

**Transponder
Mode S Level 2es**

BXP6401

BXP6401-1-(XX) Class 1

BXP6401-2-(XX) Class 2

Software Versions:

upwards from Software Version

CU: SCI1008S306 Version 22

DSP: SCI1026S305 Version 47

FPGA: SCI1039S305 Version 55

Installation and Operation

Manual DV69801.03

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Contact data for:

**Europe, Asia,
Oceania and
Africa** **Becker Avionics GmbH**
 Baden-Airpark B108
 77836 Rheinmünster (Germany)
 Tel.: + 49 (0) 7229 / 305-0
 Fax: + 49 (0) 7229 / 305-217
 Internet: www.becker-avionics.com
 Email: info@becker-avionics.com

Customer Service:

Email: support@becker-avionics.com

Contact data for:

**America,
Australia, Japan** **Becker Avionics Inc**
 Email: info@beckerusa.com



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This document and other information from Becker Avionics GmbH provide product or system options for further investigation by users having technical knowledge.

The user is responsible for making the final selection of the system and components. The user has to assure that all performance, endurance, maintenance, safety requirements of the application are met and warnings be observed. For this the user has to include all aspects of the application to be compliant with the applicable industry standards and the requirements of the responsible aviation authority. The product documentations from Becker Avionics GmbH have to be observed.

To the extent that Becker Avionics GmbH provide component or system options based upon data or specifications provided by the user, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the components or systems.

Term definition: User in the sense of user, installer, installation company.

Preface

Dear Customer,

Thank you for purchasing a Becker Avionics product.

We are pleased that you have chosen our product and we are confident that it will meet your expectations.

For development and manufacturing of our product, the guidelines for highest quality and reliability have been borne in mind, supplemented by selection of high quality material, responsible production and testing in accordance to the corresponding standards.

Our competent customer support department will respond on any technical question you may have.

Please do not hesitate to contact us at any time.

Transponder Design



BXP6401-X-(XX)
(Single Block Transponder)

List of Effective Pages and Changes

Only technical relevant modifications are described in this table.

| Document: DV69801.03 / issue 05 Article Number 0584.053-071 | | | |
|--|-----------|-------------------|--|
| Cover Page | 06/2018 | | |
| Introduction | 06/2018 | | |
| Chapter 1 – 4 | 06/2018 | | |
| Issue | Page No.: | Section / Chapter | Description |
| 05 | all | all | Changed: Editorial adjustments |
| | -- | Introduction | Added: Address box, User responsibility. Updated: User information. |
| | -- | 2.4.3 | Changed: Dimension drawing AM6400. |
| | -- | 2.5.13 | Updated: GPS Configuration |
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List of Abbreviations

List of Abbreviations

| | |
|-----------|--|
| AA | Aircraft Address (24-bit ICAO) |
| ACAS | Airborne Collision Avoidance System |
| A/D | Analog/Digital |
| ADLP | Avionics Data Link Processor |
| ADS | Comm-A Definition Subfield |
| ADS-B | Automatic Dependent Surveillance-Broadcast |
| AI | Aircraft Identifier |
| AICB | Air Initiated Comm-B |
| ALT | Altitude or Transponder ALT Mode |
| AM | Address Module |
| ARINC | Aeronautical Radio Incorporated |
| ATC | Air Traffic Control |
| ATCRBS | Air Traffic Control Radar Beacon System (US only) |
| BIT | Built-In Test |
| BITE | Built-In Test Equipment |
| CBIT | Continuous Built-In Test |
| Comm-A | 112-bit interrogation containing the 56-bit message field (uplink) |
| Comm-B | 112-bit reply containing the 56-bit message field (downlink) |
| Class 1 | XPDR with transmit power $\geq +21$ dBW (125 W) at antenna foot and ≥ 250 W at equipment output, altitude up to 50 000 ft., aircraft speed > 175 kt. |
| Class 2 | XPDR with transmit power $\geq +18.5$ dBW (70 W) at antenna foot and ≥ 140 W at equipment output, altitude up to 15 000 ft., aircraft speed > 175 kt. |
| CU | Control Unit |
| DC | Direct Current |
| Diversity | Diversity receiving and transmitting with two antennas |
| DME | Distance Measurement Equipment |
| DPSK | Differential Phase Shift Keying |
| DV | Document Identification Number |
| EASA | European Aviation Safety Agency |
| ELS | Elementary Surveillance, XPDR mode S supports the altitude and the downlinked aircraft identification (unique ICAO-24-bit-address) |
| EHS | Enhanced Surveillance, XPDR mode S supports additional parameters to e.g. heading, speed and selected vertical intention |
| es | e = Extended squitter and s = SI capability |
| ETSO | European Technical Standard Order |
| EUROCAE | European Organization for Civil Aviation Equipment |
| FAA | Federal Aviation Administration |
| FL | Flight Level |
| FMS | Flight Management System |
| FN | Flight Number |
| GICB | Ground Initiated Comm-B |
| GND | Ground |

List of Abbreviations

| | |
|-----------|---|
| GPS | Global Positioning System |
| IBIT | Initiated Built-In Test |
| IC | Integrated Circuit |
| ICAO | International Civil Aviation Organization |
| ID | Identifier |
| IDT | Ident (Identification) |
| IFR | Instrument Flight Rules |
| I/O | Input and/or Output |
| Level 2es | Surveillance with Comm A/B capability (transmitting and receiving with data block up to 112 bit). e = Extended squitter and s = SI capability |
| LCD | Liquid Crystal Display |
| Mode S | S = Selective Interrogation of the Transponder |
| MTL | Minimum Triggering Level |
| ON | Transponder ON mode (without altitude transmission) |
| PAM | Pulse Amplitude Modulation |
| PBIT | Power-on Built-In Test |
| PN | Part Number |
| PS | Power Supply |
| R | Reply |
| RF | Radio Frequency |
| RX | Receiver |
| SBY | Standby mode |
| SEL | Selection |
| SI | Surveillance Identifier |
| SPI | Special Position Identification Pulse |
| SSR | Secondary Surveillance Radar |
| STO | Store |
| SUPP | Supply Voltage DC |
| TCAS | Traffic Alert and Collision Avoidance System (US) |
| TIS | Traffic Information Service |
| TIS-B | Traffic Information Service-Broadcast |
| TNC | Threaded Naval Connector (coaxial) |
| TSO | Technical Standards Order |
| TX | Transmitter |
| VFR | Visual Flight Rules |
| VSWR | Voltage Standing Wave Ratio |
| XPDR | Transponder |

Units

Units

| | |
|------------------|---|
| A | Ampere |
| mA | Milliampere |
| °C | Degree Celsius |
| cm | Centimetre |
| dBm | Power Ratio In Decibel referenced to 1 mW |
| dB | Decibel |
| ft | Feet |
| g | Gram |
| kg | Kilogram |
| Hz | Hertz |
| kHz | Kilohertz |
| MHz | Megahertz |
| mm | Millimetre |
| Ohm (Ω) | Resistance |
| s | Second |
| V | Volt |
| mV | Millivolt |
| W | Watt |
| " | Inch |

General Safety Definitions



Indicates a hazardous situation which, if not avoided, will result in death or serious injury.



Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



Is used to address practices not related to physical injury.



Safety instructions (or equivalent) signs indicate specific safety-related instructions or procedures.

Disposal

⚠ CAUTION The packaging material is inflammable, if it is disposed of improperly by burning, toxic fumes may develop.

This product contains materials that fall under the special disposal regulation, which corresponds to the EC directive for dangerous disposal material. We recommend disposing of the respective materials in accordance with the respectively valid environmental laws.

Dispose circuit boards via a technical waste dump which is allowed to take on e.g. electrolytic aluminium capacitors. Do under no circumstances dump the circuit boards with normal waste dump.

Warranty Conditions

⚠ CAUTION The device(s) may be installed on an aircraft only by an approved aeronautical company (e.g. EASA Part 145) which shall also examine and verify the installation.

User conversions and changes are not permitted.

Any change made by the user excludes any liability on our part (excluding the work described in this manual).

- The device must not be opened.
- Do not make any modifications to the device, except for those described in the manual.
- Make connections to the inputs, outputs and interfaces only in the manner described in the manual.
- Fix the devices according to the mounting instructions.
We cannot provide any guarantee for other mounting methods.

Conditions of Utilization

General introductory notes

With this device you bought a product which was manufactured and tested before delivery with the utmost care.

Please take your time to read the following notes which you ought to follow closely during installation and operation.

Otherwise all claims under the warranty will become void and a reduced service life or even damages must be expected.

⚠ CAUTION The user is responsible for protective covers and/or additional safety measures in order to prevent damages to persons and electric accidents.

Additional Conditions of Utilization

Please refer to "Safety-Conscious Utilization", page 15.

Non-Warranty Clause

We checked the contents of this publication for compliance with the associated hard and software. We can, however, not exclude discrepancies and do therefore not accept any liability for the exact compliance. The information in this publication is regularly checked, necessary corrections will be part of the subsequent publications.

1. General Description

In this chapter you can read about:

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The single block Mode S transponder BXP6401-X-(XX) is the airborne component of the Air Traffic Control (ATC). It works as a Mode S Secondary Surveillance Radar system with added ADS-B Transmitting Subsystem functionality.

In the selective mode (Mode S), the Ground Control can interrogate the transponder individually using an ICAO 24-bit address, which is unique to the particular aircraft.

BXP6401-X-(XX) works as a part of the surveillance system in two ways:

- As Mode S transponder which provides responses to ground station interrogations and allows air traffic control (ATC) to locate, identify and track aircraft.
- As ADS-B Broadcast-Only System which spontaneously broadcasts aircraft information.

1.1. Introduction

This manual describes the operation and installation of the Mode S transponder BXP6401-X-(XX). The ID label on your device shows the part number for identification purposes (see "Type Plate", page 25).

Before starting operation of the unit(s) please read this manual carefully, with particular attention to the description referring to your device(s). This manual also contains several optional elements of the system (Blind encoder for example) that may not be contained in your delivery package and in that case are not applicable.

For further descriptions we are using the term BXP6401 instead of writing the complete model number.

The manuals "Maintenance and Repair" (**M&R**), "Installation and Operation (**I&O**) and "Operation Instructions" (**OI**) contain the following sections:

| Section | | DV69801.04 M&R | DV69801.03 I&O | 0591.823-071 OI |
|---------|--------------------------|-------------------|-------------------|--------------------|
| | General | X | X | - |
| | Installation | X | X | - |
| | Operation | X | X | X |
| | Theory of Operation | X | N/A | N/A |
| | Maintenance and Repair | X | N/A | N/A |
| | Illustrated Parts List | X | N/A | N/A |
| | Modification and Changes | X | N/A | N/A |
| | Circuit Diagrams | X | N/A | N/A |
| | Certifications | X | N/A | N/A |
| | Attachments | X | N/A | N/A |

1.2. Purpose of Equipment

The BXP6401-X-(XX) transponder is designed as a single block unit and is intended for installation in the operating consoles of aircraft.

- The dimensions correspond to the standard size of 58 mm (2¼ inch).
- All control elements are located on the front panel of the unit.
- All connectors for connection to the aircraft interwiring, address module, antenna and altitude encoder are located at the rear side of the unit.
- Serial interfaces RS422 are available at the unit connectors.

