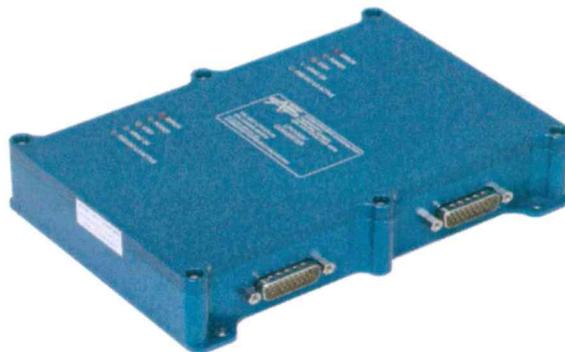




INSTALLATION MANUAL FOR LPV/VNAV CONVERTER



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Installation Manual

ETSO-H Part 3

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Document Information

I. Revision History

Rev.	Description	Pages changed	Date of issue	Changed by
A	Initial release	all	2016-08-29	JV

II. Glossary

N/A

III. List of Abbreviations

Abbreviation	Description
ANNUNC	Annunciator
APPR	Approach
ARINC	Aeronautical Radio Incorporated
ASR, AVSR	AVIONIK STRAUBING Entwicklungs GmbH
AWG	American Wire Gauge
BCD	Binary Coded Decimal
BNR	Binary Number Representation
C.S.	Certifying Staff
CLK	Clock
CVE	Compliance Verification Engineer
DAL	Design Assurance Level
DAT	Data
DE	Design Engineer
DME	Distance Measuring Equipment
DO	Document
EFIS	Electronic Flight Instrument System
EI	Entwicklungsingenieur
EMI	Electromagnet Interference
ERR	Error
ERS	Equipment Requirement Specification
ETSO	European Technical Standard Order
FAA	Federal Aviation Administration
FAF	Final Approach Fix
FMS	Flight Management System
ft	feet



Abbreviation	Description
GND	Ground
GPS	Global Positioning System
GTN	Garmin GPS/NAV/COMM device
HD	High Density
HIRF	High Intensity Radiated Fields
HoA	Head of Airworthiness
HoD	Head of Design
ICD	Interface Control Document
ILS	Instrument Landing System
IMA	Installation Manual
IND	Indicator
L HS	Leiter Herstellung
L MPL	Leiter Musterprüfleitstelle
LOC	Localizer
LPV	Localizer Performance with Vertical guidance
LPVCONV, LPV/VNAV	Project name
MDL	Master Documents List
MMA	Maintenance Manual
MPI	Musterprüfingenieur
NAV	Navigation
OEM	Original Equipment Manufacturer
OMA	Operating Manual
PFD	Primary Flight Display
PHAC	Plan for Hardware Aspects of Certification
QM	Quality Management
QTR	Qualification Test Report
REQ	Requirement
RTCA	Radio Technical Commission for Aeronautics
SRD	System Requirements Document
SUB	Subminiature
TSO	Technical Standard Order
UNC	Unified Thread Standard
VDC	Volts Direct Current
VHF	Very High Frequency
VNAV	Vertical Navigation
VOR	VHF Omnidirectional Radio Range



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1 Introduction

1.1 Purpose

This installation manual provides instructions on how to install and configure the LPV/VNAV Converter in an aircraft. It also provides a system overview including the technical specification of the LPV/VNAV Converter as well as information about the certification of hard- and software.

1.2 Scope

This manual is only applicable for installation for the LPV/VNAV Converter with the P/N as listed in Section 3.3, table 3.

2 Applicable and referenced documents

2.1 Applicable documents

The declaration () serves as a placeholder for the revision level.

The current revision levels of the documents stated in the Master Documents List (MDL).

Identifier	Doc. N°	Document title
/MDL/	ASR_1084_LPVCONV_000_MDL_()	Master Documents List, in latest revision
/SRD/	ASR_1084_LPVCONV_001_SRD_B	System Requirements Document, revision B
/ICD/	ASR_1084_LPVCONV_005_ICD_A	Interface Control Document, revision A
/QTR/	ASR_1084_LPVCONV_007_QTR_C	Qualification Test Report, revision C
/ERS/	ASR_1084_LPVCONV_024_ERS_D	Equipment Requirement Specification, revision D
/PHAC/	ASR_1084_LPVCONV_400_PHAC_C	Plan for Hardware Aspects of Certification, revision C
/MMA/	ASR_1084_LPVCONV_901_MMA_A	Maintenance Manual, revision A
/OMA/	ASR_1084_LPVCONV_902_OMA_A	Operating Manual, revision A

table 1: applicable documents

2.2 Referenced documents

Identifier	Doc. N°	Document title
/DO-160G/	RTCA DO-160G	Environmental Conditions and Test Procedures for Airborne Equipment, Issue G, 2010-12-08
/DO-178B/	RTCA DO-178B	Software Considerations in Airborne Systems and Equipment Certification, Issue B, 1992-12-01
/DO-254/	RTCA DO-254	Design Assurance Guidance for Airborne Electronic Hardware, Issue B, 2000-04-19

table 2: referenced documents



3 General Description

3.1 Introduction

Some EFIS/PFD systems are not capable of executing a GPS based vertical approaches because the EFIS system cannot process the GPS vertical approach data to display them on the EHSI/EADI and to provide it to the autopilot system.

Feeding the GPS ARINC 429 data stream directly to the NAV/ILS input of the EFIS system is not possible because of the different ARINC 429 data format.

The Avionik Straubing LPV/VNAV Converter adapts all required ARINC 429 GPS approach data, delivered by the GPS source (e.g. Garmin GTN 750) to fit the requirements of the EFIS system in NAV/ILS mode.

This enables the pilot to execute a GPS based vertical approach (e.g. LNAV/VNAV or LPV) using the aircraft's preinstalled EFIS system when it is operated in the NAV/ILS mode.

During the approach the EFIS system will indicate in NAV/ILS mode the lateral and vertical deviations as well as the distance. These data will be all derived from the GPS source although the EFIS system is operated in NAV/ILS mode.

To avoid confusion to the pilot PSEUDO ILS annunciator(s) indicate that the GPS data is currently provided to the EFIS system.

Normal LOC/ILS approach operations will not be affected by this installation of the Avionik Straubing LPV/VNAV Converter because the unit always switches the NAV/ILS data to the EFIS system, when no GPS vertical approach is activated on the GPS source or when the LPV Converter ON pushbutton is not activated.

