. 4-3 shows details on the power supply to the SOLO base station for alternating current.

Power Supply	Input Range
Nominal voltage 230 V AC	100 V ... 240 V
Frequency range	45 Hz ... 66 Hz

Tab. 4-3: eXTRAS SOLO, AC Power Supply

4.5.1.1 Service Notebook

Tab. 4-4 shows details on the power supply for the service notebook.

Power Supply	Input Range
Nominal voltage	120 V / 230 V
Frequency range	50 Hz / 60 Hz
Power Consumption (depending on the device configuration)	ca. 55 W

Tab. 4-4: Service Notebook, AC Power Supply

4.5.2 Cabling

Observe the local cabling requirements which apply in each country.

4.5.3 Equipotential Bonding and Grounding Requirements

Always ensure that the grounding installed in the building is reliable for the protection of internal wiring (i.e., designed for the maximum intended over current protection rating).

For electrical safety reasons as well as ensuring the reliable operation of the eXTRAS SOLO, it is important to ensure that the housing is grounded properly. In this context, it is necessary to distinguish between two types of grounding (i.e., protective and functional grounding).

Use a grounded (earthed) electrical outlet.

4.5.3.1 Labelling

The part of the eXTRAS SOLO which is labelled as properly grounded (rear side) must remain connected to the grounding system at all times.

The following labels are used:

Protective grounding conductor (IEC 417 No. 5019a). This symbol must not be used for other grounding points.

4.5.3.2 Protective Grounding

In case of an insulation failure, the safety standards require that any parts of the equipment which are accessible, can act as conductors, and may carry a hazardous voltage must be:

- securely connected to a protective grounding point within the system; or
- kept at a safe distance from those voltages by reinforced insulation.

Protective grounding points as well as lines which come into contact with protective ground connections must be corrosion-resistant.

In order to protect personnel against electrical hazards from the cabinet equipment, the ground lines in the power cables must be used. Each power supply must provide its own grounding (protective grounding) according to EN 60950 or IEC 950 (and according to national regulations, where applicable).

The resistance of the grounding connection between any grounding contact and any part that requires grounding must not exceed 0.1 Ω (without PE resistance itself).

4.5.3.3 Housing Connection

The ground conductor of the respective power cable is used for protective grounding purposes. In addition to this ground wire, eXTRAS SOLO base station housing must be generally grounded for EMI purposes if integrated in a cabinet.

For this purpose, the single-point grounding method (where each eXTRAS housing is grounded with a master ground using its own ground wire) is to be used. Grounding is to be realized using green-yellow insulated wires.

eXTRAs SOLO base station housing is equipped with a grounding point to ensure a reliable grounding connection (see **1**, Fig. 4-1). Use a blade terminal connector and connect a cable min. 2,5 mm^2.

Fig. 4-1: Housing Grounding Point

1	Housing grounding point

4.6 Connection of Power Supply (Mains)

The eXTRAS SOLO base station is supplied with 120 V / 230 V AC. The eXTRAS SOLO and the service notebook are connected to the building's AC power supply.

eXTRAS SOLO is delivered with one power cord 2 meters long.

The customer is responsible for providing an AC power source which is easily accessible within two meters of eXTRAS SOLO.

Before connecting this equipment, be sure to check each device's specification label. Do not connect the devices if the AC power supply does not match their specifications.

Do not connect an eXTRAS SOLO to a DC power supply.

eXTRAS SOLO is delivered with a power cable (see Fig. 4-2) which must be connected to an AC power source at the customer site.

Fig. 4-2: Power Cable for eXTRAS SOLO

Connect the power cable plug (**1**, Fig. 4-2) to the related eXTRAS SOLO (**1**, **POWER IN**, Fig. 4-3) on the front panel of the unit.

Fix the cable with the cable retainer (**2**, Fig. 4-3) and connect the power cable's other plug (**2**, Fig. 4-2) to the AC power outlet (mains).

Fig. 4-3: Power Connector for eXTRAS SOLO

4.7 Space Requirements eXTRAS SOLO

The eXTRAS SOLO is equipped with 4 feet (H= 5 mm) resulting in a total height of the unit of 230 mm. See figure Fig. 4-4 for the required footprint.

All connectors are accessible via the front.

To ensure the air flow of the ventilators consider 200 mm clearance to obstacles at the rear. The following surface area is required for the SOLO base station:

450 mm (width) x 290 mm (depth) x 230 mm (height)

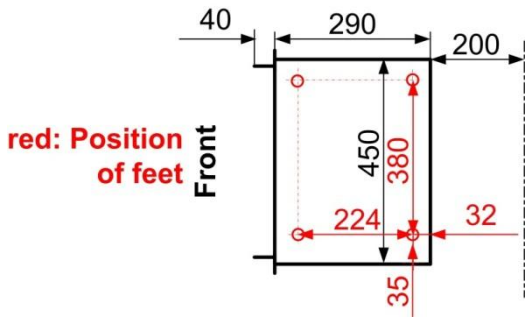


Fig. 4-4: Space Requirements for eXTRAS SOLO (Base View)

We recommend leaving approximately 0.5 m of free space around the unit.

Keep ventilation grids clear. Don't place furniture, boxes, or other items where they will block airflow.

4.8 Space Requirements Service Notebook

The following area is required for the service notebook:

339 mm (width) x 236.2 mm (depth) x 33.8 mm (height)

4.9 Start Up

To start operation of the eXTRAS SOLO, refer to the Quick Start Guide (EX0D07 EN100).

---------- END OF SECTION ----------

5 Operations

This section describes the eXTRAS SOLO homepage which is used for monitoring the unit. Additional the log files are described which give access to the so called service records (call data).

5.1 SOLO Homepage (Status Information)

The eXTRAS SOLO homepage is used to monitor the base station, diagnose potential problems and gather statistical data. The homepage supports the following hyperlinks to retrieve the related information:

- Transceiver see section 5.1.2
- Bridge Card see section 5.1.3
- Fan see section 5.1.4
- Antenna see section 5.1.5
- Alarms see section 5.1.6
- Air Interface Stack see section 5.1.7
- System Parameters see section 5.1.8
- System Information see section 5.1.9
- Start Time see section 5.1.10
- Database see section 5.1.11

Use the Windows internet explorer of the service notebook to access the eXTRAS SOLO homepage.

Connect the LAN port of the service notebook to the *ETH2* port (**1**, Fig. 3-1) of the eXTRAS SOLO.

5.1.1 Launching the Homepage

Depending on the implementation, it may be necessary to log in to Windows in order to use the service notebook.

Launch the Windows internet explorer and use the prepared favourites to open either the English or German eXTRAS SOLO homepage.

Fig. 5-1 shows an example of the eXTRAS SOLO homepage.

Fig. 5-1: eXTRAS SOLO Homepage (Example)

1	Hyperlinks to retrieve the related information
2	Favourites Symbols

5.1.2 Transceiver

Tab. 5-1 shows an example of the data related to the eXTRAS SOLO integrated transceiver module (referred as *tr-11*).

Row ID	carrier-number	usage	cell-idx	state	mode	power-state	tx-frequency	rx-frequency	trust-value	alarm
tr-11	920	2	0	NORMAL_OPERATION__0	TETRA__1	POWER_ON__1	423000000	413000000	100	no alarms

Tab. 5-1: Transceivers Table

Row ID	Element identification the details of the row refer to.
carrier-number	Used carrier number of the transceiver module based on the used bandwith/frequencies according to the TETRA AI standard.
usage	Current transceiver usage mode
cell-idx	Index of the radio cell.
state	Current state of the transceiver module.
mode	Mode of transceiver operation.
power-state	Current status of the transceiver module output.
tx-frequency	Specifies the transmit frequency (download) of the eXTRAS SOLO transceiver module (in Hz) with the frequency offset.
rx-frequency	Specifies the receive frequency (upload) of the eXTRAS SOLO transceiver module (in kHz) with the frequency offset.
trust-value	Not used in stand-alone operation.
alarm	Current alarm status of the transceiver module.

5.1.3 Bridge Card

Tab. 5-2 shows an example of the data related to the integrated bridge card.

Row ID	name	value	description
LED-8	GPS	0	GPS not fitted or GPS status cannot currently be determined
LED-7	TTIME	1	TTimeMaster - Hyperframe pulse output on COM1
LED-6	14.4MZ	0	14.4 MHz Oscillator is used on the bridge
LED-5	RESERVED	0	-
LED-4	TX-4	0	Transceiver not inserted
LED-3	TX-3	0	Transceiver not inserted
LED-2	TX-2	0	Transceiver not inserted
LED-1	TX-1	3	Transceiver is running

Tab. 5-2: Bridge Card Table

Row ID	Element identification the details of the row refer to.
name	Assigned name of the element.
value	Current value of the element.
description	Details regarding the element.

LED-2, -3, -4 and -5 are not used for the eXTRAS SOLO.
The LED elements in this list are not the LEDs on the front side of the eXTRAs SOLO.

5.1.4 Fan

Tab. 5-3 shows an example of the data related to the integrated fans of the eXTRAS SOLO.

Row ID	event	value	description
Bit-7	General Error	0	not signaled
Bit-6	Fan 0 Stopped	0	not signaled
Bit-5	Fan 1 Stopped	0	not signaled
Bit-4	Reserved	0	-
Bit-3	Reserved	0	-
Bit-2	Tachometer Overflow	0	not signaled
Bit-1	Reserved	0	-
Bit-0	Reserved	0	-

Tab. 5-3: Fans-SOLO Table

Row ID	Element identification the details of the row refer to.
event	Assigned event of the element.
value	Current value of the element.
description	Details regarding the element.

5.1.5 Antenna

Tab. 5-4 shows an example of the antenna properties.

Name	Value
output-power	1000
diversity	0

Tab. 5-4: Antenna Properties

Name	Parameter name
Value	Current value of the parameter.

Tab. 5-5 describes the interpretation of the information.

output-power	Current transceiver module output power in mW (in the example above 1 W, 30 dBm)
diversity	Current operation with both antenna inputs (= *0,* diversity, default) or without diversity (= *1*).

Tab. 5-5: Antenna Interpretation

5.1.6 Alarms (System Status)

Tab. 5-6 shows an example of the alarm list. Not all list entries are used in stand-alone operation.

Row ID	current-state	entry-time	info
alarms:BSC-PLL_43	OFF	never	
alarms:BSC-PLL_16	OFF	never	
alarms:BSC-GPS_UNLOCK	OFF	never	Sent 2 traps (rep) - finished
alarms:BSC-TETRA_TIME_UNLOCK	OFF	never	Sent 2 traps (rep) - finished
alarms:BSC-EXT_1	OFF	never	Sent 2 traps (rep) - finished
alarms:BSC-EXT_2	OFF	never	Sent 2 traps (rep) - finished
alarms:BSC-EXT_3	OFF	never	Sent 2 traps (rep) - finished
alarms:BSC-EXT_4	OFF	never	Sent 2 traps (rep) - finished
alarms:BSC-DCDC_TEMP	OFF	never	
alarms:BSC-DCDC_GEN	OFF	never	
alarms:BSC-UNKNOWN_1_10	OFF	never	
alarms:BSC-UNKNOWN_1_11	OFF	never	
alarms:BSC-DUPLEX_FILTER_REVERSE_POWER	OFF	never	Sent 2 traps (rep) - finished
alarms:BSC-LNA_3	OFF	never	Sent 2 traps (rep) - finished
alarms:BSC-LNA_2	OFF	never	Sent 2 traps (rep) - finished
alarms:BSC-LNA_1	OFF	never	Sent 2 traps (rep) - finished
alarms:BSC-PLL_25	OFF	never	
alarms:BSC-PLL_14_pt_4	OFF	never	
alarms:BSC-FANS_SOLO	OFF	2012/02/16 11:00:23-0406	
alarms:BSC-UNKNOWN_2_03	OFF	never	
alarms:BSC-UNKNOWN_2_04	OFF	never	
alarms:BSC-UNKNOWN_2_05	OFF	never	
alarms:BSC-UNKNOWN_2_06	OFF	never	
alarms:BSC-UNKNOWN_2_07	OFF	never	
alarms:BSC-PSU_DEGRADATION_SOLO	OFF	never	
alarms:BSC-PSU_FAIL	OFF	never	
alarms:BSC-UNKNOWN_2_10	OFF	never	
alarms:BSC-UNKNOWN_2_11	OFF	never	
alarms:BSC-UNKNOWN_2_12	OFF	never	
alarms:BSC-UNKNOWN_2_13	OFF	never	
alarms:BSC-UNKNOWN_2_14	OFF	never	
alarms:BSC-BSC_BRIDGE	OFF	never	
status:BSC-restart	ON	2012/02/16 10:33:55-0906	Sent 1 traps - finished
alarms:AIRM-TR[11]-TX_PA	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-TX_FGEN	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-TX_CLIP	OFF	2012/02/16 10:33:47-0781	Sent 2 traps - finished
alarms:AIRM-TR[11]-TX_REG	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-TX_WATCHDOG	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-TX_TEMP	OFF	2012/02/16 10:33:47-0781	

alarms:AIRM-TR[11]-TX_REFLECT	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-TX_CRC	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-TX_I2C	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-UNKNOWN_1_09	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-UNKNOWN_1_10	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-TX_ME_SAP	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-TX_POWER_RANGE	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-TX_FREQ_RANGE	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-TX_DSP_INIT	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-TX_DSP_DOWNLOAD	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-RX_PSU	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-RX_FGEN	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-RX_CRC	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-RX_I2C	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-UNKNOWN_2_04	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-UNKNOWN_2_05	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-UNKNOWN_2_06	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-FANS_STOPPED_SOLO	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-BRIDGE_BLOCKING	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-DSP_NOT_START	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-RX_ME_SAP	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-RX_FREQ_RANGE	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-RX_DSP_INIT	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-RX_DSP_DOWNLOAD	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-IF_BSC_UMAC	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-IF_UMAC_LMAC	OFF	2012/02/16 10:33:47-0781	
alarms:AIRM-TR[11]-RX_INTERFERENCE	OFF	2012/02/16 10:33:47-0781	Sent 2 traps - finished
alarms:AIRM-TR[11]-TX_INTERFERENCE	OFF	2012/02/16 10:33:47-0781	Sent 2 traps - finished
status:AIRM-TR[11]-HW	OPERATIONAL	2012/02/16 10:32:27-0781	Sent 2 traps - finished
status:AIRM-TR[11]-OPER	UP	2012/02/16 10:32:28-0765	Sent 2 traps - finished
status:AIRM-TR[11]-tx-power	POWER_ON	2012/02/16 10:33:55-0906	Sent 2 traps - finished
status:AIRM-TR[11]-restart	ON	2012/02/16 10:32:27-0781	Sent 2 traps - finished

Tab. 5-6: Alarms Information

Row ID	Element identification the details of the row refer to.
current-state	Current state of the alarm element.
entry-time	Time stamp when the alarm element occured (hh:mm:ss-milliseconds).
info	Details regarding the alarm event. Not in stand-alone operation.