Mode S features:

- Individual interrogation of the transponder ICAO 24-bit address.
- Support of the SI code (Surveillance Identifier).
- Register capability for elementary surveillance (ELS) and enhanced surveillance (EHS).
- Extended squitters transmission.
- Data link capability.
- GPS receiver connection capability.
- ADS-B Broadcast-Only System Class B0 i.e. broadcasts following data:
 - Airborne Position Message
 - Surface Position Message
 - Airborne Velocity Message
 - Extended Squitter Aircraft Status Message

NOTICE

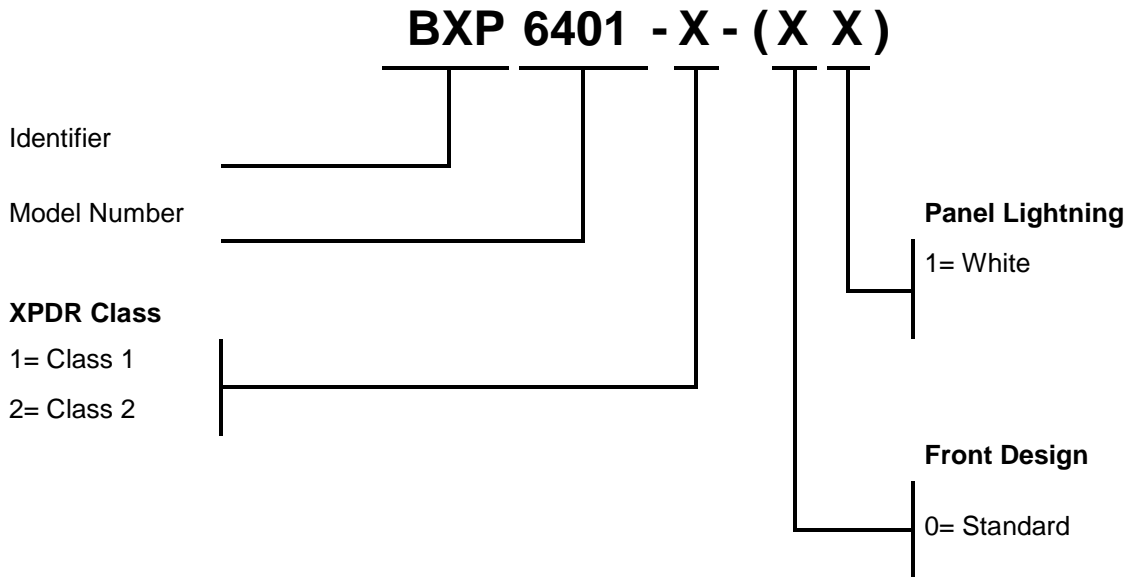
Actual generation of each ADS-B message type and data within each message depends on availability of navigation data and GPS engine capabilities.

Inherent features:

- Mode A - in this mode, the 4096 character code set on the control head is sent as a reply to interrogation from a ground station.
- Mode C - in this mode, the encoded altitude is sent in addition to the mode A reply. The altitude information must be delivered from an external device (e.g. Becker Avionics Blind Encoder BE6400).
- A special identifier pulse (SPI) can be activated by pressing the IDT button in Mode A/C and Mode S.
- Selftests (BITs). The Initiated Built-In Test (IBIT), the Continuous Built-In Test (CBIT) and the Power-on Built-In Test (PBIT) are integrated in the transponder.

1.3. Variants Overview

Within the part number, the meaning of "-X-(XX)" is:



1.3.1. Software Status

Descriptions see "Software/Firmware Status – Functionality", page 25.

1.4. Safety-Conscious Utilization

For safe operation of the product the following notes have to be observed:

SAFETY INSTRUCTIONS

- The installation of the Mode S transponder into an aircraft may be carried out only by an authorized installation company. The country regulations always have to be observed.
- Use the product only within the specified conditions, see "Technical Data" page 16.

Power supply:

- Do not connect the unit to AC sources.
- Make sure that the unit is connected to the mandatory DC source, see "Technical Data" page 16.
- Do not connect the unit with reversed polarity to the DC source.

Circuit breaker:

- If no load is connected to connector P9, pin 6 the unit should be protected from the aircraft power supply by a dedicated 3 A circuit breaker.
- If an external load is connected to connector P9, pin 6, the circuit breaker should be a 5 A type.

Address module:

- The programming of the address module AM6400-1 with the ICAO 24-bit address of the aircraft must be carried out at an installation company or in the manufacturer factory. A programming kit is available see "Order Code", page 21.

SAFETY INSTRUCTIONS

Excessive pulses on the DC bus of the aircraft may cause damage on electrical circuits of any installed instrument.

Do not switch ON the device during engine start or shutdown.

1.5. Restriction for Use

SAFETY INSTRUCTIONS

The BXP6401 is to be used inside the declared limits.

1.6. Technical Data

1.6.1. General Characteristics

| BXP6401 | Specifications |
|------------------------------|--|
| Power supply | 10...33 VDC |
| Typical consumption | 50 Mode S replies/s + Squitter 0.37 A at 14 V (illumination off) 0.22 A at 28 V (illumination off) 0.40 A at 14 V (illumination max.) 0.25 A at 28 V (illumination max.) in standby Mode: 0.22 A at 14 V (illumination off) 0.14 A at 28 V (illumination off) 0.28 A at 14 V (illumination max.) 0.16 A at 28 V (illumination max.) |
| Panel illumination | Control input |
| Illumination control current | max. 1 mA at 28 V |
| Serial interfaces | RS422 |
| Data link capability | 255 GICB registers |
| DME suppression | input voltage: < 2 V (no suppression) > 8 V (suppression) |
| | output voltage < 0.5 V (not active) > 18 V (active) |
| External Ident input | "0" (active) ≤ 3.5 V "1" (not active) ≥ 4.0 V I _{source} (shorted to GND) ≤ 10 mA |
| Ground detection input | "ground" ≤ 0.5 V "airborne" ≥ 2 V I _{source} (shorted to GND) ≤ 10 mA |
| Power-up time | 2 s (including internal self-test) |
| Internal fuse protection | F 5 A |
| External fuse protection | T 3 A (circuit breaker) (5 A circuit breaker if an external load is connected to P9 pin 6) |
| Operating temperature | -20...+55 °C (short-time +70 °C) |
| Storage temperature | -55...+85 °C |

| BXP6401 | Specifications |
|--------------------|--|
| Operating altitude | 50 000 ft. max. (class 1) 15 000 ft. max. (class 2) |
| Mode S | Class 1 or 2, Level 2es (Class 1=250 W, Class 2=140 W at unit output) <ul style="list-style-type: none"> • extended squitter capability • surveillance identifier (SI code) |

1.6.2. Transmitter Data

| BXP6401 (Transmitter Data) | Specifications |
|-----------------------------------|---|
| Transmit frequency | 1090 MHz \pm 1 MHz |
| Transmit modulation | 12MOM1D PAM (Pulse Amplitude Modulation) |
| Transmitter type | Solid state |
| Transmit power (class 1) | \geq 125 W (+21 dBW) at antenna end terminal and \geq 250 W at unit output |
| Transmit power (class 2) | \geq 70 W (+18.5 dBW) at antenna end terminal and \geq 140 W at unit output |
| Reply rate capability | Mode A/C: at least 1200 Mode A/C replies/s for a 15 pulse coded reply, can be limited to 500...1200 Mode S: at least 50 Mode S replies/s interval (thereof at least 16 long formats) |
| Mode S squitter rate (approx.) | Acquisition squitter 4/s Extended squitter 1/s |
| Reply code (mode A) | ICAO coding system with 4096 pulse reply possibilities (octal code) |
| Altitude code (mode C) | ICAO coding system 100 ft steps from -1000...62 700 ft. |
| Altitude code (mode S) | 25 ft. or 100 ft. steps (depending on source) |
| Transmit pulse shape | Pulse width 0.45 μ s \pm 0.1 μ s (mode A/C) Pulse width 0.5 μ s \pm 0.05 μ s (mode S) Rise time 0.05...0.1 μ s Fall time 0.05...0.2 μ s |
| Nominal output impedance | 50 Ω |

1.6.3. Receiver Data

| BXP6401 (Receiver Data) | Specifications |
|--------------------------------|---|
| Operating modes | Mode A/C/S, depending on interrogation |
| Receive frequency | 1030 MHz \pm 0.1 MHz (mode A/C) 1030 MHz \pm 0.01 MHz (mode S) |
| Sensitivity (MTL) | -74 dBm \pm 3 dB (for 90% reply rate in mode A/C and 99% in mode S) |
| Selectivity | \pm 15 MHz > 40 dB \pm 25 MHz > 60 dB |
| Dynamic range | \geq 60 dB |
| Bandwidth | \pm 3 MHz < 3 dB |
| Modulation (mode A/C) | PAM (Pulse Amplitude Modulation) |
| Modulation (mode S) | DPSK (Differential Phase Shift Keying) |
| Side lobe suppression | 3-pulse method (mode A/C), P5 (mode S) |
| Nominal impedance | 50 Ω |

1.6.4. Dimensions & Weight

| BXP6401 | Specifications |
|----------------------|---|
| Front panel HxW | 61.3x61.3 mm (2.41x2.41 inch) |
| Instrument diameter | 58 mm (2¼ inch) |
| Device depth (total) | 226 mm (xx inch) |
| Mounting depth | with antenna socket 206 mm (8.11 inch) with address module 239 mm (9.41 inch) with blind encoder BE6400-01 255.3 mm (10.05 inch) |
| Weight | Transponder BXP6401 \leq 0.8 kg (1.764 lb) Address module approx. 0.018 kg (0.04 lb) Blind encoder BE6400-01 approx. 0.1 kg (0.22 lb) |

1.6.5. Software

The transponder BPX6401-X-(XX) is controlled by a micro controller in the control head and the core unit. The software criticality is determined to be Level C in accordance with EUROCAE/RTCA document ED12B/DO-178B.

1.6.6. Environmental Condition

BXP6401-X-(XX) was tested in accordance with EUROCAE/RTCA ED-14D/DO-160D under consideration of below listed environmental categories and conditions:

| Characteristics | Section | Cat. | Condition |
|---|---------|----------|--|
| Temperature and Altitude | 4.0 | D1 | Equipment tested to Category D1 |
| Low Ground Survival Temperature | 4.5.1 | D1 | -55 C |
| Low Operating Temperature | 4.5.1 | D1 | -20 C |
| High Ground Survival Temperature | 4.5.2 | D1 | +85 C |
| High Short-Time Operating Temperature | 4.5.2 | D1 | +70 C |
| High Operating Temperature | 4.5.2 | D1 | +55 C |
| In-flight Loss of Cooling | 4.5.4 | Z | No auxiliary cooling required |
| Altitude | 4.6.1 | D1 A1 | 50 000 ft (class 1) for BXP6401-1-(XX) 15 000 ft (class 2) for BXP6401-2-(XX) |
| Decompression | 4.6.2 | X | No test performed |
| Overpressure | 4.6.3 | X | No test performed |
| Temperature Variation | 5.0 | B | 5 °C minimum per minute |
| Humidity | 6.0 | A | Up to 95% humidity at 50 °C |
| Shock and Crash Safety | 7.0 | B | Equipment tested to Category B |
| Vibration | 8.0 | S U | Cat. S, vibration test curve M Cat. U, vibration test curve G |
| Explosion Proofness | 9.0 | X | No test performed |
| Water Proofness | 10.0 | X | No test performed |
| Fluids Susceptibility | 11.0 | X | No test performed |
| Sand and Dust | 12.0 | X | No test performed |
| Fungus Resistance | 13.0 | X | No test performed |
| Salt Spray | 14.0 | X | No test performed |
| Magnetic Effect | 15.0 | Z | Distance for a deflection of Dc = less than 0.3 m |
| Power Input | 16.0 | B | Equipment tested to Category B |
| Voltage Spike | 17.0 | A | Equipment tested to Category A |
| Audio Freq. Conducted Susceptibility | 18.0 | B | Equipment tested to Category B |
| Induced Signal Susceptibility | 19.0 | A | Equipment tested to Category A |
| Radio Frequency Susceptibility | 20.0 | WW | Equipment tested to Category WW |
| Spurious RF Emission | 21.0 | B | Equipment tested to Category B |
| Lightning Induced Transients Susceptibility | 22.0 | A3E3X | Equipment tested to Category A3E3X |
| Lightning Direct Effects | 23.0 | X | No test performed |
| Icing | 24.0 | X | No test performed |
| Electrostatic Discharge | 25.0 | A | Equipment tested to Category A |