3.2 General System Overview

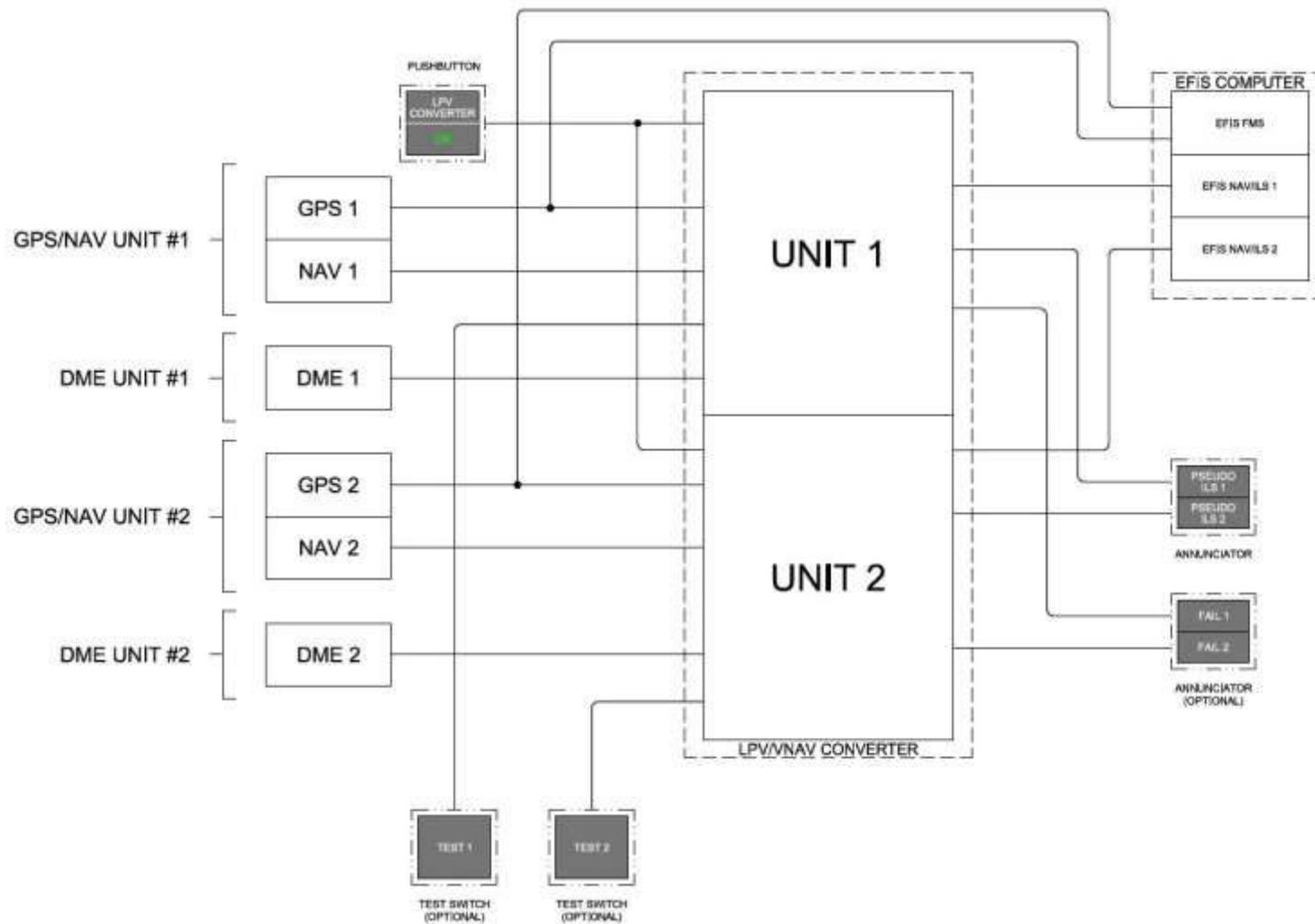


figure 1: general system overview



3.3 Configuration

AVSR-P/N:	DME-Version:	ARINC Speed RX	ARINC Speed TX	Software Version:
AS01-LPVCONV-00	King DME	Low	Low	1.0.0
AS01-LPVCONV-10	King DME	Low	High	1.0.0
AS01-LPVCONV-20	King DME	High	Low	1.0.0
AS01-LPVCONV-30	King DME	High	High	1.0.0
AS01-LPVCONV-40	ARINC DME	Low	Low	1.0.0
AS01-LPVCONV-50	ARINC DME	Low	High	1.0.0
AS01-LPVCONV-60	ARINC DME	High	Low	1.0.0
AS01-LPVCONV-70	ARINC DME	High	High	1.0.0
AS01-LPVCONV-A0	without DME	Low	Low	1.0.0
AS01-LPVCONV-B0	without DME	Low	High	1.0.0
AS01-LPVCONV-C0	without DME	High	Low	1.0.0
AS01-LPVCONV-D0	without DME	High	High	1.0.0

table 3: P/N° configuration

3.4 Technical Specification

Physical characteristics

Unit connector:	26 pin HD-SUB (Sub-D, High Density), male type
Unit weight:	0.5994 kg
Dimensions:	
• Height:	39.2 mm
• Width:	129 mm
• Depth:	176.4 mm
Mounting:	4 x 6/32 UNC
Cooling:	No external cooling is required

Supply Input:

Supply Voltage Range:	18.0 to 32.2 VDC
Current Consumption:	2 x 150 mA (@ 28 VDC)

Signal Input:

ARINC 429 Inputs: ARINC429 data (2 lines) containing VOR/ILS labels data and GPS data from GPS/NAV system.

DME Inputs:

- with a King serial bus interface:
 - **DME request** signal from the DME equipment,
 - **Serial DME Clock IN** signal from the DME equipment,
 - **Serial DME Data IN** signal from the DME equipment,
 - **DME HOLD IN** signal from the DME equipment
- with ARINC429 interface:
 - **ARINC429** data (2 lines) from DME



Discrete Inputs:

- **GPS Annunciate:** (active low) from the GPS/NAV system. This input indicates that the GPS/NAV system is in the GPS mode,
- **Approach Annunciate:** (active low) from the GPS/NAV system. This input indicates that the GPS/NAV system is in the approach mode,
- **LPV Converter ON:** (active low) from the LPV Converter ON pushbutton. This inputs enables the function of the LPV/VNAV Converter.
- **TEST IN:** (active low) from a test switch. This input initiates an internal test and drives both lamp drivers active.

Signal Output:

ARINC 429 Outputs:

ARINC 429 data (2 lines) containing VOR/ILS ARINC 429 OUT data to the EFIS/PFD systems. This output contains the modified ILS data.

