# Table of Contents

## 1 Preface

1.1 Precautions and safety 9  
1.2 Symbols and notations 9  
1.3 Interfaces and circuit categories 10  
1.4 Document history 10  
1.5 Definition of terms 10

## 2 Preparing for installation

2.1 Installation general instructions 11  
2.1.1 Selection of the installation site 11  
2.1.2 Options for installation 12  
2.2 Planning guide lines 13  
2.2.1 Power supply principles 13  
2.2.2 Power supply circuits 13  
2.2.2.1 Wire gauge 14  
2.2.2.2 Circuit breakers 15  
2.2.3 Heat evacuation and installation 15  
2.2.3.1 Units and heat dissipation 15  
2.2.3.2 Subrack installation 16  
2.2.3.3 Arrangement in the rack 17  
2.3 Earthing principles and requirements 20  
2.3.1 Earthing and power supply 20  
2.3.2 Lightning and over-voltage protection 21  
2.3.3 EMC and ESD considerations 22  
2.4 Dimensions and mechanical installation practice 24  
2.4.1 19-inch installation standard 24  
2.4.1.1 Overview 24  
2.4.1.2 Subrack 25  
2.4.1.3 Subrack with front cover 25  
2.4.1.4 DUPF1 (option) 26  
2.4.1.5 Cable tray 26  
2.4.1.6 FAMO1 27  
2.4.1.7 FAMO1-F 27  
2.4.1.8 Heat deflection shield 2 HU 28  
2.4.1.9 Heat deflection shield 1 HU 28  
2.4.2 ETSI installation standard 29  
2.4.2.1 Overview 29  
2.4.2.2 ETSI adapters 31  
2.4.3 Torques 34
3 Installation procedures

3.1 Unpacking and equipment check
3.1.1 Before you start …
3.1.2 Packing of the subrack and accessories
3.1.3 FOX615 equipment
3.1.4 Signal cables
3.2 ETSI adapters (option)
3.3 Captive nuts
3.3.1 19-inch racks
3.3.2 ETSI racks
3.4 Cable tray and power supply
3.4.1 Installing the cable tray
3.4.2 Installing the DC power supply
3.4.2.1 Power cable
3.4.2.2 External power supply circuit
3.5 Signal cables
3.5.1 Tying signal cables to the cable tray
3.5.1.1 Units
3.5.1.2 Fan unit
3.5.2 Tying cables to their connection points
3.6 Subrack
3.6.1 Installing DUPF1 (option)
3.6.2 Installing the FAMO1 or FAMO1-F power and alarm cable (optional)
3.6.3 Installing the subrack
3.6.3.1 Prerequisites
3.6.3.2 Subrack installation
3.6.3.3 Subrack earthing
3.6.4 Subrack power supply
3.6.4.1 Local power interfaces
3.6.4.2 Single circuit power supply
3.6.4.3 Dual power supply (DUPF1 option)
3.7 Fan unit or alarm unit (option)
3.7.1 Installing FAMO1 or FAMO1-F
3.7.2 FOX interface
3.7.3 Alarm interfaces
3.7.3.1 Interfaces and connectors
3.7.3.2 Alarm signal input interfaces
3.7.3.3 DUPF1 alarm interface
3.7.3.4 Alarm signal output interface
3.8 Heat deflection shield
3.8.1 Orientation of the shield
3.8.2 Installing the shield
3.9 Final steps
3.9.1 Tightening of screws
3.9.2 Cable clamps, earthing bar and EMC clips
3.9.3 Units and signal cables
3.9.3.1 Inserting units in the subrack
3.9.3.2 Connecting signal cables
3.9.3.3 Clamping cables to the subrack earthing bar
3.9.3.4 Removing units
3.9.4 Front cover
3.9.4.1 Mounting the front cover
3.9.4.2 Removing the front cover

4 Checklists

4.1 Overview
4.2 NE and units
4.3 Options
4.4 Cables
4.4.1 Cables for alarm interfaces
4.4.2 Computer cables and adapters
4.4.3 Signal cables
4.5 Installation material
4.6 Tools
4.7 Test equipment

5 Annex

5.1 Associated FOX documents
5.2 Associated documents of standard bodies
5.3 Declaration of conformity
5.4 Feature licences
Figures

Figure 1: FOX615 power distribution 14
Figure 2: Evacuation of heated air to the rear (recommended for 19-inch installation at the bottom of a cabinet) 17
Figure 3: Evacuation of heated air to the front (recommended for 19-inch installation at the top of a cabinet) 18
Figure 4: Arrangement of stacked FOX with heat deflection devices 19
Figure 5: Earthing and power supply terminals of the FOX615 subrack 21
Figure 6: 19-inch installation standard for the FOX615 24
Figure 7: Mechanical dimensions FOX615 subrack 25
Figure 8: Mechanical dimensions FOX615 subrack with front cover and DUPF1 26
Figure 9: Mechanical dimensions DUPF1 dual power supply connection box (option) 26
Figure 10: Mechanical dimensions FOX615 cable tray 27
Figure 11: Mechanical dimensions FAMO1 fan unit 27
Figure 12: Mechanical dimensions FAMO1-F fan unit 28
Figure 13: Mechanical dimensions heat deflection shield 2 HU 28
Figure 14: Mechanical dimensions heat deflection shield 1 HU 29
Figure 15: ETSI installation standard for the FOX615 30
Figure 16: 11 HU adapter for the installation of the cable tray, subrack, fan unit and heat deflection shield in ETSI racks (left side adapter shown only) 32
Figure 17: 9 HU adapter for the installation of the cable tray, subrack and fan unit in ETSI racks (left side adapter shown only) 33
Figure 18: 2 HU adapter for the installation of the heat deflection shield in ETSI racks (left side adapter shown only) 33
Figure 19: Subrack packing assembly of the FOX615 37
Figure 20: FOX615 installation with 11 HU ETSI adapters 39
Figure 21: FOX615 fixing positions in the 19-inch rack relative to the cable tray 41
Figure 22: Cable tray 42
Figure 23: FOX power supply cable 43
Figure 24: Cable tray and installation of WAGO connector blocks and power cables 44
Figure 25: Connecting wires to the WAGO connector block 45
Figure 26: Cable with ferrite toroid sample 47
Figure 27: Cable with EMC filter sample 47
Figure 28: Installation and position of connectors and cables with EMC filter with respect to the front line of the cable tray 48
Figure 29: DUPF1 installation 53
Figure 30: FOX subrack with DUPF1 installed 55
Figure 31: FOX subrack FAMO1 or FAMO1-F power and alarm cable installation 56
Figure 32: Earthing / bonding points of the FOX subrack 59
Figure 33: Principles of single circuit power supply 61
Figure 34: Principles of two circuits power supply 62
Figure 35: FAMO1 or FAMO1-F power and alarm cable 64
Figure 36: Installation of the FAMO1 or FAMO1-F power and alarm cable 65
Figure 37: FAMO1 and FAMO1-F alarm interfaces 66
Figure 38: Molex connector frames and crimp terminals 66
Figure 39: FAMO1 and FAMO1-F alarm signals input interfaces 67
Figure 40: Molex connector frame alarm signal inputs
Figure 41: DUPF1 alarm interface connection
Figure 42: FAMO1 and FAMO1-F alarm signals output interface
Figure 43: Molex connector frame system alarm signal outputs
Figure 44: Alarm output contact scheme (no alarms, inactive state)
Figure 45: Alignment of the heat deflection shield for evacuation of heated air to the rear
Figure 46: Alignment of the heat deflection shield for evacuation of heated air to the front
Figure 47: Cable clamps and earthing bars (conductive foam in bars and clamps is dark shaded)
Figure 48: Detail of unlocking a cable clamp with a screwdriver (application with left clamp shown)
Figure 49: Mounting of three plus three EMC clips to the earthing bars
Figure 50: Insertion of units in the subrack
Figure 51: Removal of units from the subrack
Figure 52: Installing the front cover to the subrack
Figure 53: Removing the front cover from the subrack
### Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1</td>
<td>Electrical interfaces and circuit categories</td>
<td>10</td>
</tr>
<tr>
<td>Table 2</td>
<td>Document history</td>
<td>10</td>
</tr>
<tr>
<td>Table 3</td>
<td>Usage of ETSI adapters</td>
<td>31</td>
</tr>
<tr>
<td>Table 4</td>
<td>Torques</td>
<td>34</td>
</tr>
<tr>
<td>Table 5</td>
<td>ETSI adapters</td>
<td>39</td>
</tr>
<tr>
<td>Table 6</td>
<td>Alarm input interfaces pin connection</td>
<td>67</td>
</tr>
<tr>
<td>Table 7</td>
<td>DUPF1 alarm input interfaces pin connection</td>
<td>68</td>
</tr>
<tr>
<td>Table 8</td>
<td>Alarm output interface pin connection</td>
<td>69</td>
</tr>
<tr>
<td>Table 9</td>
<td>Checklist FOX equipment</td>
<td>85</td>
</tr>
<tr>
<td>Table 10</td>
<td>Checklist FOX equipment</td>
<td>86</td>
</tr>
<tr>
<td>Table 11</td>
<td>Checklist ETSI adapter options</td>
<td>86</td>
</tr>
<tr>
<td>Table 12</td>
<td>Checklist alarm interface connector set</td>
<td>87</td>
</tr>
<tr>
<td>Table 13</td>
<td>Checklist computer cables</td>
<td>87</td>
</tr>
<tr>
<td>Table 14</td>
<td>Checklist for material</td>
<td>88</td>
</tr>
<tr>
<td>Table 15</td>
<td>Checklist for tools (installation)</td>
<td>89</td>
</tr>
<tr>
<td>Table 16</td>
<td>Associated documents of standard bodies</td>
<td>92</td>
</tr>
</tbody>
</table>
1 Preface

1.1 Precautions and safety

Before you handle any equipment you must comply with the safety advices. Adherence to the safety instructions ensures compliance with the safety requirements as defined in EN 60950 (Safety of Information Technology Equipment).

Please refer to the following document: 1KHW002497 FOX61x Precautions and Safety.

1.2 Symbols and notations

This User Manual uses the following symbols:

**WARNING**

Non-observance could result in death or serious injury.

*Indicates a hazard with a medium level of risk which, if not avoided, could result in death or injury to the user.*

→ Possible actions are given.

**NOTICE**

Non-observance could result in equipment damage.

*Failing to comply with this may result in physical damage.*

→ Possible actions are given.

**Risk of operating trouble!**

*Indicates that an action may lead to operating trouble or loss of data.*

→ Possible actions are given.

**Please note:**

*Shows significant information.*

→ Possible actions are given.
1.3 Interfaces and circuit categories

Table 1: Electrical interfaces and circuit categories

<table>
<thead>
<tr>
<th>Interface</th>
<th>Circuit category according to EN 60950-1</th>
<th>Max. rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local power supply</td>
<td>TNV2</td>
<td>≤ 72 V&lt;sub&gt;DC&lt;/sub&gt;, ≤ 30 A</td>
</tr>
<tr>
<td>Alarm interface</td>
<td>TNV2</td>
<td>≤ 72 V&lt;sub&gt;DC&lt;/sub&gt;, ≤ 10 mA</td>
</tr>
<tr>
<td>FAMO1 and FAMO1-F inputs</td>
<td>SELV</td>
<td>≤ 6 V, ≤ 10 mA</td>
</tr>
<tr>
<td>Alarm interface</td>
<td>SELV</td>
<td>≤ 6 V, ≤ 10 mA</td>
</tr>
<tr>
<td>FAMO1 and FAMO1-F outputs</td>
<td>SELV</td>
<td>≤ 6 V, ≤ 10 mA</td>
</tr>
</tbody>
</table>

1.4 Document history

Table 2: Document history

<table>
<thead>
<tr>
<th>Date</th>
<th>FOX Release</th>
<th>Changes since previous version</th>
</tr>
</thead>
<tbody>
<tr>
<td>December 2012</td>
<td>R1A</td>
<td>This is the first release for FOX61x.</td>
</tr>
</tbody>
</table>

1.5 Definition of terms

For an explanation of terms used in this document please refer to 1KHW028514 FOX61x Abbreviations and Terms.
2 Preparing for installation

2.1 Installation general instructions

2.1.1 Selection of the installation site

To get the best performance and MTTF with your FOX equipment you should consider the following aspects for the selection of the installation site:

Please note:
Avoid sites with important differences between the daily maximum and the nightly minimum temperature (except for cabinets with air conditioning).
→ For FOX615 installed in cabinets or similar, select sites for the cabinets which are not permanently exposed to direct sun radiation.