All *AIRM-TR[11]- alarms should be in *OFF* state.**

Otherwise call your technical support team.

The following alarms are important for the stand-alone operation:

- BSC_GPS_UNLOCK — Lock of GPS signal lost.
- TETRA_TIME_UNLOCK — TETRA hyperframe not GPS synchronised.
- BSC_DCDC_TEMP — Temperature alarm of the power supply.
- BSC_LNA1 — Low noise amplifier alarm.
- BSC_FANS_SOLO — Alarm of the integrated fans.
- BSC_PSU_DEGRADATION_SOLO — Power supply failure.
- BSC_PSU_FAIL — Power supply failure.
- BSC_BSC_BRIDGE — Internal component failure.
- BSC_restart — Restart event of the eXTRAS SOLO.
- AIRM-TR[11]-HW — Hardware alarm of the transceiver module.
- AIRM-TR[11]-OPER — Operational status of the transceiver module.
- AIRM-TR[11]-tx-power — Output power status of the transceiover module.
- AIRM-TR[11]-restart — Restart event of the transceiver module.

5.1.7 Air Interface Stack

Tab. 5-7 shows an example of the air interface stack properties.

Name	Value
stack-init-status	down
stack-current-status	UP
stack-admin-status	UP

Tab. 5-7: Air Interface Stack Properties

Name	Parameter name
Value	Current value of the parameter.

Tab. 5-8 describes the interpretation of the information.

stack-init-status	Current status of the stack initialisation process.
stack current status	Current operational status of the air interface stack.
stack-admin-status	Current administration status of the air interface stack.

Tab. 5-8: Air Interface Stack Interpretation

5.1.8 System Parameters

Tab. 5-9 shows an example of the system parameters properties.

Name	Value
name	Test
group-check-time	60
infinite-call-duration	28800
init-tx-priority-private	1
init-tx-priority-group	1
sdic-inactivity-timeout	7
sdic-transmission-timeout	45
gateway-setup-time	10
default-setup-time	4
max-queue-time	600000
forward-on-no-reply-timeout	10000
gateway-forward-on-no-reply-timeout	10000
group-status-only-to-dispatcher	false
MCC	250
MNC	111

Tab. 5-9: System Parameters Properties

Name	Parameter name
Value	Current value of the parameter.

Tab. 5-8 describes the interpretation of the information.

name	Current node name of the eXTRAS SOLO
group-check-time	Timer for the internal group context management.
infinite-call-duratioon	Specifies the maximum call duration for all types of calls. After this period of time (indicated in seconds), active calls are terminated by the system. A value of *28800* is approximately 8 hours.
init-tx-priority-private	Specifies the initial transmit priority for private half-duplex calls. This parameter should match the U-TX demand transmit priority configuration on mobile devices. *0* = Low priority, *1* = High priority, *2* = Pre-emptive priority
init-tx-priority-group	Specifies the initial transmit priority for group calls. This parameter should match the U-TX demand transmit priority configuration on mobile devices. *0* = Low priority, *1* = High priority, *2* = Pre-emptive priority
sdic-inactivity-timeout	Specifies the inactivity timeout [in s] for individual half-duplex calls. The timer starts if there is no PTT activity during a half-duplex individual call. If a party presses PTT before a timeout, the timer is stopped. As soon as the timeout threshold is reached, the call is disconnected by the system.
sdic-transmission-timeout	Specifies the transmission timeout [in s] for individual half-duplex calls. The timer starts when a party presses PTT. When the transmitting party releases the PTT button before the timeout, the timer is stopped. As soon as the timeout threshold is reached, the party is disconnected by the system.
gateway-setup-time	Not used for stand-alone operation.

default-setup-time	
max-queue-time	Specifies the maximum queue time [in ms] for calls in the eXTRAS SOLO. If no resources become available within the defined time period, the base station terminates the queued call.
forward-on-no-reply-timeout	Not used for stand-alone operation.
gateway-forward-on-no-reply-timeout	Not used for stand-alone operation.
group-status-only-to-dispatcher	Not used for stand-alone operation.
MCC	Current mobile country code of the eXTRAS SOLO
MNC	Current mobile network code of the eXTRAS SOLO

Tab. 5-10: System Parameters Interpretation

5.1.9 System Information (System Status)

The system information is using the same table as alarms. For details refer to section 5.1.6.

5.1.10 Start Time

Tab. 5-11 shows an example of the start time properties.

Name	Value
base-priority	high
start-time	2012/02/16 10:32:24-0640
version	xbss-vc90.exe, 3.2.40.4, 3424768 bytes, 2012.02.16-08:06:04
cfg-version	*unknown*
db-version	*unknown*

Tab. 5-11: Start Time Properties

Name	Parameter name
Value	Current value of the parameter.

5.1.11 Database

Tab. 5-12 shows an example of the database (subscriber) properties.

Name	Value
nr-total-subscribers	36
nr-registered-subscribers	1
nr-locally-registered-subscribers	1
double-deregistration-ctr	0
double-registration-ctr	0
successful-registration-ctr	1
successful-deregistration-ctr	0
unknown-ssi-registration-ctr	0

Tab. 5-12: Database Properties

Name	Parameter name
Value	Current value of the parameter.

Tab. 5-8 describes the interpretation of the information.

nr-total-subscribers	Total number of subscribers.
nr-registered-subscribers	Total number of registered subscribers.
nr-locally-registered-subscribers	For stand-alone operation should be the same amount as nr-registered-subscribers.
double-deregistration-ctr	Counter of double de-registrated subscribers.
double-registration-ctr	Counter of double registrated subscribers.
successful-registration-ctr	Counter of sucessful registered subscribers.
successful-deregistration-ctr	Counter of sucessful de-registered subscribers.
unknown-ssi-registration-ctr	Counter of unknown ISSI registrations.

Tab. 5-13: Database Interpretation

5.2 Log Files (Call Data / Service Records)

Records of events in the eXTRAS system are kept in log files. These logs make it possible to trace and analyse errors as well as operational processes. The log files are kept electronically. In order to ensure ease of use, these files are stored in ASCII format and can be processed and merged using the import function in other programs (e.g., Office applications). Therefore, the service notebook can be used to analyse the data. The compact form of the log files also makes it easier to archive this information.

For stand-alone eXTRAS SOLO, the log files are stored locally on the base station.

As a default, all network nodes store their log files on the network management server. These files can be found in the following directory:

`C:\Tetra\Work\NWMA\<Network node ID>\Log`

where `<Network node ID>` refers to the relevant network node (e.g., the stand-alone eXTRAS SOLO base station with the name `BS1`).

Cyclic logging: the uncompressed log files are available for the last 31 days.

A zip archive is used to store the last 125 days. The oldest log files are overwritten automatically after 125 days.

In this context, we can distinguish between two types of log files: those which record operational processes (service records), and those which capture eXTRAS status data and are necessary for system analysis.

The list below provides an overview of service records.

- Mobility logging `mobility-<timestamp>.txt`
  Records regarding the mobile subscribers' registration, deregistration and hand over.
- Call logging `calls-<timestamp>.txt`
  Records regarding all types of calls established through the system.
- SDS logging `sds-<timestamp>.txt`
  Records regarding the text or short messages transmitted in the system.
- PD logging `pd-<timestamp>.txt`
  Records regarding the packet data connections established through the system.
- AUTH Logging `auth-<timestamp>.txt`
  Records regarding the authentification of mobile subscribers to the system. Optional, only used if the authentification feature is implemented.

The following status log file is supported:

- Debug logging `debug-<timestamp>.txt`
  Records regarding application data used for the purpose of troubleshooting or identifying errors.

The information of the log files can be used for traffic data analysis. In the context of traffic data analysis, it is important to remember the following critical points:

1. The system time of the eXTRAS SOLO has to be synchronized in order for the data to be merged in system-wide processes.
2. The shorter the time frame for analysis, the easier the analysis is to perform (smaller data volumes) and the cycle buffer will not be overwritten.

For details on the log files, please refer to the following sections

Optional a traffic analysis tool is available, which supports a graphical presentation of the traffic data.

5.2.1 Log File Format

Each line in a log file represents a logged event. The log files are comma-separated text files (ASCII) and can be opened with any standard editor. This makes it easy to import the files for processing in customer-specific applications (e.g., in *Microsoft Excel*).

The name of each log file shows the type and time of the service records. A separate log file is generated for each day. The file name consists of the following parts:

`<Type of log file>.<Year>.<Month>.<Day>.txt`

Each line in the log file which begins with a number sign (#) contains comments only; for example, the header serves to explain individual elements.

Tab. 5-14 shows all of the types of service records supported and the corresponding file names.

File Name	Type	Description
`mobility-<timestamp>.txt`	Mobility logging	Records regarding the registration, deregistration and cell switches of mobile devices.
`calls-<timestamp>.txt`	Call logging	Records regarding all types of calls established through the system.
`sds-<timestamp>.txt`	SDS logging	Records regarding the text or short messages (SDS) transmitted in the system.
`pd-<timestamp>.txt`	PD logging	Records regarding the packet data connections established through the system.
`auth-<timestamp>.txt`	Authenti-fication logging	Records regarding the authentification process of mobile subscribers.
`debug-<timestamp>.txt`	Debug logging	Records regarding application data used for the purpose of troubleshooting or identifying errors.

Tab. 5-14: Overview of Log File Types

5.2.1.1 Format of Log File Entries

Certain elements in service records are the same in all types of log files. Tab. 5-15 provides an overview of those elements.

Format	Element	Description
`<Year>.<Month>.<Day-of-Month>` `<Hour>:<Minute>:<Second>.<ms>`	Log-Creation	This element indicates the time when the service record entry was generated in the system. Usually, this refers to the time when a service was executed, for example after a call is terminated.
`BS-nn` (*nn* identifies the BS) `GW`	Node-ID	ID of network node which generated the entry. This facilitates the merging of various log files from several network nodes. In this way, individual events can be traced back to their source in the network.
`AI` (= BS air interface) `DISP` (= Dispatcher) `ISDN` (= ISDN interface) `SDS-GW` (= SDTS interface)	Stack-ID	Identifies the stack which generated the service record entry.
`<ISSI>@<Stack ID>.<Node ID>`	Subscriber locator	The subscriber locator identifies the subscriber and the corresponding location of the system interfaces. The format is similar to that of an e-mail address. If the location is unknown, the *Stack ID* and *Node ID* elements will contain the string *UNKNOWN*.
`debug-<timestamp>.txt`	Debug logging	Records of application data used for the purpose of troubleshooting or identifying errors.

Tab. 5-15: General Elements

In the *Log creation* element, the date is separated from the time by a space; this must be taken into account in automated analyses of the files.

Where no information is available, the element is left blank (= `,,`).

5.2.2 Service Records

eXTRAS records and stores status and traffic data automatically. The service record data collected is stored in text form in the log files. The following subsections describe and explain how to manage service records.

Each system component which records service data stores the data in the local memory (RAM). In order to avoid exceeding the local capacity, the data is automatically transmitted the network management server's file system or the gateway (depending on the specific configuration).

Depending on the configuration, the individual network nodes will store their service records on the network management server or the gateway. These files can be found in the following directory:

`C:\Tetra\Work\NWMA\<Network node ID>\Logs`

where `<Network node ID>` refers to the relevant network node (e.g., the stand-alone eXTRAS SOLO base station with the name `BS1`).