DME Outputs:

- with a King serial bus interface:

Modified King serial bus consisting of

- **Serial DME Clock OUT** signal to the DME indicator equipment,
- **Serial DME Data OUT** signal to the DME indicator equipment,
- **DME HOLD OUT** signal to the DME indicator equipment.

- with ARINC429 interface:

ARINC 429 data (2 lines) containing DME data labels derived from the incoming GPS ARINC data. Labels 001₈ (Distance to Go), 002₈ (Time to Go), 012₈ (Ground Speed), 201₈ (DME Distance, BCD) and 202₈ (DME Distance, BNR) will be asserted.

Discrete Outputs:

- **PSEUDO ILS**, a low-active output for a pseudo ILS indicator is implemented. This output is active (low), in case the pseudo ILS is activated. This means, that the modified ARINC data are fed to the ILS,
- **Error IND**, a low-active output for an optional fail indicator is implemented.

**Status / failure annunciation:**

The LPV/VNAV Converter is designed as two independent functional units, each interfaced to the respective NAV/ILS and GPS input. The unit provides several status / failure annunciation lamps to indicate whether correct data is provided to the LPV/VNAV Converter as well the function of the units are assured.

- ERROR (red):** This lamp indicates that the LPV/VNAV Converter detects an internal failure or no correct data is provided to the system as well as no valid ARINC 429 input
- PSEUDO ILS active (green):** This lamp indicates that the LPV/VNAV Converter currently provides GPS data to the NAV/ILS input of the EFIS System. It must be active during an LPV/VNAV approach after the Final Approach Fix (FAF), but has to be extinguished when NAV/ILS data is provided to the EFIS System.
- Supervisory OK (green):** The LPV/VNAV Converter has an internal supervisory circuit, that checks continuously the data in- and output (ARINC 429) and provides the Error annunciation in case that no valid data is provided. Illuminated lamp indicates that the internal supervisory unit is active.
- ARINC Input OK (green):** When valid ARINC 429 data on the GPS input is provided to the LPV/VNAV Converter, this lamp is illuminated constantly.
- Heart Beat (green):** This lamp is illuminated when sufficient voltage supply is provided to the LPV/VNAV Converter.

3.5 Environmental Qualification

The system has been qualified according to RTCA DO-160G:

Section	Category	Procedure
04 Temperature and Altitude	D2	4.5.1 4.5.2 4.5.3 4.5.4 4.6.1
05 Temperature Variation	B	5.0
06 Humidity	B	6.0
07 Operational Shocks and Crash Safety	B	7.0
08 Vibration	[R(F)(F1)U2]	8.0
09 Explosive Atmosphere	X	9.0
10 Waterproofness	Y	10.0
11 Fluid Susceptibility	X	11.0
12 Sand and Dust	X	12.0
13 Fungus Resistance	F	13.0
14 Salt Fog	S	14.0
15 Magnetic Effect	Z	15.0
16 Power Input	B	16.0
17 Voltage Spike	A	17.0
18 Audio Frequency Conducted Susceptibility	R	18.0
19 Induced Signal Susceptibility	ZC	19.0
20 Radio Frequency Susceptibility	Y	20.0
21 Emission of Radio Frequency Energy	M	21.0
22 Lightning Induced Transient Susceptibility	A3J33	22.0
23 Lightning Direct Effects	X	23.0
24 Icing	X	24.0
25 Electrostatic Discharge	A	25.0
26 Fire, Flammability	C	26.0

table 4: environmental qualification



3.6 Software and Hardware Qualification

The system is qualified according to RTCA DO-178B and DO-254, DAL B.

4 Limitations

4.1 Installation Limitations

- For environmental limitations refer to table 4.
- Only for 28 VDC aircraft.

4.2 Interface Limitations

The LPV/VNAV Converter is designed to enable GPS vertical approach (LPV/VNAV) for aircraft equipped with Honeywell SPZ-5000 or Collins Pro Line 21 EFIS Systems. The unit fulfils Software and Hardware qualification RTCA DO-178 and RTCA DO-256 DAL B to ensure that the provided data is correctly transmitted. The aircraft's actual approach system accuracy depends on the interaction between GPS source, LPV/VNAV Converter and EFIS System.

Note: The LPV/VNAV Converter might operate with other EFIS systems too, but this is not tested by Avionik Straubing.

For identification of correct operation of the LPV/VNAV Converter a PSEUDO ILS annunciator must be installed in primary view field of the pilot.

4.3 Recommendations

The installation of a LPV Converter ON pushbutton is recommended to allow the pilot to manually select the approach guidance information to be indicated on the EFIS/PFD.



5 Installation

Avionik Straubing recommends the installer to refer to FAA Advisory Circular AC 43-13-1B prior performing the mechanical and electrical installation of the LPV/VNAV Converter into the aircraft.

5.1 Installation Requirements

The GPS source must be certified to ETSO-C146 Class Gamma or better.

The GPS/NAV-unit must supply at least the following ARINC429 labels:

Label #	Parameter Name	Repeat Rate
001	Distance to Go (BCD)	50 ms
002	Time to Go (BCD)	50 ms
012	Ground Speed (BCD)	250 ms
173	Localizer Deviation (BNR)	50 ms
174	Glideslope Deviation (BNR)	50 ms
251G	Distance to Go	230 ms

table 5: required ARINC 429 GPS data stream from GPS/NAV system

To avoid potential confusion of the pilot an external signal source indication (e.g. "PSEUDO ILS") is required in the pilot's primary field of view. This shows the pilot that a GPS approach is displayed although the EFIS system is in ILS mode.

The active approach mode must be displayed in the pilot's primary field of view.

5.2 Installation Considerations

Fabrication of a wiring harness is required. Some mechanical and electrical methods and practices are required for installation of the LPV/VNAV Converter. Ensure that routing of the wiring does not come in contact with sources of heat, RF or EMI interference. Check that there is ample space for the cabling and mating connectors. Avoid sharp bends in cabling and routing near aircraft control cables.

For input protection a 1A trip-free circuit breaker for each unit of the LPV/VNAV Converter must be installed.



5.3 Locations of Installation

The aircraft's avionic compartment is recommended as suitable mounting location for the LPV/VNAV Converter.

The LPV/VNAV Converter mounting surface must be capable of providing structural support and electrical bond to the aircraft to minimize radiated EMI and provide protection from High Intensity Radiated Fields (HIRF).

The bonding resistance between the LPV/VNAV Converter and the aircraft ground must be less than 3 mΩ.

5.4 Wiring Harness Installation

Allow adequate space for installation of cables and connectors. The installer shall supply and fabricate all of the cables. All electrical connections are made through a 26 pin HD-SUB (Sub-D, High Density), male type per unit. Section 6 defines the electrical characteristics of all input and output signals.