1.6.7. Certifications

| Conformity | BXP6401-X-(XX) |
|-------------------|--------------------------|
| EASA.210.322 | ETSO-2C112a |
| FAA | TSO-C112, class 2A or 2B |

1.7. Order Code

1.7.1. BXP6401

| Qty | Mode S Transponder 58 mm (2¼ in) | |
|-----|----------------------------------|--------------------------|
| 1 | BXP6401-1-(01), class 1 | Article-No. 0588.687-915 |
| 1 | BXP6401-2-(01), class 2 | Article-No. 0588.709-915 |

1.7.2. Accessories

| Qty | Address module | |
|-----|----------------|--------------------------|
| 1 | AM6400-1-(01) | Article-No. 0572.942-915 |

| Qty | Programming kit for Address module | |
|-----|------------------------------------|--------------------------|
| 1 | AMP6400-1 | Article-No. 0584.843-954 |
| 1 | AMP6400-2 | Article-No. 0604.054-954 |

| Qty | Blind encoder (altitude encoder) | |
|-----|----------------------------------|--------------------------|
| 1 | BE6400-1-(01) | Article-No. 0592.137-915 |

| Qty | Antenna | |
|-----|---|--------------------------|
| 1 | 1A032 Transponder antenna KEC-KC-89 (BNC) | Article-No. 0707.007-952 |

| Qty | Connector Kit CK4401-S (soldering version) | Article-No. 0552.801-954 |
|-----|--|--------------------------|
| 1 | Connector Dsub 25-s | |
| 1 | Connector housing | |
| 1 | Label XPDR | |

| Qty | Connector Kit CK4401-C (crimp version) | Article-No. 0552.798-954 |
|-----|--|--------------------------|
| 1 | Connector Dsub 25-s | |
| 1 | Connector housing | |
| 1 | Label XPDR | |

| Qty | Connector Kit CK6400-S (soldering version) | Article-No. 0586.072-954 |
|-----|--|--------------------------|
| 1 | Connector Dsub 25-s | |
| 1 | Connector Dsub 25-p | |
| 2 | Connector housing | |
| 1 | Label XPDR | |

| Qty | Connector Kit CK6400-C (crimp version) | Article-No. 0586.064-954 |
|-----|--|--------------------------|
| 1 | Connector Dsub 25-s | |
| 1 | Connector Dsub 25-p | |
| 2 | Connector housing | |
| 1 | Label XPDR | |

| Qty | | |
|-----|---|--------------------------|
| 1 | 1K046 Cable harness, length 1 m | Article-No. 0604.615-276 |
| 1 | 1SK504 BNC connector for cable RG58U, soldering | Article-No. 0725.706-277 |
| 1 | 1SK503 TNC connector for cable RG58U, soldering | Article-No. 0725.900-277 |
| 1 | TNC coaxial connector for RG-58C/U, crimp | Article-No. 0551.694-277 |
| 1 | TNC coaxial connector for RG-223/U, crimp | Article-No. 0551.732-277 |

| Qty | | |
|-----|--|--------------------------|
| 1 | TNC coaxial connector for RG-58C/U, soldering | Article-No. 0552.781-277 |
| 1 | BNC antenna connector for RG-58C/U, crimp | Article-No. 0551.708-277 |
| 1 | BNC antenna connector for RG-223/U, crimp | Article-No. 0551.740-277 |
| 1 | BNC antenna connector for RG-58C/U and RG-223/U, soldering | Article-No. 0552.771-277 |

| Qty | Available Documentation | |
|-----|---|--------------------------|
| 1 | BXP6401 Operating Instructions/Bedienungsanleitung English/Deutsch | Article-No. 0591.823-071 |
| 1 | BXP6401 Installation and Operation Manual, English | Article-No. 0584.053-071 |
| 1 | BXP6401 Maintenance and Repair Manual, English | Article-No. 0584.061-071 |
| 1 | BXP640X-XX-(XX) Data Transfer Interface Protocol | Article-No. 0590.258-071 |
| 1 | BE6400 Installation and Operation Manual, English | Article-No. 0594.547-071 |

2. Installation

This manual must be available close to the device during the performance of all tasks.

Careful planning should be applied to achieve the desired performance and reliability from the product. Any deviations from the installation instructions prescribed in this document are under own responsibility.

The transponder is designed for installation in the operating panel of an aircraft. The installation of the BXP6401 depends on the type of aircraft and equipment and therefore only general information can be given in this section.

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2.1. Packaging, Transport, Storage

Visually inspect the package contents for signs of transport damage.

2.1.1. Packaging Material and Transport

⚠ CAUTION The packaging material is inflammable, if it is disposed of improperly by burning, toxic fumes may develop.

The packaging material can be kept and reused in the case of a return shipment. Improper or faulty packaging may lead to transport damages.

Make sure to transport the device always in a safe manner and with the aid of suitable lifting equipment if necessary. Do never use the electric connections for lifting. Before the transport, a clean, level surface should be prepared to place the device on. The electric connections may not be damaged when placing the device.

First Device Checkup

- Check the device for signs of transport damages.
- Please verify if the indications on the type plate correspond to your purchase order.
- Check if the equipment is complete ("Scope of Delivery" page 24).

Storage

If you do not wish to mount and install the device immediately, make sure to store it in a dry and clean environment. Make sure that the device is not stored near strong heat sources and that no metal chippings can get into the device.

2.2. Device Assignment

This manual is valid for the following devices:

- BXP6401-1-(0X) + supplement
- BXP6401-2-(0X) + supplement

2.2.1. Scope of Delivery

- Manuals
 - Operating Instructions.
- Transponder
 - BXP6401 (corresponding to your ordered version)
- Documents of Certifications if available

2.2.2. Additional Required Equipment

- Address module AM6400-1-(01) programmed
- Connector kit
- Antenna

Details see "Accessories" page 21.

2.2.3. Type Plate

The device type is defined by the type plate (on the housing):

Example:

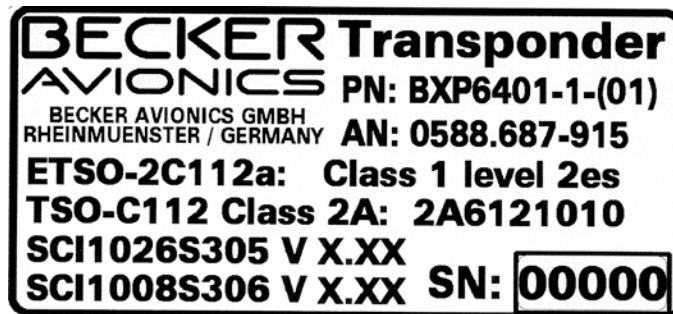


Figure 1: Type Plate (example)

Explanation:

| | |
|-------------|---|
| PN: | Example Type designation: BXP6401-1-(01) BXP6401 = Single Block Transponder 58 mm (2¼ inch) Options: -1-: class 1 -2-: class 2 (0X): standard (classic front design) (X1): white panel lighting |
| SN: | Unique number of the particular device |
| AN: | Article number |
| DoM: | Date of Manufacturing |
| | Software: Corresponding to the displayed version |
| | Compliance and Certifications Corresponding to the displayed text and logos |

2.2.4. Software/Firmware Status – Functionality

The implemented firmware version can be checked in the configuration menu, see "Configuration Mode" page 53.

Units equipped with non ADS-B out capable software can be modified from our Customer Service Department.

| Software/Firmware Status | | Functionality |
|--------------------------|----|---|
| CU VER | 2x | no ADS-B out |
| CORE VER | 42 | |
| FPGA VER | 50 | |
| CU VER | 2x | ADS-B out not certified according to TSO-C166b; only capable for GA Traffic Receiver e.g. FLARM(R) |
| CORE VER | 47 | |
| FPGA VER | 55 | |

2.3. Mounting Requirements

SAFETY INSTRUCTIONS

The device must not be opened.

When installing the device, make sure the heat dissipators of the device receive sufficient air. Keep an efficient distance of the devices with integrated ventilator fans in order to ensure free circulation of the cooling air.

Make sure that the mounting plate is not exposed to external temperature influences.

The mounting place shall be at least 30 cm from the magnetic aircraft compass, to avoid any interference to the magnetic compass by the transponder.

SAFETY INSTRUCTIONS

The installation of the Mode S transponder into an aircraft may be carried out only by an authorized installation company. The country regulations always have to be observed.

2.3.1. Blind Encoder (BE6400)

For installation of the Becker Avionics Blind Encoder BE6400 the corresponding manual has to be noticed (BE6400 I&O manual, Article-No. 0594.547-071).

- The Blind Encoder BE6400 is intended to be connected to connector J8 of the transponder
- The Blind Encoder is direct connected without any interwiring.
- It can be used only in installations that do not require connection of other equipment utilizing ADLP interface of the transponder.

2.3.2. Antenna 1A032

- Fit the transponder antenna to the bottom of the aircraft at a horizontal, flat location.
 - This location should not be in the "shadow" of aircraft structure items.
 - The highest range is achieved when the antenna is located at the lowest point of the aircraft fuselage.

SAFETY INSTRUCTIONS

The transponder antenna 1A032 is provided with a silicone rubber gasket which must also be interposed between the skin of the aircraft and the antenna.

In aircraft having a wooden or plastic airframe an electric counterweight plate or panel must be located within the fuselage at the antenna location with minimum dimensions 400x400 mm (15.7x15.7 inch).

2.3.2.1. Antenna Cable

- Cable types RG-58C/U (0.9 dB/m) or RG-223/U (0.6 dB/m) can be used.
 - With cable length >2 m between unit and antenna, we recommended cable type RG-223/U.
- Recommended cable length ≤5 m.
- Complete loss of the antenna cable ≤3 dB.