For stand-alone systems, the log files are stored locally on the base station in cases where no gateway is available.

Cyclic logging: the uncompressed log files are available for the last 31 days.

A zip archive is used to store the last 125 days. The oldest log files are overwritten automatically after 125 days.

These log files (see Tab. 5-14) can be accessed with the service notebook. Depending on the configuration, user authentification may be required (user name and password).

The responsibility for file maintenance is assigned to the system administrator or another designated employee. The log files can be exported for the purpose of statistical evaluation. As they are stored in text format, the files are very compact.

5.2.2.1 Mobility Log File

The *mobility* log file contains records regarding the registration, deregistration and cell switches of mobile devices. The example below shows the structure of this file.

```
2012.04.18 07:15:45.054,1370,AI,M,990101,,Registration,Success,,87,
2012.04.18 07:15:45.054,1370,AI,M,990101,90100,Attachment(Amendment),Success,,
2012.04.18 08:48:38.829,1370,AI,M,990112,90100,Detachment,Success,,
2012.04.18 08:48:38.829,1370,AI,M,990112,,Registration,Success,,87,
```

The elements are entered in the following sequence:

- Log-Creation — Time when entry was generated (see Tab. 5-15).
- Node-ID — Network node ID (see Tab. 5-15).
- Stack-ID — Stack ID (see Tab. 5-15).
- Subscriber-Type — ID of subscriber type; the following IDs are used:
  - *M* — For mobile devices
  - *D* — For dispatchers
- ISSI — ISSI of subscriber in decimal format.
- GSSI — GSSI of event for group selection, group deselection or group monitoring. In all other cases, this element is left blank.
- Action — Recorded action ID
  The following values are used for mobile devices:
  - *Registration* — The subscriber registers in the system through the relevant cell. The cell is identified by the *Node ID* and the *Stack ID* (see Tab. 5-15).
  - *Deregistration* — The subscriber deregisters from the system through the relevant cell. The cell is identified by the *Node ID* and *Stack ID*.
  - *Attachment* — The subscriber selects the group (GSSI) in the cell, which is identified by the *Node ID* and *Stack ID*.
  - *Detachment* — The subscriber deselects the group (GSSI) in the cell, which is identified by the *Node ID* and *Stack ID*.
  - *Enable/Disable* — The subscriber is enabled or temporarily disabled (blocked).

The following values are used for dispatchers:

- *Log-in* — Dispatcher login (in the dispatcher GUI).
- *Log-out* — Dispatcher logout (in the dispatcher GUI).

- *Monitor-started* Group monitoring started.
- *Monitor-stopped* Group monitoring stopped.

- Result — ID of recorded result; the following values are used:
  - *Success* The function requested was executed successfully by the system.
  - *Failed* The function requested was not completed successfully by the system.
- Diagnostics — Optional element for additional description of the function's result; this element contains explanatory information in free text form.
- RSSI — Received Signal Strength Indication (RSSI) from the subscriber.

5.2.2.2 Call Log File

The *Call* log file contains the recordings of all individual calls, such as individual simplex / duplex calls, telephone calls and group calls.

The records of group calls are always generated at the corresponding network node (radio cell) through which at least one subscriber takes part in group communication. The same also applies to the dispatchers; at least one dispatcher must monitor the relevant group in order for an entry to be generated. As a result, it is possible that multiple entries will be recorded at various network nodes for a single transmission. An example of the call log file might look as follows:

```
2012.04.18 09:00:33.950,1370,AI,G,7,,,2012.04.18
09:00:31.336,990103@AI.1370,,90100,,S,0,1,,2,,Transmitting party ceased (0),58

2012.04.18 09:00:35.983,1370,AI,G,7,,,2012.04.18
09:00:34.511,990112@AI.1370,,90100,,S,0,2,,1,,Transmitting party ceased (0),61

2012.04.18 09:00:50.624,1370,AI,I,8,9,2012.04.18 09:00:45.597,2012.04.18
09:00:46.538,990103@AI.1370,,990112@AI.1370,,D,0,1,4,0,0,User requested
disconnect (1),62
```

The call log file supports two types of entries (rows); one for individual calls and one for group calls. Therefore, the elements used will have a different meaning depending on the type of communication in question. The elements are entered in the following sequence; the explanations for group calls are shown in square brackets [ ]:

- Log-Creation — Time when entry was generated (see Tab. 5-15).
- Node-ID — ID of network node (see Tab. 5-15).
- Stack-ID — Stack ID (see Tab. 5-15).
- Call-Type — ID of call type; the following IDs are used:
  - *I* For individual calls
  - *G* For group calls
  - *B* For broadcast calls

The *Call-Type* element determines how the elements below are interpreted.

- Context-ID — Unique ID of call within a period, together with the *Node-ID* and *Stack-ID* (*0* ... *255*). The air interface uses the *Context-ID* in the same way as a call ID in communications with a subscriber (calling or called).
- Peer-Context-ID [n/a] — Like the *Context-ID*, this element identifies the connection to the other party. If the call is routed across cells, then there will be an entry in another log file with the same *Context-ID* at another network node (radio cell). In the case of a call within a single radio cell, only one entry will be made in one log file.
- Setup-Time [n/a] — Time at which the system receives the event triggering call setup.
- Active-Time [TX-Start-Time] — Time at which the call status is changed to active and communication begins. This element remains blank if the call is terminated prematurely. In the case of a group call, this is the time when the transmission begins for the subscriber (indicated in the *TX-Party-ISSI* element).
- Calling-ISSI [TX-Party-ISSI] — ID of calling subscriber. In the case of a group call, this is the ISSI of the subscriber with transmit authorization. This information is formatted in the same way as the subscriber address (= *subscriber locator* (see Tab. 5-15).
- Calling-External-Number [n/a] — Numerical string which identifies the calling subscriber on the ISDN / QSIG interface. This element is only available for incoming ISDN / QSIG calls which are routed via the ISDN / QSIG interface.
- Called-ISSI [GSSI] — Destination number of called subscriber. In the case of a group call, this element is the GSSI of the group in which the transmission took place. For individual calls, this information is formatted in the same way as the subscriber address (= *subscriber locator* (see Tab. 5-15). For group calls, this is the decimal value of the GSSI.
- Called-External-Number [n/a] — Numerical string which identifies the called subscriber on the ISDN / QSIG interface. This element is only available for outgoing ISDN / QSIG calls which are routed via the ISDN / QSIG interface.

- Duplex-Simplex-Selection — ID of communication mode; the following IDs are used:
  - *S* — For a simplex call
  - *D* — For a duplex call

  For group calls, this element is always set to *S*.
- Circuit-Mode — The values of this element correspond to the definitions in the TETRA Air Interface standard (see AI, Fig. 2-1).
- Priority [TX-Priority] — Initiated call priority based on the values defined in the TETRA Air Interface standard (see AI, Fig. 2-1) (*0* ... *15*), where *15* is emergency priority. For a group call, this element indicates the transmit priority. The following values are possible:
  - *0* — Low priority
  - *1* — High priority
  - *2* — Pre-emptive priority
  - *3* — Emergency call priority
- Duration [n/a] — Total duration of an active call (in seconds). In the case of simplex calls, this value is the same as or (due to empty blocks) greater than the total of *Calling-Party-Transmission-Time* and *Called-Party-Transmission-Time*. In combination with the *Active-Time*, this value can be used to determine the time when the call ended.
- Calling-Party-Transmission-Time [TX-Party-Transmission-Time] — Total transmission time (in seconds) for the calling subscriber in a simplex call. In the case of a duplex call, this value is set to *0* and only the *Duration* element is used.
- Called-Party-Transmission-Time [TX-Party-Transmission-Time] — Total transmission time (in seconds) for the called subscriber in a simplex call. In the case of a duplex call, this value is set to *0* and only the *Duration* element is used.
- Termination Cause — Like the *Disconnect Cause* in the TETRA Air Interface standard (see AI, Fig. 2-1), this element is used for individual calls. The information includes the long name and the corresponding number. The following values are available for group calls:
  - *0* — Terminated by transmitting subscriber
  - *1* — Interrupted by another subscriber (with pre-emptive or emergency priority).

- *2* Transmission timer expired. The transmission timeout can be defined for each group in the Subscriber Management (SUM) application.
- *3* Call restored in another cell.
- *4* Use of resources due to pre-emptive interruption.
- *5* Terminated by call owner.
- *6* Emergency call terminated by dispatcher.
- *100* Network error; occurs when the network connection is lost during a multi-cell subscriber broadcast.
- *101* System shutdown; occurs when the shutdown command is executed.

- RSSI — Received Signal Strength Indication (RSSI) from the subscriber.

5.2.2.3 SDS Log File

The *SDS* log file contains records on the text and short messages transmitted through the system. An example of the *SDS* log file might look as follows:

```
2012.03.18 14:22:01.422,BS-1,AI,I,20221,40000@DISP.GW-PC,TL-Unitdata, SDS-REPORT
(receipt ack),130,32,Success

2012.03.18 14:22:11.566,BS-1,AI,I,20221,40000@DISP.GW-PC,TL-Unitdata, SDS-REPORT
(consumed ack),130,32,Success

2012.03.18 14:23:31.792,BS-1,AI,I,20221,40000@DISP.GW-PC,TL-Unitdata, SDS-
TRANSFER,130,296,Failed, Timer expiry
```

- Log-Creation — Time when entry was generated (see Tab. 5-15).
- Node-ID — ID of network node (see Tab. 5-15).
- Stack-ID — Stack ID (see Tab. 5-15).
- Dest-Type — ID of call type; the following IDs are used:
  - *I* For one mobile device (individual)
  - *G* For a group

This value is only valid when the request to send a message is accepted by the system. Otherwise, the value "*I*" can be indicated even if the destination is a group.

- SDS-Type — Type of message transmitted; the following values are used:
  - *Status* For one mobile device

- *TL-Unitdata* — For a *Unitdata-Type-4* message containing an SDS-TL header.
- *Unitdata-1* — For a *Unitdata-Typ-1* message (8 bit).
- *Unitdata-2* — For a *Unitdata-Typ-2* message (16 bit).
- *Unitdata-3* — For a *Unitdata-Typ-3* message (32 bit).
- *Unitdata-4* — For a *Unitdata-Typ-4* message (up to 2048 bit).

- TL-MSG-Type — This element specifies the type of SDS-TL message for a *TL-Unitdata-Type*; the following messages are used (for details, please refer to the TETRA Air Interface standard (see AI, Fig. 2-1)):
  - *SDS-TRANSFER*
  - *SDS-REPORT* (receipt confirmation)
  - *SDS-REPORT* (read confirmation)
  - *SDS-ACK*
- Protocol-Identifier — This element specifies the protocol ID of the SDS-TL message in decimal format for a *TL-Unitdata-Type*. For a complete list of IDs, please refer to the TETRA Air Interface standard (see AI, Fig. 2-1). The ID *130* is used for an SDS-TL protocol.
- Payload-Size — This element specifies the size of the message including the SDS-TL protocol header (in bits) for a *TL-Unitdata-Type*. This element is also used for *Unitdata-4* messages.
- Result — Result of recorded function; the following values are used:
  - *Success* — The function requested was executed successfully by the system.
  - *Failed* — The function requested was not completed successfully by the system.
- Diagnostics — Optional element for additional description of the function's result; this element contains explanatory information in free text form.

5.2.2.4 PD Log File

The *PD* log file contains records on the packet data connections established in the system. An example of the *PD* log file might look as follows:

```
2012.01.21 12:32:34.644,BS-2,AI,1000,1,2003.01.21 12:30:07.589,2003.01.21
12:31:58.352,192.168.200.33,896,240,
```

NSAPI usage: All protocol instances via SNDCP use the same SNDCP instance, which also multiplexes data from different sources and transmits the data via a single LLC connection. The shared use of an LLC connection requires that different addresses can be identified. This is done by the NSAPI element (4 bits), which defines which *PDP-Type* and *PDP-Address* the mobile device uses (translated from the TETRA standard).

- Log-Creation — Time when entry was generated (see Tab. 5-15).
- Node-ID — Network node ID (see Tab. 5-15).
- Stack-ID — Stack ID (see Tab. 5-15).
- ISSI — ISSI of subscriber in decimal format.
- NSAPI — This element is always set to *1*.
- Start-Time — Time of activation.
- End-Time — Time of deactivation.
- Client-IP-Address — Shows the IP address of the client which performed the activation.
- Bytes from Client — Shows the number of bytes received (uplink).
- Bytes to Client — Displays the number of bytes sent (downlink).

5.2.2.5 AUTH Log File (Optional)

The *AUTH* log file contains records regarding the authentification of mobile subscribers (terminals). Each base station records the related events. New and undefined terminals are recorded at the TETRA switch (see Section 6.5).

An example of the *auth* log file might look as follows:

```
2012.04.24 10:21:45.131,20105,35c3197c,Failure
2012.04.24 10:23:09.903,20108,0b717df1,Success
etc...
```

- Log-Creation — Time when entry was generated (see Tab. 5-15).
- Node-ID — Network node ID (see Tab. 5-15).
- Stack-ID — Stack ID (see Tab. 5-15).
- ISSI — ISSI of the mobile subscriber (terminal) for the authentification event.
- Code — Authentification code received from the mobile subscriber (terminal).
- Status — Result of the authentification process (*Failure*/*Success*).