Please note:
Operation at lower temperatures extends the long-term reliability (MTTF) and the lifetime of the equipment.
→ Check for temperature and relative humidity within the specified range.

NOTICE
Attention to temperature range. Risk of equipment damage!
High ambient temperatures caused by other equipment may lead to overheating of the FOX615 and may cause damage to the FOX615.
→ Do not install the FOX615 near or on top of equipment that dissipates heat.

NOTICE
Attention to temperature range. Risk of equipment damage!
Obstructed airflow may lead to overheating and damage of your FOX615.
→ Make sure that the selected installation allows the equipment to dissipate the heat created within the FOX615.

NOTICE
Attention to access control. Risk of equipment damage!
Unrestricted access to equipment premises hold a risk of damaged equipment and disrupted services.
→ Select a dust-free room that is normally closed and not generally accessible.
Risk of operating trouble!
Attention to EMC properties!

Electronic equipment is sensitive to strong electromagnetic fields and may show unexpected behaviour when exposed to fields above the specified level.

→ Select an installation place with sufficient distance to equipment that produces strong electromagnetic fields (e.g. large transformers, power rectifiers, generators, electrical machines, railways etc.).

WARNING
Attention to proper earthing. Risk of electric shock!

Improper earthing of the equipment carries a high risk that could result in serious injury, and that could damage your equipment.

→ Make sure that the selected site provides efficient earthing terminals, and that the FOX615 is properly connected to earth. Only proper earthing of the equipment will protect you and your equipment from lightning.

A carefully chosen installation site is the first step to reliable and error-free system operation.

2.1.2 Options for installation

The FOX615 has several options that must be considered for the planning and preparation of the equipment installation:

• Standard options
  – Adapters for ETSI installation
  – Heat deflection shield R7A1 (19-inch)
    If ordered, the above accessories are separately packed.

• Dual power supply (DUPF1 option)
  The DUPF1 is a dual power supply connection box for the FOX subrack that allows you to feed the FOX subrack and FAMO1 or FAMO1-F from 2 separate power supply circuits.
  The DUPF1 is separately ordered and has its own packing.

• Fan unit (FAMO1 option)
  The FAMO1 is the fan unit for the FOX subrack providing active cooling.
  Note that there are FOX units for which active cooling is mandatory.
  Please refer to 1KHW002464 FOX61x System Description.
  The FAMO1 is separately ordered and has its own packing.

• Alarm unit (FAMO1-F option)
  The FAMO1-F is the alarm unit for the FOX operated without active cooling, i.e. without the FAMO1 unit. The alarm unit provides the same alarm interfaces as the fan unit FAMO1.
  The FAMO1-F is separately ordered and has its own packing.

Although possible, a later rearrangement of the installation for the above options creates additional work and service interruptions.
2.2 Planning guidelines

2.2.1 Power supply principles

The FOX615 is designed for single or dual DC power supply. For the dual power supply the DUPF1 dual power supply connection box (option) is required. Both power feeding circuits are terminated in the DUPF1.

To cope with the high power capabilities of the FOX all power supply interfaces and the FOX power cabling use

- 2 conductors for the $U_T (-48/-60 \text{ VDC})$
- 2 conductors for the 0 V and system ground (subrack construction)

The cable tray can provide 1 or 2 connector blocks for external power supply circuit(s) each able to connect 2 x 2 conductors for power feeding and power return. The connector blocks can handle conductors with cross sections of up to 4 mm².

The paragraphs below describe recommended implementations of the power supplies for the FOX.

2.2.2 Power supply circuits

The power supply circuits for the FOX615 power supply can be

- directly connected to the remote DC power distribution point:
  
  Each remote power distribution point has its own circuit breaker to fuse the supply circuit up to the FOX subrack. The circuit breaker is also used as a disconnect device for the subrack.
  
  This rack wiring diagram, without the remote DC power distribution point, is shown on the left side of Figure 1.

- connected to a power connection block in the rack.
  
  The power distribution points for all the equipment in the rack are implemented in the rack. Each power distribution point has its own circuit breaker “CB 1” to fuse the supply circuit up to the FOX615 subrack. The circuit breaker is also used as a disconnect device for the subrack.
  
  This rack wiring diagram is shown on the right side of Figure 1.

For single power supply of the FOX only the power supply circuit “PSC₁” is implemented. For dual power supply with the DUPF1 the power supply circuits “PSC₁” and “PSC₂” are implemented.

For details of the DUPF1 installation, refer to section Installing DUPF1 (option) (on page 51).
2.2.2.1 Wire gauge

The high power capabilities of the FOX imply requirements on the minimum cross sections of the supply circuits. To specify the minimum cross sections of the supply circuits PSC1 and PSC2 it has to be considered that

- the voltage at the terminal blocks “A” according to EN 300 132-2 must be $\geq 40.5 \text{ V}_{\text{DC}}$.
- the voltage at the FOX615 connector blocks for safe operation must be
  - $\geq 40 \text{ V}_{\text{DC}}$ with DUPF1, the voltage drop on PSC must be $\leq 0.5 \text{ V}$.
  - $\geq 39.5 \text{ V}_{\text{DC}}$ without DUPF1, the voltage drop on PSC must be $\leq 1.0 \text{ V}$.
- the FOX615 connector blocks accept cross sections of up to 4 mm$^2$ for conductors of the PSC circuits.
- the maximum power rating for the FOX615 is 30 A.
The minimum wire gauge required for the conductors of the power supply circuits (for one FOX615) between the terminal blocks A and the FOX sub-rack is 4.0 mm².

With 2 x 4.0 mm² wires for the power feed and 2 x 4.0 mm² wires for the power return the length of the PSC lines is limited to
- ≤ 3.7 m with DUPF1.
- ≤ 7.4 m without DUPF1.

**Risk of operating trouble!**
**Attention to EMC properties!**
*Please note that the power feeding and returning wires must be arranged in the wiring in such way that the magnetic induction is kept low.*

- Power cables with low inductivity are commercially available.

### 2.2.2.2 Circuit breakers

It is essential to fuse each power supply circuit (-VBAT = -48/-60 VDC) for the FOX615 subrack at its power distribution point with a 30 A slow-blow fuse or a circuit breaker ("CB 1" in Figure 1).

**WARNING**

*Hazardous electric currents. Risk of flashover and electric shock!*

*Omitting the fuses or circuit breakers in the power supply circuits might lead to seriously damaged equipment or create a fire in the case of overload or short circuits.*

- Make sure that the fuses or circuit breakers are correctly installed and intact for each of the power supply circuits.

### 2.2.3 Heat evacuation and installation

#### 2.2.3.1 Units and heat dissipation

Traffic units operated in the FOX615 subrack can dissipate a high amount of heat. To evacuate the heated air from the subrack, a passive or active cooling can be used.

Passive cooling, i.e. without a fan unit, requires the deployment of specific functional units. The maximum ambient temperature is reduced compared to the actively cooled subrack. Please refer to "FOX61x System Description" for the list of passive cooling FOX units.

**Active cooling, i.e. with a fan unit, requires the deployment of a subrack specific fan unit FAMO1.**

Active ventilation with the FAMO1 fan unit is mandatory to prevent units from overheating and to evacuate the excess heat from the units and the subrack.

For reliable operation of the FOX615, it is essential to evacuate the heat from the FOX subrack and from its environment.
2.2.3.2 Subrack installation

The ambient temperature for operation of the FOX615 with active cooling is rated from -25°C to +60°C with a relative humidity of up to 95% (non-condensing).

The ambient temperature for operation of the FOX615 with passive cooling is rated from -25°C to +55°C with a relative humidity of up to 95% (non-condensing).

For detailed specification of the temperature range for FOX operation and related operational conditions, refer to 1KHW002460 FOX61x Product Features and Characteristics.

**NOTICE**

Attention to temperature range! Attention to temperature range. Risk of equipment damage!

It is essential to preserve the system specifications and to prevent the system from overheating.

→ The site of installation must provide an ambient temperature within the specified range at any time.

If you plan to stack equipment, take into account that the system below will heat up the air defining the ambient conditions for the equipment above!

To avoid overheating of the equipment due to inadequate installation adhere to the following instructions.

- Do not block the air flow through the subrack and its cards.
- Avoid the installation of other equipment directly above the FAMO1 or FAMO1-F unit. Respect a minimum distance of 2 HU (2 x 44.45 mm) to the equipment above.
  
  If the equipment above is sensible for dissipated heat, you must install a heat deflection shield R7AI above the FAMO1 or FAMO1-F (refer to the figures in section Arrangement in the rack (on page 17)).

- Avoid the installation of the FOX615 subrack (cable tray) directly above other equipment. Respect a minimum distance of 2 HU (2 x 44.45 mm) to the equipment below.
  
  If the equipment below dissipates heat, you must install a heat deflection shield R7AI below the cable tray (refer to the figures in section Arrangement in the rack (on page 17)).

- Do not install subracks without a cable tray. The cable tray is an integral part of the FOX615 and allows cold air to flow into the subrack. Install the cable tray in such a way that 2HU space is provided between the tray and the chassis air inlet.

- If you stack equipment, install heat deflection shields R7AI between the subracks (refer to the figures in section Arrangement in the rack (on page 17)) to evacuate the heated air to the rear or front of the rack.

- In cabinets using a swing frame the uppermost position of an R7AI is height 1. In cabinets without a swing frame it is height 2. This allows optimum air evacuation through the front door.

- In cabinets without active ventilation it is recommended to omit the dust filters at the top.
2.2.3.3 Arrangement in the rack

The heat deflection shield R7AI removes the hot air aspired by the fan unit through the subrack below to the front or rear of the rack. If equipment is producing heat below the FOX615 subrack, a heat deflection shield R7AI is also required below the cable tray.

Depending on the evacuation of the heated air, there are two ways of installing the heat deflection shield R7AI (refer to Figure 2 and Figure 3:

- **Evacuation to the rear:**
  The heat deflection shield R7AI is installed in such way that the
  - cold air flows from the cabinet air inlet into the subrack
  - heated air evacuates from the subrack to the rear

![Figure 2: Evacuation of heated air to the rear (recommended for 19-inch installation at the bottom of a cabinet)](image)

- **Evacuation to the front:**
  The heat deflection shield R7AI is installed the opposite way in order to allow the
  - heated air from the subrack below to evacuate through the front door air outlet.
Figure 3: Evacuation of heated air to the front (recommended for 19-inch installation at the top of a cabinet)

The FAMO1 is a fan unit designed for the FOX615 and installed between the subrack and the heat deflection shield R7AI on top.

With passive cooling operation of the FOX subrack the FAMO1 is replaced by the alarm unit FAMO1-F. If no external alarm interfaces are required the alarm unit can be omitted. Also in this case the heat deflection shield R7AI should be placed with a 1 HU distance above the FOX615 subrack.

**CAUTION**

Attention to temperature range! Risk of equipment damage!

*It is essential to preserve the system specifications and to prevent the system from overheating.*

→ The site of installation must provide an ambient temperature within the specified range at any time.

For illustration of the implementation of this basic arrangement of the FOX subrack, FAMO1 or FAMO1-F and heat deflection shield R7AI in the rack, refer to Figure 4.
Figure 4: Arrangement of stacked FOX with heat deflection devices
Please note:
The installation of stacked subracks in standard ETSI racks requires other arrangements, since there is normally no room for the evacuation of the heated air at the rear of the racks.