2.4. Dimensions

2.4.1. Transponder BXP6401-X-(XX)

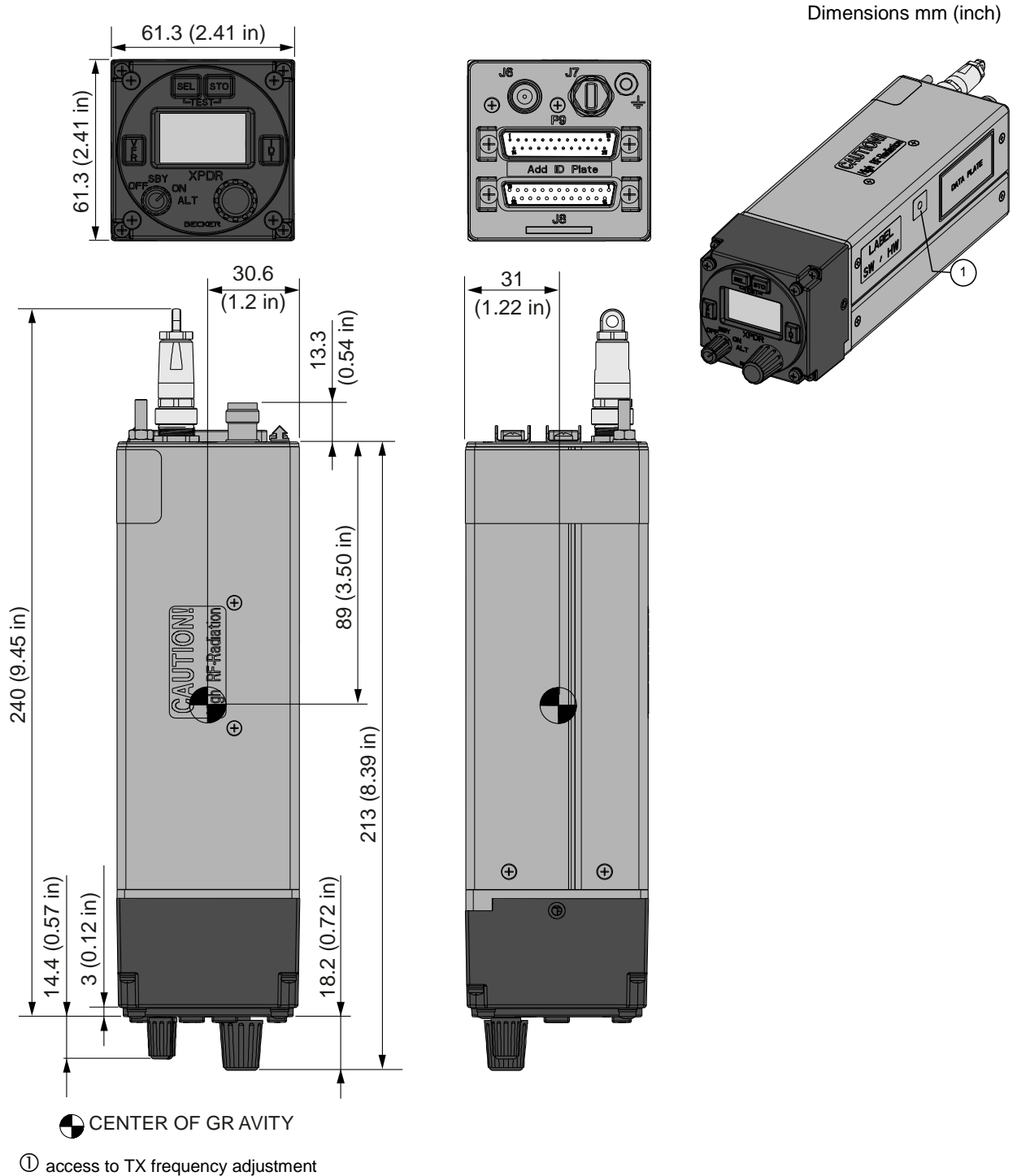


Figure 2: Transponder BXP6401-X-(XX)

NOTICE

"Center of Gravity" without blind encoder, address module and mounting kit.

Allowable deviation for dimensions without tolerances: DIN ISO 2768 T1 C

| | | |
|----------------|-------------------|---------------------|
| xx...6 (±0.3) | >30...120 (±0.8) | >400...1000 (±2.0) |
| >6...30 (±0.5) | >120...400 (±1.2) | >1000...2000 (±3.0) |

2.4.2. **BXP6401 – Drilling Template**

Dimensions mm (inch)

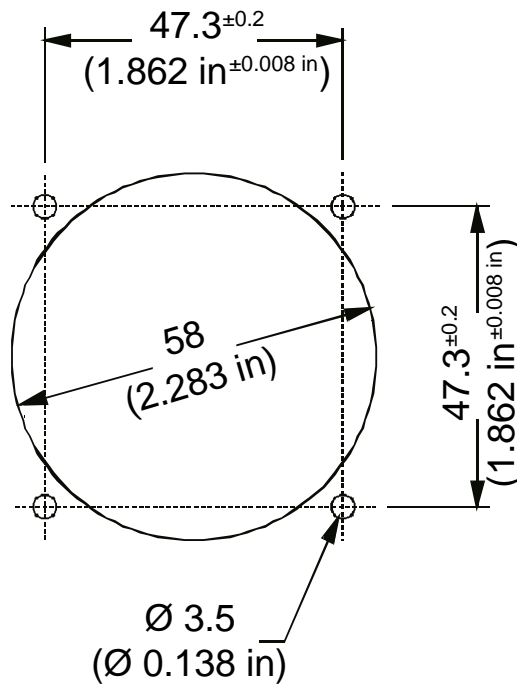


Figure 3: BXP6401 – Drilling Template

2.4.3. **Address Module AM6400-1-(01)**

Dimensions mm (inch)

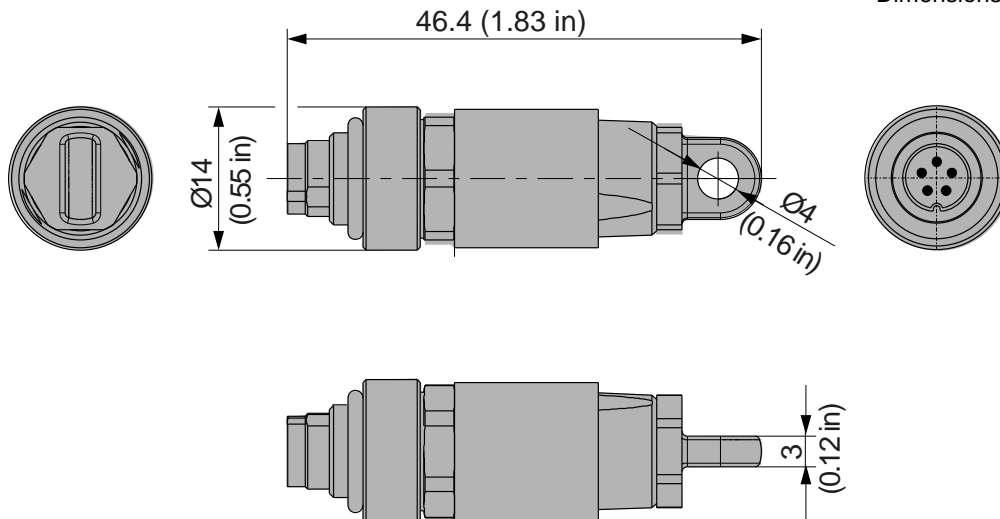


Figure 4: Address Module AM6400-1-(01)

2.4.4. Blind Encoder BE6400

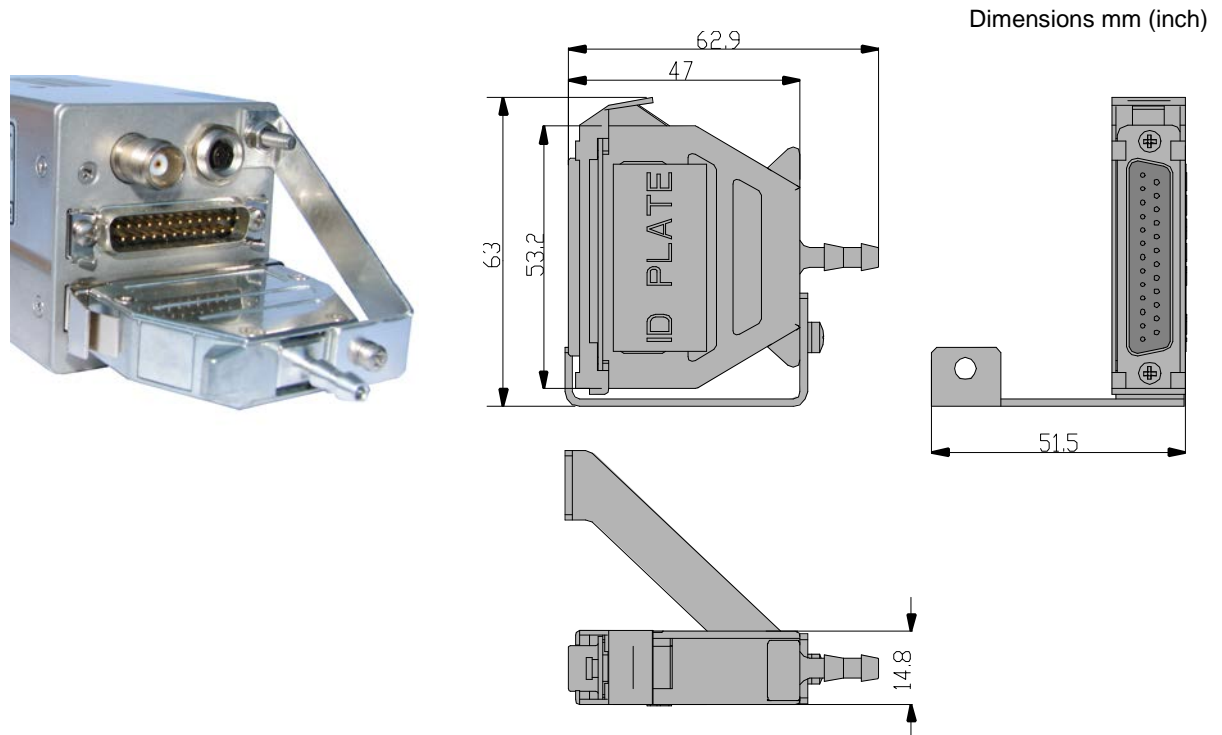


Figure 5: Blind Encoder BE6400

2.4.5. Antenna 1A032

Dimensions mm (inch)

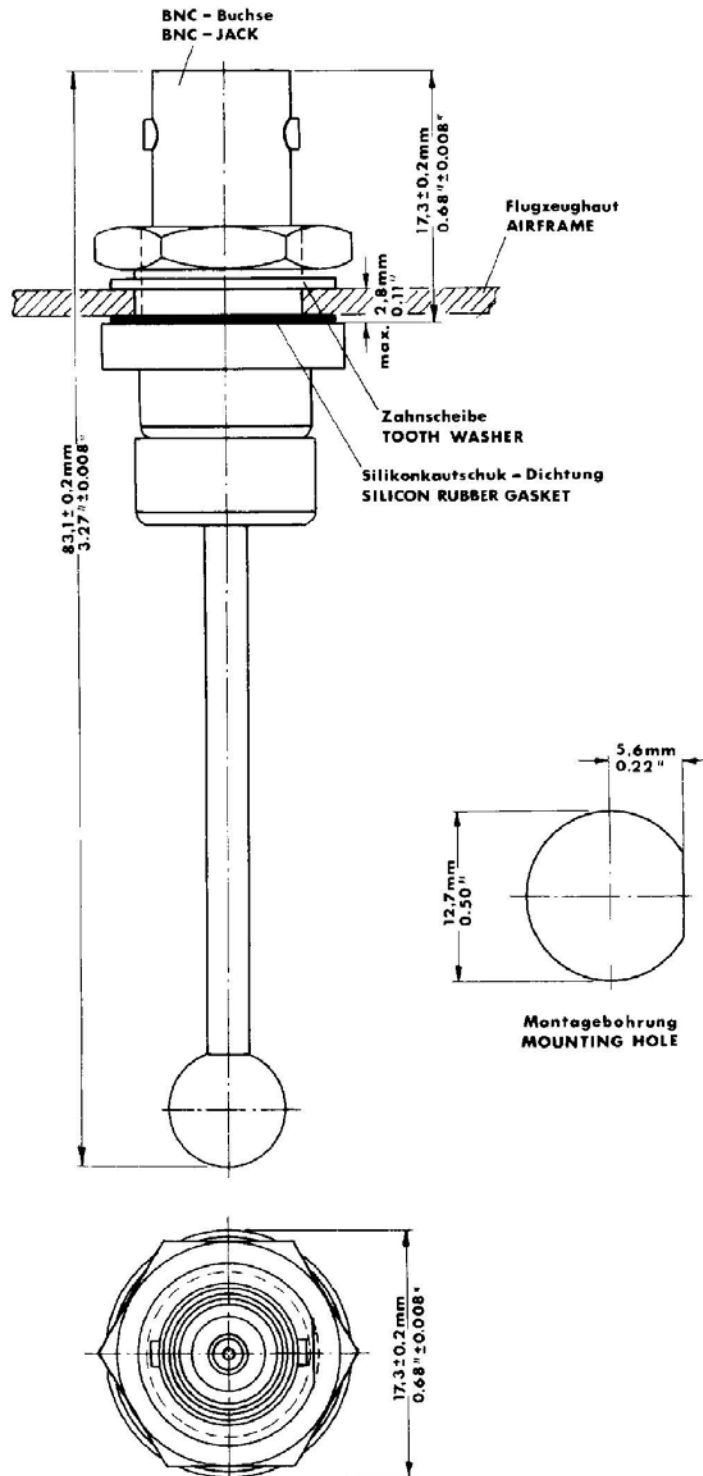


Figure 6: Antenna 1A032

2.5. Electrical Installation

SAFETY INSTRUCTIONS

- The installation of the Mode S transponder into an aircraft may be carried out only by an authorized installation company. The country regulations always have to be observed.