5.2.3 Status Log File

5.2.3.1 Debug Log File

The *Debug* log file contains application-specific records which can be used for troubleshooting and error identification. An example of the *debug* log file might look as follows:

```
2012.03.18 14:25:09.112, WRN, CFG: Registry key not defined
2012.03.18 14:25:10.313, DBG, DD: ReadSubscriberRecord request for 20224.
2012.03.18 14:25:33.467, INF, NWM: Flushing log files
```

- Log-Creation — Time when entry was generated (see Tab. 5-15).
- Severity — Indicates the event's degree of severity with regard to the system component. The following values are used:
  - *DBG* — For debugging events
  - *INF* — For informal events
  - *WRN* — For warnings
  - *ERR* — For errors
- Text — Description of the event in text form.
- Additional elements — Optional elements which record additional details depending on the event.

5.3 Software / Services

This section describes the specific services on the stand-alone eXTRAS SOLO.

Tab. 5-16 describes all eXTRAS SOLO services and their functions.

Abbreviation	Name	Description
BSCIP	Base Station Controller	Controls the BS hardware and software, interface to Upper MAC
BSS	Base Station Switch	Air interface LLC and Layer 3, Calls and SDS messages are switched.
ISC-SERVICE	Intersite Communication Service	Serves as a messaging multiplexer
SColl	Local Status Distribution	Collects local status information (e.g. from the air interface)
VCD	Version Control Daemon	Installs the software, subscriber data and configurations; controlled by *SPCDD* / *Configuration Tool*
WD	Watchdog	Monitors all services on the eXTRAS SOLO

Tab. 5-16: eXTRAS SOLO, Stand-alone Services Overview

Fig. 5-2 provides an overview of which services run on the stand-alone eXTRAS SOLO.

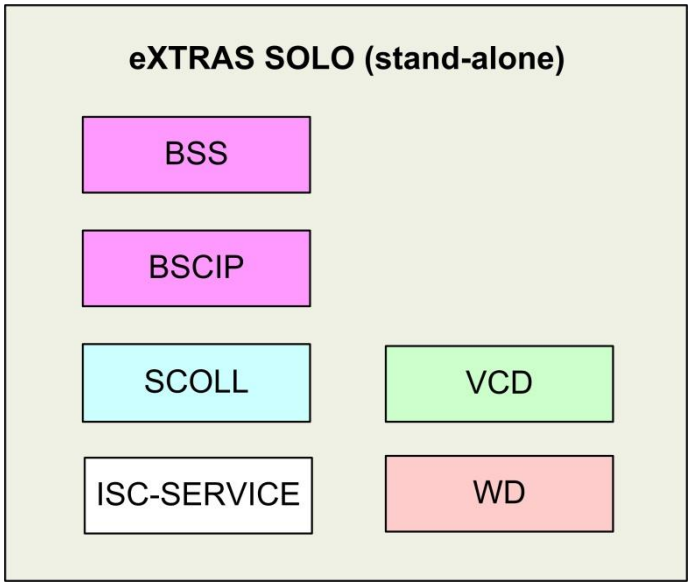


Fig. 5-2: Services on the Stand-alone eXTRAS SOLO

---------- END OF SECTION ----------

6 Utilities and Configuration

This section provides a detailed description of the required administration programs as well as an overview of system administration tasks and associated activities.

Further on details regarding the configuration possibilities are part of this section.

6.1 Subscriber Management (SUM)

The *Subscriber Management* (SUM) application is used to manage the operational settings (e.g. permissions, timers) for the mobile subscriber. The service notebook is used to execute the SUM application.

A detailed description can be found in the following document:

- Subscriber Management with support for multiple organizations
  - User Manual EX0D02 EN500

For a better understanding of the subscriber definitions consider the following aspects for the Subscriber Management:

- Permissions are not assigned directly to subscribers.
- Permissions are assigned by using a template (called *Service Classes*). The *Service Classes* define the permissions which are allocated to the subscribers.
- Subscribers are not assigned directly to talk groups.
- The *Service Class(es)* (permission templates) is/are assigned to talk group(s). All subscribers belonging to the assigned *Service Class(es)* are member of the talk group(s).

6.2 Configuration Tool (Parameters)

The *Configuration Tool* application is used to manage the parameters of the eXTRAS SOLO (e.g. power setting, frequency) for the eXTRAS SOLO base station. The service notebook is used to execute the *Configuration Tool* application.

A detailed description can be found in the following document:

- Configuration Tool
  - User Manual EX0D07 EN101

Changes in the parameters of a system which is in live operation may only be made by trained system administrators.

Never change any parameters if you are not familiar with the potential effects of the change.

Before changing parameters, always create a backup of the current configuration.

A number of settings are defined in decibels (*dB*). Decibels represent a dimensionless, logarithmic and relative unit of measure. This means that *dB* (without any further information) only indicates the ratio of power to another device, antenna or other instrument. Antenna gain values are generally indicated in relation to a dipole, in which case the ratio is denoted as *dBD*. As an alternative, antenna gain can be expressed in relation to a hypothetical isotropic antenna, then the unit is denoted *dBi*.

eXTRAS parameters are essentially based on the unit *dBm*, which refers to the power ratio referenced to one Milliwatt (1 mW). Tab. 6-1 provides an overview of *dBm* values and the corresponding power levels.

dbm	Power [Watts]	Power [mW]
90	1.000.000 = 1 MW	
60	1.000 = 1 kW	
50	100	100.000
40	10	10.000
30	1	1.000
25	0,316	316
20	0,1	100
18	0,0631	63,1
15	0,0316	31,6
12	0,0158	15,8
10	0,01	10
8	0,0063	6,3
5	0,0032	3,2
3	0,002	2
0	0,001	1
-5		0,3126
-10		0,1
-15		0,0316
-20		0,01
-30		0,001 = 1 μW

Tab. 6-1: dBm Power Table (absolute Levels)

Tab. 6-2 provides an overview of power classes for base stations according to the *TETRA AI standard*.

Power Class	Nominal Power per Carrier
1 (40 W)	46 dBm
2 (25 W)	44 dBm
3 (15 W)	42 dBm
4 (10 W)	40 dBm
5 (6,3 W)	38 dBm
6 (4 W)	36 dBm
7 (2,5 W)	34 dBm
8 (1,6 W)	32 dBm
9 (1 W)	30 dBm
10 (0,6 W)	28 dBm

Tab. 6-2: Power Classes of BS Transmitters Based on the TETRA AI Standard

Tab. 6-3 provides an overview of power classes for mobile devices based on the *TETRA AI standard*.

Power Class	Nominal Power
1 (30 W)	45 dBm
1L (17,5 W)	42,5 dBm
2 (10 W)	40 dBm
2L (5,6 W)	37,5 dBm
3 (3 W)	35 dBm
3L (1,8 W)	32,5 dBm
4 (1 W)	30 dBm
4L (0,56 W)	27,5 dBm

Tab. 6-3: Power Classes of Mobile Devices Based on the TETRA AI Standard

Tab. 6-4 provides an overview of power increments in adaptive power control based on the *TETRA AI standard*.

Power Increments	Power
1	45 dBm
2	42,5 dBm
3	40 dBm
4	37,5 dBm
5	35 dBm
6	32,5 dBm
7	30 dBm

Tab. 6-4: Power Classes of Mobile Devices Based on the TETRA AI Standard

6.3 Software Control Centre (SCC)

The *Software Control Centre* (*SCC*) application is used to distribute and install software updates and revisions on the eXTRAS SOLO. Software revisions first have to be distributed (downloaded) and then installed in the eXTRAS SOLO.

The *Service Notebook* represents the central node in the software management environment and includes the *Central Storage Area*, where the software packages and the corresponding software files are stored.

The *SCC* handles the distribution of any software updates to the eXTRAS SOLO. The software files received are stored in the *Local Storage Area* on the SOLO's compact local memory. After the successful distribution (download) of a software update, it is necessary to start the installation process using the *SCC*. Once the eXTRAS SOLO has received an installation request, it begins to install the software update automatically. Finally, the services on the eXTRAS SOLO are restarted using the new version of the software. In terms of operation, this causes a brief interruption of service on the eXTRAS SOLO.

Updates of system-related software are delivered in the form of an update package. Always refer to the `readme.txt` attached to the update package for up-to-date information on the current software release and the update procedure.

This section describes the operation and functions of the SCC.

6.3.1 Launching the Software Control Centre

Depending on the implementation, it may be necessary to log in to Windows in order to use the software control centre of the service notebook.

The *SCC* application can be launched using either the corresponding icon on the desktop or the corresponding batch file, which is stored in the following directory: `C:\Tetra\Work\NWMA\exe\SCC\scc.exe`.

Once the user double-clicks the icon, the *SCC* main window appears (see Fig. 6-1).

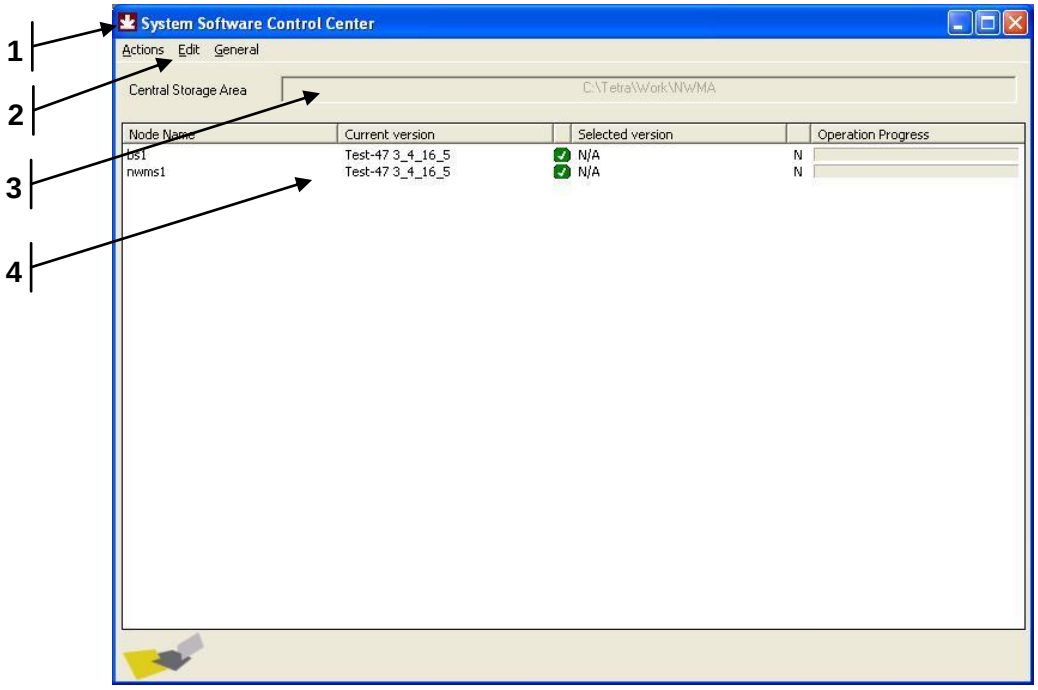


Fig. 6-1: Software Control Centre Main Window

1	Title bar
2	Menu bar
3	Central Storage Area
4	Display area for *eXTRAS* network nodes

eXTRAS SOLO shown against a gray background is defined in the system configuration but currently not available. Check cabling and communication of the service notebook.

6.3.2 Software Control Centre User Interface

The *Software Control Centre*'s object-oriented user interface can be operated using a keyboard or mouse according to the conditions and standards of the operating system. Therefore, the functions in the SCC context menu always refer to the selected network node.

6.3.2.1 SCC Menus

The following menus are available in the SCC application:

- *Actions* Management of the *Central Storage Area*
- *Edit* Clean up / purging of *Local Storage Areas* on network nodes
- *General* Exit SCC

The menu descriptions follow the sequence above.

Fig. 6-2 shows the menu items in the *Actions* menu.

Fig. 6-2: Actions Menu

- *Select Central Storage Area* — Allows the user to change the path to the *Central Storage Area*.

It is only necessary to change the path to the *Central Storage Area* during system integration. This should not be done in live systems.

- *Set FTP URL* — Allows the user to change the FTP (*File Transfer Protocol*) URL to the *Network Management Server*.
- *Reload Version List* — Updates the list of available software versions.

Fig. 6-3 shows the menu items in the *Edit* menu.

Fig. 6-3: Edit Menu

- *Purge Software* — Allows the user to clean up (i.e., purge) the *Local Storage Area* on a network node by deleting obsolete software versions.

Fig. 6-4 shows the menu items in the *General* menu.

Fig. 6-4: General Menu

- *Exit* — Closes the *SCC* application.

A context menu can be opened for each network node in the display area (**4**, Fig. 6-1). The menu items in the context menu are shown in Fig. 6-4.