The use of shielded AWG-24 wires is recommended for correct signal interface between the EFIS/GPS system and the LPV/VNAV Converter.

6 System Interface

6.1 Pin Function List

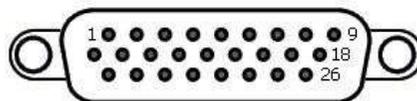


figure 2: view of J1/ J2 connector in front of the unit

Connector		J1 and J2			
Pin	Declaration	Description	Levels		I/O
			Active	Inactive	
1	LPV Converter ON	Unit selected from FMS selection switch	Ground	Open	Input
2	VOR/ILS ARINC 429 IN A	ARINC 429 (A) NAV data from NAV/GPS unit	±5V	Ground	Input
3	VOR/ILS ARINC 429 IN B	ARINC 429 (B) NAV data from NAV/GPS unit	±5V	Ground	Input
4	DME Request	DME request in DME mode from King DME	+9,25V	Ground	Input
		Not used in ARINC mode			
5	Reserved				
6	VOR/ILS ARINC 429 OUT A	ARINC 429 (A) ILS data out to EFIS/PFD	±5V	Ground	Output
7	VOR/ILS ARINC 429 OUT B	ARINC 429 (B) ILS data out to EFIS/PFD	±5V	Ground	Output
8	GPS ARINC429 IN A	ARINC 429 (A) GPS data in from NAV/GPS unit	±5V	Ground	Input
9	GPS ARINC 429 IN B	ARINC 429 (B) GPS data in from NAV/GPS unit	±5V	Ground	Input
10	GPS Annunciate	GPS Select from NAV/GPS unit	Ground	Open	Input
11	Approach Annunciate	Approach select from NAV/GPS unit	Ground	Open	Input



Connector		J1 and J2			
Pin	Declaration	Description	Levels		I/O
			Active	Inactive	
12	TEST IN	Test select from test switch	Ground	Open	Input
13	Serial DME Clock IN / DME ARINC 429 IN A	DME clock input in DME mode from King DME	+9,25V	Ground	Input
		ARINC 429 in A in ARINC mode from ARINC DME	±5V	Ground	Input
14	Serial DME Data IN DME ARINC 429 IN B	DME data input in DME mode from King DME	+9,25V	Ground	Input
		ARINC 429 in B in ARINC mode from ARINC DME	±5V	Ground	Input
15	Serial DME Clock OUT/ DME ARINC 429 OUT A	DME clock out in DME mode to EFIS/PFD	+9,25V	Ground	Output
		ARINC 429 out A in ARINC mode to EFIS/PFD	±5V	Ground	Output
16	Serial DME Data OUT/ DME ARINC 429 OUT B	DME data out in DME mode to EFIS/PFD	+9,25V	Ground	Output
		ARINC 429 out B in ARINC mode to EFIS/PFD	±5V	Ground	Output
17	Error IND	Error indication to indicator	Ground	Open	Output
18	PSEUDO ILS IND	LPV/VNAV Converter active to indicator	Ground	Open	Output
19	DME Hold IN	DME hold in	+9,25V	Ground	Input
		Not used in ARINC mode			
20	DME Hold OUT	DME hold out	+9,25V	Ground	Output
		Not used in ARINC mode			
21	Reserved	spare			
22	GND	Supply voltage	GND		Input
23	+28VDC	Supply voltage	+28VDC		Input
24	NC				
25	NC				
26	NC				