Please note:
If the equipment is stacked, a heat deflection shield R7AI is installed on top of each FAMO1 or FAMO1-F to evacuate the heat generated in the subrack. Depending on the rack, the top equipment does not require deflection.

Please note:
A heat deflection shield R7AI installed below the subrack might help to remove the hot air produced below.
Considering the above it is possible to create the layout for the FOX equipment and heat deflection devices in the rack.

2.3 Earthing principles and requirements

2.3.1 Earthing and power supply

The FOX615 is a telecommunication equipment compliant to protection class 1.

The FOX615 is designed for earthing and power supply principles according to ETSI EN 300 253 V2.1.1, Figure 2: “Example of a CBN (Common Bonding Network)/MESH-Bonding Network configuration with common DC return conductor connected to the CBN at multiple points”.

For details of the Common Bonding Network principles, refer to ETSI EN 300 253 V2.1.1.

In the FOX subrack the 0-volt potential of the (external) power supply is directly connected to the mechanical construction of the subrack and the (internal) electronic ground GND which is fed via the backplane to the units.

The negative power supply voltage $U_T (-48/-60 \text{ V}_{DC})$ is first filtered in the subrack. The filtered voltage ($U_{TF}$) is then fed via the backplane to the units for local conversion.

The subrack requires reliable earthing / bonding to the CBN. The subrack mounting flanges are conductive and provide a conductive contact to the rack if the rails of the rack also provide a conductive surface. If the rack does not provide a conductive surface or is not connected to the CBN, one of the four screws used for the fixing of the subrack to the rack can be used as terminal for the subrack earthing via an earthing cable.
2.3.2 Lightning and over-voltage protection

The FOX units provide secondary over-voltage protection for their interfaces in cooperation with external equipment.

The primary protection (as required for lightning protection) is implemented external to the FOX615, normally at the connection points of the signal cables to the outside world. Depending on the units and interfaces, the implementation of gas discharge tubes at the external connection point is suitable for providing such protection.
2.3.3 EMC and ESD considerations

The FOX615 subrack with the front cover installed represents a Faraday cage like construction. This premises that all signal cables are connected to the cable earthing bar as instructed. Conductive metal sheets all around the subrack protect the FOX615 from ESD and electromagnetic fields.

The 19-inch mounting flanges of the subrack are conductive and provides a conductive contact to the rack if the rails of the rack provide a conductive surface. The subrack provides terminals for the system earthing.

Please note:

It is essential to place the ferrite toroid which is close to the unit connector between the earthing bar of the subrack and the connector of the unit.

When in operation, the FOX615 is protected against ESD in accordance with IEC/EN 61000-4-2 and in accordance with the specified EMC properties, provided that

- all parts have been installed as instructed in the technical customer documentation,
- all the equipment is properly grounded,
- the front cover is installed on the FOX615 subrack,
- ABB approved cables are used.

ABB gives no warranty for cables manufactured by third party and will not accept liability for EMC/ESD compliance if the FOX615 is operated with cables that are not approved by ABB.
Electrostatic discharges. Risk of equipment damage!

All the plug-in units used with the FOX615 are ESD sensitive units.

→ They must be handled with care.

Respecting the following rules will help you to avoid early equipment damage and is a prerequisite for successful equipment installation and operation:

• The original packing provides the best protection for your equipment. Leave the equipment in its original packing until you install it in the subrack.

• Respect ESD protection regulations. To prevent damage of electronic components by electrostatic discharges, wear a grounded protective wrist strap.
2.4 Dimensions and mechanical installation practice

2.4.1 19-inch installation standard

2.4.1.1 Overview

All mechanical parts relevant for the installation of the FOX615 are for 19-inch installation.

---

**Figure 6:** 19-inch installation standard for the FOX615

1. Cable tray
2. Subrack
3. FAMO1 or FAMO1-F (option)
4. Heat deflection shield R7AI (option)
Please note:
The standard heat deflection shield R7AI has a height of 2 HU. For subrack installations with constricted room in a rack, a heat deflection shield R7AI with a reduced height of 1 HU is available.

Please note:
If you want to protect the subrack (2) from heated air generated below the subrack, you must install a heat deflection shield below the cable tray (1) as well.

2.4.1.2 Subrack

The Figure 7 shows the layout and the mechanical dimensions of the 19-inch subrack, including earthing bars.

![Figure 7: Mechanical dimensions FOX615 subrack](image)

2.4.1.3 Subrack with front cover

The Figure 8 shows the mechanical dimensions of the 19-inch subrack with front cover and installed DUPF1 option.
2.4.1.4 DUPF1 (option)

The Figure 9 shows the mechanical dimensions of the DUPF1 dual power supply connection box (option) fitting to the subrack of the FOX615.

Please note:
Figure 9 shows the DUPF1 without electronic components and cables.

2.4.1.5 Cable tray

The Figure 10 shows the mechanical dimensions of the 19-inch cable tray fitting below the FOX615 subrack.
2.4.1.6 FAMO1

The Figure 11 shows the mechanical dimensions of the 19-inch FAMO1 fan unit fitting above the FOX615 subrack.

2.4.1.7 FAMO1-F

The Figure 13 shows the mechanical dimensions of the 19-inch FAMO1-F alarm unit fitting above the FOX615 subrack.
2.4.1.8 Heat deflection shield R7AI 2 HU

The Figure 13 shows the mechanical dimensions of the 19-inch heat deflection shield R7AI with a height of 2 HU.

2.4.1.9 Heat deflection shield R7AI 1 HU

The Figure 14 shows the mechanical dimensions of the 19-inch heat deflection shield R7AI with a height of 1 HU.
2.4.2 ETSI installation standard

2.4.2.1 Overview

The ETSI installation for the FOX615 relies on adapters, which allows you to install the 19-inch FOX equipment in ETSI racks.
Figure 15: ETSI installation standard for the FOX615

1. 19-inch cable tray mounted on ETSI adapters
2. 19-inch subrack mounted on ETSI adapters
3. 19-inch FAMO1 or FAMO1-F mounted on ETSI adapters (option)
4. 19-inch heat deflection shield R7AI mounted on ETSI adapters (option)
5. ETSI adapters 11 HU

Installations without the heat deflection shield R7AI use 9 HU ETSI adapters.
Please note:
The deflection shield (4) evacuates the heated air generated in the subrack (2) to the rear or front of the subrack (depending on the shield orientation).

If you want to protect the subrack (2) from heated air generated below the subrack, you must install an additional heat deflection shield R7AI below the cable tray (1).

2.4.2.2 ETSI adapters

For the installation of the cable tray, the subrack, the fan unit and optionally the heat deflection shield R7AI in a rack complying with the ETSI installation practice, there are special adapters required.

As shown in the table below, there are three sets of adapters available:

<table>
<thead>
<tr>
<th>Application</th>
<th>ETSI adapters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment No.</td>
<td>11 HU</td>
</tr>
<tr>
<td>Cable tray</td>
<td>1</td>
</tr>
<tr>
<td>Subrack</td>
<td>2</td>
</tr>
<tr>
<td>Fan unit or alarm unit</td>
<td>3</td>
</tr>
<tr>
<td>Heat deflection shield</td>
<td>4</td>
</tr>
</tbody>
</table>

Please note that the equipment number identifies the equipment position relative to the ETSI adapters in the figures below.
**Figure 16:** 11 HU adapter for the installation of the cable tray, subrack, fan unit and heat deflection shield R7AI in ETSI racks (left side adapter shown only)
PREPARING FOR INSTALLATION

Figure 17: 9 HU adapter for the installation of the cable tray, subrack and fan unit in ETSI racks (left side adapter shown only)

Figure 18: 2 HU adapter for the installation of the heat deflection shield R7AI in ETSI racks (left side adapter shown only)

Please note:
The adapters contain integrated M6 nuts which fit to the holes of the FOX equipment (19-inch mounting standard).
2.4.3 Torques

Torques as follows apply for the installation of 19-inch/ETSI equipment (subracks, cable tray, FAMO1, FAMO1-F, heat deflection shields, adapters) and the screws of the unit front covers in the FOX615 subrack.

<table>
<thead>
<tr>
<th>Screw</th>
<th>Use/application</th>
<th>Torque [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Recommended</td>
</tr>
<tr>
<td>M2.5</td>
<td>Unit front covers</td>
<td>0.45</td>
</tr>
<tr>
<td>M2.5 (4.8)</td>
<td>DUPF1</td>
<td>-</td>
</tr>
<tr>
<td>M6 (4.8)</td>
<td>Earthing / bonding terminal</td>
<td>-</td>
</tr>
<tr>
<td>M6 (4.8)</td>
<td>19-inch / ETSI equipment (subracks) and adapters</td>
<td>-</td>
</tr>
</tbody>
</table>
3 Installation procedures

3.1 Unpacking and equipment check

3.1.1 Before you start …

Before you start the installation of the FOX615, please check and complete preparatory steps as follows:

- Layout of the equipment in the rack
  The proper layout of the FOX615 (and other) equipment in the rack is a prerequisite for all installation. This layout must consider:
  - FOX subracks with cable trays
  - Fan units (optional)
  - Alarm units (optional)
  - Heat deflection shields (optional)
  - Power supply, including power cabling and fusing
  - Signal cabling
  - Other equipment

  The layout must indicate the exact position of each cable tray, subrack, fan unit, alarm unit and heat deflection devices in the rack considering its mechanical dimensions and the rules for the equipment installation.

- Rack (19-inch / ETSI)
  - Rack is installed.
  - Metallic parts of the rack connected to the system ground.

- -48/-60 VDC power supply
  - Power distribution points installed.
  - Positive rail connected to system ground.
  - Negative supply rail features an individual circuit breaker protection for each subrack power feeding cable: Rating 30 A (slow).
  - The power supply circuit(s) is (are) available on the FOX cable tray. The circuit(s) is (are) checked and fused (30 A slow) at the supply side (terminal block “A”). Refer to Figure 1: FOX615 power distribution (on page 14).

- Heat dissipation
  - Measures for heat management in the rack implemented. This includes in particular measures for the heat evacuation from the rack.
  - The ambient temperature at the bottom of the subrack must never exceed the temperature range for system operation as specified in 1KHW002460 FOX61x Product Features and Characteristics.

- Checks of material
  - FOX equipment (cable trays, subracks, fan units, units etc.)
  - Optional equipment (fan units, alarm units, heat deflection shield etc.)
  - Cables (including latching clips for connectors)

  Material checked and ready for installation.

- Subrack
  - The slot (number) in the subrack defined for each unit.
- Number of the slot and position of the cable with respect to the slot is documented for all units. Normally the slot number and the number printed on the cable tray correspond.
- Units are not yet inserted.
- Instructions for installation
  - Adhere to the general instructions as provided in the previous paragraphs.
  - Instructions for the installation of units (user guides) are available.

It is good installation practice to follow the steps for the installation of the FOX in the order shown in the paragraphs below.

### 3.1.2 Packing of the subrack and accessories

The FOX615 equipment is packed in separate packages as follows:
- Subrack assembly and power cable
- FAMO1 fan unit, power/alarm cable and cable clips
- Optional items in separate packages:
  - FAMO1 fan unit, power/alarm cable and cable clips
  - FAMO1-F alarm unit, power/alarm cable and cable clips
  - DUPF1 and additional power cable
  - Heat deflection shield R7AI
  - ETSI adapters
- Units

Depending on order/delivery the above packages are packed in covering packages.
Figure 19: Subrack packing assembly of the FOX615

1 19-inch subrack including front cover (not shown)
2 Power supply cable for subrack
3 19-inch cable tray
Please note:
The packing of the FOX does NOT contain the following installation material:
→ Captive nuts (for the rack)
→ Screws to fix the subrack, cable tray, adapters etc. in the rack (captive nuts)

The packages for the FAMO1 fan unit, FAMO1-F alarm unit, dual power supply connection box DUPF1, ETSI adapters, heat deflection shield etc. and units are not shown in detail here.