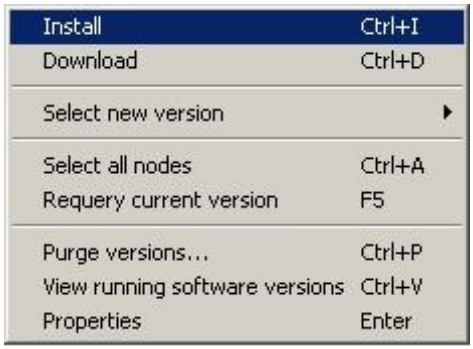


Fig. 6-5: Context Menu

- *Install* — Starts the local installation process for the selected network node; this means that the services are stopped and later restarted using the new version of the software. This function is only available after a software download.
- *Download* — Initiates the process of distributing (downloading) a software update to a network node. This function is only available once a new version has been selected.
- *Select new version* — Lists all software versions (including older ones) which are available for distribution from the *Central Storage Area*.
- *Select all nodes* — Selects all network nodes which are visible in the *Software Control Centre*'s main window.
- *Requery current version* — Re-queries the current software version on a network node.
- *Purge versions* — Allows the user to clean up (i.e., purge) the *Local Storage Area* on the selected network node by deleting obsolete software versions.
- *View running software versions* — Lists all running applications and the corresponding software versions on the selected network node (see Fig. 6-6).
- *Properties* — Lists general information on the selected network node (e.g., storage space in use, available storage space).

6.3.2.2 Current Software Version on Network Node

The *Running software* window (see Fig. 6-6) lists all services currently running on the selected network node and provides additional information on each respective application (e.g., software version, *Used binary*).

Fig. 6-6: Current Software Version on Network Node

- *App. key* — Name of software module installed
- *Running version* — Version of software module installed
- *Running* — Displays the current status of the application (*Yes* / *No*).
- *Guarded* — Indicates whether the application is being guarded, that is, whether it is being monitored by the *Watchdog* (*wd*; *Yes* / *No*).
- *Running mode* — Indicates how the application is running (*Service* / *Program*).
- *Used binary* — Displays the local storage location of the application.
- *Configured binary* — Displays the configured storage location of the application.

Click **Save** to store the presented information into a file. If required, this file can be sent to the support team.

6.3.2.3 Information in the Display Area

The columns in the SCC display area (**4**, Fig. 6-1) show the following information for each eXTRAS network node:

Node Name	Displays the logical name of the eXTRAS network node.
Current version	Displays the current version of the software package running on the network node.
Status Symbol	Displays a symbol indicating the state of certain actions (for details, please refer to Section 6.3.2.4).
Selected version	Displays the version of the software package selected for the *Download* and *Install* functions.
Operation Progress	Displays a bar to indicate how far the download / distribution of software packages has progressed.

6.3.2.4 Status Symbols

Status symbols are used in order to indicate the current state of a process. Fig. 6-7 shows an example of these symbols.

Fig. 6-7: Status of Network Node

The following symbols are used in the SCC application:

- Indicates that an action or change has been completed successfully.
- Indicates that an action or change has failed.
- Indicates that an action is required in order to apply or complete a certain change.

6.3.3 Updating the Software on an eXTRAS SOLO with SCC

This section describes the steps involved in managing the software on eXTRAS network nodes.

6.3.3.1 Check Central Storage Area

By default, the directory path is set to `C:\Tetra\Work\NWMA`. This setting is coordinated with other system settings and processes, and therefore it must not be changed in a live system.

1. In order to verify the current directory path setting, check the *Central Storage Area* text field at the top of the *Software Control Centre*'s main window (see Fig. 6-8).

Fig. 6-8: Central Storage Area

6.3.3.2 Querying Current Software Versions

The current software version on each network node is displayed in the *Current version* column in the *Software Control Centre*'s main window (see Fig. 6-9).

Node Name	Current version
bs1	Test-47 3_4_16_5
nwms1	Test-47 3_4_16_5

Fig. 6-9: Current Version Column

1. In order to re-query the current software version displayed for a network node, right-click the desired network node and then click the *Requery current version* menu item in the context menu.

6.3.3.3 Installing a Software Package (Release)

1. If necessary, open the self-extracting software package provided. This package stores all of the required files in the appropriate directories.
2. Right-click the network node to be updated.
3. In the context menu, choose *Select New version* and then select the version to be installed.

Once the software version has been chosen, it will be displayed in the *Selected version* field for the respective network node in the main window, and the status of the network node will change to .

4. Right-click the desired network node again and choose the *Download* menu item in the context menu.

In the main window, the progress of the transfer will be displayed under *Operation Progress*. This process takes several minutes.

Wait until the *Operation Progress* bar shows that the process has been completed. In addition, ensure that the status of the network node has changed to .

5. Right-click the network node again and choose the *Install* menu item in the context menu.

Once the installation process has been initiated, the status of the network node will change to .

The *Install* function triggers a restart of all services on the eXTRAS SOLO and starts the processes using the newly installed version. For the duration of the restart process, the eXTRAS SOLO will be unavailable; therefore, it is important to coordinate this process with operations.

Wait until the status of the network node has changed to and then ensure that the selected software version is displayed in the *Current version* field for the network node.

6.3.3.4 Purging Software Versions

1. In order to clean up (i.e., purge) obsolete software versions and save storage space, right-click the desired network node and then click *Purge versions…* in the context menu.
2. Select the desired package from the list of software packages stored locally on the network node.
3. Click `Purge selected` to delete the software package.

It is advisable to retain at least one previous software version in order to have a reliable backup version available if necessary.

6.3.3.5 Displaying Running Versions of Services (Software Versions)

The *Running Software* window lists all applications currently running on the selected network node and provides additional information on each application.

1. Right-click the desired network node.
2. Choose the *View running software versions* item in the context menu.

For details on this window, please refer to section 6.3.2.2.

6.4 GPS Time Synchronization

GPS time is used by default as a reference for the synchronization of the air interface (AI) and system time of the eXTRAS SOLO. Ensure that the GPS antenna is connected to the eXTRAs SOLO and the reception of the GPS signal is possible.

For the analysis of operational states and service records, it is crucial to ensure that the eXTRAS SOLO log events using a uniform system time.

Use the configuration tool of the service notebook to check the related parameters.

Fig. 6-10 shows the default settings.

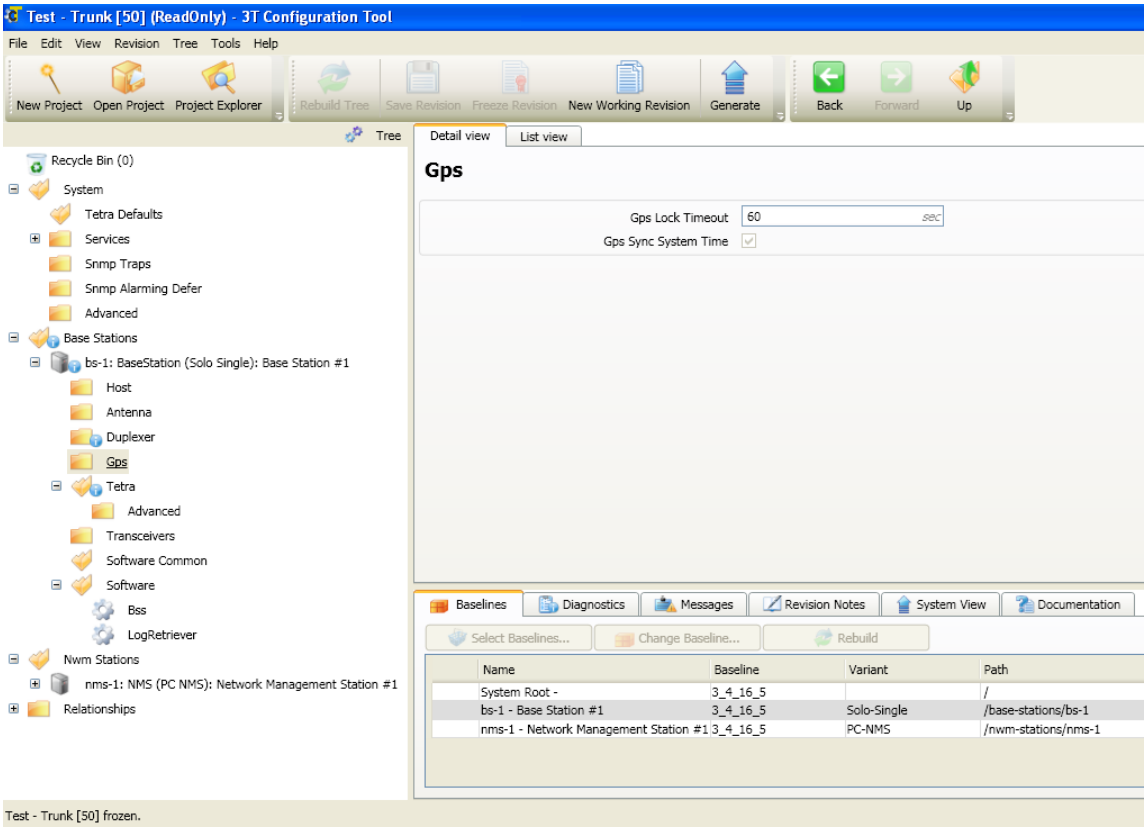


Fig. 6-10: GPS Synchronisation Parameters

6.5 Stand-alone eXTRAS SOLO (One Carrier)

Fig. 6-13 shows the block diagram of the radio operation for the stand-alone configuration.

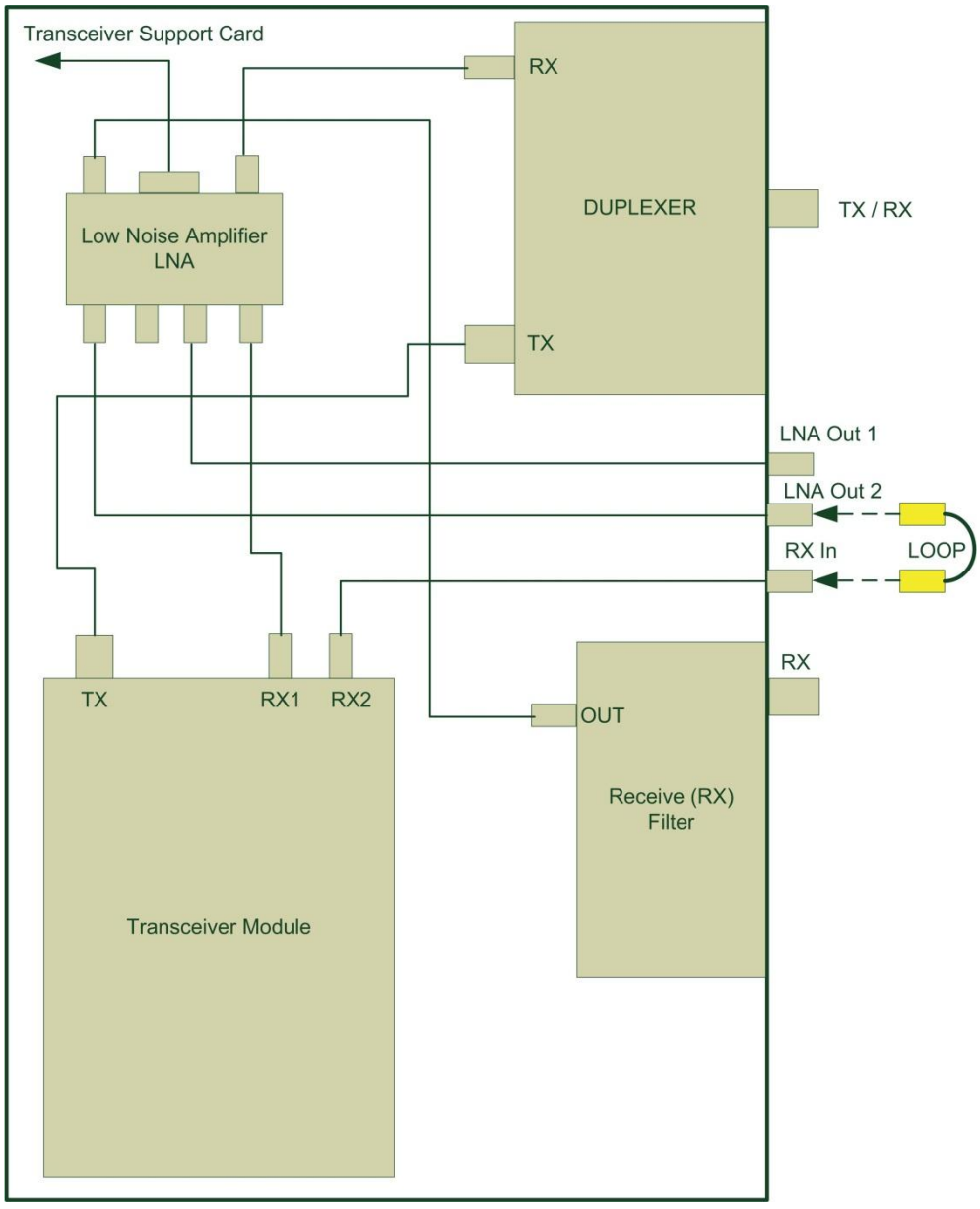


Fig. 6-11: Radio Operation of the Stand-alone Configuration

6.6 Master / Slave Configuration (Two Carriers)

For a two carrier operation a second eXTRAS SOLO is required which has to be connected to the master unit (first eXTRAS SOLO) according to the overview shown in Fig. 6-12.