table 6: pin assignment

7 Drawings

7.1 Installation drawing

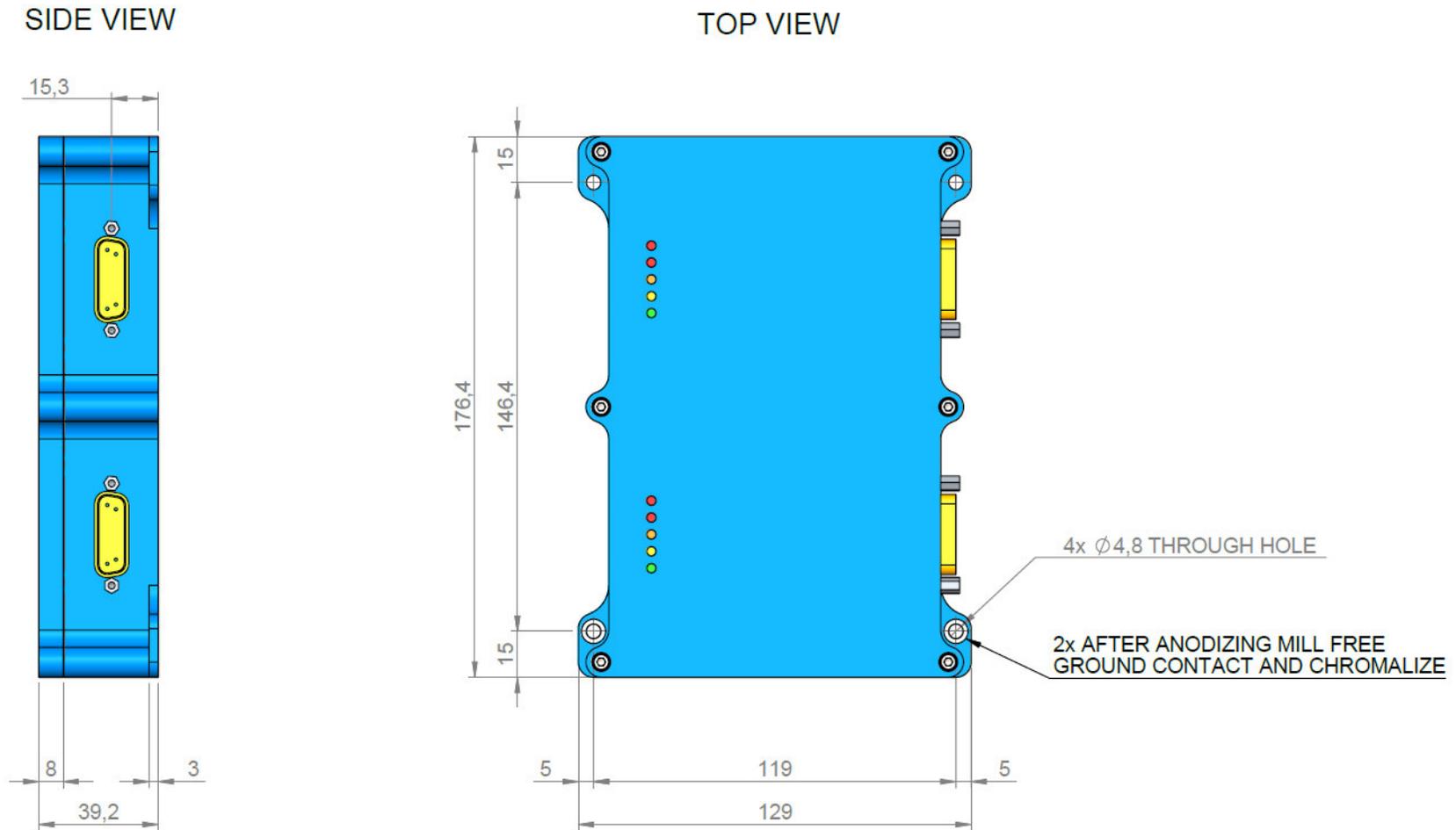


figure 3: installation drawing

7.2 Label drawing

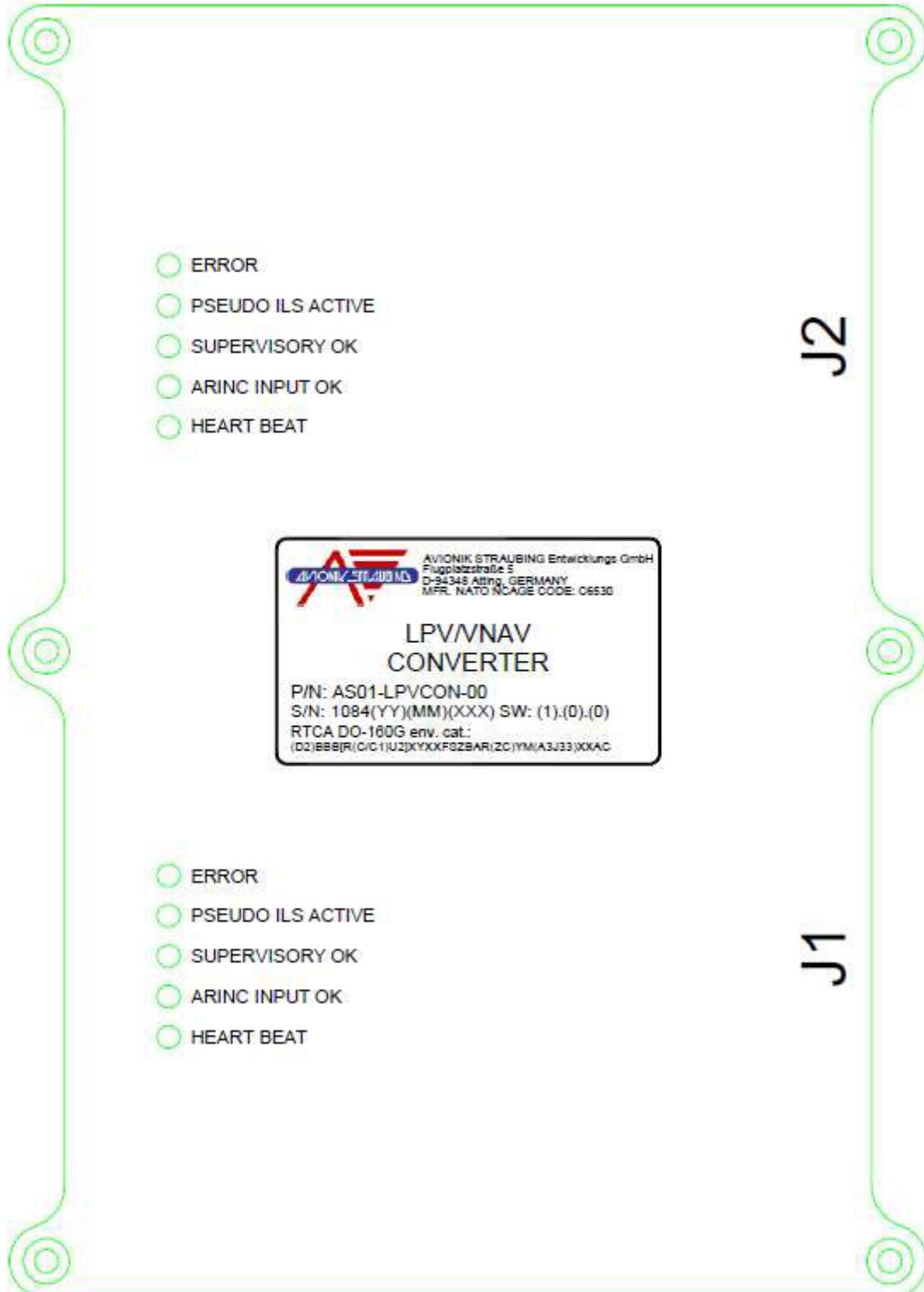


figure 4: label drawing

7.3 Interconnect Drawings

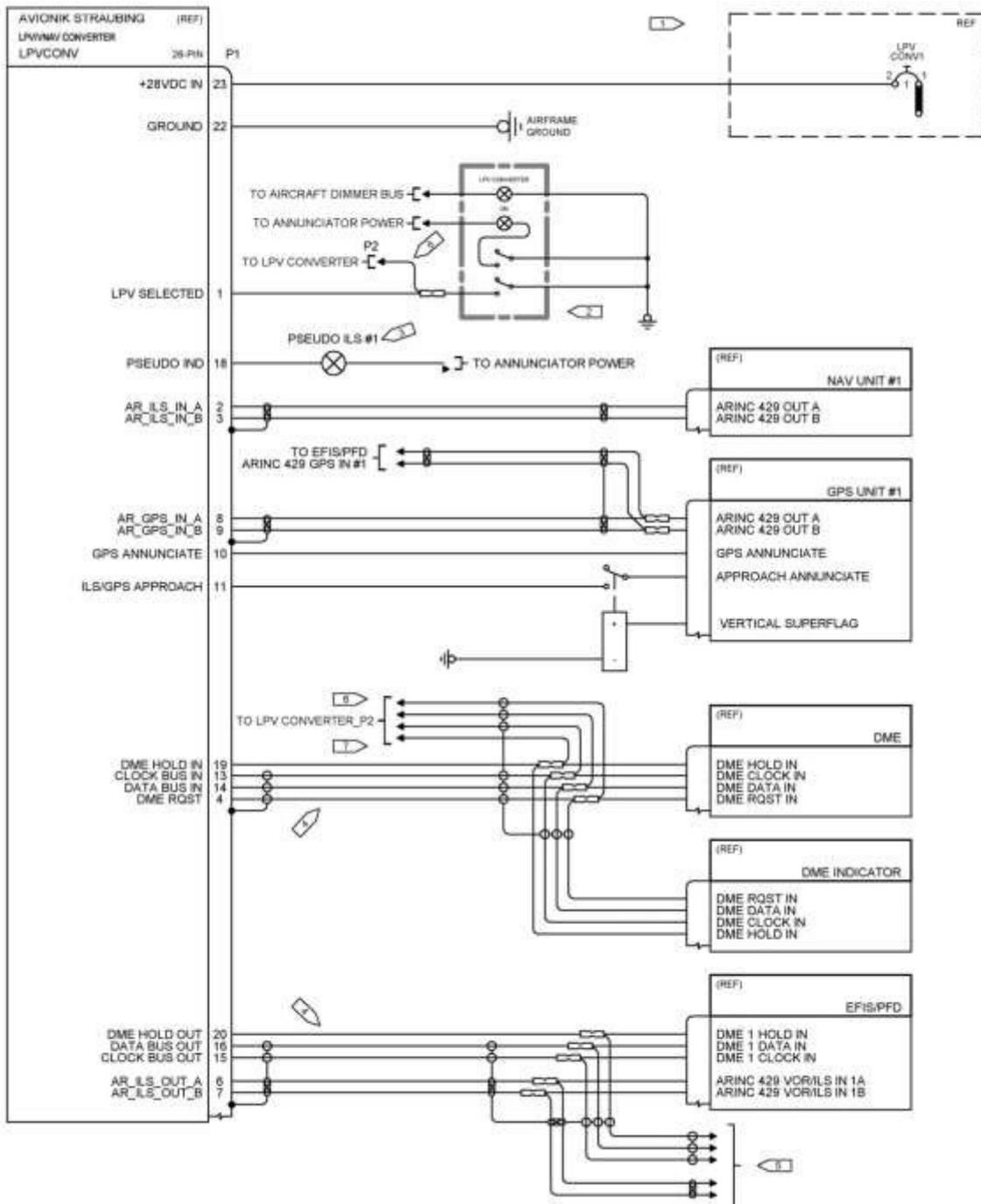


figure 5: interconnection Avionik Straubing LPV/VNAV Converter J1

Notes:

1. The Circuit Breaker should be connected to the same Electrical Bus as the NAV1 System.
2. Refer to Section 11.4.2 for the recommended Layout of the LPV Converter Switch/Pushbutton
3. Refer to Section 11.4.1 for the recommended Layout of the Pseudo ILS Annunciator
4. These King Serial DME Connections are only available on LPV Converter with P/N AS01-LPVCONV-00, -10, -20, -30.
5. If more than one EFIS display is installed in the aircraft (e.g. Collins Pro Line 21 EFIS System) the LPV Converter must be connected to the Arinc 429 VOR/ILS IN1 and DME inputs of all EFIS displays