3.1.3 FOX615 equipment
Check the unpacked equipment before you start the installation:
• Check for complete consignment and for correct designation (refer to ordering information).
• Check the equipment for damages due to storage, transport or handling.
• Check the backplane connectors (subrack) for damaged pins.
• Check the front (if any) and backplane connectors of the units for damaged pins.
• Leave units in their protective ESD bags until you plug them into the subrack.

Please note:
Do not throw away any pieces packed with the equipment; you might use them later.

Please note:
There are no connectors packed with the units. The connectors and cables are in separate packing.

Please note:
Keep the original packing of the components if you plan to move or dispatch the equipment later; the original packing provides the best protection for the equipment.

3.1.4 Signal cables
All external equipment connects via the connectors on the front panel of the units to the FOX615 (unit and traffic interfaces, maintenance interfaces, alarm and clock interfaces). ABB provides signal cables of variable length for all traffic and system interfaces.

For the visual inspection of signal cables check the following:
• Mechanical condition of the connectors and the cables.
• The contact holes of the connector must be clean.
• Mechanical condition of the latching system of the units.
  ABB provides cables with latching clips.
• The labelling (designation) of the cables must conform to the documentation of the installation.

Connector sets are provided for interfaces which are user configurable (alarm interfaces). The sets contain the Molex connector frame and crimp terminals.
3.2 ETSI adapters (option)

The FOX615 equipment directly fits to 19-inch racks. To install the FOX615 in ETSI racks you must first install the appropriate ETSI adapters.

ETSI adapters are available as follows:

Table 5: ETSI adapters

<table>
<thead>
<tr>
<th>ETSI adapters</th>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height units</td>
<td>Fixing holes N</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
</tr>
<tr>
<td>11 HU</td>
<td>5</td>
</tr>
<tr>
<td>9 HU</td>
<td>4</td>
</tr>
<tr>
<td>2 HU</td>
<td>2</td>
</tr>
<tr>
<td>9 HU + 2 HU</td>
<td>4 + 2</td>
</tr>
</tbody>
</table>

a. N corresponds to the number of holes that each ETSI adapter provides to fix the adapter to the nuts in the ETSI rack.

Figure 20: FOX615 installation with 11 HU ETSI adapters
The FOX615 installation with 9 HU ETSI adapters (without heat deflection shield) is similar and not shown here.

ETSI adapter installation Proceed as follows:
1. Select the appropriate adapter pair (left and right side, check for the pattern of the fixing threads of the cable tray).
2. Locate the position of the ETSI adapters in the ETSI rack. If not already implemented, fit N captive nuts on the left and the right side for each fixing hole in the adapter.
3. Lift the left ETSI adapter into position and secure it using N M6 screws. Tighten the screws provisionally.
4. Lift the right ETSI adapter into position and secure it using N M6 screws. Tighten the screws provisionally.

End of instruction

Please note:
The ETSI adapter sets contain the following installation material:
• Captive nuts (for the ETSI rack)
• Screws to fix the
  − adapters in the ETSI rack (captive nuts)
  − subrack, cable tray, fan unit, heat deflection shield etc. (whatever applies) to the adapters (integrated M6 nuts)

3.3 Captive nuts

3.3.1 19-inch racks
Captive nuts are required for the installation of the FOX615 equipment in 19-inch racks. In the 19-inch rack the nuts must be installed at positions relative to the bottom captive nut of the cable tray as follows:
Captive nuts installation  Proceed as follows:

1. Locate the fixing position of the FOX615 cable tray in the 19-inch rack and fit 2 captive nuts at positions (11) and (12), left and right.

2. Locate the fixing position of the FOX615 subrack in the 19-inch rack and fit 2 captive nuts at positions (21) and (22), left and right.

3. Optional: Locate the fixing position of the FAMO1 or FAMO1-F in the 19-inch rack and fit 2 captive nuts at positions (31) and (32), left and right.

4. Locate the fixing position of the heat deflection shield R7Al (optional) in the 19-inch rack and fit 2 captive nuts at positions (41) and (42), left and right.

End of instruction
Please note:
The packing of the FOX615 does NOT contain captive nuts.

### 3.3.2 ETSI racks

You need captive nuts for the ETSI rack to fix the ETSI adapters.

Please note:
The ETSI adapter sets contain the appropriate number of captive nuts to fix the adapters (left and right) in the ETSI rack.

The ETSI adapters contain integrated M6 nuts for the installation of the FOX615 equipment at the appropriate positions (refer to Figure 20).

### 3.4 Cable tray and power supply

#### 3.4.1 Installing the cable tray

For your convenience, you should first install the cable tray with the signal cables and power supply circuits before you install the FOX subrack.

**Figure 22: Cable tray**

Cable tray installation Proceed as follows:

1. Locate the fixing position of the cable tray in the 19-inch rack or within the ETSI adapters.
2. Lift the cable tray into position and secure it using four M6 screws.
3. Tighten the screws provisionally.

End of instruction

The numbers on the front of the cable tray correspond to the slot numbers of the subrack.
3.4.2 Installing the DC power supply

3.4.2.1 Power cable

The power cable (refer to Figure 23) connects the external power circuit(s) to the FOX local power interface(s). One end of the power cable is terminated with the TYCO connector for the FOX subrack (or DUPF1). The other end is terminated with the WAGO connector block. This connector block provides the connection point for the external power supply.

Power cables are required as follows:

- **Single** power source supply:
  1 power supply cable is required

- **Dual** power source supply:
  2 power supply cables are required.

**Please note:**

*The second power cable is delivered together with the DUPF1 in a separate package.*

![WAGO connector block and TYCO connector](image)

Legend:

1. WAGO connector block
2. TYCO connector

The WAGO connector block is mounted on the cable tray either inside the

- right OR left side panel of the cable tray for **single power** source supplies.
- right AND left side panels of the cable tray for **dual power** source supplies.

*Figure 24* shows the 2 installation options.
Installation Procedures

Figure 24: Cable tray and installation of WAGO connector blocks and power cables

Please note:
The order of the polarity (plus, minus) on the left side is reversed compared to the order on the right side.

Please note:
Figure 24 shows the set-up for front connection of the external power supply circuit(s). It is also possible to implement the WAGO connector block (L, R) for rear connection of the power supply circuit. In this case the power cables leave the cable tray towards the front and the polarities on the WAGO connector block appear reversed compared to the presentation in Figure 24.

To install the power supply cable(s) and connector block(s) on the cable tray proceed as follows:

1. Select the left or right side of the cable tray for the best fit to your external power supply circuit and place the FOX power supply cable on the cable tray.
2. Align the power cable in such way that the WAGO connector block is close to the front of the cable tray. The tail with the red and blue wires and the TYCO connector look to the rear.
3. Locate the studs on the back of the WAGO connector block in front of the fixing holes inside the side panels of the cable tray.
4. Snap the studs of the block into the 2 holes from inside the cable tray, while the cable tail is looking to the rear of the cable tray.

5. Check the WAGO connector block for firm fit.

6. Repeat steps 1 … 5 if you want to install a second power cable on the opposite side of the cable tray for dual power source supply.

**End of instruction**

### 3.4.2.2 External power supply circuit

**WARNING**

**Hazardous electric currents. Risk of flashover and electric shock!**

*Make sure that*

- The external -48/60 V$_{DC}$ power is switched off before you connect the power leads to the WAGO connector block(s).
- The power cables provide sufficient insulation (e.g. near the WAGO connector block).

*With life power supplies short circuits with flash over might result.*

![Figure 25: Connecting wires to the WAGO connector block](image)

Legend to symbols of connector block:

- $+$ 0 Volt conductor for power supply (red wires)
- $-$ -48/60 Volt DC for power supply (blue wires)

**External power supply circuit connection Proceed as follows:**

1. Arrange the 2 wires (max. 4 mm$^2$) with the negative voltage power supply and the 2 wires (max. 4 mm$^2$) of the power return close to the WAGO connector block installed on the cable tray.
2. Select the first wire of the power return (+).
3. Strip the insulation off the wires at 10 … 11 mm (1).
4. The WAGO connector block has a cage spring wire grip. 
   Open the grip by pushing down (e.g. with a screwdriver) (2), push the 
   stripped wire in (3), and release the grip (refer to Figure 25).
5. Check the connection for firm fit and unprotected single wires.
6. Repeat steps (2) to (5) to connect the other wire of the power return (+).
7. Repeat steps (2) to (5) to connect the remaining 2 wires of the negative 
   voltage power supply (-).

**End of instruction**

The installation of the FOX power supply is concluded after the installation of 
the FOX subrack in the rack with the connection of the subrack to the supply 
 circuits.

For details, refer to section Subrack power supply (on page 60).
3.5 Signal cables

3.5.1 Tying signal cables to the cable tray

The cable tray makes the installation of the external cabling for the units easier. It provides a means to arrange and fix the cables before the installation of the subrack and thus provides space for convenient working.

On the front, the cable tray carries a label bar with numbers corresponding to the slot positions of the subrack. It is essential that you align the position of the connectors and cables for each unit and interface with respect to the front line of the cable tray.

The signal cables have a common metallic braid shield for all the signal leads of the cable. Depending on the unit and its traffic signals the signal cable provides different EMC measures:

- **Ferrite toroid** near the connector (of the unit interface)

![Figure 26: Cable with ferrite toroid sample](image)

This scheme is used for interface cables which are generally shielded from interface to interface such as
- Data circuits,
- etc.

- **EMC filter** consisting of a ferrite toroid near the unit connector and a second ferrite toroid

![Figure 27: Cable with EMC filter sample](image)

This scheme is used for interface cables which are not generally shielded from interface to interface such as
- POTS circuits,
- ISDN circuits,
- etc.

For either cable, the exposed metallic braid shield is connected to the earthing bar of the FOX subrack.
Please note:
Depending on signal type and cable construction there are also cables without ferrites implemented.

Figure 28 shows the cable installation on the cable tray.

Figure 28: Installation and position of connectors and cables with EMC filter with respect to the front line of the cable tray

Legend:
1 Cable ties fixing the cable to the cable tray
2 Exposed part of the cable shield

The distance between the cable tray and the connector as well as the type of the cable and connector depends on the plug-in unit (although identical for most units and interfaces). The distance of the area with exposed cable shield is constant with respect to the front line of the cable tray.

Installation of cables onto the cable tray Proceed as follows:
1. Label the cables with their respective slot number (as previously documented).
2. Align each cable on the cable tray with respect to the slot number.
3. Align the connectors with respect to the front line of the cable tray as indicated with the installation instructions for the corresponding unit (refer to Figure 28). The cable length between connector and cable tray depends on the unit and interface (for detailed information, refer to the user manual of the corresponding unit).

4. Place the front cable ties in order to allow the cables to be bent neatly to the earthing bar in the front part of the cable tray.

5. Install the rear cable ties. The positions of these cable ties depend on the cable type (refer to Figure 28).

6. Secure each cable loosely (e.g. using cable ties). It should still be possible to move cables back and forwards. The signal cables have to be arranged (and fixed) on the cable tray so as not to block the access to adjacent units in the subrack.

**End of instruction**

---

**NOTICE**

**Attention to temperature range. Risk of equipment damage!**

*Blocking the airflow might lead to overheating inside the subrack.*

→ Cables should be positioned so as not to block the airflow into the subrack.

---

### 3.5.1 Units

The user manuals of the units provide the layout of the cables used for the interfaces of each unit. For most units with traffic interfaces one cable connects all the interfaces of the unit.

For details on the installation of signal cables refer to the units user manuals.

### 3.5.2 Fan unit

The fan unit features the following signal interfaces for connection:

- Alarm input interfaces,
- Alarm output interfaces.

The cables for these interfaces are not generally connected but implemented as required. For your convenience it is a good practice to install these cables now together with the signal cables on the cable tray.