For a better overview no external equipment is connected (like GPS and HF antennas).

Unused HF ports have to be terminated with 50 Ω.

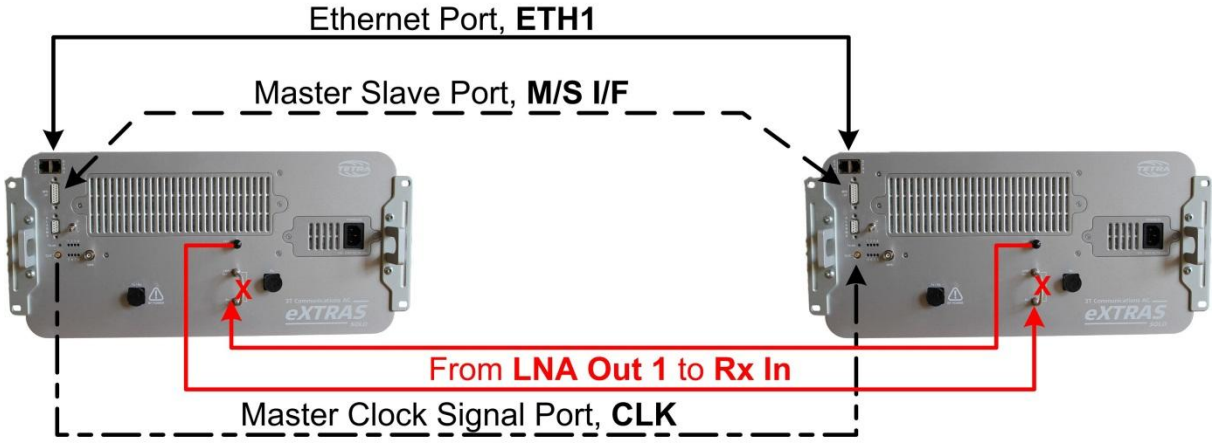


Fig. 6-12: Master / Slave Configuration

Fig. 6-13 shows the block diagram of the radio operation for the master / slave configuration.

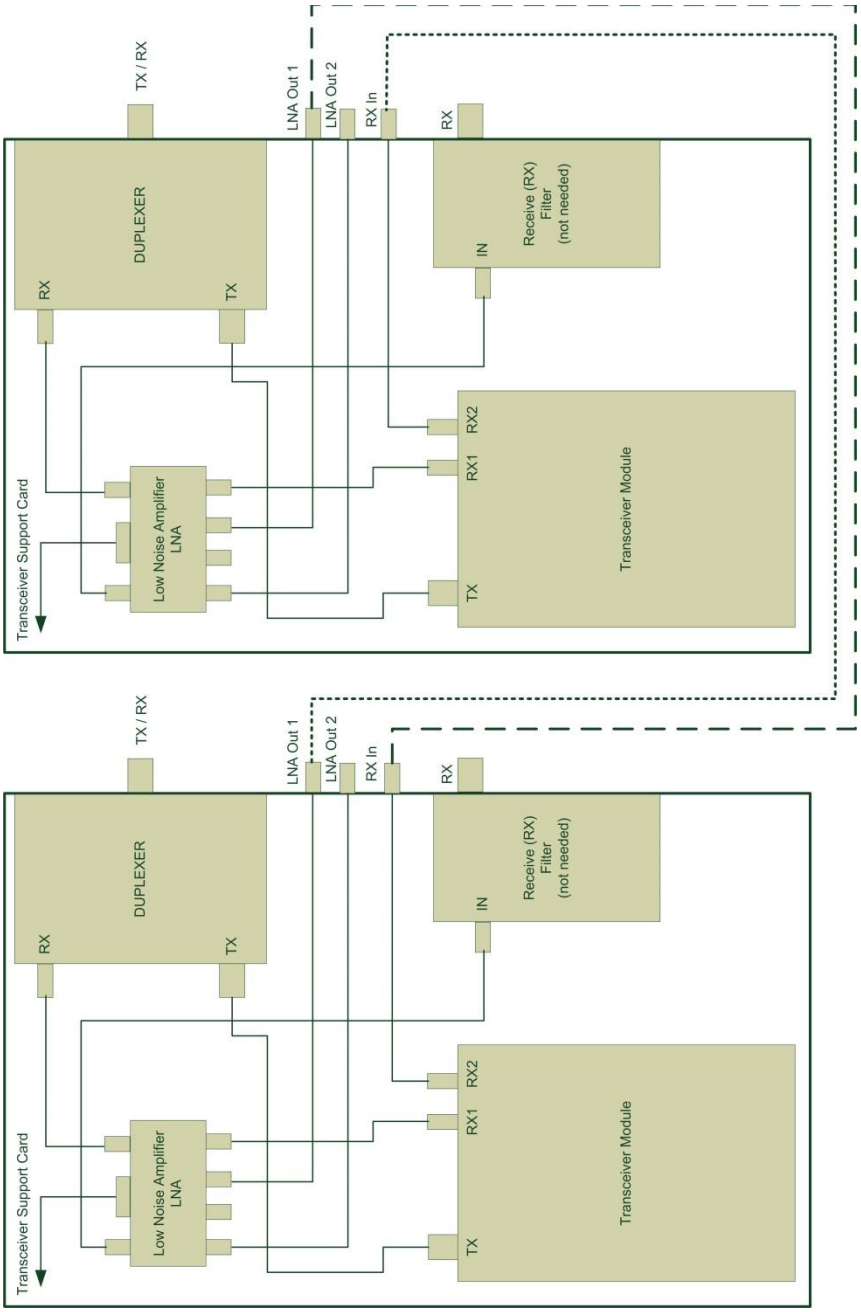


Fig. 6-13: Radio Operation of the Master / Slave Configuration

---------- END OF SECTION ----------

7 Troubleshooting

This section describes the basic steps for troubleshooting of the eXTRAS SOLO. Users are required to take these steps before contacting the support team.

If the problem is still not resolved after the work steps described in this manual have been carried out, it is necessary to prepare a detailed description of the problem and general information on the eXTRAS system before contacting the support team. The following information should be readily available when the support team is contacted:

- *System ID* — The System ID identifies the specific eXTRAS system; this information can be found in the system specifications.
- *System software release* — The system software release of each network node is required and can be queried using the Software Control Centre (*SCC*; see Section 6.3.3.2).
- *System configuration* — A copy of the current system configuration is required. This can be created using the *Configuration Tool* (see User Manual EX0D07EN101).
- *Network node ID* — The ID of the relevant network node is required; this information can be found in the system specifications.
- *Network node logs* — The log files for the relevant network node are required. These files are stored on the *Network Management Server*.

All network nodes store their logs on the *Network Management Server*. The logs are stored under the following path:

`C:\Tetra\Work\NWMA\<Network node ID>\Logs`

where `<Network node ID>` refers to the relevant network node (e.g., *BS1*).

- *Component type* — The type of system component affected is required; this information can be found in the system specifications.
- *Serial number* — The serial number of the system component affected is required; this information can be found in the system specifications.
- *Screenshots* — Generate screenshots of any error messages and undescribed or unexpected dialog boxes which appear.
- *Logs* — If necessary, save any additional log files indicated in error messages and in undescribed or unexpected dialog boxes.

7.1 General Troubleshooting Tips

Many problems can be avoided or resolved by paying attention to the tips provided in this section.

7.1.1 Faulty or Loose Cable Connections

An RF or data transmission link may not work properly due to faulty or loose cable connections. For example, this may cause a loss of radio coverage or data transmission.

Look for loose or obviously faulty connections. If the routing of cable connections appears to be in order, ensure that all cables are connected firmly. If that does not remedy the problem, try replacing the cable.

7.1.2 Non-standard Cables

An RF or data transmission link may not work properly due to the use of non-standard cables. For example, this may cause limited radio coverage or an increased number of network collisions and can severely impair network performance.

Always use correctly wired standard cables. A list of cable types recommended for use in the eXTRAS system can be found in the system specifications.

7.1.3 Clogged Air Filters

If the air filters in the eXTRAS SOLO are clogged, the internal components of the eXTRAS SOLO may overheat.

If overheating persists for an extended period of time, the components may be damaged and malfunctions may result.

It is highly advisable to include the air filters in the eXTRAS SOLO in a scheduled maintenance plan and to check the filters regularly. If the filters are clogged or worn, they must be replaced immediately. For further details on replacing the filter, please refer to section 7.2.

7.1.4 Incomplete Subscriber Database

An incomplete or misconfigured subscriber database may bring about a situation in which mobile subscribers (MSs, mobile devices) cannot register in the eXTRAS SOLO, in which services such as individual calls are not supported, or in which certain talk groups cannot be selected.

In such cases, use the Subscriber Management application (SUM, see Section 3) to check whether the subscriber database contains any misconfigured or unintended service classes, subscribers, talk groups or talk group assignments. In addition, be sure to check whether any entries are missing. Also check the programming of the mobiles.

7.2 Replacing Air Filters

7.2.1 Replacing the Power Supply Air Filter

The eXTRAS SOLO base station is equipped with a power supply which has an integrated air filter. This filter has to be checked regularly. If the air filter is damaged or displaced, it should be replaced immediately. In order to change the air filter, follow the instructions below.

1. Locate the eXTRAS SOLO power supply ventilation grid (**2**, Fig. 7-1).

Fig. 7-1: Power Supply Ventilation Grid

1	Left fixing screw of the ventilation grid
2	Power supply ventilation grid
3	Right fixing screw of the ventilation grid
4	Power supply connector
5	Power ON/OFF switch

2. Power OFF (**5**, Fig. 7-1) the eXTRAS SOLO and disconnect the power cable (**4**, Fig. 7-1).

3. Remove the two fixing screws (**1**, Fig. 7-2).

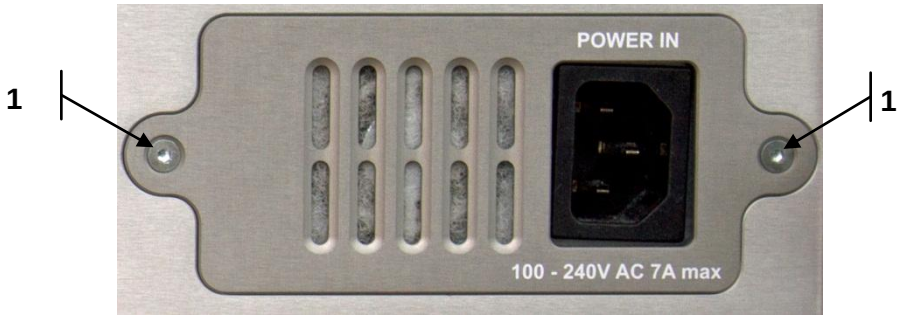


Fig. 7-2: Power Supply Ventilation Grid Fixing Screws

1	Fixing screws

4. Remove the power supply ventilation grid (see Fig. 7-3).

Fig. 7-3: Removing the Power Supply Ventilation Grid

1	Air Filter

5. Clean the existing air filter or insert a new air filter. Mount the ventilation grid as shown in Fig. 7-2.
6. Tighten the two fixing screws (**1**, Fig. 7-2).

7. Reconnect the power cable (**4**, Fig. 7-1) to the eXTRAS SOLO.
8. Power ON (**5**, Fig. 7-1) and check the proper operation of the eXTRAS SOLO with the LEDs (see section 3.4).

7.2.2 Replacing the Transceiver Air Filter

The eXTRAS SOLO base station is equipped with a transceiver module which has an integrated air filter. This filter has to be checked regularly. If the air filter is damaged or displaced, it should be replaced immediately. In order to change the air filter, follow the instructions below.