Power supply:

- Do not connect the unit to AC sources.
- Make sure that the unit is connected to the mandatory DC source, see "Technical Data" page 16.
- Do not connect the unit with reversed polarity to the DC source.

Circuit breaker:

- If no load is connected to connector P9, pin 6, or if the unit is used with the retrofit adapter, the unit should be protected from the aircraft power supply by a dedicated 3 A circuit breaker.
- If an external load is connected to connector P9, pin 6, the circuit breaker should be a 5 A type.

Address module:

- The programming of the address module AM6400-1 with the ICAO 24-bit address of the aircraft must be carried out only at an installation company or in the manufacturer factory.

For installations in a more severe electromagnetically environment use shielded cable connectors and a common shielding for the transponder interwiring.

⚠ CAUTION

Radiation risk:

A safe distance to the installed antenna must be ensured by corresponding installation measures around human body damage (e.g. at the eyes) and/or avoid the inflammation of combustible materials by radiated energy.

2.5.1. Grounding

The transponder has a threaded grounding bolt at the rear side of the unit. Use this point as grounding contact.

SAFETY INSTRUCTIONS

Make sure that the grounding contact area is adequate and that the connection has low resistance and low inductance. Never use a grounding point on paint-coated surfaces!

2.5.2. BXP6401 Connector Layout

J6: Antenna
J7: Address module

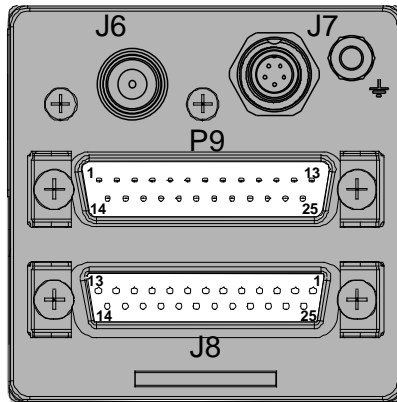


Figure 7: BXP6401 Connector Layout Rear Side

2.5.3. Connector J6

Antenna connector RF (at rear side, connect the transponder via cable to antenna).

- Type: TNC female.
- Antenna cable: low-loss 50 Ω cable, RG 58C/U or RG 223/U type.
- Signal: bi-directional

2.5.4. Connector P9 (Dsub 25-pol male)

| P9 Pin | Pin name | Function | Source | Destination | Recommended cable type |
|--------|--------------------|---|---|--------------------|------------------------|
| 1 | A1 | Altitude A1 | encoding altimeter (parallel interface) | BXP6401 | AWG24 |
| 2 | A2 | Altitude A2 or GPS /Enable* | encoding altimeter (parallel interface) aircraft DC supply ground* | BXP6401 | AWG24 AWG26 |
| 3 | A4 | Altitude A4 | encoding altimeter (parallel interface) | BXP6401 | AWG24 |
| 4 | IDENT_N | IDENT switch | external IDENT button | BXP6401 | AWG26 |
| 5 | EXT. SUPPRESSION | Aircraft suppression system | bi-directional | bi-directional | Coaxial cable |
| 6 | SWITCHED POWER OUT | Switched supply voltage I _{max} = 1 A | BXP6401 | encoding altimeter | AWG20 |
| 7 | REPLY OUT | Output for ext. reply lamp, lamp to be connected to positive illumination voltage | BXP6401 | reply lamp | AWG26 |
| 8 | RX+ | RS422 GPS receiver** | GPS receiver | BXP6401 | AWG26 shielded |
| 9 | RX- | RS422 GPS receiver** | GPS receiver | BXP6401 | AWG26 shielded |
| 10 | Illumination A | Illumination control | Illumination voltage | BXP6401 | AWG24 |

| P9 Pin | Pin name | Function | Source | Destination | Recommended cable type |
|--------|----------------|--|---|-------------|------------------------|
| 11 | SUPP | Supply voltage input, external 5 A fuse for current protection | DC supply voltage source 10...33 V | BXP6401 | AWG20 |
| 12 | SUPP | Supply voltage input, external 5 A fuse for current protection | DC supply voltage source 10...33 V | BXP6401 | AWG20 |
| 13 | GND | DC supply ground, additionally connected to Pin25 | DC supply voltage ground | BXP6401 | AWG20 |
| 14 | B1 | Altitude B1 | Encoding altimeter (parallel interface) | BXP6401 | AWG24 |
| 15 | B2 | Altitude B2 | Encoding altimeter (parallel interface) | BXP6401 | AWG24 |
| 16 | B4 | Altitude B4 | Encoding altimeter (parallel interface) | BXP6401 | AWG24 |
| 17 | C1 | Altitude C1 | Encoding altimeter (parallel interface) | BXP6401 | AWG24 |
| 18 | C2 | Altitude C2 | Encoding altimeter (parallel interface) | BXP6401 | AWG24 |
| 19 | C4 | Altitude C4 | Encoding altimeter (parallel interface) | BXP6401 | AWG24 |
| 20 | D4 | Altitude D4 | Encoding altimeter (parallel interface) | BXP6401 | AWG24 |
| 21 | Not connected | - | - | - | - |
| 22 | Not connected | - | - | - | - |
| 23 | Illumination B | Illumination GND | Illumination ground | BXP6401 | AWG24 |
| 24 | Not connected | - | - | - | - |
| 25 | GND | Ground, additionally connected to Pin13 | DC supply voltage ground | BXP6401 | AWG20 |

Note P9:

*If no parallel altimeter is used then pin2 serves as GPS Enable/Disable input (active LOW). If no GPS receiver is used Pin2 should be left not connected.

For details see "Aircraft Wiring", page 39.

2.5.5. Connector J8 (Dsub 25-pol female)

| J8 Pin | Pin name | Function | Source | Destination | Recommended cable type |
|--------|---------------|---------------------------------|---------------------------|-------------|------------------------|
| 1 | Not connected | Reserved for protocol selection | - | - | - |
| 2 | GPS_EN | GPS /Enable* | Aircraft DC supply ground | BXP6401 | AWG26 |
| 3 | GND | Ground connection | Aircraft DC supply ground | BXP6401 | AWG24 |
| 4 | BSUPP | Supply for BE6400 ¹⁾ | BXP6401 | BE6400 | - |

| J8 Pin | Pin name | Function | Source | Destination | Recommended cable type |
|--------|---------------|--------------------------------------|------------------------------|------------------------------|---|
| 5 | Not connected | - | - | - | - |
| 6 | Not connected | - | - | - | - |
| 7 | Not connected | - | - | - | - |
| 8 | Not connected | - | - | - | - |
| 9 | Not connected | - | - | - | - |
| 10 | Not connected | Reserved for SQ | - | - | - |
| 11 | GND SWITCH | "Weight on wheel" sensor, active LOW | Aircraft | BXP6401 | AWG26 |
| 12 | ALTS- | RS422 data interface ²⁾ | Serial encoding altimeter | BXP6401 | AWG26 shielded |
| 13 | ALTS+ | RS422 data interface ²⁾ | Serial encoding altimeter | BXP6401 | AWG26 shielded |
| 14 | TISRX- | RS422 data interface | Avionics Data Link Processor | BXP6401 | AWG26 twisted pair, shielded all together |
| 15 | TISRX+ | RS422 data interface | Avionics Data Link Processor | BXP6401 | AWG26 twisted pair, shielded all together |
| 16 | Not connected | - | - | - | - |
| 17 | TISTX- | RS422 data interface | BXP6401 | Avionics Data Link Processor | AWG26 twisted pair, shielded all together |
| 18 | TISTX+ | RS422 data interface | BXP6401 | Avionics Data Link Processor | AWG26 twisted pair, shielded all together |
| 19 | Not connected | - | - | - | - |
| 20 | Not connected | - | - | - | - |
| 21 | GND | ground connection | Aircraft DC supply ground | BXP6401 | AWG24 |
| 22 | Not connected | - | - | - | - |
| 23 | Not connected | - | - | - | - |
| 24 | Not connected | - | - | - | - |
| 25 | Not connected | - | - | - | - |

Note J8:

1) Do not connect if no BE6400 is used.

2) Serial encoding altimeter connection (not for BE6400).

*If no GPS receiver is used then Pin2 should be left not connected.

For details see "Aircraft Wiring", page 39.

2.5.6. Connector J7 (5-pol female)

| J7 Pin | Pin name | Function | Source | Destination |
|--------|----------------------|---------------------|---------|-------------|
| 1 | VCC | Power supply | BXP6401 | AM6400 |
| 2 | I ² C_CLK | Clock | AM6400 | BXP6401 |
| 3 | Not connected | Reserved | - | - |
| 4 | I ² C_DAT | Data | AM6400 | BXP6401 |
| 5 | GND | Power supply return | BXP6401 | AM6400 |

2.5.7. External Suppression

External suppression should be connected if another transponder or DME is installed in the aircraft. The suppression pulses may not be compatible with all models of DME. In this case, leave the suppression pin open (i.e. P9 pin 5).

In cases when the DME has only a suppression output (e.g. Bendix/King KN62, KN64 and KNS80) a diode shall be inserted in the suppression line. Details see "Aircraft Wiring" page 39.

2.5.8. External IDENT Push-Button

If this input (unit connector P9 pin 4) is briefly connected to GND (e.g. by an external push-button), the IDENT function (SPI) is started in the same way as when using the IDENT push-button on the front panel.

2.5.9. Ground Switch

- If required, connect an automatic ground switch ("Weight on Wheel" sensor) at unit connector J8 pin 11.

2.5.10. Illumination

For external illumination control:

- Connect the illumination voltage to unit connector P9 pin 10 and attach Pin 23 to the illumination ground.
- Set the max. illumination voltage in the installation menu.

For manual illumination control:

- Set dimming input to "none" in the installation menu.
- Set illumination intensity manually in the configuration menu.

2.5.11. Programming of the Address Module

The 24-bit ICAO address once allocated by the local authority is stored for the assigned transponder in the Address Module AM6400.