For details of the alarm interfaces, refer to the section Alarm interfaces (on page 66).

Cable tray and cables are now ready for the installation of the FOX subrack.

### 3.5.2 Tying cables to their connection points

The cables terminated on the FOX are connected to their connection points in accordance with the documentation of the installation and the local requirements.
Risk of operating trouble!
Attention to EMC properties!

*it is essential to maintain the EMC characteristics of the FOX system.*

→ Connect the shield of the cables at both sides, at the FOX earthing bar and at the external earthing / bonding point (e.g. distribution frame).

Lightning protection is implemented at the connection points of the cables to the outside world. The FOX equipment only provides secondary protection.

The description of lightning and over-voltage protection is beyond the scope of this installation guide. For more information on the implementation of lightning and over-voltage protection, refer to 1KHW002463 FOX61x Lightning Protection.
3.6 Subrack

3.6.1 Installing DUPF1 (option)

The following description applies for FOX subracks with the DUPF1 dual power supply option only. This option is required for dual source power supply of the subrack. If you do not use the DUPF1 option you can proceed with section Installing the FAMO1 or FAMO1-F power and alarm cable (optional) (on page 55).

The DUPF1 is delivered in a separate package together with an additional power cable.

The DUPF1 unit is mounted on the FOX subrack and secured with two screws to the left and right of the DUPF1. There is no impact on the FAMO1 or FAMO1-F installation.

You must install the DUPF1 before the FOX615 subrack is installed in the rack. Figure 30 shows the FOX subrack with installed DUPF1 option.
Please note:
A subsequent installation of the DUPF1 is not possible without service interruption and requires substantial installation effort.

The installation of the DUPF1 requires unlimited access to the bottom rear of the FOX615 subrack. This access is normally only possible with unplugged signal cables and if the subrack is removed from the rack.
DUPF1 installation  Proceed as follows:

1. Place the FOX subrack on its back (backplane).
2. Align the DUPF1 as shown under a) in Figure 29.
3. Arrange the power connector (D11) and power cables of the DUPF1 in such way that they take the position shown under b) in Figure 29. The power connector is approximately in line with the left hand power interface (D2) of the DUPF1.

This arrangement requires that you
- move the connector (D11) in directions (A) and (B)
- move and bend the (red) power cables in direction (C)

The alarm interface cable (52) and its connector (D21) must be free as shown under b) in Figure 29.

4. Turn and align (D) the DUPF1 with the power cables in their position to the lower edge (power interface) of the FOX subrack as shown under b) in Figure 29.

5. Move (E) the DUPF1 with the power connector and cables in their position close to the lower edge of the FOX subrack.

6. Plug (F) the power connector (D11) of the DUPF1 firmly to the power interface (P1) of the FOX subrack (Figure 29, c)).

7. Align the 4 studs (11), (12), (13), (14) and 2 fixing screws (31), (32) on the back of the DUPF1 in front of the corresponding slots (21), (22), (23), (24) and treads (41), (42) in the subrack while checking that the DUPF1 power cable is still correctly folded well inside the DUPF1 shape (Figure 29, c)).

8. Move (G) the DUPF1 towards the subrack while inserting the 4 studs (11), (12), (13), (14) into the corresponding slots (21), (22), (23), (24) in the subrack (Figure 29, c)).

9. Press the DUPF1 against the FOX subrack and fix the left hand screw (31) and the right hand screw (32) loosely (Figure 29, c)).

10. Check the DUPF1 power cable and the DUPF1 mechanics for correct fitting to the subrack. Make sure that none of the power cables is clamped! The alarm interface cable (52) and its connector (D21) must be free as shown under b) in Figure 29.

Rearrange the power and alarm interface cables if required.

11. Tighten the screws (31) and (32).

End of instruction

The FOX subrack with the DUPF1 installed is now one unit and must look as shown in Figure 30:
This concludes the mechanical installation of the DUPF1. The DUPF1 alarm interface cable connects to the FAMO1 or FAMO1-F. For details, refer to section Interfaces and connectors (on page 66).

3.6.2 Installing the FAMO1 or FAMO1-F power and alarm cable (optional)

The Figure 31 shows the installation of the FAMO1 or FAMO1-F power and alarm cable to the FOX subrack.

You must install the FAMO1 or FAMO1-F power and alarm cable before the FOX615 subrack is installed in the rack. The installation is independent of the DUPF1 option.
Please note:
A subsequent installation of the FAMO1 or FAMO1-F power and alarm cable is normally not possible without service interruption and requires substantial installation effort!

The installation of the FAMO1 or FAMO1-F power and alarm cable requires unlimited access to the bottom rear of the FOX615 subrack. This access is normally only possible with unplugged signal cables and if the subrack is removed from the rack.

Proceed as follows:
1. Place the FOX subrack on its back (backplane).
2. Plug (K) the subminiature-D connector (F₁₁) into the interface (P₂) of the FOX subrack.
   If the DUPF1 option is installed the connector fits through the hole in the DUPF1 housing (refer to Figure 30).
3. Secure (43), (44) the connector with the 2 fixing screws (33), (34) integrated in the connector housing.

End of instruction
3.6.3 Installing the subrack

3.6.3.1 Prerequisites

Before you mount the subrack, please make sure that the installations of the
• Captive nuts (19-inch racks only),
• ETSI adapters (ETSI racks only),
• Cable tray with power cables,
• Power supply circuits
  (Optionally with 2 power supply circuits if the DUPF1 option for dual
  power supply is installed),
• Signal cables,
• DUPF1 option (if applicable) for dual power supply is installed on the sub-
  rack, and
• FAMO1 or FAMO1-F power and alarm cable, option (if applicable)
  are complete and checked.

Please note:
A subsequent installation of the DUPF1 and/or FAMO1 or FAMO1-F power
and alarm cable is not possible without service interruption and requires sub-
stantial installation effort!

The installation of the DUPF1 and/or FAMO1 or FAMO1-F power and alarm
cable requires unlimited access to the bottom rear of the FOX615 subrack.
This access is normally only possible with unplugged signal cables and if the
subrack is removed from the rack.

3.6.3.2 Subrack installation

The steps to install the subrack are as follows:

Subrack installation Proceed as follows:
1. Locate the fixing position of the subrack in the 19-inch rack or within the
   ETSI adapters above the FOX cable tray.
2. Lift the subrack into position and secure the subrack using four M6
   screws.
3. Ensure that the FAMO1 or FAMO1-F power and alarm cable stays free
   within the cable tray and leaves with the FAMO1 or FAMO1-F connector
to the front of the subrack.
   Optionally:
   Ensure that the DUPF1 alarm interface cable stays free within the cable
   tray and leaves with the DUPF1 connector to the front of the subrack.
4. Ensure that the power cable(s) stay(s) free within the cable tray and
   remain accessible from the front.
5. Tighten the M6 screws provisionally.

End of instruction
3.6.3.3 Subrack earthing

For reliable EMC results of the FOX installation it is required that the FOX subrack is connected to the protective ground.

**WARNING**

Attention to proper earthing. Risk of electric shock!

*It is mandatory to connect the FOX subrack to a suitable protective ground e.g. the Common Bonding Network!*

There are two methods how to provide the earthing for the FOX subrack:

- The subrack is connected to the protective ground directly via the rack:
  The 19-inch mounting flanges of the subrack are conductive and provide a conductive contact to the rack if the rails of the rack also provide a conductive surface. The rack must be connected to the protective ground. This is the preferred method, providing a simple and reliable system earthing.
- As an alternative the subrack is connected to the protective ground via an earthing cable (refer to Figure 32):
  The earthing wire must
  - have a cross section of 10 mm²,
  - be equipped with a crimp lug (10 mm² wire cross section, M6 screws) on the FOX subrack side,
  - be reliably connected to the Common Bonding Network (For details of the Common Bonding Network principles, refer to ETSI EN 300 253 V2.1.1).
  The rack normally provides a suitable terminal of the CBN.
Figure 32: Earthing / bonding points of the FOX subrack

Legend:
1 Earthing cable
2 Crimp lug for M6 screw
3 Toothed washer for M6 screw
4 Washer for M6 screw
5 Flat head screw M6 x 15 mm (min.)
6 Possible earthing / bonding points on the subrack mounting flange with M6 screw
7 Left and right mounting rail of the rack

The steps to connect the earthing / bonding point of the FOX subrack to the local Common Bonding Network are as follows:
**Earthing / bonding point connection**

**Proceed as follows:**

1. Select one of the possible earthing / bonding points (6) on the subrack mounting flange to be used for the subrack earthing.
2. Remove the M6 screw (5) from the selected earthing / bonding point.
3. Fix the crimp lug (2) of the earthing cable (1) with the M6 screw (5) (don’t forget the toothed washer (3) and the washer (4)) on the selected earthing / bonding terminal (6) of the subrack mounting flange.
4. Tighten the M6 screw (5) provisionally.
5. Connect the other end of the earthing cable (1) to a suitable terminal of the CBN.

**End of instruction**

**Risk of operating trouble!**

*It is essential to keep the resistance of the earthing connection between the subrack and the protective ground very low (recommended value according to EN 60 950: < 0.1 Ohm).*

---

### 3.6.4 Subrack power supply

#### 3.6.4.1 Local power interfaces

The FOX615 subrack provides 1 interface for the common power supply of the subrack and FAMO1 or FAMO1-F. The power interface of the subrack connects

- 2 conductors (blue) for the U_T (-48/-60 V_{DC}),
- 2 conductors (red) for the 0 V and system ground (subrack construction).

This power interface is alternatively provisioned with power from the

- power cable for single power supply (refer to Figure 33),
- DUPF1 for dual power supply (refer to Figure 34). The DUPF1 provides 2 power interfaces for the 2 power cables of the 2 power supply circuits (supply protection).

**WARNING**

*Hazardous electric currents. Risk of flashover and electric shock!*

*With life power supplies short circuits with flash over might result.*

→ Before connecting the power supply make sure that the external - 48/60 V_{DC} power is switched off.

#### 3.6.4.2 Single circuit power supply

The following installation description applies for FOX615 installations without DUPF1.

*Figure 33* shows the principle of the power supply via a single supply circuit.
Figure 33: Principles of single circuit power supply

Legend:
- PSC 1 Power Supply Circuit 1

Please note:
The connector block “S₁” is alternatively installed inside the right (as shown in Figure 24) or left side of the cable tray.

→ refer to section Installing the DC power supply (on page 43).

The short power cable “C₁” connects the power interface “P₁” of the FOX615 subrack to the connector block “S₁” providing the external power supply circuit.

The red conductors (+) are on top when plugging the cable “C₁” to the power interface “P₁” of the subrack.

Please note:
Figure 33 shows the front connection of the external power supply circuit (PSC 1).

It is also possible to implement the WAGO connector block (S₁) for rear connection of the power supply circuit. In this case the subrack power cable leaves from the front and plus/minus polarities on the WAGO connector block appear reversed compared to the presentation in Figure 33.

Power supply connection Proceed as follows:
1. Turn the TYCO connector of the power cable in such way that the red cables are on top (connector key to the right).
2. Locate the TYCO connector in front of the power interface of the FOX subrack.
3. Plug the TYCO connector firmly to the fast-on contacts on the subrack.
4. Align the power cable as appropriate inside the cable tray.
5. Check the power connection for firm fit.

End of instruction

3.6.4.3 Dual power supply (DUPF1 option)

The following installation description applies for FOX615 installations with DUPF1.

Figure 34 shows the principle of power supply via two power supply circuits:

Figure 34: Principles of two circuits power supply

Legend:
- PSC 1 Power Supply Circuit 1
- PSC 2 Power Supply Circuit 2

Please note:

*Power supply with 2 supply circuits (dual power supply) requires the DUPF1 option!*  

Two connector blocks “S₁” and “S₂” for 2 external supply circuits are installed inside the right and left side of the cable tray (refer to section *Installing the DC power supply* (on page 43)).