1. Locate the eXTRAS SOLO transceiver ventilation grid (**1**, Fig. 7-1).

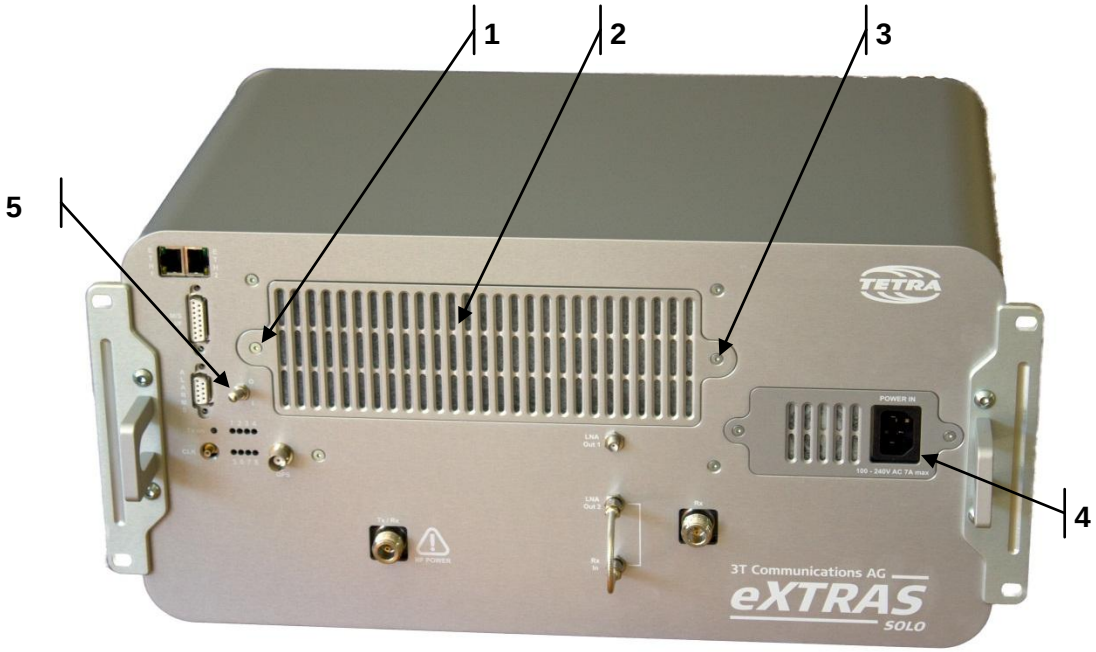


Fig. 7-4: Transceiver Ventilation Grid

1	Left fixing screw of the ventilation grid
2	Transceiver ventilation grid
3	Right fixing screw of the ventilation grid
4	Power supply connector
5	Power ON/OFF switch

2. Power OFF (**5**, Fig. 7-4) the eXTRAS SOLO and disconnect the power cable (**4**, Fig. 7-4).

3. Remove the two fixing screws (see Fig. 7-5).

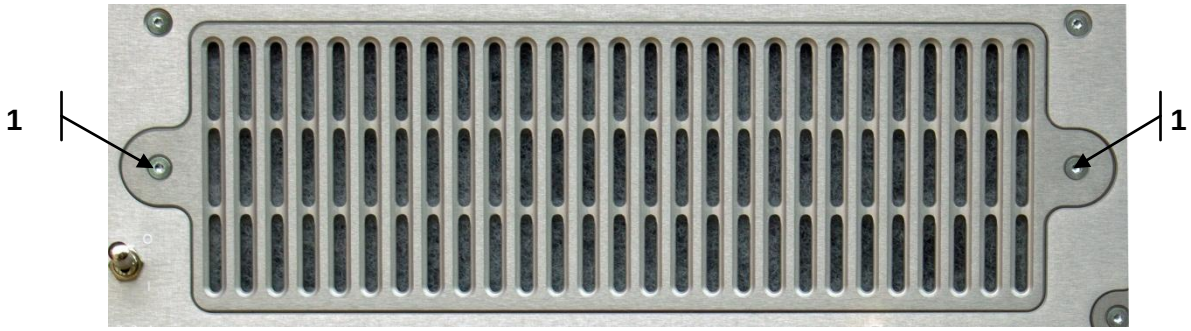


Fig. 7-5: Transceiver Ventilation Grid Fixing Screws

1	Fixing screws

4. Remove the transceiver ventilation grid (see Fig. 7-6).

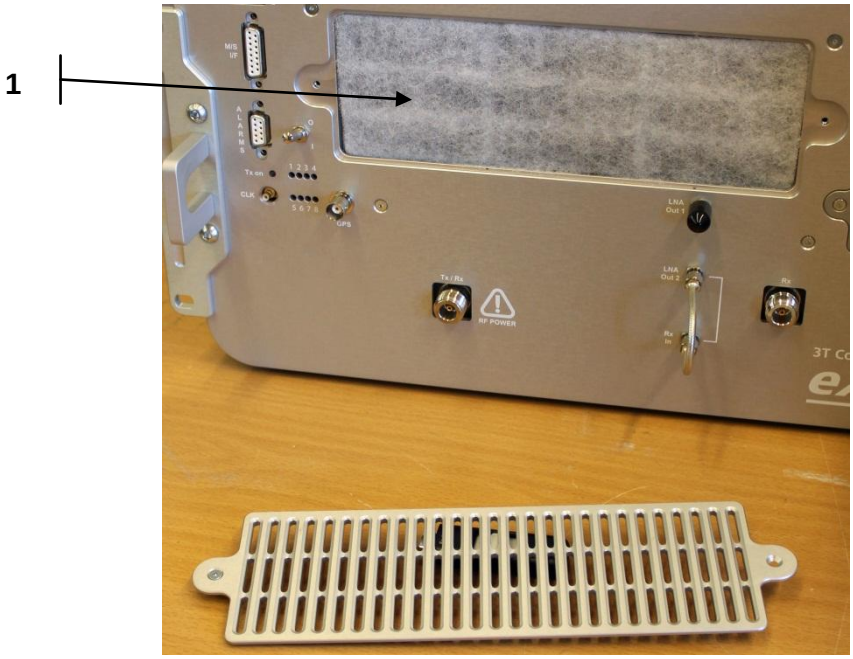


Fig. 7-6: Removing the Transceiver Ventilation Grid

1	Air Filter

5. Clean the existing air filter or insert a new air filter. Mount the ventilation grid as shown in Fig. 7-5.
6. Tighten the two fixing screws (**1**, Fig. 7-5).
7. Reconnect the power cable (**4**, Fig. 7-4) to the eXTRAS SOLO.
8. Power ON (**5**, Fig. 7-4) and check the proper operation of the eXTRAS SOLO with the LEDs (see section 3.4).

7.3 Tracing

Note: Only use the eXTRAS SOLO HTTP tracing function after consultation with the technical support team.

HTTP tracing enables the HTML-based output of processes on an eXTRAS SOLO base station. This logging of process events takes place only in the local memory of the eXTRAS SOLO. For this purpose, four ring buffers are set up for the interim storage of trace results; each buffer can store up to 10,000 events. One of them is always the active buffer, while the other three can be used for analysis. Each buffer is operated cyclically, that is, the oldest entries are overwritten when the buffer overflows.

The trace results are logged as long as the function is activated by means of the *HTTP Tracing* parameter for the network node in question (Configuration Tool parameter, see Section 6.2) and the relevant service is running locally on the eXTRAs SOLO. When the service is stopped, the trace output is deleted.

The Internet Explorer of the service notebook can be used in order to display the buffer. Each service is assigned a defined port via which the trace results can be retrieved. The IP address of the eXTRAS SOLO and the assigned port number of the software package are necessary for the purpose of addressing the trace output. The address is entered in the following format:

`http://<IP-Address>:<Port number>/tracerhome`

Example of the base station supervisor (BSS) on a eXTRAS SOLO base station:

`http://<192.168.10.1>:<51500>/tracerhome`

The page provides an overview of the four ring buffers and information on the service software. In addition, the output of trace events can be managed using filters.

Tab. 7-1 lists the port number used for eXTRAS SOLO services.

eXTRAS Service	Port Used
BSS	51500

Tab. 7-1: Port Number for HTTP Tracing

An example of the output from a test system is shown in Fig. 7-7.

xbss-vc90.exe, 3.2.40.4, 3424768 bytes, 2012.02.16-08:06:04

State	Idx	NrEv	Start Time	End Time	Show	Activate	AI Tracer
ACTIVE	0	0	10:30:25.562	n/a	(active)	(active)	(active)
FROZEN	1	0	10:28:43.734	10:30:25.562	Show	(Clear and) Activate	Activate AI Tracer
IDLE	2	0	n/a	n/a	Show	(Clear and) Activate	Activate AI Tracer
IDLE	3	0	n/a	n/a	Show	(Clear and) Activate	Activate AI Tracer

Fig. 7-7: General Tracing Output

The heading in Fig. 7-7 consists of the following elements:

- Name of file executed *xbss-vc90.exe*
- Version *3.2.40.4*
- Size of file executed *3424768 bytes*
- Date of build *2012.02.16-08:06:04*

The table below the heading provides the following information:

- *State* State of the ring buffer; the following states are possible:
  - *FROZEN* Stopped; no trace events are being logged.
  - *ACTIVE* Trace events are being logged.
  - *IDLE* The buffer is not in use.
- *Idx* Index of buffer (static).
- *NrEV* Number of trace events stored (maximum: 10,000)
- *Start Time* Local time on network node at which the collection of trace events began.
- *End Time* Local time on network node at which the collection of trace events was terminated.
- *Show* Hyperlink to display trace events (only possible for buffers in the *FROZEN* or *IDLE* state)
- *Activate* Deletes the content of the corresponding buffer and starts collecting trace events. The end time for the previously active buffer and the start time for the buffer activated are set.
- *AI Tracer* Special trace function for the air interface on the base station.

Once a buffer is selected by clicking on Show, the content displayed from the trace buffer can be controlled by way of filter settings. Fig. 7-8 shows an example. In this example, the heading is identical to the information described above.

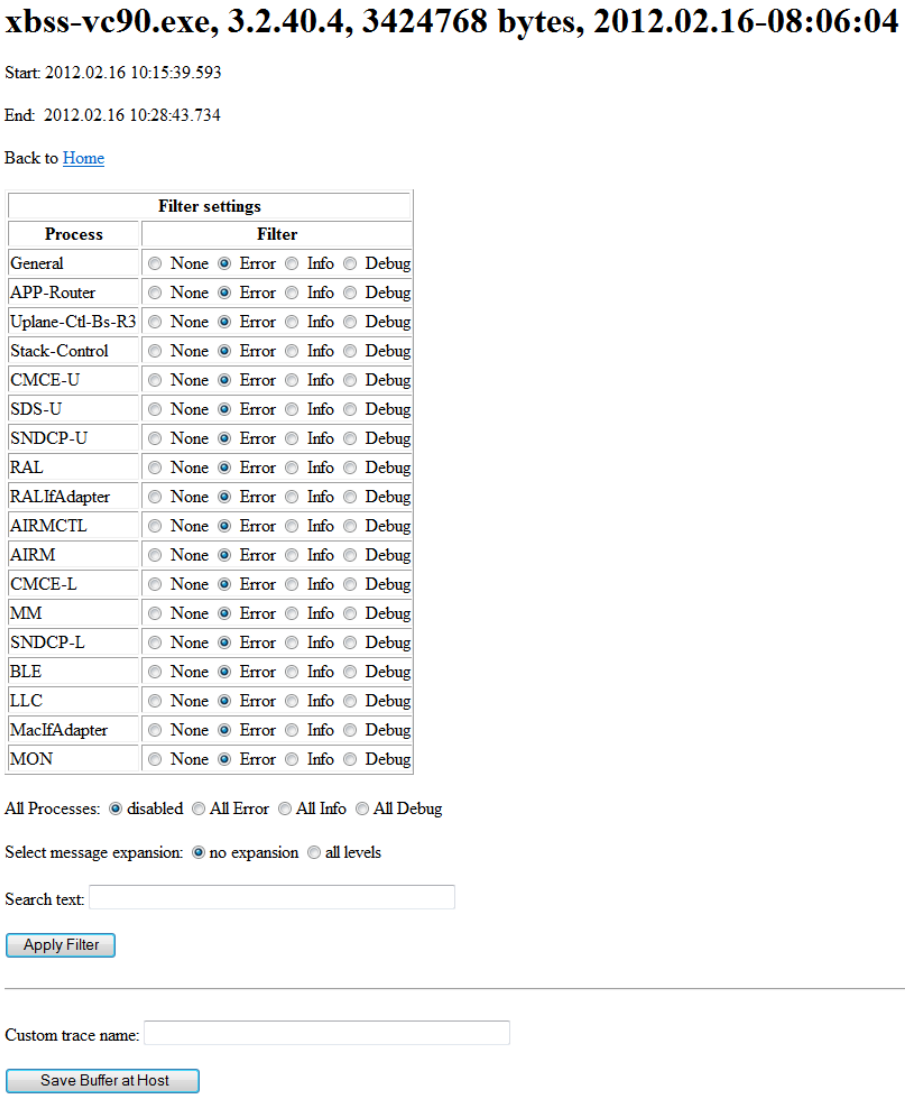


Fig. 7-8: Filter for Trace Function

The *Process* column lists the internal names of the processes in the software package. For each process, the information displayed can be filtered individually. The following settings are available:

- *None* Trace results are not displayed for the process.
- *Error* Only error events are displayed for the process.
- *Info* Error and info events are displayed for the process.
- *Debug* Error, info and debug events are displayed for the process.

Use **Save Buffer at Host** to make the buffer content available for later analysis. The content will be stored on the local hard disk of the service notebook.

Below the filter settings, two additional settings are available which can be used to control the output:

- *Select message expansion:*
  - *No expansion* Shows only the events, not the details. The user can open the details by clicking again. This provides a clear overview of the flow of messages.
  - *All levels* Shows the complete content of the messages. This is useful when it is necessary to analyse details.
- *Search text:* The trace results only include events which contain the text entered.

Fig. 7-9 shows an example of the trace buffer output.