The address module programmer kit AMP6400 is for reading and storing fixed aircraft data into the Address Module. This tool is for service and maintenance only. The CD-ROM, which is part of the address module programmer kit, includes a description of the programming procedure. Insert the CD-ROM into a PC and follow the instructions. If auto start is disabled on your PC, please start "setup.exe" manually.

2.5.12. Avionics Data Transfer

- The BXP6401 is a "data link transponder" according to RTCA DO-181C, respectively a "level 2" transponder according to Eurocae ED-73B. This stands for the capability to transfer data from the ground to a connected ADLP or a similar device and vice versa.
- The transponder transmits information as reply on a Ground Initiated Comm-B (GICB) request or by means of the extended squitter function. In both cases the valid information must be available in the GICB registers in the transponder.
- The transponder also transmits information by means of the Air Initiated Comm-B (AICB) function. In this case the information must be available in a special register in the transponder. The transponder announces the message and transmits it after authorisation from the ground station.
- In the other direction, the transponder is able to receive information within a Comm-A format from the ground station, which is then buffered and transferred to the connected device.
- In the BXP6401 a "storage design" is implemented for uplink- as well as for downlink messages. This means that all information that might be transferred from the transponder is buffered inside the transponder first.
- The buffers can be accessed from an ADLP or a similar device via the interface on the rear connector J8. The interface is marked with "TISRX" and "TISTX" in the aircraft wiring diagram (see page 39).
- The related protocol is specified in the attachment document "Data Transfer Interface Protocol BXP640X-XX-(XX)". This manual is available at the Becker Avionics Product Support under Article-No. 0590.258-071.

2.5.13. GPS Configuration

- If a GPS receiver is used, connect “GPS_EN” (GPS Enable) to DC supply ground.
 - Use connector J8 pin2 for GPS/EN, if a parallel altimeter is connected.
 - Use connector P9 pin2 for GPS/EN, if a serial altimeter is connected.
- Use connector P9-8 (RX+) and P9-9 (RX-) for GPS receiver data line connections.
- GPS receiver supply connection to BXP6401:
 BXP6401 “SWITCHED POWER OUT” P9 pin6* \triangleq supply voltage P9 pin11, 12. (if its current consumption ≤ 1 A, otherwise it should be connected directly to aircraft supply).

*when the BXP640X is switched ON the output voltage P9 pin6 corresponds to the supply voltage (P9 pin11, 12).

Details see:

”BXP6401 with Parallel Encoding Altimeter & GPS Receiver” page 40.

”BXP6401 with Serial Encoding Altimeter & GPS Receiver” page 41.

The equipment is capable to operate with following certified GPS receivers:

- FreeFlight System GPS/WAAS 1201 Sensor, part number 84100-02-XXXX
- NexNav miniGNSS/ GPS-SBAS Sensor/ Receiver.

The equipment is also capable to operate with GPS receivers which providing EIA-232C or EIA-422 interface with serial asynchronous transmission parameters: 4800, n, 8, 1 and transmit data with continuous NMEA-0183 protocol GGA and VTG sentences.

2.5.13.1. GPS Device Protocols

Electrical format – RS232 with the following characteristics:

| | FreeFlight 1201 | NexNav | NMEA |
|-------------|------------------------|---------------|-------------|
| Baud Rate: | 19200 bps | 19200 bps | 4800 bps |
| #Data Bits: | 8 | 8 | 8 |
| Parity: | none | none | none |
| Stop Bits: | 1 | 1 | 1 |
| Code: | binary | binary | ASCII |

2.6. Settings after Installation

Installation mode is available from SBY mode only.

- Press button SEL,
- Turn the rotary encoder until "INS" appears in the bottom line of the display.
- Select by pressing rotary encoder/push-button.

The installation setup is protected by password "6435".

- Enter password and press store button (STO).

Information front panel see "User Interface", page 46

| Select with button | Select with rotary encoder | | Store button (STO) |
|--------------------|---|------------|--|
| ALTM SELECT | GARMIN / TRIMBLE NORTHSTAR UPS AT (BECKER BE6400) UPS AT LORAN MAGELLAN SHADIN ARNAV PARALLEL | default | store store store store store store store store |
| DIMMING INPUT | None (set illumination intensity manually in the configuration menu) +5 VDC +14 VDC +28 VDC | default | store store store |
| SQUITTER | Short ACQ SQU * | default on | off/on |
| REPLY RATE LIMIT | RPL RATE LMT 500-1200 replies/s in Mode A/C (setting in steps of 50) | | store |
| SPECIALS | DATA LINK ** DEFAULT CONFIG *** ALT HIGH RESOL | | store store store |
| Error Latch | LOW VOLT HIGH TEMP ANTENNA RF POWER DME ERR SQRT ERR CORE EE RECEIVER FIX DATA ALTIMETER DATA LINK Clear latch | | view only view only view only view only view only view only view only view only view only view only view only clear latch |

*Transponders equipped for extended squitter operation should have a means to disable acquisition squitters to facilitate the suppression of acquisition squitters when all TCAS units have been converted to receive extended squitter.

**Shall be disabled if no ADLP or similar device is connected.

*** Default configuration:

| | |
|--------------------------------|--------------|
| Dimming input | none |
| Brightness | 50% |
| Altitude displayed in ALT mode | |
| AI in SBY | |
| AI in ON | |
| Illumination characteristics | max. range |
| Code | 0000 |
| VFR | 0000 |
| Flight number | eight blanks |
| Flight number | not active |

2.7. Warning and Failure Indications

It is possible to read out the error latches. If multiple failures are listed please keep in your mind the listed failures and delete the latches with the "Clear Latch" store sequence.

- Read out/clear error latches see "Read Out and Clear Error Latches", page 53.
- Explanation about the different possible errors: see "Warning and Failure Indication List", page 54.

2.8. Aircraft Wiring

**SAFETY
 INSTRUCTIONS**

Installation of the unit varies according to aircraft and equipment design. It is therefore only possible to provide general guidelines in this section.