The DUPF1 option on the FOX subrack provides 2 power interfaces “D₁” and “D₂” which are connected via the 2 power cables “C₁” and “C₂” to the connector blocks “S₁” and “S₂”.

The blue conductors (−) are on top when plugging the cable “C₁” and “C₂” to the power interfaces “D₁” and “D₂” of the DUPF1.
Please note:

Figure 34 shows the front connection of the external power supply circuits (PSC 1, PSC 2).

It is also possible to implement the WAGO connector blocks (S1, S2) for rear connection of the power supply circuit. In this case the subrack power cables leave from the front and the plus/minus polarities on the WAGO connector block appear reversed compared to the presentation in Figure 34.

Power supply connection to DUPF1

Proceed as follows:

1. Turn the TYCO connector of the left and right power cables in such a way that the blue cables are on top (connector key to the left).
2. Locate the TYCO connector of the left power cable in front of the left “D2” power interface of the DUPF1.
3. Locate the TYCO connector of the right power cable in front of the right “D1” power interface of the DUPF1.
4. Plug the TYCO connectors firmly to the fast-on contacts on the DUPF1 interfaces “D1” and “D2”.
5. Align the left and right power cables as appropriate inside the cable tray.
6. Check the left and right power connections for firm fit.

End of instruction

WARNING

Hazardous electric currents. Risk of flashover and electric shock!

The DUPF1 has no fuses for the external power supplies.

→ The power supply circuits 1 and 2 must be fused for the operation with DUPF1.
3.7 Fan unit or alarm unit (option)

3.7.1 Installing FAMO1 or FAMO1-F

Installation of the FAMO1 fan unit or FAMO1-F alarm unit

**Proceed as follows:**

1. Locate the fixing position of the FAMO1 or FAMO1-F in the 19-inch rack or within the ETSI adapters above the FOX subrack (refer to Figure 6 and Figure 15 respectively).

2. Lift the FAMO1 or FAMO1-F into position and secure the FAMO1 or FAMO1-F using four M6 screws.

3. Tighten the M6 screws provisionally.

4. Fit the cable clips (21) and (22) provided with the FAMO1 or FAMO1-F package to the left and right side of the FAMO1 or FAMO1-F front panel (refer to Figure 36).

**End of instruction**

3.7.2 FOX interface

The FAMO1 or FAMO1-F power and alarm signals are connected via the power and alarm cable to the FOX subrack.

![Figure 35: FAMO1 or FAMO1-F power and alarm cable](image)

Legend:

1. Subminiature-D connector (15 way) connects to the subrack
2. Molex connector (12 way) connects to the FAMO1 or FAMO1-F
Connection of the FAMO1 or FAMO1-F power and alarm interface

**Proceed as follows:**

1. The subminiature-D connector has been connected to the P2 interface of the FOX subrack before the subrack installation (refer to section Installing the FAMO1 or FAMO1-F power and alarm cable (optional) (on page 55)).

2. Tie the FAMO1 or FAMO1-F power and alarm cable (31) from the cable tray along the left bracket of the subrack up to the FAMO1 or FAMO1-F.

3. Plug the Molex connector to the F1 interface of the FAMO1 or FAMO1-F.

4. Secure the FAMO1 or FAMO1-F power and alarm cable in cable clamp (21).

5. Check the lock of the Molex connector for safe fit.

6. Arrange the cable in such a way that it does not block the fixing slots for the subrack front cover in the brackets.

**End of instruction**
3.7.3 Alarm interfaces

3.7.3.1 Interfaces and connectors

The FOX alarm interfaces are physically all implemented on the FAMO1 or FAMO1-F unit. The individual input and output interfaces are arranged in groups with a connector per group.

Figure 37: FAMO1 and FAMO1-F alarm interfaces

All alarm interfaces use Molex connectors. To avoid wrong connections connectors with different number of contacts are implemented for each interface type.

For all connections between FOX equipment cables are provided. Connector sets are provided for interfaces which are user configurable (alarm interfaces). The sets contain the Molex connector frame and crimp terminals.

Figure 38: Molex connector frames and crimp terminals

Legend:
1 Molex connector frame
2 Mini-Fit HCS™ crimp terminal (AWG 18 … AWG 24)
3 Wire (AWG 18 … 24)
S Inserting the Mini-Fit HCS™ crimp terminal into the connector frame
P Plugging the connector frame into the FAMO1 or FAMO1-F interface

The crimp terminals (2) accept wires as follows:
• Wire diameter: typ. 0.8 mm (AWG 20)
• Wire insulation diameter: 1.3 … 3.1 mm

For each connection you have to crimp a Mini-Fit HCSTM crimp terminal on the corresponding cable. The crimp terminal is then inserted with the cable fit into the Molex connector frame in the appropriate position.

A connector set with connector frames (1 frame 4x2, 1 frame 3x2) and crimp terminals (14 Mini-Fit HCSTM) is available for optional alarm signal connections.

For details of the crimp process, refer to the instructions provided with the crimp tool (for the crimp tool reference, refer to Table 15: Checklist for tools (installation) (on page 89)).

### 3.7.3.2 Alarm signal input interfaces

The FAMO1 or FAMO1-F provides 3 interfaces for the monitoring of alarm signals (inputs) for totally 12 alarm signals. Each interface can handle up to 4 alarm signals.

![Figure 39: FAMO1 and FAMO1-F alarm signals input interfaces](image)

Each alarm interface F3, F4, F5 uses a pin assignment as follows:

![Figure 40: Molex connector frame alarm signal inputs](image)

**Table 6: Alarm input interfaces pin connection**

<table>
<thead>
<tr>
<th>Alarm Interface</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>Connector Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm_in 1</td>
<td>Alarm_in 5</td>
<td>Alarm_in 9</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Alarm_in 2</td>
<td>Alarm_in 6</td>
<td>Alarm_in 10</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Alarm_in 3</td>
<td>Alarm_in 7</td>
<td>Alarm_in 11</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Alarm_in 4</td>
<td>Alarm_in 8</td>
<td>Alarm_in 12</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

Standard crimp contacts are connected and implemented within the individual Molex connector frames as required for monitored alarm signals.

If the DUPF1 is implemented it uses 2 of the 12 alarm inputs. For details, refer to section DUPF1 alarm interface (on page 68).
3.7.3.3 DUPF1 alarm interface

The DUPF1 provides a cable with a 4x2 way Molex connector for its alarm signals. The DUPF1 alarms are connected to one of the 3 alarm interfaces F3, F4, F5 on the FAMO1 or FAMO1-F, normally to the F5 interface. The DUPF1 connects to the highest 2 inputs of the 4 alarm inputs provided via the Molex connector:

Table 7: DUPF1 alarm input interfaces pin connection

<table>
<thead>
<tr>
<th>Alarm Interface</th>
<th>DUPF1 interface</th>
<th>Connector Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>F3</td>
<td>F4</td>
<td>F5</td>
</tr>
<tr>
<td>Alarm_in 1</td>
<td>Alarm_in 5</td>
<td>Alarm_in 9</td>
</tr>
<tr>
<td>Alarm_in 2</td>
<td>Alarm_in 6</td>
<td>Alarm_in 10</td>
</tr>
<tr>
<td>Alarm_in 3</td>
<td>Alarm_in 7</td>
<td>Alarm_in 11</td>
</tr>
<tr>
<td>Alarm_in 4</td>
<td>Alarm_in 8</td>
<td>Alarm_in 12</td>
</tr>
</tbody>
</table>

a. The DUPF1 alarm cable does not carry the GND potential. Only the wire with the alarm signals is provided, using pin 5 and pin 6.

The DUPF1 alarm outputs are implemented as “breaking” contacts, i.e. the alarm signals provide ground potential if the alarm is inactive.

Figure 41: DUPF1 alarm interface connection
DUPF1 alarm interface connection

**Proceed as follows:**

1. Tie the DUPF1 power and alarm cable from below the cable clamp (not shown in Figure 41) along the right bracket of the subrack up to the FAMO1 or FAMO1-F.
2. Plug the Molex connector to the F5 interface of the FAMO1 or FAMO1-F.
3. Secure the DUPF1 alarm cable in cable clamp (22).
4. Check the lock of the Molex connector for safe fit.
5. Arrange the cable in such a way that it does not block the fixing slots for the subrack front cover in the brackets.

**End of instruction**

*Please note:*

*The DUPF1 connector does not use the remaining 2 alarm inputs. If required these inputs can be used for other alarm signals.*

3.7.3.4 Alarm signal output interface

The FAMO1 or FAMO1-F provides the interface F2 for the output of the 2 system alarm signals:

- Service Affecting Alarm (SAA)
- Service Not affecting Alarm (SNA)

**Figure 42:** FAMO1 and FAMO1-F alarm signals output interface

The alarm signal output interface F2 uses a pin assignment as follows:

**Figure 43:** Molex connector frame system alarm signal outputs

For the connection of alarm signals Mini-Fit HCS™ crimp terminals are implemented within the Molex connector frame as described in the table below.

**Table 8:** Alarm output interface pin connection

<table>
<thead>
<tr>
<th>Alarm Type</th>
<th>Pin</th>
<th>Pin</th>
<th>Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non Urgent</td>
<td>SNA_make 6</td>
<td>SNA_break 5</td>
<td>SNA_com 4</td>
</tr>
<tr>
<td>Urgent</td>
<td>SAA_break 3</td>
<td>SAA_make 2</td>
<td>SAA_com 1</td>
</tr>
</tbody>
</table>

**SxA_make:** The contact closes if the alarm becomes active = AC
**SxA_break**: The contact opens if the alarm becomes active = AO

**SxA_com**: The contact connects or interrupts to the common signal = COM

**Risk of operating trouble!**

_The layout of the connector for the break and make contacts of the Service Affecting and Service Not Affecting alarm signals are inverted!_

![Diagram](image)

_Figure 44: Alarm output contact scheme (no alarms, inactive state)_

The alarm output use relay contacts which are galvanically isolated from the other circuits.

### 3.8 Heat deflection shield R7Al

#### 3.8.1 Orientation of the shield

The heat deflection shield R7Al removes the hot air rising through the sub-rack(s) below to the front or rear of the rack. If there is no equipment generating heat below the subrack of the FOX615, the heat deflection is not required.

- **Evacuation to the rear:**
  
  The heat deflection shield R7Al is installed in such way that the cold air flows from the front into the subrack above and evacuates the heated air from the subracks below to the rear (recommended for 19-inch installation).

  The heat deflection shield R7Al is oriented as follows (top open):
Figure 45: Alignment of the heat deflection shield R7AI for evacuation of heated air to the rear

- **Evacuation to the front:**
  The heat deflection shield R7AI is installed the opposite way in order to allow the cold air to flow from the rear into the subrack above and to evacuate the heated up air from the subracks below to the front. The heat deflection shield R7AI is oriented as follows (top closed):
3.8.2 Installing the shield

Heat deflection shield R7AI installation

Proceed as follows:

1. Turn the shield for heat evacuation to the rear or front (refer to Figure 45 or Figure 46) whichever is appropriate for your installation.

2. Locate the fixing position of the shield in the 19-inch rack or within the ETSI adapters above the FAMO1 or FAMO1-F (option) or above the FOX615 subrack (refer to Figure 6 and Figure 15 respectively).

3. Lift the shield into position and secure the shield with four M6 screws.

4. Tighten the M6 screws provisionally.

End of instruction

Please note:

For efficient heat evacuation of the heat produced below the FOX equipment the installation of a heat evacuation shield (proper orientation) below the cable tray is recommended (refer also to Figure 4).
3.9 Final steps

3.9.1 Tightening of screws

The FOX subrack equipment is now completely installed in the rack. If required, the individual subracks can be readjusted for their final in position in the rack.

If all equipment is in its final position the M6 screws must be tightened definitively. For recommended torques, refer to section Torques (on page 34).