6. These connection to P2 are only required if the LPV converter #2 is used with a second GPS system.
7. If a second DME is installed in the aircraft the second DME must be connected to the P2 connector.

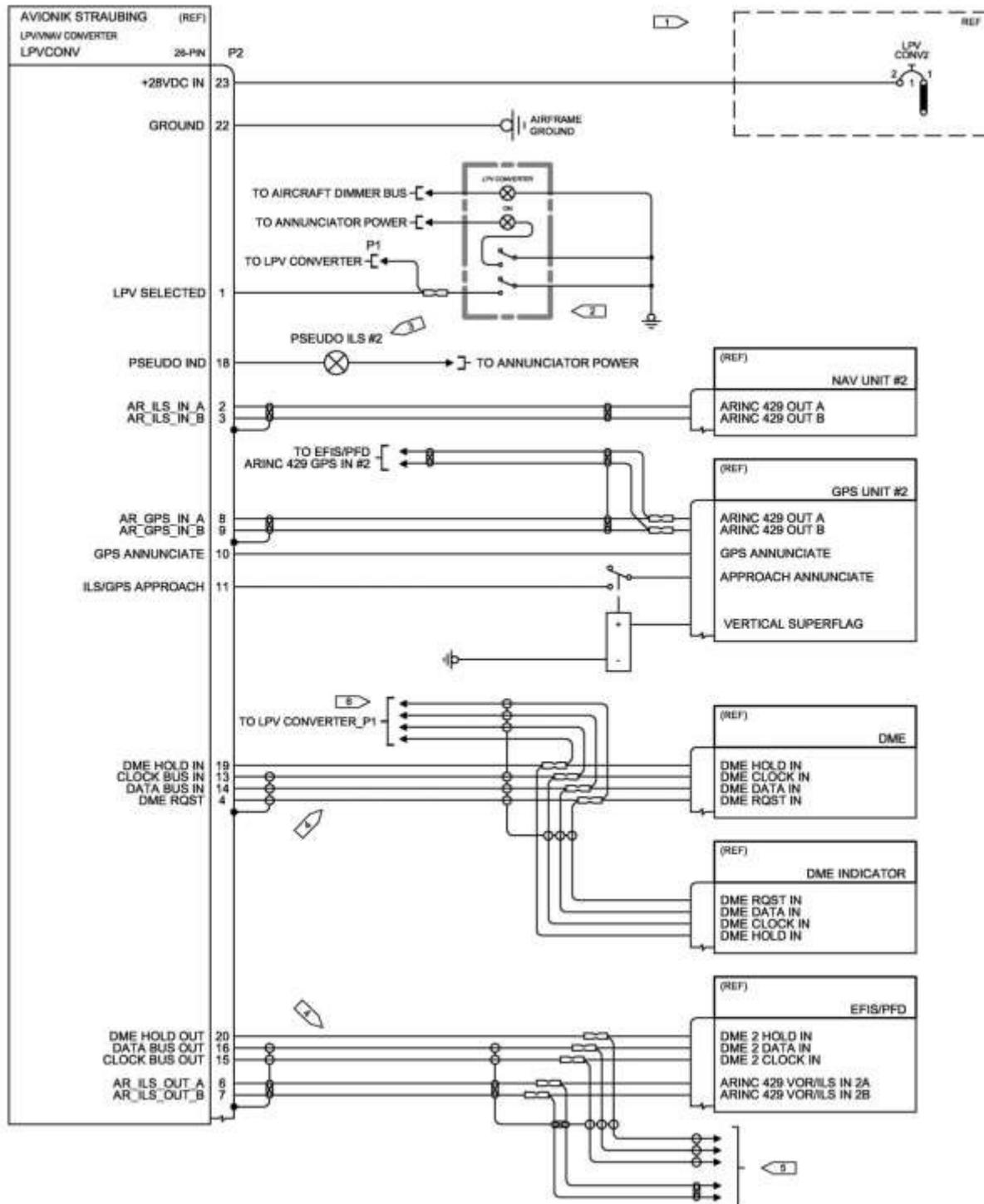


figure 6: interconnection Avionik Straubing LPV/VNAV Converter J2

Notes:

1. The Circuit Breaker should be connected to the same Electrical Bus as the NAV2 System.
2. Refer to Section 11.4.2 for the recommended Layout of the LPV Converter Switch/Pushbutton
3. Refer to Section 11.4.1 for the recommended Layout of the Pseudo ILS Annunciator
4. These King Serial DME Connections are only available on LPV Converter with P/N AS01-LPVCONV-00, -10, -20, -30.
5. If more than one EFIS display is installed in the aircraft (e.g. Collins Pro Line 21 EFIS System) the LPV Converter must be connected to the Arinc 429 VOR/ILS IN2 and DME inputs of all EFIS displays
6. If a single DME is installed in the aircraft the DME must be connected to the P1 and P2 connector.