2.8.1. BXP6401 with Parallel Encoding Altimeter & GPS Receiver

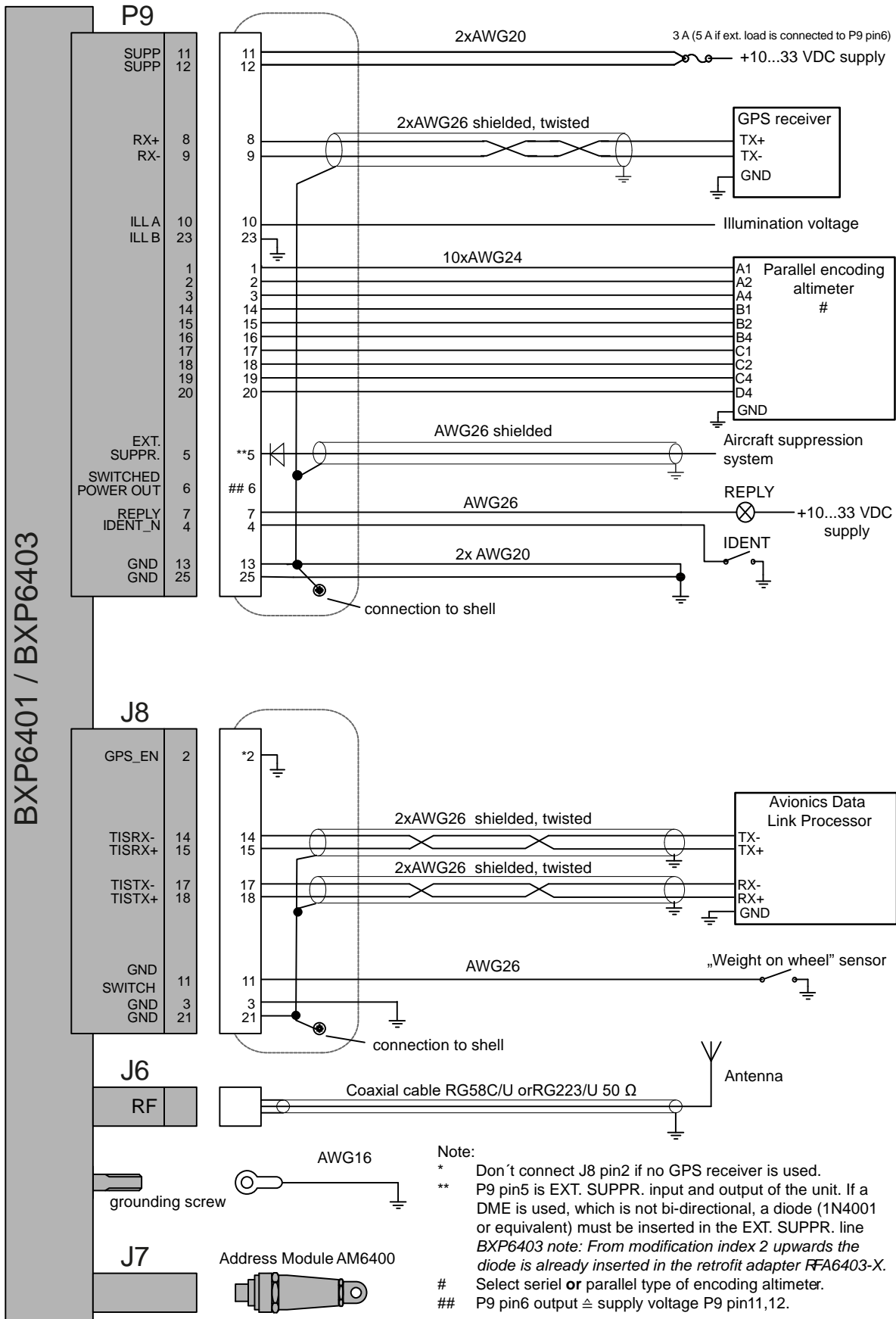


Figure 8: BXP6401 with Parallel Encoding Altimeter & GPS Receiver

2.8.2. BXP6401 with Serial Encoding Altimeter & GPS Receiver

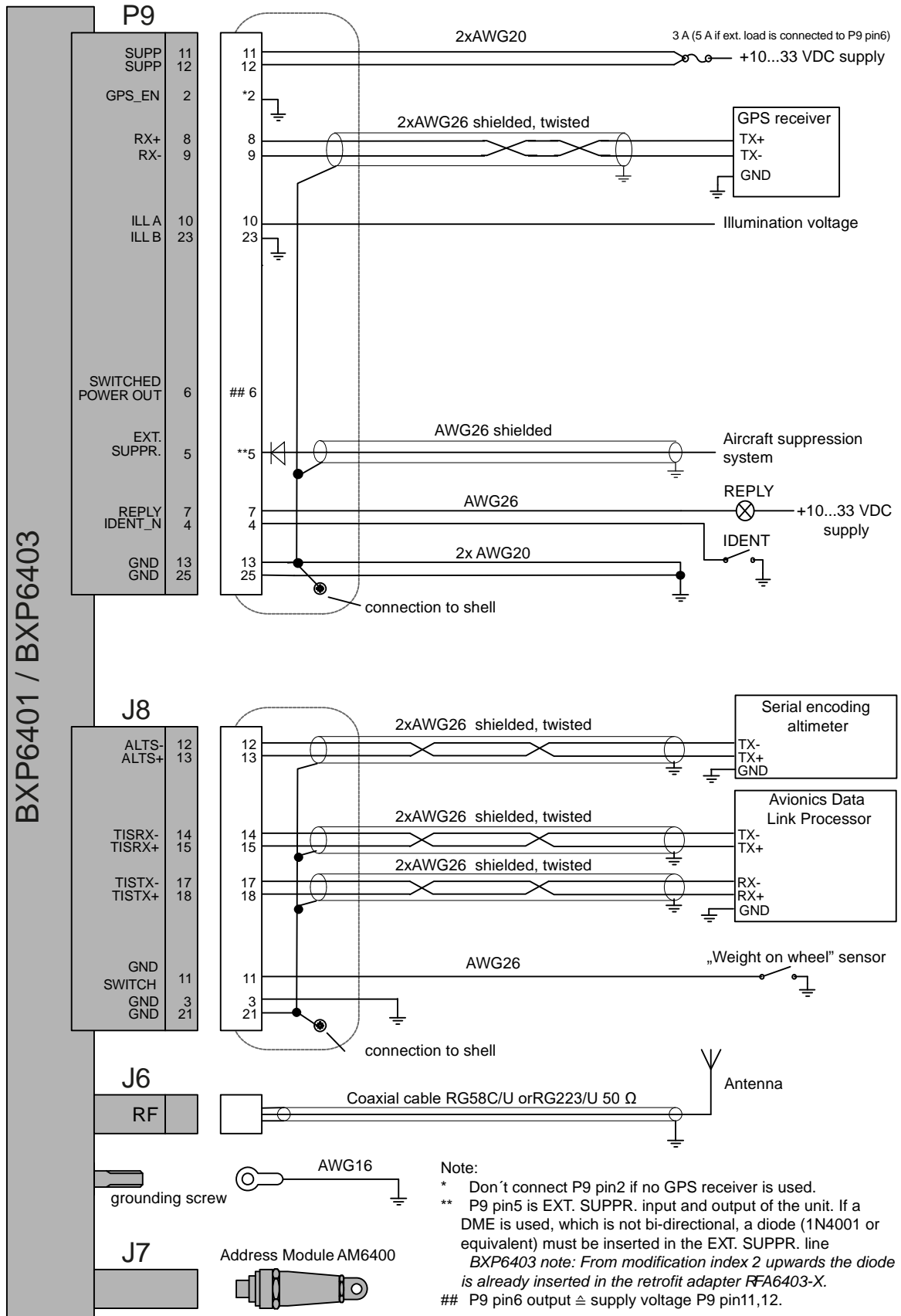


Figure 9: BXP6401 with Serial Encoding Altimeter & GPS Receiver

2.8.3. BXP6401 with Serial Encoding Altimeter Connection (Cutout)

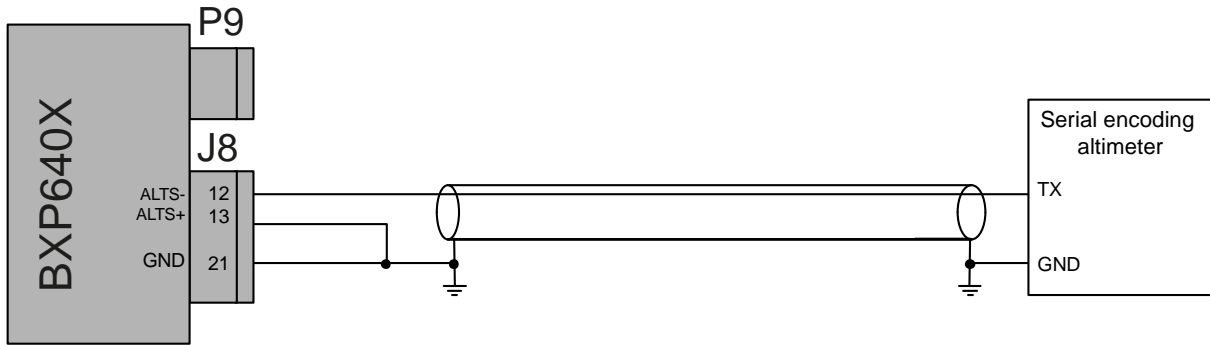


Figure 10: BXP6401 with Serial Encoding Altimeter Connection (not for BE6400)

2.8.4. BXP6401 with RS232 GPS Receiver Connection (Cutout)

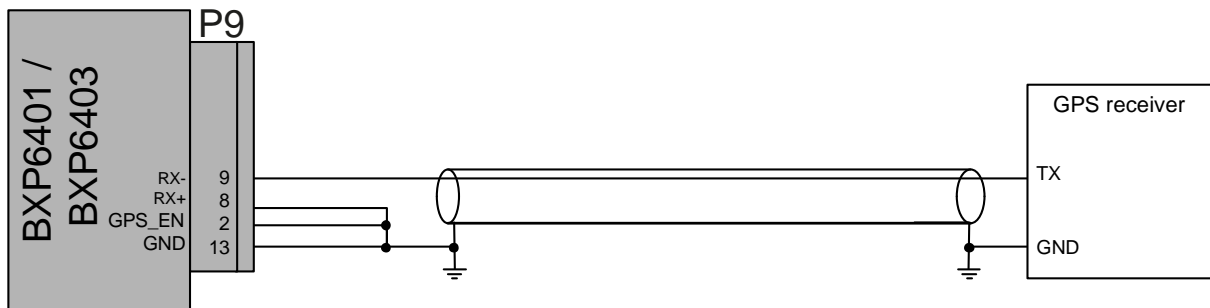


Figure 11: BXP6401 with RS232 GPS Receiver Connection (not with BE6400)

NOTICE

If the blind encoder BE6400 is directly connected to J8 it is not possible to connect a GPS receiver for ADSB-out function to J8.

2.9. Check after Installation

SAFETY INSTRUCTIONS

After the installation, check the transponder to ensure satisfactory operation of the unit.

This should be done on the ground. Generally, this should not be used during flight.

2.9.1. Pre-Flight Check Using Self Test

2.9.1.1. Switch-on test:

- Switch the transponder operating mode switch from OFF to SBY.
 - A power-on built-in test (PBIT) then follows automatically for 1 second.
 - During the test "WAIT is indicated.
- If the test was successful, the unit switches then to the mode set on the mode switch.

2.9.1.2. Test triggered (IBIT):

- Press the SEL button and STO button at the same time in mode ON or ALT.
 - A test of all available test routines then follows for 1 second.
 - During the test, "IBIT" is indicated on the display.
- If the IBIT was successful, the transponder switches immediately into the normal operating mode.
- In case of a fault appears the report "FAILURE" in the display.
- Switch OFF the transponder at the fault indication.

2.9.2. Check of the Address Module

The installation company has to make sure that the corresponding address module AM6400 is installed with the transponder and that the address module is programmed correctly. It is recommended to connect the address module with the aircraft tightly.

2.9.3. Test and Adjustment of Transmit Frequency

- Set code 0000 on the transponder and mode A interrogation on the ramp test set.
- Check transmit frequency by means of the ramp test set.
- Transmit frequency must be 1090 ± 1 MHz.
- If out of range send the transponder to authorised service.

2.9.4. Check of the Transmit Power

After installation of equipment and antenna the transmit power has to be checked at the antenna end of the feeder line. Requirement:

≥ 125 W (21 dBW) at class 1 transponder.

≥ 70 W (18.5 dBW) at class 2 transponder.

⚠ CAUTION

Radiation risk:

A safe distance to the installed antenna must be ensured by corresponding installation measures around human body damage (e.g. at the eyes) and/or avoid the inflammation of combustible materials by radiated energy.

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3. Operating Instructions

3.1. Device Description

The BXP6401 intended for installation in an aircraft. It works in accordance with the secondary radar principle and allows air traffic control to locate, identify and track aircraft.

All controls and indicators are located on the front panel.

In this chapter you can read about:

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3.1.1. Device Assignment

This manual is valid for the following devices:

- See page 24

3.1.2. Packing, Transport, Storage

- See page 24

3.1.3. Scope of Delivery

- See page 24

3.1.4. Type Plate

- See page 25

3.1.5. Software/Firmware Status – Functionality

- See page 25

3.1.6. Controls and Indications

3.1.6.1. User Interface



Figure 12: User Interface - BXP6401

| | Symbol | Description | Main Function |
|----|-----------------|---|---|
| A | Mode selector | Rotary switch (4 positions) | OFF: Switch off the transponder SBY: Switch on the transponder in standby mode ON: Switch on the transponder in mode A/S. Transmission of altitude information is suppressed. ALT: Switch on the transponder in mode A/C/S. The altitude information is transmitted. |
| B* | SEL | Push-button | Open and select the menu. |
| C | STO | Push-button | Stores the selected values to the settings. |
| D | Display, part 1 | 2-line LC Display | Display the following information: <ul style="list-style-type: none"> • Code indication in the top row. • Flight level in the bottom row. • Various information in the bottom row. • Additional indicators on the left side (see ref. G). |
| E | Rotary switch | Rotary optical encoder (rotary mode of F) | Rotary switch to change settings (16 steps per turn). |
| F | Button | Push-button (mode of E) | Push to jump from digit to digit for settings or from one menu to the next; generally used as an enter key. |
| G | Display, part 2 | LCD indicators | Displays additional indicators, R for reply, ID for Ident, ALT for XPDR ALT mode or ON for XPDR ON mode, FL for flight level. |
| H | IDT | Push-button | Activates the Special Identifier (SPI) in addition to the reply code for approx. 18 seconds; during this time "ID" appears in the display. |
| J | VFR | Push-button | Activates VFR code in the upper row of the display. |

3.2. Start-Up

NOTICE

Excessive pulses on the DC bus of the aircraft may cause damage on electrical circuits of any installed instrument.

Do not switch ON the device during engine start or shutdown.

- Check the circuit breaker is set and switch on the aircraft power supply.
- Switch on the device by turning the rotary knob (A) from OFF to SBY.
 - A Power-on Built-In Test (PBIT) follows automatically for 1 second.
- On power-up, the device starts.
 - The software initiates circuits and performs PBIT. During that the display shows "Wait".



Figure 13: Start-Up

- After successful finished PBIT –test the transponder switches to the mode set by the mode switch (A).

3.2.1. Transponder Code

- The transponder code is displayed in the top line all times in modes SBY, ON, ALT.

3.2.2. Aircraft Identification / Flight Number

- Depending on the configuration settings, the Aircraft Identification (AI) or Flight Number (FN) is displayed in the bottom line.

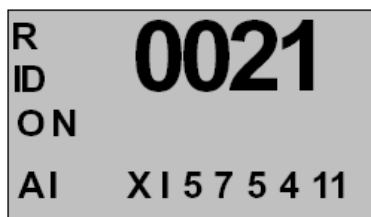


Figure 14: Aircraft Identification (AI)

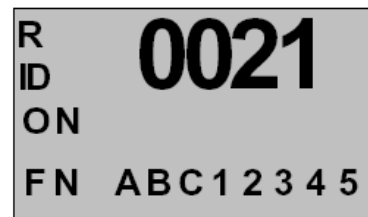


Figure 15: Flight Number (FN)

3.2.3. Flight Level

- The Flight Level (FL) is displayed in ALT mode in the bottom line of the display (altitude = FL x 100 in ft).

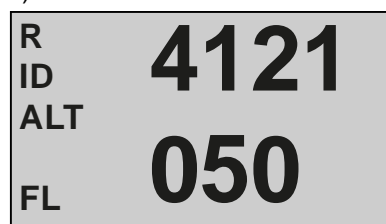


Figure 16: Flight Level (FL)

3.2.4. Self Tests (BITs)

Following tests are integrated in the transponder or can be triggered at the transponder:

IBIT (Initiated Built-in Test) can be activated in any mode (excluding the configuration mode):

- Push button SEL and STO at the same time.
 - The test starts all available test routines including the transmitter test routine.
 - During the test, "IBIT" is indicated on the display (test time 1 second).
 - During the test any other actions are not recognized.
- After successful test, the transponder switches into the normal operating mode.
- Negative results of the test are indicated on the display with "FAILURE".
- Do not switch the transponder in mode ON or ALT if a failure is indicated

CBIT (Continuous Built-in Test):

- CBIT works as a kind of watchdog during operation.
- Negative results of the test are indicated on the display with "FAILURE".
- Do not switch the transponder in mode ON or ALT if a failure is indicated.