3.9.2 Cable clamps, earthing bar and EMC clips

The subrack of the FOX615 subrack provides a left side and a right side cable clamp and earthing bar. Each bar has its own clamp, each of which is independent from the other.

![Figure 47: Cable clamps and earthing bars (conductive foam in bars and clamps is dark shaded)](image)

The steps to remove the right side cable clamp from its earthing bar are as follows:
Cable clamp removal  Proceed as follows:

1. Tear the spring bracket outward to the right (11) until it unlocks from the notch (14) on the earthing bar.
   To unlock the notch from the tab, proceed with a *screwdriver No. 2* (standard slot head) as shown in Figure 48 (left cable clamp shown for better visibility!).
   - Insert the blade of a screwdriver No. 2 into the cut-out (31) of the spring bracket.
   - Rotate (R) the screwdriver towards the spring bracket while applying the blade of the screwdriver to the edge (32) of the spring bracket.
   - Stop rotating when the notch unlocks (U) from its tab on the earthing bar.
   - While with the screwdriver keeping the notch unlocked from the tab, rotate (C) the spring bracket outwards.

2. Remove the right end of the clamp from the earthing bar by rotating it outward (12).

3. Unhook the left end of the clamp from the earthing bar (13) and remove (A) the clamp completely.

4. Follow the same steps mirrored to the left to remove the left side clamp from its earthing bar.

End of instruction

![Figure 48: Detail of unlocking a cable clamp with a screwdriver (application with left clamp shown)](image)

**Please note:**

*For re-installation of the cable clamp the signal cables must be fixed on the cable tray and connected to the interfaces of the units!*

To install the right side cable clamp to its earthing bar proceed as follows:
Cable clamp installation  **Proceed as follows:**

1. Check the placement of the conductive foam (16) on the earthing bar and cable clamp. Realign if appropriate.
2. Check the fit of the signal cables on the earthing bar. Realign if appropriate.
3. Hook the left side of the clamp onto the notch (15) on the earthing bar (21).
4. Rotate the right side of the clamp inward (22) onto the notch (14) on the earthing bar until the spring bracket to the right **snaps in**.
5. Check both spring brackets for fit.

**End of instruction**

Follow the same steps mirrored to the left to reinstall the left side cable clamp to its earthing bar.

---

**Risk of operating trouble!**

**Attention to EMC properties!**

*When plugging units which are accessed with optical cables only, the conductive foams in the cable clamp and in the earthing bar will be separated by the insulated cables. The resulting gap impairs the specified EMC characteristics.*

→ **ABB offers EMC clips providing an electrical connection between the conductive foams in the cable clamp and in the earthing bar.**
→ **The EMC clips have to be pushed into the conductive foam of the earthing bars to close the gap.**
→ **EMC clips have to be used where three or more units with optical cables are plugged in adjacent slots.**
→ **Three evenly spaced EMC clips have to be used per earthing bar to maintain the specified EMC characteristics of the FOX.**
→ **Please order the required amount of EMC clips at ABB.**

---

**Figure 49:** Mounting of three plus three EMC clips to the earthing bars
3.9.3 Units and signal cables

3.9.3.1 Inserting units in the subrack

Normally the FOX615 subrack is delivered without units. The units are separately shipped. For commissioning or replacement you must insert units into the FOX subrack. Carefully read the instructions below before you insert units into the subrack.

NOTICE

Electrostatic discharges. Risk of equipment damage!

*Units are sensitive to electrostatic discharges!*

→ Use a grounded protective wristband when handling units!
→ Keep the units in their ESD protective plastic bags until you use the units!
Unit insertion **Proceed as follows:**

1. Remove the cable clamp(s) from the earthing bar(s) of the subrack. Follow steps (11) to (13) in Figure 47 for the right and/or the left side cable clamps.
2. Identify the slot for the plug-in unit and engage the unit to the upper and lower rails. Slide unit **half way** in (Figure 50, a).

3. Insert plug-in unit as follows:
   - Push both levers (11), (12) in outward position (A).
   - Slide the unit in until its connectors touch the front of the backplane connectors (13). Do **not** insert completely!
   - To engage the unit with the backplane connectors, press carefully and simultaneously the levers (11) and (12) inwards (B) while **at the same time pressing** (C) the unit via the unit front into the subrack.
   - The lever movement and insertion force will engage the connectors of the unit to the backplane connectors.
   - Tighten both fixing screws (14) to fix the unit to the subrack (for recommended torques, refer to section **Torques** (on page 34)).

4. Repeat the steps 2 to 3 for all units to insert.

**End of instruction**

**Risk of operating trouble!**

*Forced insertion can damage the connectors of the unit and/or the backplane.*

→ Never use force to insert a unit!

### 3.9.3.2 Connecting signal cables

**Signal cable connection**

**Proceed as follows:**

1. Applicable for DIN based front connectors only:
   - Check for latching clips (refer to positions (LC) in Figure 50). If no clips are fitted, insert the clips to the positions shown in Figure 50. The latching clips are packed with the original cables from the manufacturer or provided separately.

2. Plug the connector of the signal cable onto the front connector of the unit.

3. Attend to the click of the latching system (if provided) or secure connector if applicable.

4. Realign the cable(s) on the cable tray. Ensure close contact of the dismantled cable shield to the earthing bar.

5. Fix the cable(s) firmly (e.g. using cable ties).

6. Repeat the steps 1 to 5 for all units and interfaces.

**End of instruction**

**Please note:**

*Latching clips are required for some of the connectors (DIN 41 612 based interfaces):*

→ Latching clips are packed with the original cables from the manufacturers.
3.9.3.3 Clamping cables to the subrack earthing bar

Clamp the cables to the bar only if all cables are installed and properly arranged with respect to the units and the cable tray:

Cable clamping Proceed as follows:
1. Snap in the cable clamp and close the earthing bar.
   For details of this procedure, refer to section Cable clamps, earthing bar and EMC clips (on page 73) and Figure 47: Cable clamps and earthing bars (conductive foam in bars and clamps is dark shaded) (on page 73).
   Proceed as instructed in the corresponding paragraphs for the right and/or the left side cable clamps.

End of instruction

Risk of operating trouble!
Attention to EMC properties!
Assure the specified EMC characteristics of the FOX.
   → Connect all shields properly to the earthing bar of the subrack.

3.9.3.4 Removing units

NOTICE Electrostatic discharges. Risk of equipment damage!
Units are sensitive to electrostatic discharges!
   → Use a grounded protective wristband when handling units! Pack units into an ESD protective bag immediately after removal. The original packing provides the best protection for the units.

Figure 51: Removal of units from the subrack

Legend:
BP Backplane with connectors
UR   Upper Rail in the subrack
LR   Lower Rail in the subrack
LC   Latching clips (not available on all units!)

To remove units from the subrack you have to reverse the steps required for the installation of units. Proceed as follows:

**Unit removal**  **Proceed as follows:**

1. Remove the front cover from the subrack.
   - Refer to  *Figure 53: Removing the front cover from the subrack* (on page 83) and proceed as instructed in the corresponding paragraphs.

2. Remove the cable clamp(s) from the subrack earthing bar(s).
   - Refer to  *Figure 47: Cable clamps and earthing bars (conductive foam in bars and clamps is dark shaded)* (on page 73) and proceed as instructed in the corresponding paragraphs for the left and/or the right side cable clamps.

3. Unplug the connector(s) of the signal cable
   - Check for latching clips (refer to positions (LC) in Figure 51) or other strain relieve devices.
   - Separate at the same time both clips (or other devices) from their notch in the cover of the connector.
   - Unplug the connector now.

4. Remove the unit (Figure 51)
   - Unscrew both fixing screws (14) of the unit.
   - To disengage the unit from the backplane connectors push both levers (11) and (12) simultaneously in outward position (A). Allow the unit to move outside while pressing on the levers.
   - Remove (B) the unit from the subrack.
   - Handle the unit according to the recommendations for ESD sensitive devices.

5. Repeat the steps 3 to 4 for all units to remove.

**End of instruction**
Please note:
Screws (14) that are unscrewed in such a way that they protrude from the front panel of the unit can block the outward movement (A) of the levers.

3.9.4 Front cover

3.9.4.1 Mounting the front cover

Figure 52: Installing the front cover to the subrack

Please note:
The front cover also covers the earthing bar and a part of the cable tray.
The steps to install the front cover on the subrack are as follows:

**Front cover installation**  
**Proceed as follows:**

1. Hinge the lower lids (1) of the front cover into the slots of the left and right side earthing bars (2) and press (A) it firmly into the slots.

2. Rotate the front cover towards the front of the subrack (3) while applying a constant force (B) in the direction of the earthing bar.

3. Glide the left hand and the right hand locks into the slots in the subrack (4).

4. Align the upper lids of the front cover to the slotted rail at the upper edge of the subrack (5).

5. Close the cover firmly (C). Listen for the clicks of the right and left hand locks (6).

6. Check the cover for correct fitting.

**End of instruction**
3.9.4.2 Removing the front cover

Figure 53: Removing the front cover from the subrack

The steps to remove the front cover on the subrack are as follows:
Front cover removal  **Proceed as follows:**

1. To unlock the cover tear the outer edge of the left hand and the right hand lock (1) while applying force to the front cover towards the subrack (A).
2. Rotate now the upper edge of the front cover outward (2) while retaining the locks (1) in their unlocked position (B).
3. Continue rotating the cover outward (3) until it reaches the horizontal position.
4. Remove lower lids of the front cover (4) from the slots of the left and right side earthing bars (5).
5. Remove the cover completely (C).

**End of instruction**

**Risk of operating trouble!**

**Attention to EMC properties!**

*The FOX subrack without its front cover mounted does not comply with all EMC standards.*

→ To make sure the FOX615 complies with EMC standards, fit the front cover after installation work has been completed as described in section *Mounting the front cover* (on page 81).
4 Checklists

4.1 Overview

The checklists below help you to prepare equipment and material for installation. There is a checklist provided for the
- FOX equipment (NE and units)
- Cables
- Material
- Tools

4.2 NE and units

<table>
<thead>
<tr>
<th>Description</th>
<th>Identification</th>
<th>Quantity (per subrack)</th>
<th>Units</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOX615 package:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- FOX615 subrack</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Front cover subrack</td>
<td></td>
<td>1</td>
<td></td>
<td>Packed with the subrack</td>
</tr>
<tr>
<td>- Cable tray</td>
<td></td>
<td>1</td>
<td></td>
<td>Packed with the subrack</td>
</tr>
<tr>
<td>- -48/-60 VDC power cable (subrack-to cable tray)</td>
<td></td>
<td>1</td>
<td></td>
<td>Cable packed with cable tray</td>
</tr>
<tr>
<td>Control unit</td>
<td>CESM1</td>
<td>1 (2)</td>
<td></td>
<td>(Unit protection)</td>
</tr>
<tr>
<td>Service units:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type</td>
<td>n</td>
<td></td>
<td>Type and number as required</td>
</tr>
</tbody>
</table>

Please note:
For the contents of the standard packaging, refer to the section Unpacking and equipment check (on page 35) on packaging of the subrack and accessories.
4.3 Options

Table 10: Checklist FOX equipment

<table>
<thead>
<tr>
<th>Description</th>
<th>Identification</th>
<th>Quantity (per subrack)</th>
<th>Units</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAMO1 package:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- FAMO1 unit</td>
<td>FAMO1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Power and alarm cable for FAMO1</td>
<td></td>
<td></td>
<td></td>
<td>Cable packed with FAMO1</td>
</tr>
<tr>
<td>FAMO1-F package:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- FAMO1-F unit</td>
<td>FAMO1-F</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Power and alarm cable for FAMO1-F</td>
<td></td>
<td>1</td>
<td></td>
<td>Cable packed with FAMO1-F</td>
</tr>
<tr>
<td>Heat deflection shield R7AI</td>
<td></td>
<td>1</td>
<td></td>
<td>Normally 1 per subrack</td>
</tr>
<tr>
<td>DUPF1</td>
<td>DUPF1</td>
<td>1</td>
<td></td>
<td>DUPF1 contains the alarm cable</td>
</tr>
</tbody>
</table>

Table 11: Checklist ETSI adapter options

<table>
<thead>
<tr>
<th>Description</th>
<th>Identification</th>
<th>Quantity (per subrack)</th>
<th>Units</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETSI adapters:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Set 2 HU adapters for ETSI installation</td>
<td></td>
<td>1</td>
<td></td>
<td>Required for later installation of the heat deflection shield R7AI</td>
</tr>
<tr>
<td>- Set 9 HU adapters for ETSI installation</td>
<td></td>
<td>1</td>
<td></td>
<td>Subrack + cable tray + FAMO1 or FAMO1-F</td>
</tr>
<tr>
<td>- Set 11 HU adapters for ETSI installation</td>
<td></td>
<td>1</td>
<td></td>
<td>Subrack + cable tray + FAMO1 or FAMO1-F + heat deflection shield R7AI</td>
</tr>
</tbody>
</table>

4.4 Cables

4.4.1 Cables for alarm interfaces

There are no prefabricated cables available for the FAMO1 and FAMO1-F alarm interfaces. Connector sets are available to allow on-site manufacturing of cables and connections.
The alarm connector set contains the connector frames and crimp pins for 1 alarm signal output interface and 1 alarm signal input interface.