8 Installation Procedure

Use Installation Kit (P/N: AS12-LPVKIT-00), consisting of:

- Connector 26 pin HD-SUB (Sub-D, High Density), female type
- Crimp socket
- Shell D-Sub

→ **Consider personal electrostatic discharge protection!**

- Remove the protection caps of connectors
- Mount the unit on suitable position according to section 5.4 into the aircraft
- Manufacture a cable harness according to requirements of Section 5.5 and Section 6.1 and adapt it in accordance with aircraft wiring
- Connect cable harness to unit #1 (J1) and unit #2 (J2), (as applicable)
- Measure bonding resistance between bonding point and aircraft ground ($R \leq 3m\Omega$)
- Perform Functional Test

9 Functional Test

The functional test procedure as described below is intended for the installation of the LPV/VNAV Converter in combination with a Garmin GTN 6XX/7XX as interfaced GPS source. For testing other approved GPS sources the test procedure needs to be adapted by the installer before testing.

9.1 Unit #1

- Provide electrical Power to the Aircraft
- Turn on the Garmin GTN unit #1 and set the unit into Demo Mode by pressing and hold the Direct-to key during power up
- Turn on the EFIS System of the aircraft and check that power is supplied to the LPV/VNAV Converter
- Check the following status lamps on the LPV/VNAV Converter unit #1:
 - ERROR: check extinguished
 - PSEUDO ILS active: check extinguished
 - Supervisory OK: check illuminated
 - ARINC Input OK: check illuminated
 - Heart Beat: check illuminated
- Select FMS 1 on the EFIS System to indicate the GPS data of GTN unit #1
- Select an LPV or LNAV/VNAV approach on the GTN unit (i.e. Straubing Wallmühle, EDMS, RNAV 27 GPS LPV, Transition STAUB) and fly the approach in Demo Mode of the GTN unit
- Check the indications on the EFIS System, consistent with the indications on the GTN display:

GPS distance	check provided and consistent with GTN
Lateral Deviation indication	check provided and consistent with GTN
- At reaching the final approach fix during the flight in Demo Mode of the GTN unit, switch the EFIS System to NAV/ILS 1 mode and check the following indications:
 - Distance to next waypoint check provided and consistent with GTN
 - Lateral Deviation indication check provided and consistent with GTN
 - Vertical Deviation indication check provided and consistent with GTN
 - External Pseudo ILS Annunciator check illuminated
 - Pseudo ILS lamp on the LPV/VNAV Converter unit #1 check illuminated
- Pull the Circuit Breaker of the LPV/VNAV Converter unit #1:
 - Check that NAV/ILS data from NAV Receiver #1 is provided to the EFIS System in NAV/ILS 1 mode
 - Check that GPS data from GTN #1 is provided to the EFIS System with FMS 1 selected

9.2 Unit #2

Note: This Functional Check is only applicable for installation of the dual LPV/VNAV Converter units.

- Provide electrical Power to the Aircraft
- Turn on the Garmin GTN unit #2 and set the unit into Demo Mode by pressing and hold the Direct-to key during power up
- Turn on the EFIS System of the aircraft and check that power is supplied to the LPV/VNAV Converter
- Check the following status lamps on the LPV/VNAV Converter unit #2:

- ERROR:	check extinguished
- PSEUDO ILS active:	check extinguished
- Supervisory OK:	check illuminated
- ARINC Input OK:	check illuminated
- Heart Beat:	check illuminated

- Select FMS 2 on the EFIS System to indicate the GPS data of GTN unit #2
- Select an LPV or LNAV/VNAV approach on the GTN unit (i.e. Straubing Wallmühle, EDMS, RNAV 27 GPS LPV, Transition STAUB) and fly the approach in Demo Mode of the GTN unit
- Check the indications on the EFIS System, consistent with the indications on the GTN display:

GPS distance	check provided and consistent with GTN
Lateral Deviation indication	check provided and consistent with GTN

- At reaching the final approach fix during the flight in Demo Mode of the GTN unit, switch the EFIS System to NAV/ILS 2 mode and check the following indications:

- Distance to next waypoint	check provided and consistent with GTN
- Lateral Deviation indication	check provided and consistent with GTN
- Vertical Deviation indication	check provided and consistent with GTN
- External Pseudo ILS Annunciator	check illuminated
- Pseudo ILS lamp on the LPV/VNAV Converter unit #2	check illuminated

- Pull the Circuit Breaker of the LPV/VNAV Converter unit #2:
 - Check that NAV/ILS data from NAV Receiver #2 is provided to the EFIS System in NAV/ILS 2 mode
 - Check that GPS data from GTN #2 is provided to the EFIS System with FMS 2 selected

10 Troubleshooting

For troubleshooting see LPV/VNAV Converter Maintenance Manual (Doc.-N°: ASR_1084_LPVCONV_901_MMA_()), in latest revision) or call AVIONIK STRAUBING GmbH.

11 Operating instructions

This section provides information about the functions and the operation of the Avionik Straubing LPV/VNAV Converter and the external annunciators, when installed in accordance with this manual.

11.1 Capabilities

The Avionik Straubing LPV/VNAV Converter enables vertical navigation during an GPS/SBAS based approach by transferring the respective navigational data, provided by an approved GPS source (i.e. Garmin GTN 750) to the NAV/ILS input of the aircraft's preinstalled EFIS system (i.e. Honeywell SPZ 5000 or Collins Pro Line 21).

Note: The capabilities of the aircraft's navigational system in relation to the respective EFIS and autopilot system always depend on the approval of the legal authority responsible for authorization of the respective aircraft.