PBIT (Power-on Built-in Test):

- The transponder has a power-on BIT after switching on (test time 1 second)..
 - During the test any other actions are not recognized.
 - During the PBIT the transponder is in the SBY mode but this is not indicated on the display.
- After successful test, the transponder switches into the normal operating mode.
- Negative results of the test are indicated on the display with "FAILURE".
- Do not switch the transponder in mode ON or ALT if a failure is indicated.



Figure 17: Failure

3.2.5. Blind Encoder

- In a normal installation the blind encoder is only powered if the transponder is not switched OFF (at least SBY).
 - A blind encoder needs a warm-up time (sometimes several minutes).
 - Therefore, although the solid state transponder needs no warm-up time, turn the transponder to SBY immediately after starting the engine.

3.3. Operation

3.3.1. Selection Mode

In selection mode additional information is displayed in the bottom line of the display. Some of the data are editable, some are read only:

- Press SEL button and rotate encoder (E) for selection.

| Selection | Description | editable | read only | Note |
|-----------|------------------------------------|----------|-----------|--|
| VFR | 4096 code presetting | yes | - | editable; see "VFR Code Presetting", page 51. |
| AI | Aircraft Identifier (Tail Number) | - | yes | fixed; read only from address module (can be replaced by FN). If no valid AI is stored, "-----" is displayed. |
| FN | Flight Number or Company Call Sign | yes | - | editable; see "Aircraft Identification (AI or FN)", page 50, can be replaced by AI (fixed) by selecting "AI DEF" |
| AA | Aircraft Address (24bit ICAO) | - | yes | fixed; read only from address module (unique number for each aircraft) |
| MA | Maximum Airspeed | - | yes | fixed; read only from address module |
| AT | Aircraft Type | - | yes | fixed; read only from address module |
| CFG | Configuration | yes | - | available in SBY mode only, see Configuration Mode, page 53. |
| INS | Installation Setup | yes | - | available in SBY mode only; protected by password, see "Settings after Installation", page 38. |

3.3.2. Aircraft Identification (AI or FN)

- With flight plan:
 - The definition out of the flight plan: e.g. Flight Number (FN) or Company Call Sign.
- Without flight plan (VFR):
 - Tail Number (Call Sign)

The indication of Aircraft Identifier (AI) in the bottom line of the display is in mode SBY and ON only if selected in configuration menu. The Aircraft Identifier (AI) fixed is available in any mode after pressing SEL button and turning the rotary encoder (E). The default value for Aircraft Identifier (AI) is the Tail Number of the aircraft and is stored in the address module.

If a flight plan exists, it has to be checked, which Aircraft Identifier (AI) has to be used. If a Flight Number (FN) is assigned it has to be entered. If a Company Call Sign is mentioned, this has to be entered. To enter it see "Setting the Fight Number", page 50.

In this case the indication on the display changes to FN (Flight Number). If the Call Sign (Tail Number) is mentioned, no change, as it is the default setting from the Address Module.

3.3.2.1. Setting the Fight Number

- Press SEL button to enter the select mode.
- Rotate rotary encoder (E) until AI is displayed.
- Push button (F) to switch to FN. The cursor is set on the first character.
- Rotate rotary encoder (E) to change this character.
- Push button (F) to set the cursor to the next character.
- Repeat steps 4 and 5 until the flight number is entered.
- If the flight number consists of less than 7 characters, put a space at the end to fill the remaining characters with spaces.
- Store the changes with STO button. For leaving the setting procedure without storing, push the SEL button.

NOTICE

Aircraft Identifier (AI) / Flight Number (FN) consist of max. 7 characters (left hand side oriented). Dashes or spaces are not allowed. If the FN consists of less than 7 characters, the remaining characters on the right side shall be filled with spaces.

3.3.2.2. Switching Back to Default AI

- Press SEL button to enter the select mode.
- Rotate rotary encoder (E) to the indication FN=XXXXXXXX.
- First push on button (F) indicates "FN=AI DEF" (inverted).
- Can be set to AI=DEF with STO button.

3.3.2.3. Changing the Flight Number (FN)

- Press SEL button.
- Rotate rotary encoder (E) until FN is displayed.
- Push button (F) twice to enter the FN editing mode.
- Change the FN as described above.

3.3.3. VFR Code Presetting

Press the SEL button to get into configuration mode (selection is indicated in the left bottom corner of the display under the operating mode indication).

- Rotate rotary encoder (E) to the indication VFR=XXXX.
- First push to button (F).
 - Left digit of the code is selected.
 - Change the digit with (E).
- Second push to button (F).
 - Next left digit of the code is selected.
 - Change the digit with rotary encoder (E).
- Same procedure for next digits.
- Fifth push to button (F).
 - First digit is selected.
- Press STO button to store, the selection stops in this case (changes can be stored at any time).
- VFR code that was preset in this way can be activated as described, see "VFR Code Activation" page 52.
- After 10 s the selection is cancelled if no action happens.
- Press SEL button to leave the setting procedure.
 - Normal mode is available.
 - Indication SEL on the display changes back to mode indication.

3.3.4. Flight Operation in Mode A/C/S (Code and Altitude)

SAFETY INSTRUCTIONS

Do not set a code with 7500 / 7600 / 7700. These special codes are reserved for emergencies. See "Special Codes for Air Emergency", see page 52.

- When ATC requests the transmission "squawk", switch the transponder to ALT using mode switch (A).
Only possible if the transponder is connected to a coding altimeter.
 - If so, tell ATC that you do not have mode C ("mode charlie not available").
 - In exceptions the altitude has to be turned off, i.e. switch the transponder to ON using mode switch (A).
- The transponder replies using the selected code
In response to mode C interrogation it transmits the altitude of the aircraft to ATC.
 - "R" on the left next to the code on the display shows the transponder replies.
- After a "squawk ident" request from ATC, press Ident button IDT briefly.
This transmits an additional special pulse (SPI) for approx. 18 s, which enables the aircraft to be clearly identified on the radar screen of the controller.
 - "ID" appears on the left side in the LC display during this time.
- **Switch the transponder to Stand-by (SBY), if the code has changed. Otherwise it could happen that a code with a special meaning e.g. hijack will be transmitted and unwanted actions could take place (see "Special Codes for Air Emergency", page 52).**

3.3.5. VFR Code Activation

- Press the VFR button.
 - The preselected code is displayed.
- After 3 s, the displayed code gets active and overwrites the previous code.
- Press push-button again within 3 s reactivates the previous code.
- The unit is delivered without an assigned code.
 - If VFR button is pressed for 0.5 s, "----" is shown in the display and the transponder switches back to the previous active code.

3.3.6. Internal and External Identifier

- Press IDT button on the control panel or from external input located on the transponder to trigger special identifier pulse (SPI).
 - IDT is shown on the display as long as SPI is active.

3.3.7. Special Codes for Air Emergency

Special codes, which depend on the type of incident, are stipulated for certain air emergencies:

- 7500 Hijacking of the aircraft,
- 7600 Loss of communication,
- 7700 Emergency on board which constitutes an immediate danger to the aircraft.

The code evaluation devices of the radar systems automatically alarm the controllers at the radar screens immediately, if one of these special codes is received.

3.3.8. Configuration Mode

NOTICE The configuration mode is available from SBY mode only.

To get into configuration mode press button SEL, turn rotary encoder (E) until "CFG" appears in the bottom row of the display. Available options are defined in the following table.

| Select with push-button (F) | Select with rotary encoder (E) | | Store button (STO) |
|---|--------------------------------|---------|--------------------|
| BRIGHTNESS (only if dimming input is set to "none" in installation menu) | 0% | | store |
| | ... | | store |
| | 50% | | store |
| | ... | | store |
| | 100% | | store |
| ILLUM CURVE (only if external illumination control is set in the installation menu) | Characteristics | | store to change |
| VIEW CONFIG | AI IN SBY | default | ON OFF |
| | AI IN ON | default | ON OFF |
| | FL IN ALT | default | ON OFF |
| DEVICE INFO | CU VER | | view only |
| | CORE VER | | view only |
| | FPGA VER | | view only |
| | DEV TYPE | | view only |
| | SERIAL NB | | not supported |

NOTE: If no type is available, this field indicates nothing.

The view of some entries can vary dependent on the software version.

3.3.9. Read Out and Clear Error Latches

- Switch transponder to SBY mode.
- Press SEL.
- Rotate rotary encoder counter-clockwise until "INS" is highlighted.
- Push to button (F) to confirm.
- Using the rotary encoder enter the password "6435". Confirm each digit selection.
- Once all digits are entered, press STO.
- Press button (F) to scroll pages until you reach the "Error Latches" page.
 - In case multiple error latches were present, it is recommended to have them cleared out and wait for a single FAILURE, so that the problem can be better pinpointed.

To clear the latches, on the same page:

- Rotate rotary encoder to scroll to the end of the page, when "Clear Latches" will be highlighted press STO.

3.4. Warning and Failure Indication List

| Display Contents | Description |
|--------------------------|---|
| Low Voltage. | Indicates battery low condition. It can also appear in some non-battery installations if the supply goes down very slowly while the transponder is on. When this error is indicated, the RF power error and SQTR error may appear too, as a secondary effect. |
| High Temperature. | Indicates that the transmitter temperature is too high. This may be due to excessive ambient temperature, bad cooling and transponder over interrogation. |
| Antenna. | VSWR error. Wrong antenna or antenna connection. May be in some cases triggered by some other events influencing the antenna RF properties (e.g. a person standing near to or touching the antenna while transmitting). May induce RF power error and SQTR error. |
| RF Power. | Typically it is the transmitter malfunction or loss of transmitter power. This error may also appear if other L-Band equipment (e.g. DME or another XPDR) is transmitting without indication of its transmission through the mutual suppression signal. May induce SQTR error. |
| DME Error. | Is a mutual suppression system error. Either the mutual suppression output of the transponder is broken or there is a failure (e.g. short circuit) in the mutual suppression cabling or other equipment. |
| SQRT Error. | Squitter transmission error. The transponder is not providing obligatory squitter transmissions with relevant timing. This error can be induced by other malfunctions e.g. those indicated by RF power error or antenna error. |
| Core EE. | Data in the transponder non-volatile memory are corrupted. The transponder will not operate and requires servicing. |
| Receiver. | The receiver is not operating correctly. In most cases this means the transponder needs repair. Sporadically may be triggered without internal reason if the transponder is operating in a very "dense" environment (high number of interrogations) |
| FIX data. | Indicates that the transponder does not receive all necessary fixed data. There may be few reasons: incorrect configuration or the Address Module having incorrect data or faulty. |
| Altimeter. | Indicates that the blind encoder data are not available to the transponder for any reason, e.g.: <ul style="list-style-type: none"> - missing or broken blind encoder, - incorrect blind encoded type selection, for settings of BE6400 please follow the installation and operation manual BE6400, - blind encoder is in warm-up state and does not deliver valid data |
| Data Link. | Indicates that the ADLP is enabled in the transponder configuration but the transponder cannot contact the ADLP, due to e.g. missing or broken ADLP or GPS-Signal. If the ADLP is disabled, this error will not be triggered. |

Contact maintenance shop for assistance.

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