4.4.2 Computer cables and adapters

The connection of the control unit to the local craft device or to the management communication structure (such as a LAN) requires standard computer cables.

<table>
<thead>
<tr>
<th>Description</th>
<th>Identification</th>
<th>Quantity</th>
<th>Units</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet electrical cables:</td>
<td></td>
<td></td>
<td></td>
<td>Uplink and/or management interfaces</td>
</tr>
<tr>
<td>FOX side:</td>
<td></td>
<td></td>
<td></td>
<td>Electrical interfaces up to 4 per CESM1</td>
</tr>
<tr>
<td>- terminated RJ45, signals crossed over [=], shielded, up to 1 Gbit/s</td>
<td></td>
<td>(4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOX side:</td>
<td></td>
<td></td>
<td></td>
<td>Electrical interfaces up to 4 per CESM1</td>
</tr>
<tr>
<td>- terminated RJ45, signals 1:1 [X], shielded, up to 1 Gbit/s</td>
<td></td>
<td>(4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethernet optical cables:</td>
<td></td>
<td></td>
<td></td>
<td>Uplink and/or management interfaces</td>
</tr>
<tr>
<td>FOX side:</td>
<td></td>
<td></td>
<td></td>
<td>Optical interfaces up to 2 per CESM1</td>
</tr>
<tr>
<td>- SFP cage, connector and fibre specification depend on SFP module</td>
<td></td>
<td>(2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.4.3 Signal cables

ABB provides cables for units with traffic interfaces. For most units one cable connects all the interfaces of the unit.

For information about signal cables, refer to the user manuals of the units.
## 4.5 Installation material

### Table 14: Checklist for material

<table>
<thead>
<tr>
<th>Description</th>
<th>Identification</th>
<th>Quantity</th>
<th>Units</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screws, washers, crimp lug subrack</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Screws flat head (slot or Phillips) M6</td>
<td></td>
<td>4</td>
<td>per subrack</td>
<td></td>
</tr>
<tr>
<td>- Screws flat head (slot or Phillips) M6</td>
<td></td>
<td>4</td>
<td>per cable tray</td>
<td></td>
</tr>
<tr>
<td>- Washer for 6 mm screws</td>
<td></td>
<td>1</td>
<td>per bonding point</td>
<td></td>
</tr>
<tr>
<td>- Toothed washer for 6 mm screws</td>
<td></td>
<td>1</td>
<td>per bonding point</td>
<td></td>
</tr>
<tr>
<td>- Crimp lug for 6 mm screws for the subrack earthing cable</td>
<td></td>
<td>1</td>
<td>per bonding point</td>
<td></td>
</tr>
<tr>
<td>- Crimp lug for 6 mm screws for the subrack earthing cable (10 mm² cross section)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screws FAMO1, FAMO1-F and heat deflection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Screws flat head (slot or Phillips) M6</td>
<td></td>
<td>4</td>
<td>per FAMO1</td>
<td></td>
</tr>
<tr>
<td>- Screws flat head (slot or Phillips) M6</td>
<td></td>
<td>4</td>
<td>per FAMO-F</td>
<td></td>
</tr>
<tr>
<td>- Screws flat head (slot or Phillips) M6</td>
<td></td>
<td>4</td>
<td>per heat deflection shield R7AI</td>
<td></td>
</tr>
<tr>
<td>Screws ETSI adapters:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Screws flat head (slot or Phillips) M6</td>
<td></td>
<td>4</td>
<td>per pair of ETSI adapters 2 HE</td>
<td></td>
</tr>
<tr>
<td>- Screws flat head (slot or Phillips) M6</td>
<td></td>
<td>8</td>
<td>per pair of ETSI adapters 9 HE</td>
<td></td>
</tr>
<tr>
<td>- Screws flat head (slot or Phillips) M6</td>
<td></td>
<td>10</td>
<td>per pair of ETSI adapters 11 HE</td>
<td></td>
</tr>
<tr>
<td>Captive nuts (19-inch rack):</td>
<td></td>
<td></td>
<td></td>
<td>normally part of the rack</td>
</tr>
<tr>
<td>- Subrack and cable tray</td>
<td></td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- FAMO1</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- FAMO1-F</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Heat deflection shield R7AI</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable ties</td>
<td></td>
<td>2</td>
<td>per signal cable</td>
<td></td>
</tr>
<tr>
<td>Latching clips for connectors</td>
<td></td>
<td>2</td>
<td>per standard connector</td>
<td></td>
</tr>
<tr>
<td>- provided with signal cables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- ordered separately for connector (sets)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labels for cables</td>
<td></td>
<td></td>
<td></td>
<td>as required</td>
</tr>
</tbody>
</table>

* Only required if the subrack earthing is done via an earthing cable.
Please note:
The ETSI adapter sets contain the following installation material:
• Captive nuts (for the ETSI rack)
• Screws to fix the
  - adapters in the ETSI rack (captive nuts)
  - subrack, cable tray, fan unit, heat deflection shield etc. (whatever applies) to the adapters (integrated M6 nuts)

4.6 Tools

The installation of the subrack and the cable tray requires no special tools. The checklist below provides an overview of the most important standard tools required for the installation.

<table>
<thead>
<tr>
<th>Description</th>
<th>Identification</th>
<th>Quantity</th>
<th>Units</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screwdriver for standard slot head screws</td>
<td>no. 1-4</td>
<td>1</td>
<td>Units, subrack, general use</td>
<td></td>
</tr>
<tr>
<td>Screwdriver for Phillips head screws</td>
<td>no. 1-3</td>
<td>1</td>
<td>Units, subrack, general use</td>
<td></td>
</tr>
<tr>
<td>Crimp tool for Mini-Fit HCS™ crimp terminals</td>
<td>69008-0724</td>
<td>1</td>
<td>Alarm cables</td>
<td></td>
</tr>
<tr>
<td>Parallel action Hand tool for 5556/5558 Terminals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wire stripper</td>
<td></td>
<td>1</td>
<td>General use</td>
<td></td>
</tr>
<tr>
<td>Wire cutter</td>
<td></td>
<td>1</td>
<td>General use</td>
<td></td>
</tr>
<tr>
<td>Flat pliers</td>
<td></td>
<td>1</td>
<td>General use</td>
<td></td>
</tr>
<tr>
<td>Connection tool for MDF terminal strips</td>
<td></td>
<td>1</td>
<td>Brand of MDF</td>
<td></td>
</tr>
<tr>
<td>Multimeter (Volt, Ampere, Ohm)</td>
<td></td>
<td>1</td>
<td>General use, to check the polarity of the power supply, etc.</td>
<td></td>
</tr>
<tr>
<td>Wrist strap (bonding point M4 preferred)</td>
<td></td>
<td>1</td>
<td>Unit handling</td>
<td></td>
</tr>
<tr>
<td>Bench mats</td>
<td></td>
<td>1</td>
<td>Unit handling</td>
<td></td>
</tr>
</tbody>
</table>

4.7 Test equipment

The installation of the basic equipment (subrack, control unit, power units) does not require special test equipment. Requirements for test equipment for
the traffic units and signals depend on the type of interfaces and signals to be tested.

Please contact ABB for recommendations on test equipment, if you need information on suitable test equipment for a particular traffic interface of the FOX.
5 Annex

5.1 Associated FOX documents

1KHW028514  FOX61x Abbreviations and Terms
1KHW002459  FOX61x Release Notes
1KHW002460  FOX61x Product Features and Characteristics
1KHW002497  FOX61x Precautions and Safety
1KHW002462  FOX612 Installation
1KHW002463  FOX61x Lightning Protection
1KHW002464  FOX61x System Description
1KHW002465  FOXCST Installation Manual
1KHW002466  FOXCST Operation Manual
1KHW002467  FOX61x TDM Services
1KHW002468  FOX61x Ethernet Services
1KHW002469  FOX61x CESM1
1KHW002470  FOX61x LESU1
1KHW002471  FOX61x ETOP1
1KHW002472  FOX61x ELET1
1KHW002473  FOX61x LEDE1
1KHW002474  FOX61x DATI1
1KHW002475  FOX61x EPSI1
1KHW002476  FOX61x SAMO1
1KHW002477  FOX61x SAMO2
1KHW002478  FOX61x LEDS1
1KHW002479  FOX61x LEDA1
1KHW002480  FOX61x LEIX1
1KHW002481  FOX61x LECO1
1KHW002482  FOX61x Electrical Cables
5.2 Associated documents of standard bodies

Table 16: Associated documents of standard bodies

<table>
<thead>
<tr>
<th>Body</th>
<th>Standard</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETSI</td>
<td>EN 300 132-2</td>
<td>Equipment Engineering (EE); Power Supply Interface at the Input to Telecommunications Equipment; Operated by Direct Current (DC)</td>
</tr>
<tr>
<td>ETSI</td>
<td>ETSI EN 300 253 V2.1.1</td>
<td>Environmental Engineering (EE): Earthing and bonding configuration inside telecommunication centres</td>
</tr>
<tr>
<td>IEC</td>
<td>IEC/EN 61000-4-2</td>
<td>Electromagnetic compatibility (EMC) Part 4-2: Testing and measurement techniques Electrostatic discharge immunity test</td>
</tr>
</tbody>
</table>

5.3 Declaration of conformity

EC Declaration of Conformity

The FOX products as listed below
- FOX615 Subrack
- FOX FAMO1
- FOX FAMO1-F
- FOX DUPF1
- FOX Control Unit(s) as stated in the applicable release notes
- FOX Service Units as stated in the applicable release notes

if used for the intended purpose, correctly installed and operated according to the applicable user manuals, comply with the European Directives as follows:

<table>
<thead>
<tr>
<th>Standard</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006/95/EC</td>
<td>Low Voltage Directive</td>
</tr>
</tbody>
</table>

Conformity to the previously mentioned EC directive is proven for complete compliance to the following harmonised standards:

<table>
<thead>
<tr>
<th>Standard</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETSI EN 300 386 V1.3.3</td>
<td>Electromagnetic compatibility and Radio spectrum Matters (ERM); Telecommunication network equipment; Electromagnetic Compatibility (EMC) requirements</td>
</tr>
</tbody>
</table>
Please note that the list of compliant products represents the state of product availability at the time when this document has been compiled. The list of compliant products is subject to change with the extension of the FOX platform.

The up-to-date EC declaration of Conformity for the FOX is available on request via utility.communications@ch.abb.com.

5.4 Feature licences

Part of the FOX functionality is subject to feature licences. For more information on feature licences please refer to 1KHW002459 FOX61x Release Notes.