11.2 Normal Operation

Performing a GPS based Vertical Approach (LNAV/VNAV or LPV) with an approved **EFIS system** following actions and indications are required:

- Activate the Avionik Straubing LPV/VNAV Converter using the "LPV CONVERTER ON" pushbutton.
- Select the desired GPS system to be indicated on the EFIS System in GPS/FMS mode.
- Activate "**LNAV/VNAV**" or "**LPV**" approach on the GPS unit selected above.
- Select the respective **NAV 1/2** mode of the EFIS System when "**Pseudo ILS 1/2**" annunciator is illuminated.

Note: In **NAV1/2** mode of the EFIS System the course pointer will not auto slew the correct course and must be rotated to the correct course by the pilot.

Note: While flying inbound the Final Approach Fix (FAF) the GPS source couples the "LNAV/VNAV" or "LPV" approach. The indication on the GPS unit's display changes accordingly from Terminal Mode ("**TERM**") to Approach Mode ("**LNAV/VNAV**" or "**LPV**"). The "**Pseudo ILS 1/2**" annunciator is illuminated afterwards. This indicates that the Avionik Straubing LPV/VNAV Converter switches the LNAV/VNAV or LPV signal to the NAV input of the EFIS System.

- Check the active Approach Mode on the GPS unit ("**LPV**" or "**LNAV/VNAV**")
- Check the active "**Pseudo ILS 1/2**" annunciation to confirm that the GPS source is selected although **NAV 1/2** is indicated on the EFIS.
- Check that the Autopilot/Flight Director is in Approach Mode.



Note: The “**DME distance**” on the EHSI might indicate the distance to the next “**GPS**” waypoint. This is applicable when a DME signal is interfaced to the respective Avionik Straubing LPV/VNAV Converter unit.

Note: To ensure a stable approach, toggling between GPS based Vertical approach (**LNAV/VNAV or LPV**) and ground based approach (ILS) using the “**LPV CONVERTER ON**” pushbutton is not recommended. To avoid additional workload during the final approach segment the pilot is recommended to continue the selected approach or to execute a missed approach and reselect another approach type afterwards.

Coupling the autopilot during approaches:

The installation of the Avionik Straubing LPV/VNAV Converter supports coupling the autopilot in Approach Mode once vertical guidance is available.

Once established on the final approach course with the Final Approach Fix as the active waypoint and the GPS source enables vertical guidance, the autopilot system can be engaged in Approach Mode. The autopilot will fly the GPS approach/ glide path afterwards.

11.3 Abnormal Operation

During a LPV or LNAV/VNAV approach, if GPS accuracy requirements cannot be met, the GPS receiver might downgrade the approach. That downgrade removes the Ground on the respective J1/J2 Connector on Pin 11 of the Avionik Straubing LPV/VNAV Converter. The respective LPV/VNAV Converter unit will be deactivated afterwards providing only NAV/ILS data to the EFIS System in NAV mode.

All GPS lateral and vertical approach deviation indications on the EHSI in NAV mode will be removed. The “**PSEUDO ILS 1/2**” indicator will be no longer illuminated.

The approach may be continued after selecting the GPS source on the EFIS system in GPS/FMS mode.

11.4 External annunciations

11.4.1 External “PSEUDO ILS 1/2” annunciator

Location:

The external “**PSEUDO ILS 1/2**” annunciator must be located on the instrument panel, next to the pilot’s EFIS in the pilot’s primary field of view.

The installation of a second “**PSEUDO ILS 1/2**” annunciator might be required if a second EFIS system (i.e. on copilot side) is installed in the aircraft providing equal approach capabilities.

Annunciation:

The external “**PSEUDO ILS 1/2**” annunciator is green illuminated when the respective unit of the Avionik Straubing LPV/VNAV Converter is active and providing GPS approach data to the EFIS System while it is in NAV/ILS mode. Pilot must be aware that the “**PSEUDO ILS 1/2**” annunciator overrules the active ILS indication; the EHSI displays GPS data although ILS is displayed on the EHSI.

Single GPS-LPV/VNAV Converter installation:

In case that a single GPS source is interfaced to the Avionik Straubing LPV/VNAV Converter it is strictly recommended to interface it to the J1 connector of the Avionik Straubing LPV/VNAV Converter. For this configuration a “**PSEUDO ILS 1**” annunciator as pictured below is required.



figure 7: annunciator single PSEUDO ILS

Dual GPS – LPV/VNAV Converter installation:

In case that dual GPS sources are interfaced to the Avionik Straubing LPV/VNAV Converter a bifid “**PSEUDO ILS 1/2**” annunciator, as pictured below, is required to indicate separately whether the GPS source #1 or GPS source #2 or both (in correlation with the Avionik Straubing LPV/VNAV Converter) are providing GPS vertical approach data to the EFIS System.



figure 8: annunciator dual PSEUDO ILS

11.4.2 External “LPV Converter ON” pushbutton

Location:

The external “**LPV Converter ON**” pushbutton must be located on the instrument panel, next to the pilot’s EFIS in the pilot’s primary field of view.

Note: Only single installation of this pushbutton is allowed to avoid confusion of the pilot/copilot whether the Avionik Straubing LPV/VNAV Converter is activated or not.

Appearances:



figure 9: annunciator LPV CONVERTER OFF

When only the permanent “**LPV CONVERTER**” is visible in white color the Avionik Straubing LPV/VNAV converter is not active.

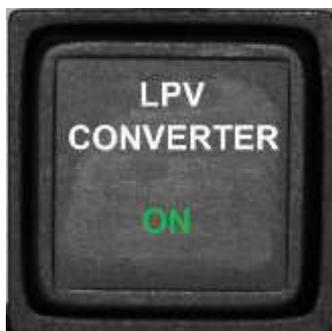


figure 10: annunciator LPV CONVERTER ON

When the permanent “**LPV CONVERTER**” is visible in white color and additionally “**ON**” is illuminated in green color the Avionik Straubing LPV/VNAV converter is active.



12 Limited Warranty

The LPV/VNAV Converter is warranted to be free from defects in materials or workmanship for two years from date of purchase. This warrant does not cover failures due to abuse, misuse, accident or unauthorized alterations or repairs.

IN NO EVENT AVIONIK STRAUBING GMBH WILL BE LIABLE FOR ANY INCIDENTAL, SPECIAL INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM USE, MISUSE OR INABILITY TO USE THIS PRODUCT OR DEFECTS IN THE PRODUCT.

AVIONIK STRAUBING GmbH retains exclusive right to repair or replace the unit or offer a full refund of the purchase price at its sole discretion. This shall be a sole and exclusive remedy for any breach of warranty.

To obtain warranty service contact AVIONIK STRAUBING GmbH or the aircraft Manufacturer (OEM).

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