SeqNr	Time	Severity	PID	Class	State	Event	Details	MsgRef
1425	10:34:13.218	INFO	LocalDb: UnitdataUplink for unknown SSI 2010					
1443	10:34:13.218	DEBUG	RegisterSubscriber successfully called for ISSI 2010 with LocationUpdateType 0. Notification is not sent.					
1446	10:34:13.218	DEBUG	Database::UpdateSubscriberUpdateList increased itsLastEventIdProvided (first assigned EventId) by 1 to [0x00000000 0x00000001] for anISSI : 2010					
1447	10:34:13.218	DEBUG	Standard Terminal supporting SCCH 2010 registered on SCCH 6					
1448	10:34:13.218	DEBUG	LocalDb: Registered SSI 2010 on cell 0 with SCCH information 6 CCCH: 1					
1449	10:34:13.218	DEBUG	Database::Attachment called for subscriber 2010 with an attachment list 1 entries long.					
1450	10:34:13.218	DEBUG	Database::MergeAttachedGroupsIntoDatabase with 1 entries called for subscriber 2010					
1451	10:34:13.218	INFO	Database::MergeAttachedGroupsIntoDatabase for GSSI 90900, created new entry in database.					
1453	10:34:13.218	DEBUG	Database::UpdateSubscriberUpdateList increased itsLastEventIdProvided by 1 to [0x00000000 0x00000002] for anISSI: 2010					
1454	10:34:13.218	DEBUG	GssiDesc 90900 created, current ts is 0					
1455	10:34:13.218	DEBUG	LocalDb: Attached GSSI 90900 with Class of Usage 4 to SSI 2010					
1473	10:34:13.218	ERROR	P[fh]	AiStackMm	n/a	SND	P[UNKNOWN] UNKNOWN	Isc_DataTransferReq/TbapGm_GroupInfoReq
1485	10:34:13.218	INFO	Fct(MM-DD-Observer)			SND	P[fh] AiStackMm	TbMm_SRI_StatusNotification

Fig. 7-9: Example of Trace Buffer Output

The following information is output for each event:

- *SeqNr* The sequential number identifies the events and starts running when the service is launched.
- *Time* Local time stamp indicating when the event occurred.
- *Severity* Classification of severity (*INFO*, *DEBUG* or *ERROR*)
- *PID* Internal process ID
- *Class* Internal class description
- *State* Current state (for a *state machine* only), otherwise *n/a*
- *Event* For timers: *EXPIRE* or *START*
  For messages: *SND* (send) or *RCV* (receive).
- *Details* For timers: Name of timer
  For messages: PID and class description of sender / recipient.

- *MsgRef* For timers: Details of timer
  For messages: Hyperlink to message content

As the trace buffer is only stored locally, the entire HTML page displayed must be stored for later analysis on the computer's hard drive using either **Save Buffer at Host** or the Windows Internet Explorer. In this process, it is advisable to activate the *all levels* option.

---------- END OF SECTION ----------

Abbreviations

The following abbreviations are used in this manual:

A

AC	Alternating current
A/D	Analogue/digital
ACK	Acknowledge
AF	Audio frequency
AI	Air interface
AIE	Air interface encryption
AP	Access priority
ASCII	American Standard Code for Information Interchange

B

BS	Base station
BSC	Base station controller
BSS	Base station supervisor

C

CD	Compact disc

D

DC	Direct current
DGNA	Dynamic Group Number Assignment
DSP	Digital signal processor

E

EMI	Electromagnetic influence
EMV / EMC	Electromagnetic compatibility
ESD	Electrostatic discharge
eXTRAS	eXtensible Trunked RAdio System

F

FR 400	Frequentis TETRA Radio 400, a 48V DC model base station
FTD_IP	Frequentis TETRA Dispatcher with IP connection
FTG_64	Frequentis TETRA Gateway
FTG_64 ARG	Frequentis TETRA Gateway extension for an analogue gateway
FTN_C	Frequentis TETRA Network Management Client
FTN_S	Frequentis TETRA Network Management Server
FTR	Frequentis TETRA Recorder, Central Recorder
FTS 100	Frequentis TETRA Switch 100
FTS 100 RED	Frequentis TETRA Switch 100 in redundant operation
FTN-SC	Frequentis TETRA Network Management Server/Client, a single-workstation solution for network management

G

GPS	Global Positioning System
GSM	Global System for Mobile Communications
GSSI	TETRA Group Short Subscriber Identification

H

HE	Rack unit, 1 U = 44.45 mm, or 1¾ inch
HTTP	Hypertext Transfer Protocol
HW	Hardware

I

ID	Identification
IF	Interface
IOP	Interoperability
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISI	Inter System Interface
ISSI	TETRA Individual Short Subscriber Identity

J

-

K

KMC	Key Management Centre (air interface encryption)

L

LAN	Local area network
LE	Late entry
LLC	Logical Link Control
LNA	Low noise amplifier
Log	Log
LSI	Line station interface

M

MAC	Medium access control
MCC	Mobile country code
MCCH	Main control channel
MIB	Management Information Base
MNC	Mobile network code
MoU	Memorandum of understanding
MS	Mobile subscriber, mobile station

N

NMI	Network management interface
NMS	Network management system

O

-

P

PABX	Private access branch exchange
PC	Priority call
PCI	Peripheral Component Interconnect (bus standard)
PD	Packet data
PDCH	Packet data channel
PRI	Primary rate interface (an ISDN interface)

PSTN	Public switched telephone network
PTT	Push-to-talk

Q

QSIG	ISDN-based signalling protocol

R

RTP	Real-Time Transport Protocol
RX	Receive / receiver

S

SCC	Software Control Centre
SCCH	Secondary control channel
SDS	Short data service
SIP	Session Initiation Protocol
SNDCP	Sub network Dependent Convergence Protocol
SNMP	Simple Network Management Protocol
SSI	Short Subscriber Identity
SUM	Subscriber Management
SW	Software

T

TAI	TETRA Air Interface
TCP	Transmission Control Protocol
TETRA	Terrestrial Trunked Radio
TMO	TETRA trunked mode
TPI	Talking party identification
TS	Time slot
TX	Transmit / Transmitter

U

USB	Universal Serial Bus
USV / UPS	Uninterruptible power supply

V

VoIP	Voice over IP (internet protocol telephony)

W

WAN	Wide area network
WAP	Wireless Application Protocol
WAV	Container format for the digital storage of audio files

X

-

Y

-

Z

-

---------- END OF SECTION ----------

Glossary

This section provides definitions of key terms used in the manual.

Base Station (BS), FR400 or SOLO

The *FR400* or *SOLO* base station (BS) makes all layers of the TETRA air interface(s) available in a cell. The BS also supports what is known as stand-alone operation (BS fall back) or isolated operation, which maintains operations within a cell even if the TETRA switch fails.

Central Recorder FTR

An optional system component in the eXTRAS system. The Central Recorder records all TETRA-encoded voice packets. It also makes it possible to convert the TETRA-encoded voice packets into WAV format. In addition, the Central Recorder provides a client which enables the local playback of recordings.

De-registration

The routine by which a TETRA mobile device de-registers with the TETRA infrastructure (base station) with its Individual Short Subscriber Identity (ISSI). This routine is also carried out in the handover from one radio cell to a neighbour cell.

Direct Call

A special type of individual call in which the subscriber selects the desired mobile device from a list and can speak immediately by pressing PTT.

Direct Mode (DMO)

Direct mode enables communication between two mobile devices without using the TETRA infrastructure. In order to do so, the mobile devices use a frequency reserved specifically for this purpose. This frequency is set when the mobile devices are programmed.

Dispatcher

The person who coordinates and manages tasks for one or more groups.

Dispatcher (FTD_IP)

The *FTD_IP* dispatcher enables PC-based access to the expanded features of eXTRAS. The PC is connected to the gateway - and thus to eXTRAS - via Ethernet (LAN / IP). Both signalling as (TCP/IP) well as voice communications (G.711/RTP) are transported via this connection.

Diversity

By using two receiver antennas, it is possible to improve the signal received at the base station.

Dual Watch

This function allows a subscriber to use a mobile device in direct mode in order to check whether group calls are being held in the TETRA infrastructure.

Dynamic Group Number Assignment (DGNA)

Dynamic Group Number Assignment allows authorized users to assemble ad-hoc/temporary groups during live operation. These groups do not have to be predefined in the mobile device (in contrast to static groups), but are assigned to the mobile device via the air interface as needed. In this way, it is possible to meet short-term operational needs without having to set up static groups.

Emergency Call

A call with the highest priority (15, pre-emptive) which - given a shortage of resources - may also terminate current calls in order to connect.

Gateway, FTG_32

A special system component in eXTRAS which makes interfaces to external networks available. These interfaces can be used for voice communication (e.g., ISDN lines, VoIP) or to exchange data (e.g., SDS or packet data).

Group Call

A call by a subscriber to a group (semi-duplex: one group member speaks, the others listen). Semi-duplex operation is controlled by the PTT button.

Inactivity Time

Defines the period of time between the last PTT request and the release of an assigned time slot when no communication takes place.

Individual Call

A call in which two parties communicate with one another. Such calls can be made in semi-duplex mode using the PTT button or in full duplex mode (without the PTT button, like a telephone call). The possible types of individual call depend on the subscriber's authorizations.

Inter System Interface (ISI)

Standardized TETRA interface which connects TETRA networks from different manufacturers (ETS 300 392-3-5).

Individual Short Subscriber Identity (ISSI)

Unique subscriber number for an individual terminal device in a TETRA network.

Late Entry

A function for group calls which enables a subscriber to join an active group call at a later point if the subscriber was not available when the call started.

Mobile Station / Subscriber (MS)

Mobile subscriber (MS) is the standard TETRA term for mobile (vehicle-based) and portable (personal) devices.

Packet Data (PD)

Packet data (PD) is the TETRA term for packet data service, which enables the IP-based transmission of data between terminal devices and computer equipment connected to the mobile devices. The equipment is connected using a peripheral equipment interface (PEI), which is a standardized interface for mobile devices. If available, it is also possible to transmit data via the PD gateway to external wired IP networks.

Peripheral Equipment Interface (PEI)

The Peripheral Equipment Interface for mobile devices provides a standardized interface for external applications (e.g., notebooks) using an RS-232 connector (ETS 300 392-5).

Pre-emptive priority call

A call for which the calling subscriber is assigned a voice connection immediately. If all voice channels are occupied, an existing call is disconnected.

Priority

Each subscriber and group is assigned a priority in order to enable the management of resources in the TETRA network. If queues arise in the system, the assigned priority levels determine the sequence of connections.

Push-to-talk (PTT)

A button which must be pressed in order to request a call (semi-duplex). Pressing this button triggers the assignment of a voice channel in the system. The PTT button is not necessary for full duplex calls (individual calls).

Queue

If all channels are occupied when a radio connection is requested, the subscribers waiting for a free channel are managed in a queue. The assignment of available channels is handled according to the priority assigned to each subscriber/group.

Radio Cell

The radio area (coverage) of a base station.

Registration

The routine by which a TETRA mobile device registers with the TETRA infrastructure (base station) with its Individual Short Subscriber Identity (ISSI). This routine is also carried out in the handover from one radio cell to a neighbour cell.

Real-Time Transfer Protocol (RTP)

A standardised protocol to transfer audio-visual data (streams) via an IP based network. This protocol is based on packets and is responsible for coding, packaging and sending speech data within eXTRAS. The transmission layer is based on UDP (user datagram protocol).

Session Initiation Protocol (SIP)

An open standard for VoIP which arranges the protocol for establishing, controlling and releasing the communication of two or more subscribers. Based on this protocol the subscribers can negotiate and agree on the necessary communication modalities. For the transmission of the speech data stream an additional protocol is required which is for eXTRAS the real time transfer protocol (see RTP).

Short Data Service (SDS)

The Short Data Service is used to exchange status messages and short messages among mobile subscribers and dispatchers. Status messages are transmitted as numbers which are translated into the corresponding display text on the related device. Short messages are transmitted with predefined packet sizes (16, 32 or 64 bits). Text messages are transmitted with variable packet sizes (0 to 2047 bits). Read and receipt confirmations can be requested for text messages.

Switch, FTS_100

The *FTS_100* implements the crossbar switch for the eXTRAS system. This switch handles the exchange of TETRA-encoded voice packets for the connected base stations and, if necessary, also makes them available to the gateway (for connections to dispatchers or to external networks) or the *FTR_32* Central Recorder.

TETRA (Terrestrial Trunked Radio)

This standard is defined as a universal platform for a wide variety of mobile radio services and in particular for communication solutions where security is critical. Details on the standard are readily available at www.etsi.org.

TETRA Air Interface (TAI)

A standardized interface for communication between radio devices and base stations (ETS 300 392-2).

The TETRA Air Interface uses time division multiplexing and is defined with four independent communication channels per carrier. The distance between each carrier frequency is 25 kHz. Frequency division multiplexing is also used, as each radio channel is operated using an uplink and a downlink frequency.

The transmission rate for the individual radio channels in the air interface is 9 kBit/s. A carrier makes 4 communication channels available (TDMA, Time Division Multiple Access).

Trunked Mode Operation (TMO)

This term describes the normal voice communication mode in a TETRA network, which means that the mobile subscriber is registered in the TETRA network and is not being operated in direct mode.

Voice over IP (VoIP)

A general term used for IP telephony also. It is used to describe a family of transmission technologies to transfer the necessary information for telephony (signalling and speech) via IP based data networks. In eXTRAS the protocol for signalling is based on TCP/IP. To connect an external PABX the session initiation protocol (see SIP) is supported. The transmission of the speech is done with the real time transport protocol (see RTP). The connection of the base station to the TETRA switch *FTS_100* is based on VoIP as well as the connection to the gateway *FTG*, the central recorder *FT*R and the dispatcher *FTD_IP*.

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